University of Copenhagen

Improving University Science Teaching and Learning – Pedagogical Projects 2011, vol. 4, no. 1-2

This is numbers 1-2 in the fourth volume in a series of publications of educational development projects made by participants in the teacher development course for assistant professors and post-docs held by the Department of Science Education, University of Copenhagen.

The aim of the series is to provide insight into the kinds of educational tasks and problems new teachers are facing, and to show how they manage them in inspiring ways.

Improving University Science Teaching and Learning

Pedagogical Projects 2011

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Preface

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The present volume of papers on university teaching and learning is the result of work carried out by participants at the teacher development programme (TDP) for academic staff at science related faculties at the University of Copenhagen. It comprises contributions from two classes of participants who completed their TDP in August 2011 and January 2012 respectively.

The papers present the experiences and results from the concluding project that the participants carry out as a part of the TDP. The development programme combines theoretical and practical components and an important component in this is the final project where the participants are asked to address a problem of their concern in relation to their own teaching. In most cases, the projects include some kind of teaching experiment and subsequent reflection and evaluation of the experiment informed by theory on higher education teaching and learning. As the contributions in the present and in previous volumes reveal, this can take on an array of different shapes. This variety is, from our point of view, in itself an asset of publishing papers reporting from these projects because it bears witness to the diversity of challenges, possibilities, and restraints that university teachers are facing in different contexts.

This and previous volumes of pedagogical projects serve multiple purposes. They provide examples of teaching and learning activities and the development of these that can be used as inspiration for other university teachers. In many cases, the papers present specific ideas that can be adopted and adapted to other contexts, frequently also beyond the field of science. Another purpose is that the papers through the themes the partici-

pants have chosen to address also provide a glimpse of what could deserve attention from others than the individual teachers in order to improve the learning experiences of students (and the teaching experience of teachers!). The challenges in the teaching that the participants explore are entirely chosen by themselves and therefore they represent what is considered relevant and important for the individual teachers at that particular time and place.

Furthermore, the anthologies document the amount of talent and ideas present in the group of young teachers at university, and hold through this holds promises for the further development of higher education learning and teaching. Precisely this, improving the quality of the teaching and learning experience, has received increased attention from the very top of the University of Copenhagen. The board and management have formulated strategies for the university that emphasise that the teaching is an important area of focus. Based on the papers presented in this and the previous three volumes in the series, it can be argued that quality development from below is indeed an option, drawing on the experiences of the teachers. Moreover, an initiative issued by the vice-chancellor at the university, 'Den gode uddannelse' ('The good education'), showed that teachers who have participated in this particular TDP are well-represented in the project groups developing new ideas within that initiative.

However, it is also important to pay attention to the level of support (or lack of same) that the teachers are provided with at their departments and teaching programmes. Frequently it is necessary to involve more people to change even one course, not even considering what is needed to revise the curriculum of a module or entire programme. Fortunately, some of the participants experience support and acknowledgement from other staff at their departments and their ideas and experiments are used to develop the programmes further. That this is not always the case seems clear in one of the papers in the present volume:

> *Coming up with the ideas and restructuring the course was a fairly easy task based on all the information and tools I had been presented for and read about during "AdjunktPædagogikum" and IUP. The hardest part was to get all the involved teachers to respond to my inquiry, find time to answer questionnaires, and prepare for the meeting. [. . .] (Nissen, this volume)*

This somewhat discouraging experience of reluctancy to engage in development work suggests that there is a need for the management to consider how it can provide fertile conditions for enthusiastic and qualified

teachers to engage in the development of the university teaching. It is not particular to the University of Copenhagen that an unfortunate cocktail of time constraints, combined pressure of teaching obligations and research productivity, experiences that in a career perspective achievements in research have more weight than those of teaching, and of the culture of higher education in general frequently hampering pedagogical development in higher education. Indeed, it was the theme of the national conference on teaching and learning in higher education 2011 (cf. Horst et al. 2011), and similar experiences have been reported in the international literature.

In this light, this is the final purpose of these volumes of papers reporting from pedagogical projects: To inform the management levels of higher education institutions that the potential, the interest, and the competencies for improving the quality of the students' learning experiences can be found out there in the departments. They may need, however, some support and encouragement.

The papers in this volume

The present papers stem from two classes, and therefore constitute two numbers in our series. The participants were free to decide whether to write their papers in Danish or English and we have not changed that. Therefore some papers are in Danish while others are in English. The papers have been organised in five parts according to the theme or challenge they are addressing. In the final part of this introduction we will briefly present each paper.

Planning, designing or redesigning units, courses or programmes

The project of *Majken C.L. Zibar* presents a peer-evaluation activity at a compulsory course that students take at the very beginning of the geology bachelor's programme. Her focus is on improving the students' report writing skills and to encourage the students to integrate feedback on preliminary versions of their reports in the final versions. The students are asked to read report drafts and provide feedback in groups. The paper reports from a tryout of the activity related to a laboratory exercise. Based on students' evaluation and the peer supervision of another adjunct Majken Zibar discusses the activity and where it needs further development.

In his project, *Christian Lyder Jacobsen* discusses the use of lecture-review quizzes in a second-year computer science course. The quizzes were intended for students to use immediately after lectures in order to have students re-engage with the lecture material. They consisted of multiple-choice questions available at the course web site. The evaluation of the students' use of the quizzes showed that more students used them for repetition just before the exam than for repetition after the lecture, partly because the quizzes in some cases were not available immediately after the lecture. The author presents some concerns regarding the use of the multiple-choice format and discusses different further developments that might achieve the intended purposes of the quizzes.

The paper by *Nynne Capion* reports on the redesign of a part of a combined theoretical and practical course at the veterinary Master's programme. The teaching organisation was changed and the assessment format adjusted in order to make the students take on more responsibility for their own learning and for the patients, but also to experience their efforts as meaningful. The changes succeeded in linking the theoretical work closer with the clinical activities, and the revised assessment format focused on the students' working with problems rather than on their recollection of theoretical content.

Thomas Skov discusses the pros and cons of short courses such as the two-day course Chemometrics that is the focus of his paper. Drawing upon five years of frequent experience with teaching this course, he describes the different aspects of short courses and the educational potentials and pitfalls involved in that particular format. The paper includes five pieces of advice for teachers to help them organise, prepare and teach short courses.

The paper by *Henrik Holm* concerns constructive alignment in a course in Mathematics and Optimization at the Faculty of Life Sciences. Students at LIFE are not math students, but are majoring in subjects where math plays an auxiliary role only. Therefore it is crucial for the content to be related to examples of relevance to the students. Henrik Holm describes and reflects upon the intended learning objectives (ILOs) of the course, and their relation to the teaching and learning activities (TLAs) – lectures, mini-exercises, problem solving sessions and student projects. Each activity type is exemplified. The analysis shows that the course is well aligned, and the students' evaluations (oral and questionnaire) confirm this. The feedback from the students leads to a consideration of whether the exam format should be modified.

Construtive alignment is also the focus of *Lene Tranberg Andersen*'s paper. Lene Andersen assesses the alignment of intended learning outcomes, teaching and learning activities and the form of assessment in an e-learning course on ?Introduction to Dairy Technologies? ? a MSc course at the Food Science and Technology program. In addition to this, Lene Tranberg Andersen discusses some of the main challenges involved organizing e-learning courses, specifically how the quality of the online discussions can be strengthened. The course is structured according to the 5-stage model developed by G. Salmon whereby the students are faced with increasingly complex tasks in the e-learning environment. However, Lene Tranberg Andersen?s judgment is that students did not progress to the final stages as intended. A number of suggested initiatives that will probably strengthen student learning are discussed. The course was assessed by a combination of continuous and final assessments, and Lene Tranberg Andersen has important considerations about the difficulties in using continuous assessment.

Dirk L. Christensen's paper explores students' views on a course (Ethnicity and chronic disease in a global perspective) being taught by one regular lecturer (course responsible) and multiple guest lecturers. He explains the practical and pedagogical consequences of having multiple specialists as guest lecturers while trying to maintain a sense of coherence between the different lectures by having a regular lecturer present. Data was collected using a questionnaire designed for the project filled out by the students after course end. Dirk L. Christensen finds that the format was conducive and poses that the positive results could be due to the quality of the lecturers.

Annemette Nielsen's paper likewise presents a method for increasing students' sense of coherence in a course containing different themes and several guest lecturers. Based on critical comments from students attending the course previous years she introduced the use of mind maps as a way of preparing the students for the following guest lecture and for relating the content of the particular lecture to the broader scope of the course. Based on an array of evaluation methods she concludes that even if the responses in the written evaluation are ambiguous the overall picture is that the students valued the activities that should support their understanding of the relation between the different course elements. It is, however, important that these activities are integrated in the course planning from the beginning rather than being added on.

Evaluating and revising existing courses or units – course development

In her paper, *Lise Byskov Herslund* describes the redesign of a course on urban sociology that she has developed and taught at the Faculty of Life Sciences. The redesign was sparked by the teachers experiencing that the learning quality and learning approaches of the students were dominated by a surface approach. Based on careful reflections on the students' backgrounds and learning experiences and on the course layout, the paper presents a redesign with emphasis on both student activity and on facilitating particularly the reading and writing activities. The changes appear successful, but further adjustments may be needed.

Ulla Vig Nissen presents the redesign of an entire course delivered at Master's level at the Department for Exercise and Sport Sciences. Based on feedback from teachers who had previously taught at the course she suggests a new structure of the course as a whole, changes in the way each class session should be organised as well as suggestions for a revised content. The feedback from former and future teachers was positive. Since the course is not offered every year it has not been possible to test the new format. In the concluding comments, Ulla Vig Nissen reflects on some of the difficulties in changing courses at university.

The paper by *Peter L. Langen* reports an experiment with a new teaching format in a course in Geophysical Fluid Dynamics. He has assessed the students' experiences of both the "traditional format" with lecturing and subsequent exercise classes, and the newly introduced hybrid format that interchanges between lecturing and problem solving with relatively short intervals. In general, students are enthusiastic about the new format, particularly the fact that they immediately get to apply the concepts considered in the lectures. The students assessed the format by means of questionnaires with Likert scale response options and open questions. Peter L. Langen argues convincingly that the mixed method teaching format he has adopted has strong merits over the traditional format in this course and should be maintained, but that the traditional format also has a role to play because students also need longer periods of time to work and grapple with the concepts.

Marianne Vestergaard's describes the actual and planned developments in relation to a second year course on "Galaxies" at the Niels Bohr Institute. Far more focus was put on student centred activities, making computer exercises more accessible to students, and focussing on student's self-

discovery. The thorough student evaluations testify that the students support the made changes. Throughout the paper, Marianne Vestergaard includes examples of teaching material that illustrate and substantiate what she is arguing. In the final part of the paper, she considers how to improve the constructive alignment of the course by modifying the exam, and how a different sequencing of the astronomical curriculum across the study could help address some of challenges in the course and in the programme as such.

Susanne Kaae, in her paper, deals with the "re-alignment" of the course "Lægemiddelpolitik, -økonomi og -etik" (a course for 200 students). Her paper is based on teacher and student experiences and evaluations and an analysis of exam papers from the first run of the course. Through her analysis, she examines the intended learning objectives as stated in the course description as well as their link to existing teaching and learning environments.

Trine Agervig Carstensen analyses key elements of the course: "Urban sociology – human, place and city", in particular the consequences of using essay writing in course examinations in relation to the alignment with stated course objectives. Based on a close examination of course learning objectives she concludes that the stated course objectives are adequate, if somewhat imprecise, and she suggests improvements that would improve course alignment. Trine Agervig Carstensen offers a critical discussion of the use of essays for examination, of the influence of teacher instruction on student outcomes as well as the reliability and validity of the examination. The paper points to a number of possible improvements to be achieved by specifying course objectives, including more written assignments in the course to allow students to gain confidence in the writing assignments, and by altering the essay format to a more common form of written assignment.

The paper by *Kasper Grove-Rasmussen* describes the revision of an experimental course on quantum phenomena in nano-scale systems in order to strengthen the relationship between the theoretical and experimental parts of the course. This is done by changing the sequencing of the activities so that the theory needed for the experiments is always presented to the students prior to the experimental work. Kasper Grove-Rasmussen finds that the changes made have had an effect: Contrary to the 2010 results, the students of 2011 experience a good connection between the various teaching and learning activities. He finally identifies a number of remaining problems in the course (related to the tutorials), and provides suggestions for how these problems can be addressed.

Andrej Christian Lindholst describes how the participation in the Adjunktpædagogikum course has provided him with new tools for planning and conducting his teaching. The project compares his teaching activities in 2010 and 2011 in the course "Urban forestry and urban greening". In 2010, students were not wildly enthusiastic about the teacher's ability to motivate for course work and communicate course content. Andrej Lindholst was well aware of this, and frankly states that it affected him both personally and professionally. In 2011 a number of changes were made, in part inspired by his participation in Adjunktpædagogikum. Problem based elements were introduced, a wider range of student activities, and improved constructive alignment was sought. Evaluations from 2011 show that students value the changes markedly, and having a clearer structure and plan gave self-confidence. To us, as teachers in Adjunktpædagogikum, Andrej Lindholst's paper is a good example of how Adjunktpædagogikum may contribute to strengthening new teachers' self-efficacy beliefs with respect to teaching.

Stimulating student activity and deep learning

In his paper, *Søren Bøye Olsen* develops and tests the use of conceptual questions and clickers at a course on economics at the Master's programme, Environmental and Natural Resource Economics. He had noticed that a surprisingly high proportion of the students at the exam had misunderstood some of the basic concepts addressed at the course and therefore introduced the use of conceptual questions, clickers and peer-instruction in order to increase the students' inclination to adopt a deep approach. Søren Bøye Olsen describes the implementation of one session following this principle and reports the students' evaluation. He concludes that it is a possible and beneficial activity in an economic course in order to raise the students' engagement in discussion of basic course concepts.

Bhim Bahadur Ghaley reports on the redesign of a unit in a course on tropical crop production in order to increase the alignment between the theoretical and the practical part of his teaching by means of clickers. In one case, the clickers were used to introduce interactive elements into an introductory lecture. In another case, the clickers were used to provide students with opportunities to apply the introduced theoretical knowledge on a concrete case. Results showed that the use of buzz groups in relation with clicker questions in all cases increased the number of correct answers. All students found the clickers helpful in their learning.

The paper of *Jesper Harholt* concerns the implementation of cooperative learning structures in a course in biochemistry for students at the Faculty of Life Sciences. His ambition was to move away from a strong teacher focus towards a type of teaching where students' interaction was placed at the centre of the teaching and learning activities. Jesper Harholt describes how a seven-lesson session comprising experiments and lecturing was changed by introducing two cooperative learning structures: "Think-pair-share" and a variation of a so-called "Expert-puzzle". Both elements, but in particular the latter (where the students discuss and compare experimental results), were well-received by the students. Jesper Harholt concludes that the implementation of cooperative learning elements in the course has been successful, and a path to pursue further in other parts of the course and in general.

Stine Broeng Metzdoff's paper describes planned changes in a course on Enzymology and Experimental Biochemistry, focussing on increased student activity and elements of peer-assessment. She argues that the teaching and learning activities in the course do not match the intended learning outcomes, and outlines a number of relevant adjustments. For instance, the students should work with a number of pre-lab conceptual questions, and the lab manual was altered. The suggested changes had not been implemented, but two former course participants had been interviewed about their views on the course and the suggested changes. The students agreed that the suggested changes will improve the course.

Peer instruction and group based peer assessment is the topic of *Nicolas Thibault*'s paper. Nicolas Thibault has introduced elements of formative peer assessment (in relation to student essays, presentations and feedback) in a course in Basic and Invertebrate Paleontology, and evaluated the students perception of these new elements as compared to more traditional teacher-focussed approaches. Generally the students have been pleased with and benefited from the new format, and prefer this student-activating format to more a teacher-focussed approach.

Language and cultural diversity in university teaching

The paper by *Ayse Basak Cinar* addresses the use of English in teaching Danish students. She studies the students' attitudes to and experiences with English as a medium of instruction, using a questionnaire in relation to a lecture delivered in English. The majority of the students agreed that developing professional English competencies was relevant, and most of the

students did not experience attending lectures in English to be more difficult than attending classes in Danish. However, almost one out of five experienced difficulties, and a majority of the students agreed that they participated less in discussions when in English. Ayse Basak Cinar points at different measures – both during lectures and outside – that could facilitate the students' participation.

In her paper, *Mette Kristensen* discusses the effect of offering a two-day introductory English workshop to students who enter an MSc programme in nutrition. The entire programme is taught in English and the students are offered a two-day workshop. At the workshop the students are introduced to learning strategies when taught in English and they take tests to evaluate their strengths and weaknesses in reading, writing and listening to English. The students were positive to the workshop, but no discernible effects could be traced in the examination results. Mette Kristensen notes that lack of active student participation is a major concern in English-medium classrooms and suggests reduced class sizes as a way to increase student participation.

Supervision and supervision styles

In her project, *Meike Burow* has investigated the relationship between PhD students' conceptions of supervision and supervision style in relation to the conceptions of their supervisors. All participants are employed at Meike Burow's department (Plant Biology and Biotechnology). Ten pairs of PhD student and supervisor were asked to participate in a survey about supervision and asked to graphically designate in a two-dimensional plot the perceptions of PhD student's degree of autonomy and the supervisor's recent supervision style. Both questionnaire and graph displays interesting discrepancies in the perception of the supervision situation between (most of) the PhD students and their supervisors.

Finally, and in a similar vein, *Anders P. Tøttrup*'s paper deals with the supervision of the thesis that completes the bachelor's programme. He points out that supervision in many ways differ from other kinds of teaching, in that there are less clear tools and guidelines for teachers to draw upon, and that it is less researched than other teaching formats. Based on a small-scale survey among students and supervisors, Anders Tøttrup discusses the expectations students and supervisors have, the initiation of the project (not least, who formulates the project), the time used for supervision, and the extent to which students and supervisors evaluate the supervision process. Among the results, Anders Tøttrup points out that there is

an obvious need to develop tools and guidelines concerning how to address and adjust the expectations of students and supervisors.

Part I

Planning, designing or redesigning units, courses or programmes

1

Formativ "peer-assessment" af grupperapporter

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Jeg underviser i faget "Grundlæggende geofysik og hydrogeologi". Kurset er et obligatorisk kursus for geologi-studerende og ligger på første år, blok 1. Det overordnede mål med kurset er at introducere fagområderne geofysik og hydrogeologi ved at give de studerende et bredt overblik over elementære metoder og problemstillinger inden for de to fagemner. En væsentlig del af undervisningen tager udgangspunkt i konkrete problemstillinger, hvor de studerende indsamler, integrerer og fortolker geofysiske og hydrogeologiske data. Undervisningen er derfor meget varieret med klassiske forelæsninger, laboratorieøvelser, feltturer og projektarbejde. I løbet af kurset arbejder de studerende på opgaver, som afleveres samlet inden kursets afslutning. Der tages udgangspunkt i disse rapporter ved den individuelle mundtlige eksamen. Kurset er traditionelt blevet delt af to undervisere. I 2009 blev jeg bedt om at være ansvarlig for den hydrologiske del af kurset og har undervist i kurset en gang tidligere (2010 var jeg på barsel).

Generelt set er kurset meget velstruktureret med ni klare og beskrivende målbeskrivelser, meget passende og varieret undervisning, samt en evalueringsform, der nøjagtigt måler de kompetencer, vi ønsker, de studerende skal opnå i løbet af kurset. Men der er jo altid områder, der kan forbedres.

Som nævnt tidligere er hele undervisningen centreret omkring to rigtige problemstillinger: 1) Et forureningsudslip fra et affaldsdeponi, og 2) saltvandsindtrægning og forurening af et grundvandsmagasin. De studerende arbejder sammen i grupper af tre og udarbejder i løbet af i kurset to delopgaver, hvor de formidler deres opnåede viden. Selv om det at skrive rapport ikke er hovedmålbeskrivelsen for faget, er det en vigtig og nødvendig færdighed, de skal opnå i løbet af deres bacheloruddannelse. For at kunne

forbedre kvaliteten af deres rapporter har tidligere studerende afleveret den første delopgave halvvejs i kurset for at muliggøre formative feedback fra de kursusansvarlige. Sidste gang jeg underviste i kurset, brugte jeg mange ressourcer på at læse deres rapporter igennem og give dem konstruktiv kritik, men til min store skuffelse var det min opfattelse, at de studerende ikke lærte noget af den givne feedback. De ændrede stort set ikke et komma i den første delopgave som følge af mine kommentarer, og anden delopgave indeholdt lignende fejl og mangler som dem, jeg havde fremhævet i den første delopgave. Jeg ønsker med dette projekt at undersøge alternative metoder til, hvordan man bedst dygtiggører de studerende på dette område.

Metode

Jeg valgte at undersøge, hvorvidt en aktivitet med "peer-assessment" kunne forbedre deres rapportskrivningskompetencer. Ideen var, at de studerende selv skulle evaluere hinandens første delopgave og give feedback i stedet for at modtage den formative feedback fra undervisererne. Der var en del faktorer, som spillede ind, som jeg mente kunne være med til at gøre dette til en vellykket aktivitet:

- Aktiviteten forbedrer de studerendes kompetencer uden at øge underviserens arbejdsbyrde, samt kræver ikke for meget undervisningstid, dvs. ændrer ikke markant på vægtningen af de øvrige aktiviteter i kurset.
- Den studerende oplever, hvor vigtigt det er, at rapportskriveren har tænkt på sit publikum.
- Måske tager de studerende denne ikke-obligatoriske del af kurset mere alvorligt, når det er medstuderende, der skal læse det, de afleverer, og motiverer dem til at komme tidligere i gang med arbejdet.
- Den konflikt, at underviseren skal give både den formative og endelige (summative) evaluering, undgås. De føler måske allerede, at den endelig evaluering har fundet sted efter første gennemlæsning og tænker, at det ikke nytter at ændre noget som følge af kritikken.
- Underviserens dilemma med at man ikke må lave konkrete rettelser, men kun må komme med overordnede feedback undgås, eftersom det er i strid med reglerne, at de studerende går til eksamen i allerede evalueret stof.

Evaluering af medstuderende

Det engelske begreb "peer-assessment" kan virke uforståeligt for helt nystartede studerende, og jeg valgte i stedet for at bruge begrebet "evaluering af medstuderende", idet jeg ikke kunne finde en bedre dansk oversættelse. Jeg blev anbefalet at bruge en del tid på at introducere de studerende til både evalueringen og god rapportskrivning, eftersom det ikke var sikkert, at alle studerende havde nogen erfaring inden for disse områder. Der er dog kun afsat syv timer om ugen til kurset fordelt på to dage (en time om ugen mindre end siden sidste gang jeg underviste), og derfor skulle denne nye aktivitet holdes til et minimum for ikke at tage for meget tid og fokus fra de øvrige aktiviteter, se figur 1.1 for fordelingen af aktiviteter i kurset. Det var desuden svært at vælge, hvornår aktiviteten skulle indsættes i undervisningsforløbet. Dilemmaet var at finde et kompromis mellem at de studerende havde haft langt nok tid til at arbejde på deres første delopgave, samt at de helst skulle opfordres til at komme i gang med første delopgave inden de skulle starte arbejdet på anden delopgave, cirka halvvejs i blokken (uge 5).

Jeg valgte følgende implementering:

1. En lille øvelse i "evaluering af medstuderende" i forbindelse med en laboratorieøvelse (uge 3).
2. Forelæsning om evalueringen og diskussion af evalueringskriterier (primo uge 5) – 1 time
3. Aflevere delopgaver til hinanden (ultimo uge 5)
4. Selve "evaluering af medstuderende" (uge 6) – 1 time
5. Opsamling på evalueringen samt uddeling af spørgeskema (uge 6) – 1 time

Det umiddelbare største problem med denne plan var, at de studerende kun havde haft fem timer af de i alt 16 timer afsat til gruppearbejde inden de skulle aflevere et udkast til hinanden, samt at den første delopgave var større med to tredjedele vægtning af den samlede belastning.

Ideen bag den første lille øvelse (punkt 1) var, at de skulle begynde at tænke kritisk på, hvordan de formidlede deres resultater med fokus på beregningerne, mellemregninger, enheder, samt grafisk præsentation. Efter at have gennemgået en øvelse i laboratoriet, skulle de behandle de indsamlede data og udveksle gennemregninger og figurer med nabogruppen. Forinden ville jeg gennemgå nogle eksempler af beregninger og figurer på overhead,

	Timer pr. studerende	Andel	Timer til "nye" aktivitet
Forelæsninger*	17	36%	2
Feltturer	14	29%	0
Laboratorieøvelser	1	2%	0
Gruppearbejde	16	33%	1
I alt	*48*	*100%*	*3 (6%)*

*Inkluderer introduktion til kurset, spørgetime, m.m.

Figur 1.1. Antallet af timer fordelt på forskellige aktiviteter.

både gode og dårlige eksempler, og vi skulle have en snak om, hvad der var god afrapporteringspraksis.

Med udgangspunkt i den første øvelse ville jeg så i denne forelæsningstime prøve at starte en diskussion om, hvad der ellers var vigtigt at tage højde for, når man skrev en rapport, og sammen skulle vi på tavlen udarbejde nogle evalueringskriterier, de kunne støtte sig til, når de læste hinandens rapporter (punkt 2). Derudover ville jeg give nogle forslag til, hvordan man kunne give formativ feedback. Blandt andet:

- Start med at fremhæve det positive i rapporten.
- Brug eksempler til at forklare, hvad I mener.
- Lyt til hinanden: Spørg først om begrundelsen af et valg før selv at komme med forslag til forbedringer.

Jeg valgte at bede en af de andre adjunkter i min peer-supervision gruppe om at observere denne time for efterfølgende at få en objektiv vurdering.

Grupperne skulle derefter udveksle delopgaver to og to efter en plan, jeg udleverede og havde en uge til at læse hinandens rapporter, inden de skulle komme med feedback (punkt 3 og 4). Til selve "evalueringen af medstuderende" var der afsat en gruppearbejdstime (Fig. 1.1).

Umiddelbart efter denne time var idéen at mødes med de studerende og tale om, hvordan aktiviteten havde forløbet. Et spørgeskema, som jeg ville medbringe, skulle desuden udfyldes. Dels ville de blive bedt om selv at komme med egne kommentarer (hvad der havde været godt og hvad der kunne gøres bedre), og dels ville de blive bedt om at svare på nogle specifikke spørgsmål vedrørende det at give og modtage feedback og selve aktivitetsforløbet. Derudover blev der foretaget en standard evaluering af hele kurset i den sidste del af blokken på Absalon.

Resultat

For at evaluere hvordan "evaluering af medstuderende" blev modtaget af de studerende, og om den rent faktisk havde nogen effekt, kan jeg bruge svarene på de udleverede spørgeskemaer, samtalen jeg havde efter peer-supervisionen, diskussion med min medunderviser, samt mine egen overvejelser og refleksioner. Herunder vil jeg gøre rede for disse resultater hver for sig.

Spørgeskemaer

Der var i alt 50 studerende tilmeldt kurset. Der var fem studerende, der aldrig dukkede op og yderligere fire faldt fra i løbet af de første par uger, så vi var nede på 41. Vi havde 39 studerende til eksamen, derudover to der afleverede blankt og én, der skal til sygeeksamen i februar. Jeg fik 35 svar (ca. 85%) på mine spørgeskemaer og otte (ca. 20%) svarede på Absalon (kursusevalueringen), så datagrundlaget for kursusevalueringen er noget usikkert. Desuden drejede ingen af kommentarerne under spørgsmål 10 direkte om "evaluering af medstuderende"-aktiviteten, og derfor er denne evaluering ikke medtaget i dette projekt. I figur 1.2 har jeg sammenfattet resultaterne fra det udleverede spørgeskema.
Hovedkonklusionerne fra de stillede spørgsmål er, som følger:

- Der var ingen, der fandt det ubehageligt at give eller modtage kritik, og langt de fleste (92,6%) af de studerende følte sig godt informeret.
- 20,7% følte ikke, at de fik feedback og op mod 41,4% mente, at den modtagne feedback kun drejede sig om detaljer.
- Alligevel ændrede cirka to trejdedele en del i deres opgave som følge af kritikken og mente at deres delopgave blev markant bedre, og over halvdelen (58,6%) mener at de er blevet bedre til at skrive rapporter generelt.
- 41,4% mente, det var svært at finde noget at kritisere i de andres rapporter, men 72,4% fandt i stedet for fejl og mangler i deres egen rapport. Kun 41,4% synes at de evalueringskriterier, vi lavede sammen, var nyttige og kun halvdelen synes at den time vi brugte på at lave kriterierne hjalp dem i deres rapportskrivning.
- 1/3 mente tiden skulle være blevet brugt på noget andet og op mod 3/4 synes de havde haft for lidt tid til at skrive første delopgave.
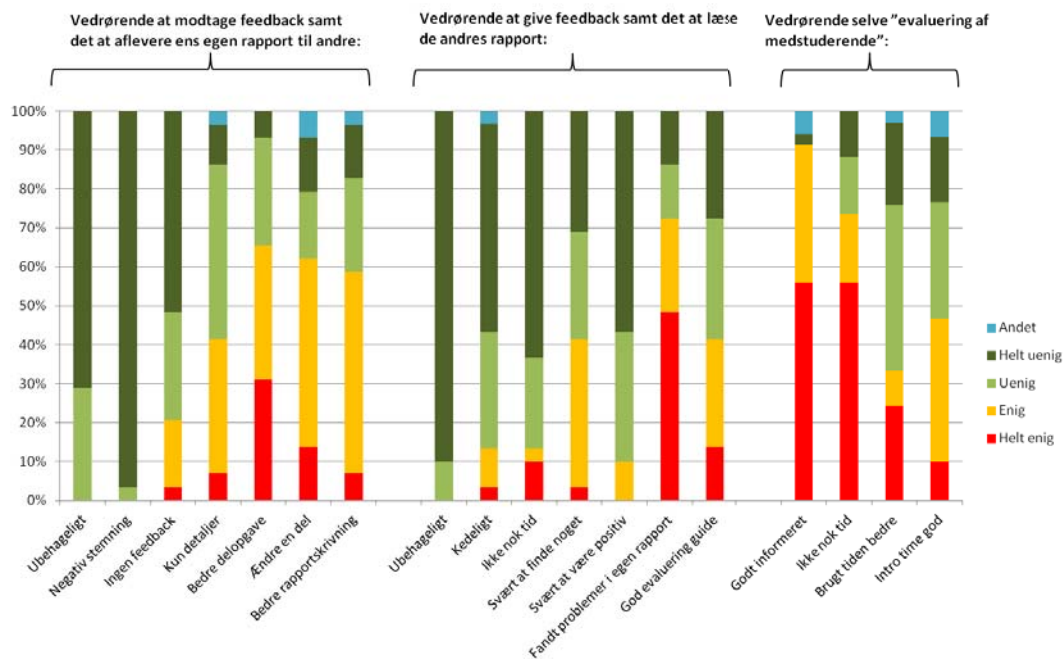
Figur 1.2. Resultatet af spørgeskemaet udleveret umiddelbart efter "evaluering af medstuderende".

De positive ting, de fremhævede ved "evaluering af medstuderende", var:

- Godt for at få inspiration/idéer til andre måder at tackle opgaven på.
- Gav en bedre klarhed og struktur af opgaven. Fokus på hvad der var vigtigt at have med.
- Lokaliseret konkrete fejl.
- De blev skubbet i gang med rapportarbejdet tidligt i blokken.
- Godt for det sociale miljø på studiet, dels fordi at det var hyggeligt, og del fordi at det gav mulighed for at kommunikere med flere medstuderende. Skabte et netværk, som de kunne bruge senere.
- De fik udbygget forståelsen af stoffet, idet de diskuterede de emner, der var svære at forstå.

Anbefalingerne til forbedringer inkluderede:

- Det skulle have været lagt længere henne i blokken, så de havde nået mere på delopgaven (20 stk.).
- Ikke nødvendigt med time om rapportskrivning og evalueringskriterier (4 stk.).

- Mindre tid afsat til aktiviteten (4 stk.).
- Synes det var fint, som det var (4 stk.).
- Ønskede at kritikken var mere generel og ikke om det sproglige (3 stk.).
- Savnede nogle gode evalueringskriterier (2 stk.).
- At man havde nøjes med at evaluere en mindre del af delopgaven (2 stk.).
- Hvis man kunne få feedback fra flere grupper (1 stk.).
- Fået mere information om aktiviteten tidligere i forløbet (1 stk.).
- At det var frivilligt, om man ville deltage (1 stk.).
- Mindre tid på selve evalueringen af grupperne (1 stk.).

Peer-supervision

Som nævnt tidligere fik jeg en anden adjunkt fra min peer-supervision gruppe til at komme og give mig noget feedback af, hvordan den undervisningstime gik, hvor jeg sammen med de studerende skulle diskutere projektarbejde og udarbejde de evalueringskriterier, de skulle bruge. Overordnet set mente min medadjunkt at undervisningen forløb godt med en afslappet atmosfære og god dialog med de studerende, hvor næsten alle bidrog. Problemet var bare at timen kom til at handle alt for meget om rapportstruktur (hvilke afsnit der skulle være) og ikke om selve de kriterier, de kunne bruge i deres evaluering af hinanden. Og derfor blev det for generelt med for lidt kød på, hvilket også blev tydeligt, da jeg skulle samle evalueringskriterierne sammen.

Egne refleksioner

Det var også min egen fornemmelse at den time, vi brugte til at diskutere evalueringskriterier, kunne være blevet brugt mere konstruktivt i klar tråd med min medadjunkt og også med det som mange af de studerende udtrykte. Problemet var at en stor del af de emner, som man kunne diskutere og som var relevante i forhold til deres evaluering, havde vi allerede brugt tid på ved den først lille øvelse i forbindelse med laboratorieforsøget. Og derfor kom der ikke rigtig noget nyt til, udover at rapporten skulle have en rød tråd og at man skulle tænke på sit publikum. Jeg havde planlagt at timen skulle være meget improviseret, men jeg manglede klart at kunne styre diskussionen noget mere. Undervisningstimen forløb godt og var måske ikke hel spild af tid, eftersom de rapporter, de fik afleveret, alle var velstrukturerede med gode introduktioner og beskrivelser af, hvad de ønskede

at formidle. Det var dog mit indtryk at de havde rimelig meget erfaring med rapportskrivningen fra gymnasiet eller HF, hvilket også gav sig udtryk i at kun halvdelen følte at timen hjalp dem i deres rapportskrivning, og endnu færre synes at kriterierne, som vi udarbejde kunne bruges. Min medunderviser mente heller ikke at rapporterne bar præg af at være væsentlig anderledes i år end sidste år på trods af de studerendes egen fornemmelse for at rapporterne blev bedre af den modtagne og givne kritik. I forhold til de rapporter jeg modtog for to år siden var der sket en klar udvikling i en positiv retning, og der var ingen, der havde afleveret punktvis besvarelser af de enkelte spørgsmål (som jeg har set tidligere), men dette kan også skyldes at de i gymnasiet nu bruger mere tid på studieforberedende aktiviteter.

Den første lille øvelse i "evaluering af medstuderende" gik heller ikke helt efter planen. Laboratorieforsøget gik godt, og vi fik en god snak om figurer, enheder og beregninger, og hvor vigtigt det var at forholde sig til ens resultater i forhold til ens baggrundsviden, men de studerende brugte alt for langt tid på at løse opgaverne og nåede derfor aldrig at udveksle gennemregninger og figurer med nabogruppen. Jeg burde nok have afsat mere tid til aktiviteten eller have skåret ned på antallet af opgaver og eventuelt have haft en medunderviser (ph.d.) til at være til stede for at hjælpe med at svare på spørgsmål. Desværre glemte jeg at forhøre mig om, hvordan de studerende følte, denne aktivitet var gået i det senere udleverede spørgeskema.

Af andre spørgsmål som jeg efterfølgende ville have synes var interessante at få svar på kan desuden nævnes:

- Om de havde prøvet "evaluering af medstuderende" eller noget der lignede før.
- Ville det have været bedre senere på studiet.
- Skulle vi (underviserne) have lavet grupperne.
- Skulle de have byttet med mere en anden gruppe.
- Havde de overhovedet modtaget eller givet kritik til en anden gruppe.

Jeg observerede, at da mange grupper blev opløste eller ændrede sammensætning, var der problemer med at nogle grupper ikke nåede at blive færdige med noget, som de kunne få feedback på eller bidrog med feedback til en anden gruppe. Og eftersom grupperne kun var sat sammen to og to, gik det desværre ud over den gruppe, de var blevet parret med. Som nævnt tidligere glemte jeg at inkludere et spørgsmål om dette i spørgeskemaet, men det var min fornemmelse at fire ud af de 14 grupper ikke gennemførte aktiviteten.

De studerende havde muligvis haft for få gruppearbejdstimer, inden vi bad dem udveksle delopgaver, hvilket størstedelen (73,5%) pointerede i deres spørgeskemabesvarelser. Måske ved bare at forskyde det hele en uge således at de havde haft 5–7 timers yderligere gruppearbejde inden (10–12 timer ud af de 16 timer, se figure 1.1), så ville de have følt sig bedre rustet. Dette ville så betyde at de ville få mindre tid til anden delopgave, hvilket jeg ikke vurderer ville skabe et stort problem for de studerende, idet anden delopgave er kortere og væsentlig nemmere at gå til, eftersom det meste af teorien er den samme som i første delopgave.

Min største bekymring ved "evaluering af medstuderende" var at de studerende alle arbejdede på samme problematik og samme data, og derfor kunne de føle sig fristet til at "låne" fra hinandens resultater og konklusioner. Sidste gang jeg underviste, oplevede jeg at de samme fejl gik igen i flere rapporter og altså en indikation af at de hellere vil spørge deres medstuderende end underviserne, når de er i tvivl om noget, men i år var der tale om enkelte tilfælde af direkte plagiering. De studerende afleverede rapporterne digitalt og Absalon-funktionen viste i nogle tilfælde op mod 4% overlap mellem rapporterne. Heldigvis blev det bedømt til at være uvæsentligt (de studerende havde øjensynligt arbejdet sammen på tværs af grupperne) og havde derfor ingen konsekvenser for de studerende, men det er nok et emne, som man skal nævne for de studerende, inden de udfører "evalueringen af medstuderende".

Konklusion

Selvom den afprøvede "peer-assessment" aktivitet ikke forløb helt planmæssigt og ikke alle studerende følte det gavnede deres rapportskrivning, tror jeg stadig at "peer-assessment" kan bidrage positivt i ens undervisning. Det kan godt tænkes at denne type aktivitet egner sig bedre til et kursus, som ligger senere på studiet, men kan måske ændres fra den form, jeg afprøvede til også at blive vellykket i det kursus, jeg underviser i på første år, blok 1. Mange af de studerende virkede i hvert fald meget positive over for mit projekt og en gavnlig pointe, jeg ikke havde tænkt over, inden jeg gik i gang, var den effekt, det havde på det sociale miljø, som har en stor indflydelse på gennemførelsesprocenten af et studie.

Hvis jeg skulle gentage "evaluering af medstuderende" næste gang, jeg underviser, ville jeg nok udskyde hovedaktiviteten en uge samt udelade den time, hvor vi diskuterede og lavede evalueringskriterier. I stedet for kunne

man udbygge den lille introduktion i forbindelse med laboratorieøvelsen således at den bliver gennemført som planlagt, men også således at den inkluderer en snak om vigtigheden af en rød tråd i rapporten. Selv om vi informerede de studerende om den endelige evalueringsform samt udførelsen af "evaluering af medstuderende" fra første dag af kurset og i kursusplanen, var der stadig et par stykker, der mente at de ikke havde modtaget information herom tidligt nok. Dette understreger nødvendigheden af at man ikke kan gentage disse slags informationer for mange gange og at man skal være meget klar, når man melder ud over for de studerende.

2

Online Lecture Review Quizzes as a Study Aid

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Lecturing is the traditional way that students are taught at universities. The format affords an individual teacher the ability to address a large number of people and thus reduces the number of persons required to teach a large course. The effectiveness of the traditional lecture is widely contested however: Bligh (1998) outlines a number of problems with lectures and then goes on to argue that if lectures are not replaced outright they must be combined with other methods of teaching; Gibbs (1981) presents 20 reasons for why lecturing is, in his own words, "terrible"; and Mazur (2009) has shown that despite good evaluations, final exam performance suggest that lectures do not promote the desired learning outcomes.

This paper describes lecture review quizzes, introduced in an effort to address some of the problems with lectures, in particular trying to provide students with an opportunity to re-engage with the material after class. The quizzes were introduced into the 2010/2011 Datanet (Computer Networking) course at the University of Copenhagen, along with a large change in the compulsory assignments, described briefly in the background section. After providing background, the paper will focus on the on-line, multiple-choice lecture review quizzes and address the question: are online lecture review quizzes an effective way of making students re-engage with the lecture material?

2.1 Background on the Course

The computer networking course (Datanet) is a compulsory second year undergraduate course at the Computer Science Department at the University of Copenhagen. It has run largely unchanged for a number of years based on various editions of the book Computer Networking — A Top-Down Approach by Kurose and Ross. The course uses the lecturing material accompanying the book as well as the provided problem sets for the exercise classes. Assignments mainly test the practical aspects of the course (network and distributed programming) and the two hour written exam addresses the more theoretical aspects.

The author took over the course in the 2009/2010 academic year and delivered the course in Danish, but all teaching materials were in English: the textbook, auxiliary reading materials, slides, problem sets, and assignments. The exam was provided in both Danish and English (with identical questions) and the students were able to choose to answer the entire exam in either Danish or English.

The course in 2009/2010 resembled that of previous years (before the author took over the course). However, some material (mainly that on routing algorithms and wireless networks) was replaced with a section on distributed systems (which is not covered by the textbook). The distributed systems portion of the course replaces the distributed systems course that was previously offered at the Computer Science Department. The additional material lead to a change in the assignments such that two out of the total of four assignments were reworked to relate to the distributed systems part of the course (which is not covered in the exam).

The 2010/2011 academic year saw two major changes: the two distributed systems assignments were changed substantially; and lecture review quizzes were introduced (the main topic of this paper). Both changes were introduced in the planning stage of the 2010/2011 Datanet course, before the author started on the university didactics course. During the university didactics course a number of smaller self-contained changes were applied, mostly in the context of a number of specific lectures. These small experiments will not be discussed further in this paper.

The distributed systems assignments from the 2009/2010 course had students build clients for a trivial distributed system, which they tested by running three instances of their clients on their own computer. This simplistic approach runs contrary to a real distributed system, i.e., a system that consists of many interconnected clients running on a potentially large

number of different physical computers.[1] Limiting the interactions that a student's work must have with the outside world omits a large, and important, part of the learning experience surrounding distributed systems. This apparent deficiency, and the authors interest in constructionism[2] as described and eloquently applied in Resnick's *Turtles, Termites, and Traffic Jams* (1997) motivated a complete overhaul of the distributed system assignments.

Inspired by the authors previous work in creating constructionist assignments and learning experiences (e.g. *Patterns for programming in parallel, pedagogically* (2008)), the assignments were changed so that students had to build a client for an almost real[3] system: a distributed anonymising web-proxy, a somewhat simplified version of the Tor[4] system. In the new assignments each student's client must be able to interact not only with itself, but also all the clients written by all the other students on the course. The students must deal with real issues, such as incorrectly implemented clients and network disconnections, and document these and possible solutions in their assignment reports. The goal of redesigning these assignments were to make them more constructive i.e., making the assignment more meaningful and, at least potentially, useful to the student. While at times the unsanitised environment in which students had to build their work was clearly frustrating, the assignment reports suggests that students have experienced and managed much more authentic distributed systems problems than in the previous year.

2.2 Lecture Review Quizzes

The second change in the 2010/2011 course was the addition of lecture review quizzes. These on-line quizzes follow up on the material presented in lectures. The quizzes were voluntary and the intention was that they form part of the formative (self) assessment of the students. Currently the students obtain formative assessment by going to the exercise classes and in

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[1] Skype, BitTorrent, and World of Warcraft are examples of contemporary distributed systems.

[2] Papert's constructionism builds on the ideas of Piaget's constructivism.

[3] The assignment can be seen at the following URL:
http://christian.lyderjacobsen.org/portfolio/datanettracker/

[4] The Tor onion routing project: https://www.torproject.org/

the form of the marked assignments (which in general provide a consider-able amount of feedback, though the actual amount does of course vary depending the person grading a particular assignment). Along with the exam the compulsory assignments form the summative assessment for the course.

The primary motivator for creating the quizzes was to provide a quick way for students to re-engage with the lecture material after the lecture has finished. The aim was to increase knowledge retention after the lecture, but without using the quiz during the actual lecture. Biggs & Tang (2007) briefly discuss the positive effect of actively engaging in the material at the end of and/or after the lecture.

As the quizzes are online and strictly multiple choice they can be assessed automatically and feedback about correct and incorrect answers can be provided instantly to the student. Student can use this assisted self-assessment in order receive reasonably objective feedback about their understanding of the covered material. This supplements the chapter review questions in the textbook (which does not provide model answers) and the exercise classes which also covers lecture review questions, though more selectively. The intention of providing the quizzes was that the students should do the quiz shortly after the lecture in order to help them identify focus areas that they need to review.

Initially the quizzes were made available for a limited amount of time in order to encourage students to take the quiz shortly after the lecture. The idea was that they would then be put online again close to the exam where they would be available as a tool for exam preparation. However after some discussion with students and instructors on the course it was decided, when the third quiz was published, that the quizzes would be available throughout the course with students able to take the quizzes as many times as they wished.

The quizzes ran for the first seven lectures, covering the core parts of the networking course. The distributed systems topics, as well as the security and cryptography sections were not covered by the lecture review quizzes. Covering the later parts of the course were, mainly due to time constraints, not planned for the 2010/2011 course.

The quizzes did, in general, not attempt to provide concept questions as those used prominently in, for example, Mazur's teaching (2009) but instead provide a larger set of small multiple choice questions related to the material in a specific lecture. Concept questions are also used in a significantly different setting: Mazur has changed the format of the lecture to be guided by asking multiple choice concept questions and letting students dis-

cuss their answers amongst themselves in order to improve understanding. This is in contrast with the lecture review quizzes presented in this paper, which are used in the students own time, after the lecture has completed.

2.3 Examining the Students Use of the Quizzes

In order to provide for their intended use, the quizzes would ideally have been put on-line and made automatically available at the end of each lecture. This of course relies on the quizzes having been prepared well in advance of each lecture. While a large amount of the work in preparing the quizzes was completed before the course started, the workload during the course unfortunately meant that some quizzes were severely delayed in relation to the lecture which they covered. Figure 2.1 shows that for the majority of the quizzes the delay was either zero or just over a week. It is clear however that the quizzes for Lecture 5 and Lecture 6 presented significant problems. The delays in publishing these two quizzes where due to the large amount of work required in preparing the infrastructure for the new distributed systems assignment discussed earlier.

Quiz name	Delay (in days)
Lecture 1	0
Lecture 2	0
Lecture 3	4
Lecture 3/4 DNS	8
Lecture 4	8
Lecture 5	39
Lecture 6	36
Lecture 7	0

Fig. 2.1. Delay between lecture and publishing of a quiz (in days).

Even if students had wanted to use the quizzes as intended (as a review tool shortly after the lecture) this would at times have been impossible. Looking at the data collected from the quizzes, it can be seen that students did in fact start out by taking the quizzes very close to the lecture, but this practice quickly faltered.

Figure 2.2 shows the distribution of students taking a particular quiz on a particular day. The charts show the number of of times the quiz was taken

on a particular day (a dark grey bar), the days the quiz was available (the non-greyed out area), and the date of the lecture to which the quiz relates (the black line). The dark grey bars represent the number of times the quiz was taken on a given day and not the number of students taking the quiz, as a student is able to take the quiz as many times as he or she desires.

The first day on the chart represents the first lecture of the course and the last day represents the exam. The date labels on the chart are one week apart, except for the last date, the date of the exam. One student used the quizzes before the resits for the course, but this has not been included in the charts. While the quizzes are not anonymous, the exam is, and it is therefore not possible to correlate the results or use of a quiz, with a final exam score.

While the number of students taking the quizzes as a lecture review exercise is not encouraging, the number of students using it for exam review are significantly higher. The number of students using each quiz in the week before the exam lies between 20–24. This represents just under half of the students who actually took the exam (52). The number of students taking each quiz can be seen in Figure 2.3.

2.4 Evaluations

A further source of information about the use of the quizzes are the compulsory anonymous course evaluations that must be provided to students at the end of a course (but before the exam). Unfortunately the online teaching environment on which these evaluations are distributed was suffering from severe performance problems around the time of the evaluations, resulting in the course receiving feedback from only 10 out of the 52 students who completed the exam. With so few respondents it is hard to say how representative the answers are of the whole student body, though there are perhaps still some interesting observations that can be made from the data:

- Very few students answered positively to using the quizzes as lecture review, corroborating the data in Figure 2.2.
- No student answered positively to whether the on-line lecture review quizzes to helped supplement the books lecture review questions. This may suggest that the students do not use the books own review questions. A future questionnaire could explore the methods students use the review the material covered in lectures, if any.
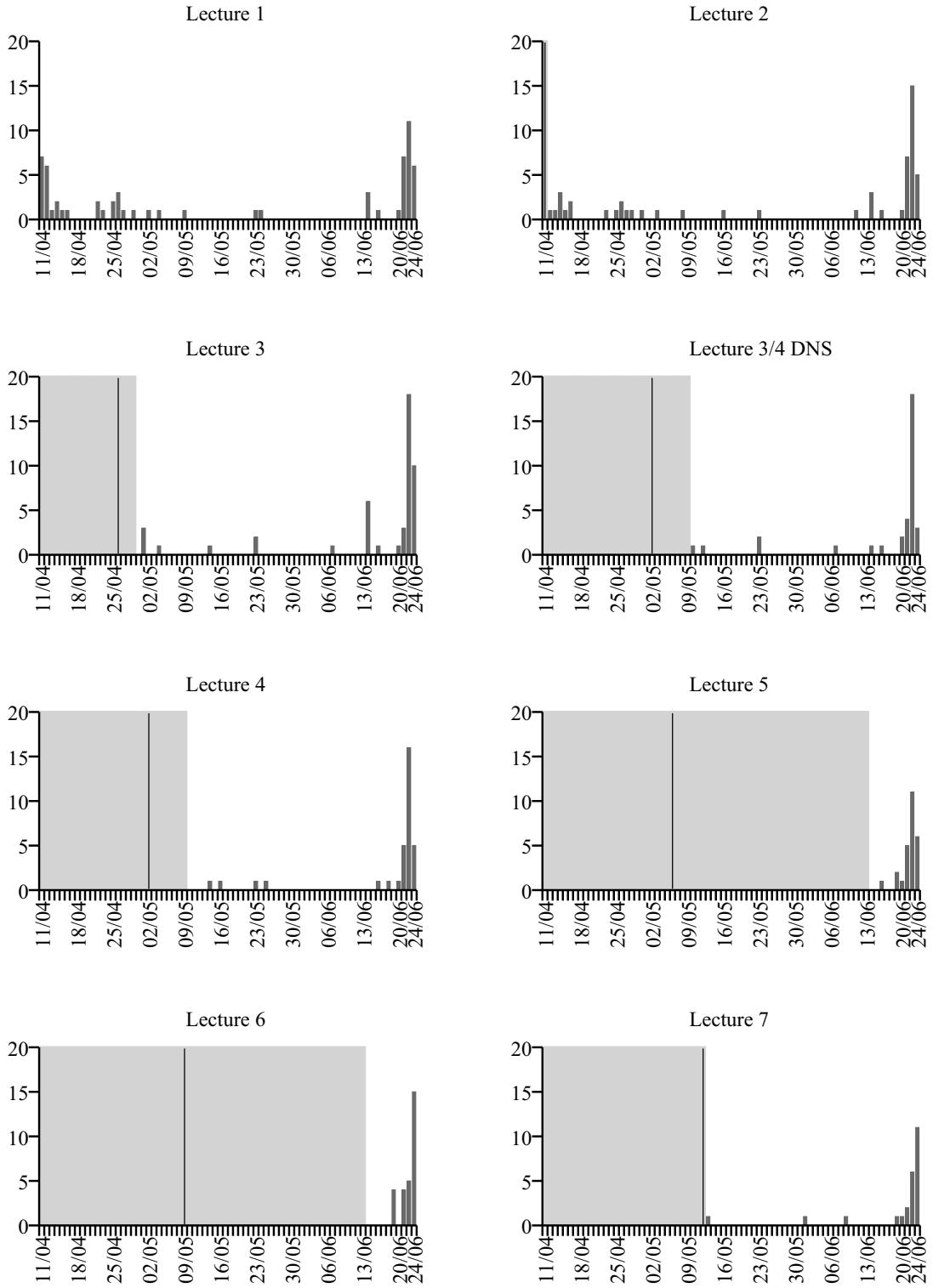
Fig. 2.2. Distribution of quizzes taken per day.

Quiz name	Students		Quiz name	Students	
Lecture 1	51		Lecture 4	28	
First week		18	First week		2
Last week		20	Last week		23
Lecture 2	39		Lecture 5	26	
First week		8	First week		4
Last week		20	Last week		24
Lecture 3	30		Lecture 6	23	
First week		3	First week		2
Last week		21	Last week		22
Lecture 3/4 DNS	27		Lecture 7	24	
First week		2	First week		1
Last week		21	Last week		21

Fig. 2.3. Number of students taking each quiz.

2.5 Discussion

Biggs & Tang (2007) provide a short but vicious assessment of multiple choice as a method of assessment. Indeed there are a number of problems with the format, some of which will be addressed in this section. There are however also positive aspects of the multiple choice question format, some of which have already been covered indirectly (such as automatic correction) and others will be alluded to in this section. While Biggs and Tang do not have many sympathetic words to offer multiple choice questions they do finish the section by writing positively about Mazur's use of concept questions in lectures and state that "[multiple choice questions] can be useful as a minor supplement to other forms of assessment and for quick quizzes".

The way they multiple choice questions are being used in the Datanet course is exactly that, as a minor supplement and is it is not used as a form of assessment at all. The fact that the quiz is voluntary and the result of the quiz does not count towards the final grade may well alleviate the problem of trying to game the quiz in order to achieve a higher score, which Biggs and Tang identify as a common problem. It is unfortunately, in the system used to deliver the quizzes, impossible to avoid a final score being displayed to the student. This could perhaps present a danger that a student will focus overly much on the score rather than on exploring the reasons behind wrong answers or questions they might have been unsure about.

A more pressing problem, given that the quizzes stated purpose is: lecture review and exam revision, is whether students might narrow their focus in revision, to cover only specific areas included in the quiz. Since the quizzes' questions have been made by the lecturer, a student might guess, most probably incorrectly, that the set of questions in the quizzes represent a strong suggestion as to what will be on the actual exam. One way to avoid this problem is to ensure that the questions are aligned to the intended learning outcomes of the course. This is one area where the quizzes used in the Datanet course could probably be improved, as they are perhaps currently aligned more towards the contents of the lectures as opposed to the intended learning outcomes of the course. This leads to the quizzes covering a large number of specific subtopics related to the lecture.

A student might also think that doing the quizzes is of no value since it is not likely that the questions in the quiz will be on the exam (they are, after all, already public!) This might again be alleviated by proper alignment of the quiz. A related problem is that the format of the quiz (multiple choice, marked automatically) and the format of the exam (short answers, marked by one of several teachers) are quite different. This discrepancy may lead to questioning of the usefulness of the quizzes since it can be hard to see a link between these two assessment methods. However this would be a misunderstanding of the intent of the quizzes that can hopefully be addressed by good communication, i.e., ensuring that students know that the quizzes are a tool to inform and self-asses, not a roadmap to the exam.

When using quizzes for formative assessment they should ideally not just show the student whether they answered the question correctly or incorrectly but should also provide formative feedback on why the question is correct or incorrect. Providing feedback for each question or incorrect answer would significantly increase the effort required to write the quizzes, but the effort is probably justified in making the quizzes a resource in themselves. 2003 generally argue positively for the use of multiple choice quizzes in education (specifically law) but put special weight on the importance of providing good feedback when using multiple choice in formative assessment. The author has not been able to find a satisfactory way of making the current online teaching system provide formative feedback. While it seems possible to add formative feedback, the feedback does not seem to feature prominently enough for it to be worthwhile spending time on.

Creating good formative feedback for the multiple choice questions is just one part of what makes a good multiple choice quiz. The questions themselves should be relevant to the students and aligned with the intended

learning outcomes. Best practices in creating questions and answers should also be investigated and employed. There are numerous, easily accessible, resources on the Internet that provide guidance on how to write effective multiple choice quizzes. It is also important to look at the results of the quizzes, both to guide the teaching itself but also improve the quizzes themselves. Unfortunately the online teaching system used does not provide raw access to students answers, offering instead only some rather unhelpfully presented aggregate data.

In order to use the results of the quizzes to inform teaching, it is important to ensure that students use the quizzes closer to the lecture, rather than just for exam review. One strategy employed by Leon (2002), is refocusing quizzes such that students are more likely to take them, for example as a mandatory preparation for the weekly exercise classes. This would enable the quizzes to directly influence the focus of the topics covered in an exercise class in order to address problem hot-spots identified by he quiz.

2.6 Conclusions

Perhaps by addressing some of the points discussed above the quizzes could become an effective way of making students re-engage with lecture material. However, given the data presented in this paper it is not possible to conclude whether online lecture review quizzes are an effective way of making students re-engage with the lecture material. It is possible to say that for the 2010/2011 Datanet course the lecture review quizzes were *not* successful in getting students to re-engage with the lecture material. It was instead used by a significant portion of the students in the days leading up to the exam. Whether it was successful as an aid in studying for the exam is also not clear from the data due to the small number of course evaluation responses.

Instead of providing a conclusive answer to the above question, the paper has identified a number of problems that can be addressed in a future course's use of the quizzes as well as suggestions for improvements based on relevant literature. Should the quizzes be used in a future course the author would be in a much better position to gather interesting data that might help answer the posed question as well as pose new and more interesting questions.

However, if engagement with the material in order to promote knowledge retention is the goal, it is perhaps important to look at alternative

approaches, or at least not rely solely on the lecture review quizzes. While the quizzes may be able provide a useful resource to some students, the effort in making them may outweigh their benefits. Using or supplementing with other methods, such as Mazur's concept questions (Mazur 2009) or the inquiry-based approach taken by King (1992) which also promotes better knowledge retention (King 1995), may ultimately be more beneficial for the students.

3

Constructive alignment i det teoretisk praktiske kursus "Klinik og patologi – Almen klinisk praksis store husdyr"

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Introduktion

Kurset *Klinik og patologi – Almen klinisk praksis store husdyr* er et kombineret praktisk og teoretisk kursus. Kurset stiller krav til de studerende om at kombinere og anvende den viden, de har lært i forudsætningsfagene (anatomi, fysiologi, patologi, bakteriologi, virologi, parasitologi, farmakologi og hele deres teoretiske sygdomslære), samt hvad de har lært på de praktiske øvelser knyttet til klinisk undersøgelsesmetodik og kirurgisk teknik. Kurset er delt op med moduler på henholdsvis mindre husdyr og store husdyr. Stordyrsdelen er igen delt op i heste og produktionsdyr, der igen er opdelt i enkeltdyrsniveau og besætningsniveau. Dette projekt omhandler udelukkende undervisning i produktionsdyr på enkeltdyrsniveau.

På nuværende tidspunkt er der to gennemgående undervisere i 10 dage, hvilket giver mulighed for at planlægge nogle pædagogiske forløb, hvor undervisningsaktiviteter kan tilpasses læringsmålene for kurset.

Målsætningen for kurset er formuleret ud fra de "*day one competences*", man skal have som dyrlæge i klinisk praksis (Appendix A). Det vil sige, at der prioriteres at give de studerende både teoretiske og praktiske redskaber, der gør dem i stand til fysisk og akademisk at håndtere arbejdet i praksis og forbereder dem på, hvordan de kan kommunikere omkring patienter samt selv at videreudvikle deres kompetencer.

Den afsluttende evaluering af de studerende foregår ved en multiple choice-eksamen, hvor de bedømmes med bestået ikke-bestået ved minimum 13 rigtige svar ud af 20 spørgsmål. Multiple choice-spørgsmål understøtter overfladisk læring, og det er muligt at teste evnen til at huske/lære

udenad, genkende og identificere (Biggs & Tang 2007). Denne eksamensform tester ikke de studerendes evne til at anvende kliniske redskaber (hænder, øjne, ører, stetoskop, etc.). Studerendes evne til at se sammenhænge, analysere, argumentere, forklare og kombinere viden fra forudsætningsfagene og deres evne til at kommunikere omkring patienter og forløb bliver heller ikke testet. Tidligere har evaluering af dette kursus været en individuel praktisk mundtlig eksamen, men dette er der ikke længere resurser til på grund af meroptaget af veterinærstuderende og ændringer i studieordninger med mere. Den nye eksamensform har medført, at der ikke længere er "constructive alignment" (CA) (Biggs & Tang 2007) i dette kursus.

CA er en betegnelse for sammenhæng mellem læringsmål, undervisningsaktivitet og evaluering/eksamen. Kort sagt, at der er en plan med, hvad studerende skal have lært på kurset (læringsmål), at undervisningen tilrettelægges, så de studerende lærer det, der er planlagt (undervisningsaktiviteter) og til sidst en evaluering eller eksamen der tester de studerende i det, de har lært og som det var planen, de skulle lære, altså læringsmålene.

Formålet med dette projekt – eksperiment i undervisningen – er at forsøge at få constructive alignment i den del af Klinik og patologi, Almen klinisk praksis store husdyr – 300029, der omhandler produktionsdyr, enkeltdyr inden for den givne undervisnings- og forberedelsestid.

Rammerne for projektet er blok 1 og 2 2011/2012 med fire hold af ca. 20 studerende med Nynne Capion, som den ene af to undervisere samtlige dage og samtlige hold. Ændringerne i kurset vurderes ud fra skriftlig og mundtlig evaluering af kurset, samt underviseres vurdering af tidsforbrug (underviser og studerende) og studerendes deltagelse.

Beskrivelse af de væsentligste ændringer i kurset

Kurset er planlagt så de studerende arbejder i hold på cirka fire personer. Den første dag indledes med en fælles introduktion til hospitalsfaciliteter, regler og procedure på hospitalet. Indlagte patienter fordeles ud til holdene, der herefter arbejder selvstændigt med diagnostik og behandling af patienterne. Eftermiddage bruges på seminarer, hvis formål er at formidle teoretisk viden om sygdomme hos produktionsdyr på en mere uddybende og klinisk relevant måde end til forelæsningerne på det teoretiske kursus.

Efter at have brugt denne opbygning af kurset i flere år er det min erfaring, at de studerende ikke når læringsmålene. Eftermiddagsseminarer er

UGE 1	Mandag	Tirsdag	Onsdag	Torsdag	Fredag
Formiddag	Intro	Hold A Kvægoperation Hold B Patienter i klinikken samt køer i klovboks	Hold B Kvægoperation Hold A Patienter i klinikken samt køer i klovboks	Patienter	Patienter
Eftermiddag	Teori om kvægoperation Toggle pin VSLD Haleamputation Patteamputation Skydning	Hold A Kvægoperation Hold B Opgaver om klovlidelser	Hold B Kvægoperation Hold A Opgaver om klovlidelser	Patologi	Seminar: Diarre og væsketerapi Gennemgang af cases

UGE 2	Mandag	Tirsdag	Onsdag	Torsdag	Fredag
Formiddag	Patienter	Grantoftegård Tema om får	Patienter	Patienter	Gjorslev Gods Afhorning og luftveje
Eftermiddag	Seminar: Respirationsvejs-Lidelser Gennemgang af cases	Seminar: Små drøvtyggere	Seminar: Gjorslev Gods -analgesi -afhorning -lovgivning	Daglig status	Gjorslev Gods Afhorning og luftveje

Figur 3.1. Ugeplaner for undervisning som det så ud før adjunktpædagogikum projekt i KNUD

passiv indlæring (McManus 2001, Herskin 2004), hvor underviseren forelæser om et emne. For undervisere er dette en meget nem måde at bruge undervisningstiden, da forberedelsestiden er kort. De studerende er også tilfredse med denne undervisningsform, da de føler, de lærer meget, og deres egen indsats er relativt lille. Problemet med denne type undervisning er, at det entydigt bliver underviserens ansvar, at de studerende lærer noget. Derudover teoretiseres der over sygdomme, det bliver nærmest repetition fra tidligere fag. Det bliver ikke håndgribeligt for de studerende, og den praktiske del har de svært ved at få integreret. Eksempelvis "Hvordan vil du auskultere en kalv med bronchopnemoni og consollidation i de cranioventrale dele af lungerne?" og "Hvordan vil du vurdere denne kos hydreringsgrad?". Det bliver meget nemmere at lære, når der direkte følger demonstration med.

Derudover er der en tendens til, at de studerede går hjem efter disse seminarer eller forelæsninger og derfor ikke bruger tiden i klinikken til at arbejde selvstændigt med patienterne og med undersøgelsesteknikker.

Læringsmålene for dette kursus kunne omformuleres helt kort: Efter endt kursus skal den studerende på 30 minutters kunne udføre en klinisk

	Mandag	Tirsdag	Onsdag	Torsdag	Fredag
Struktur		Hold A Operation Hold B Klinik	Hold B Operation Hold A Klinik		
8.30-9.00	Introduktion	Daglig status	Daglig status	Daglig status	Daglig status
9.00-11.00	Fordeling af patienter	Behandling Diagnostik	Behandling Diagnostik	Behandling Diagnostik	Behandling Diagnostik
11.00-14.30	Daglig status Behandling	Undervisning *Gennemgang klovlidelser*	Undervisning *Gennemgang klovlidelser*	Undervisning *Prøve-prøve Hold 1 gennemgår klinisk undersøgelse*	Undervisning *Hold 2 gennemgår GI lidelser hos kalve*
14.30-16.00	Diagnostik Forberedelse	Diagnostik Forberedelse	Diagnostik Forberedelse		Diagnostik Forberedelse

UGE 2	Mandag	Tirsdag	Onsdag	Torsdag	Fredag
Struktur		FÅR (10-13)			GJORSLEV
8.30-9.00	Daglig status	Daglig status	Daglig status	Daglig status	Afhorning
9.00-11.00	Behandling Diagnostik	Behandling Diagnostik Grantoftegaard	Behandling Diagnostik	Behandling Diagnostik	Afhorning
11.00-14.30	Undervisning *Hold 3 gennemgår luftvejslidelser hos kalve*	Undervisning *Fælles opsamling på klinisk us af får*	Undervisning *Hold 4 gennemgår GI lidelser hos kvæg*	Undervisning *Prøve Hold 5 gennemgår mastitis*	14.00 malkning
14.30-16.00	Diagnostik Forberedelse	Diagnostik Forberedelse	Diagnostik Forberedelse		

Figur 3.2. Undervisningsforløb med undervisningsaktiviteter og evaluering som det så ud under adjunktpædagogikum projekt i KNUD

undersøgelse, opstille en tentativ diagnose, opstille en plan for terapi og eventuelt videre diagnostisk udredning og informere ejeren om prognose og eventuel profylakse i besætningen.

Indeholdt i dette læringsmål ligger, at de studerende skal kunne alle relevante kliniske undersøgelsesprincipper, de skal kunne anvende de mest gængse parakliniske tests, og de skal have et stort kendskab til lidelser, der rammer produktionsdyr og til mulige terapeutiske og profylaktiske tiltag. Det vil sige alle deres forudsætningsfag.

Undervisningsaktiviteter i projektet

De studerende arbejder stadig i hold på cirka fire personer. Jeg oplever, at gruppearbejdet giver en tryghed, som de studerende kan have brug for, og det skaber er fagligt miljø, der er givende i denne indlæringsproces.

I planlægningen af undervisningsaktiviteter har det været vigtigt for mig at finde måder, hvorpå jeg kunne motivere de studerende til selv at tage ansvar for deres patienter og opleve, at deres mening og beslutning var

betydningsfuld (at give dem tillid til at tro på at de godt kan blive dyrlæger). Det har mundet ud i aktiviteten STUEGANG (9.00-9.30), hvor hvert hold studerende laver en plan for deres patienter med baggrund i deres fund fra den kliniske undersøgelse (daglig status), som de skal argumentere for, og som derefter bliver besluttet sammen med underviser.

En anden undervisningsaktivitet er de sygdomsfremlæggelser eller gennemgange, der har erstattet eftermiddagsseminarerne (se Fig. 3.1). Her får hvert hold et emne og et paradigme, som de skal gennemgå med udgangspunkt i en patient i stalden. Fremlæggelsen foregår ved patienten i stalden. Det fremlæggende hold skal kort demonstrere og beskrive for deres medstuderende, hvordan man klinisk, paraklinisk, terapeutisk, prognostisk og profylaktisk håndterer netop denne patient type.

Derudover er der følgende løbende undervisningsaktiviteter:

- Journalisering: skriftlig kommunikation af klinisk fund.
- Undersøgelsesteknik og metodik: Øvelse i inspektion, palpation, perkussion, auskultation etc.
- Instruktion, demonstration og øvelse i terapeutiske principper: I forbindelse med diagnostik og terapi vil de studerende varetage hovedparten af indgrebene, der foretages på dyrene.

Forberedelse/selvstudie

Dette har hele tiden været en del af kurset, og denne del har jeg bibeholdt i forbindelse med mit projekt. Jeg har forsøgt at gøre det meget tydeligt for de studerende, hvad selvstudie tiden skal bruges til. Der har været en tendens til, at de studerende tog hjem for at læse, da de følte sig meget pressede over alle de (teoretiske) ting, de ikke kunne huske og alle de andre eksaminer, de skulle forberede sig til.

Ved at give de studerende mere konkrete opgaver (fremlæggelser, journalisering og praktiske øvelser) udnytter de fleste nu tiden sammen med deres patienter i klinikken og bruger reelt tiden til at forberede sig og til at forbedre sig.

Evaluering/eksamen

Alle aktiviteter, der foregår i undervisningstiden (11.00-14.30), bliver evalueret og munder ud i en karakter. Problemorienteret klinisk journal (daglig status) afleveres for hver patient hver dag senest kl. 14.30 og underviser

evaluerer, giver kommentarer og karakter. De studerende opfordres til at spørge, hvis de er i tvivl om kommentarer til deres journaler. Derudover får de mundtlig feedback på alvorlige fejl eller mangler i deres arbejde. På denne måde kan vi evaluere gruppen, men ikke individet.

Hver torsdag i løbet af undervisningstiden vil de studerende få en "prøve": 30 min. til individuel problemorienteret journal, der bedømmes med karakter og individuel mundtlig feedback. Den første prøve fungerer som en øjenåbner, da de studerende bliver forbløffende over, hvor hurtigt 30 minutter går. I uge 2 fungerer prøven som den endelige vurdering af den enkelte studerende og bedømmelsen af denne prøve sammenholdes med det generelle indtryk, den enkelte har gjort i den samlede periode. Det er denne evaluering, der som mit udgangspunkt, skal kunne erstatte den nuværende multiple choice eksamen.

Vurdering af ændringer

Skriftlig evaluering

De skriftlige evalueringer har været svære at bruge til vurdering af effekten af ændringer, da evalueringsmetoden ændrede sig i samme periode fra at være specifik for hver del af kurset og for hver underviser (2 uger) til at være en samlet evaluering af hele kurset og alle undervisere (8 uger).

Derudover er der kun en mindre del henholdsvis 47% og 40% af de studerende, der evaluerer, hvilket ikke nødvendigvis vil give et "retvisende" billede. Det vil typisk være de to poler, de meget tilfredse og de meget utilfredse, der evaluerer.

Det fremgår dog af den skriftlige evaluering fra blok 1 (efter mit projekt), at de studerende, der har evalueret er tilfredse, måske ligefrem begejstrede for de nye tiltag (karakterer, feedback og prøve-prøve) der er blevet afprøvet på kurset. De giver også udtryk for, at de og deres arbejde bliver taget alvorligt, når undervisere giver sig tid til at give dem feedback på deres skriftlige og mundtlige præstation (Appendix B).

Mundtlig evaluering

Den mundtlige evaluering er foretaget løbende igennem undervisningstiden, hvor der er blevet fulgt op på, hvordan de enkelte undervisningsaktiviteter opleves. De studerende udtrykker oplevelsen af et rigtig godt og

veltilrettelagt kursus. De kan rigtig godt lide strukturen, og at der er en struktur. De har oplevet tidligere klinik undervisning som ustruktureret og lidt tilfældig afhængig af patient materiale og undervisere. De giver udtryk, for at de får meget ud af de individuelle prøver, og de ville gerne have flere af dem. De føler sig meget mere motiverede til at læse op på det faglige stof, fordi de får karakterer. De er også meget motiverede af at få så meget ansvar for patienterne og for at få lov til at arbejde selvstændigt.

Undervisers vurdering af egen og studerendes indsats

Min vurdering er, at generelt har de studerende været glade for den feedback, de har fået både holdvis og individuelt, på deres problemorienterede journaler og på deres mundtlige oplæg. Det er blevet meget tydeligt for dem, hvor de kan forbedre sig. Det har givet dem en større forståelse for, hvad de skal lære eller sagt på en anden måde, hvordan de når læringsmålene igennem undervisningsaktiviteterne. Skellet mellem den praktiske del og den teoretiske/akademiske del af kurset er blevet mindre, og de enkelte elementer er blevet bedre integreret. Det har været overraskende så motiverede, de studerende blev af at få karakterer, især da de første karakterer var lave. Alle karakterer blev fulgt op af konkrete forslag til forbedringer. Strukturen motiverede dem også til at blive om eftermiddagen og arbejde selvstændigt med deres patienter og dermed udnytte undervisningstiden optimalt.

Det har enkelte gange været nødvendigt at prioritere mellem undervisning og behandling af akutte patienter. I prioriteringen har indgået overvejelser omkring, hvor den undervisningsmæssige værdi har været størst.

Min egen store udfordring har været ikke at bruge for lang tid på forberedelse, evalueringer, karaktergivning og feedback. Jeg har forsøgt at holde alle mine opgaver i forbindelse med projektet inden for arbejdstiden, og den første uge undtaget, er dette også lykkedes. Jeg har oplevet, at det er blevet hurtigere at "rette" opgaver og nemmere at vurdere karakteren. Som et lille sideprojekt har jeg bedt mine medundervisere om også at give karakterer, og vores vurderinger er meget ens. Derudover er denne måde at undervise og evaluere mere tilfredsstillende for mig som underviser.

Jeg håber meget, at dette kan betyde, at denne form for undervisning og evaluering kan erstatte den nuværende multiple choice-eksamen, så vi reelt kan vurdere de studerende som praktiske teoretikere i forhold til læringsmålene.

Konklusion

Den overordnede konklusion på projektet er, at det er muligt at skabe constructive alignment på kursus 300029, produktionsdyr enkeltdyr. Det er muligt at evaluere de studerende individuelt efter det skitserede undervisningsforløb.

De studerende er mere motiverede, målt i den tid de bruger på kurset både tilstedeværelse i klinikken og forberedelse derhjemme. De studerende giver samtidig udtryk for, at de er meget tilfredse med undervisnings- og evalueringsformen.

Derudover kan det konkluderes, at implementering af nye undervisningsaktiviteter tager længere tid i starten, men efter en opstartsfase kan alle aktiviteter inklusive evaluering/eksamen afholdes inden for undervisningstiden.

A Kursusbeskrivelse 300029

Uddrag af studiehåndbogen: Klinik og patologi - Almen klinisk praksis store husdyr - 300029 Kursusbeskrivelse 2010/2011

Kursusindhold:

Med relation til danske forhold vil kurset give ovennævnte forudsætninger vedrørende praktisk diagnostik, behandling, forebyggelse og rådgivning indenfor medicinske infektions- og organsygdomme, samt mindre kirurgiske indgreb. Den studerende skal under supervision indøve diagnostik, behandling og forebyggelse af sygdomme som forekommer i danske produktionsdyrs- og hestebesætninger. Med udgangspunkt i det levende dyr skal den studerende under supervision indøve diagnostik af de almindeligst forekommende sygdomme hos hest, kvæg, små drøvtyggere og svin og anvende deres viden om sygdommenes opståen, symptomer, behandling og forebyggelse. Den studerende skal efter endt kursus kunne forstå basale diagnostiske og terapeutiske principper til løsning af sygdomsproblemer i stordyrspraksis, herunder kvantitative metoder til besætningsdiagnostik, og udmønte en etisk og dyreværnsmæssig ansvarlig holdning overfor husdyr, klienter og forbrugere. Undervisningen skal bibringe den studerende principper for de kliniske kompetencer, der er nødvendige for at kunne arbejde i klinisk hestepraksis, kvægpraksis, svinepraksis og praksis med små drøvtyggere. Kursus skal stimulere den studerende til selvstændig opsøgning af klinisk praktik selvstudium og problemløsning med henblik på livslang efteruddannelse og specialisering.

Læringsmål (målbeskrivelse) for 300029:

Dette kursus skal give den studerende mulighed for at integrere tidligere kursers teoretiske viden og praktiske færdigheder i superviserede kliniske situationer under hospitals- og praksisforhold. Kurser danner basis for, at den studerende som færdig dyrlæge er i stand til, på ansvarlig vis, at opnår kompetencer, som er nødvendige for at arbejde selvstændigt i kliniske praksis. Når kurset er færdigt forventes den studerende at kunne:

Viden:

- Beskrive sygdomme, diagnoser, terapi og profylakse med klinisk fags-prog - Identificere årsager til almindeligt forekommende medicinske og kirurgiske sygdomme hos store husdyr på individ- og flokniveau.
- Reflektere over sygdommenes risikogrupper, risikofaktorer samt fore-byggende foranstaltninger. - Have overblik over diagnostik og håndtering af ondartede smitsomme sygdomme og zoonoser.
- Reflektere over håndteringen af usikkerhed ved diagnostik og progno-ser. - Reflektere over arbejdet som besætningsdyrlæge (jf. Bekendtgørelser om disse funktioner).

Færdigheder:

- Anvende kliniske og para-kliniske responsparametre i diagnostisk ar-bejde
- Diagnosticere relevante medicinske og kirurgiske sygdomme hos store husdyr på individ- og flokniveau på baggrund af regelret gennemførte kliniske undersøgelser.
- Forklare årsager til almindeligt forekommende medicinske og kirurgi-ske sygdomme hos store husdyr på individ- og flokniveau.
- Anvende almindelige terapeutiske principper.

Kompetencer:

- Tage ansvar for undersøgelse, diagnostik og behandling af anden mands dyr.
- Bedømme velfærds- og fødevaresikkerhedsproblemer i dyrehold.
- Bedømme etiske aspekter ved veterinære indgreb og evt. fravalg af dis-se.
- Selvstændig opsøgning af klinisk praktisk selvstudium og problemløsning med henblik på livslang efteruddannelse og specialisering.

B Studenterevaluering blok 4 2010/2011(før) og blok 1 2011/2012 (efter)

Uddrag af skriftlig evaluering af kurset.

"Kvægdelen var virkelig god! det var positivt at man kunne få lov til at lave tests så man i sidste ende selv kunne sætte diagnosen."

"Godt man skal aflevere nogle ting som man får feedback på. Prøve-prøve er en rigtig god ting! Dejligt at man har et reelt ansvar overfor patienter og at man ikke hele tiden bliver kigget over skulderen, det gør SÅ meget for ens selvtillid og for ens indsats når man ved man selv er 'ene ansvarlig' for patienterne."

"Jeg vil give ros for Nynnes undervisning og hendes nye idé med evaluering af daglig status + fremlaeggelser:)"

"Jeg er ikke meget begejstret over multiple choice eksamen. Nynnes forslag lyder, i mine ører, meget bedre".

"Nu har vi selvfølgelig ikke været til eksamen endnu, men fornemmelsen er at denne eksamensform ikke helt afspejler kursusbeskrivelsens formål med kurset. Jeg synes det ville afspejle undervisningsformen bedre hvis eksamen bestod af evaluering i klinikken, evt. med prøver, som vi har haft det oppe i produktionsdyrstalden ved Nynne. Det ville afspejle vores kliniske færdigheder bedre."

"Grundlæggende er det store problem, at eksamen slet ikke svarer til kurset. Det var simpelthen ikke muligt for mig at koncentrere mig om mine enkeltdyr, når jeg vidste at jeg skulle hjem og læse på pensum til en skriftlig eksamen. Hvis det var løbende evalueringer, så jeg kunne fordybe mig og lære om det emnet nu engang var den pågældende dag. Denne form for eksamen dur simpelthen ikke til et klinisk fag. Derudover føles det til grin, at skulle til en eksamen der i så høj grad ligner en man allerede har taget og bestået. Det mener jeg absolut skal ændres."

"Det var så godt at få ansvaret for en patient og være den der skal gennemtænke en behandling, forløb osv. af patienterne. Det fungerede også godt at vi havde ting vi skulle aflevere, det tvinger en til at arbejde aktivt med tingene og få det tænkt igennem."

"Det var super godt med en lille eksamen i form af 30 min. til at udføre en klinisk journal! meget gerne flere af dem og det er meget mere relevant som eksamen end den skriftlige der er nu."

"Det har været enormt spændende at prøve at få noget rigtigt ansvar for sine patienter. Rigtig godt med tests og evalueringer af ens daglige status."

"De små 'eksamener' vi fik med 30 minutter til en patient fungerede rigtig godt, det var meget relevant, og man lærte rigtig meget af det!"

"Utroligt lærerigt med fuldt patientansvar, man får virkeligt afprøvet grænserne for hvad man kan. Selvom det virkeligt går lige til grænsen for hvad

man rent faktisk kan nå virker det som en god ide med evaluering af journaler der afleveres hver dag og 'prøven' hver torsdag er god til at se hvordan man har rykket sig."

"Den fælles stuegang, især på kvægdelen, har været god. her har man fået udbytte af de patienter man ikke selv har haft, samt haft mulighed for at diskutere hvorfor vi gør som vi gør."

"Det var godt med feedback på de journaler vi afleverede, og at vi lavede en 'prøve' hvor vores evner til at undersøge, diagnosticere mm blev testet. Det synes jeg ville være et rigtig godt alternativ til eksamen end den multiple choice der benyttes nu. Det var fedt at det var os der tog beslutningerne og ansvaret for vores patient."

"Der bør ikke være en skriftlig eksamen til et så praktisk kurus. Man får dårlig samvittighed over manglende tid til eksamenslæsning, men samtidig vil hellere bruge tid i klinikken når muligheden er der."

4

How to effectively Teach a short Course

Thomas Skov

Department of Food Science, University of Copenhagen

Setting the scene

Problem

How do I effectively teach a short course? In a short course I will probably have a more mixed audience – how do I cope with that? These two questions will be discussed here based on my experiences from teaching the same short course three times a year over the last five years. I will mainly touch upon how amendments to the short course can be justified from a didactical perspective, but also describe some didactical techniques that are also useful for longer courses. Through my experience and by participating in Adjunktpædagogikum I have realized how the use of well selected didactical techniques can improve the learning outcome significantly and here I reflect on the impact of a modified teaching style.

"In a short course don't be a stranger – make the audience feel good, be congenial and tell a few jokes"

Course description

Chemometrics is a multidisciplinary course applying mainly mathematical and statistical terms but also chemistry and biology is often needed to interpret the derived findings (course description in Appendix A). In chemometrics multivariate patterns are extracted and the methods work on data where we have measured several parameters (i.e. variables) for several samples

(i.e. objects). This could for example be to find out which sensory parameters are characteristic for apple varieties when compared to pears and vice versa. As one parameter rarely provides the whole answer (doubtful that e.g. sweetness can separate all apples from pears) the multivariate techniques are very popular within food but also pharmaceutical areas. Thus, the participants that attend the short course are mostly working with or studying food or pharmaceuticals and often the audience is quite mixed (students, engineers, laboratory technicians, managers, medical researchers as well as academic colleagues).

Short courses versus semester courses – pros and cons

A short course has a severe challenge related to the restricted time available and to compare directly with a semester course is not fair. Things that cannot be compared are everything related to the time e.g. time for reflection, time to do extra exercises, time to read up on selected topics. These will not be discussed here as short courses will always be inferior with respect to learning outcomes that develop over time. Very often the intention, the audience, the expected outcome and learning style are different in a short and a semester course but these differences can be handled and exploited.

First a few remarks to what I believe are the most important advantages and disadvantages of a short course. The advantages of short courses are plenty: 1) they are more time efficient, 2) more intense, 3) attractive for a broader and mixed audience, 4) participants are often more motivated, 5) can be profitable and 6) more fun for the teacher (and the participants). Disadvantages are: 1) too little time, 2) the deepness of the understanding will be challenged, 3) the teaching style must be adapted to fit the shorter time available, 4) the teacher must have certain skills as these cannot be acquired over time, 5) the long days can be tough for the teacher and the participants and 6) everything must be very organized (Bentley et al. 2008, Kleinbaum 1995).

In my short course I try to teach practically the same material as my colleague do in the semester chemometrics course. The challenge is what the participants need (and would like) to learn (i.e. expectations). This is often very different between the courses and the teaching style must be adapted to this. Besides the time and different backgrounds (students vs. professionals) the main differences are: 1) willingness to learn, 2) motivation, 3) awareness of what to learn ("I need a technique that can do this", "but what are the pitfalls then…" and "when do I use what" etc.). These

must be evaluated before each course which often implies that despite a very similar course material the courses must be taught in different ways.

What is required to effectively teach a short course?

Back in 1995 Birch put forward ten suggestions for effectively teaching short courses to a heterogeneous group. These are still very relevant and comprise many useful didactical elements. In the following I will discuss some of these suggestions combined with my own experiences and ideas to develop a teaching style that fits my short course. The following sections will be split into three parts; a why, a how and an outcome part where I describe the suggestions from a didactical point of view.

"Short courses are short, and there is no time for practices that do not contribute toward impact" (Moon 2004)

Structure of a short course

Why: For a short course to run smoothly – i.e. to have impact, to create a good learning atmosphere and to make sure the learning outcomes are achieved – an efficient course structure is essential!

How: My short course is split into three parts; lectures, exercises and breaks. It is the intention that lectures and exercises should take up the same amount of time. In the lectures I present new topics, provide examples and discuss elements with the participants (how this is done will be further described in the following). In the exercises the participants will use acquired skills, discuss the new topics and get familiar with how to do things on their own. The exercises are also meant as a break from the teacher's voice to sit down and 'quietly' think about (maybe reflect) what has been presented so far in the course. The exercises are always done in groups of minimum two participants which I have found to give a very good forum for discussion. The lectures and exercises contain a mix of very simple examples and more complex real-world cases that include many of the expected data types the participants deal with on a daily basis.

I also try to get to know the state of the audience (tired, motivated, stressed etc.). This allows me to be flexible with the breaks and to be able to do so only few fixed breaks are inserted in the course program. This is on purpose as I make sure several smaller breaks are placed whenever needed depending of the state of the participants (and myself). At the same time

having some fixed breaks ensures that the participants know when to have time to talk to colleagues, check their E-mail, call the company etc. and can plan the day according to this. I also use these breaks to have time to discuss a specific question put forward by a participant during a lecture and where the answer is too complex and/or irrelevant for everyone.

Outcome: Through discussing (lectures, breaks and exercises), reflecting (breaks and exercises) and testing (exercises) I believe the participants can teach themselves further based on what has been covered in the lecture. The simple examples get everyone on board but only through the real-world cases the participants will see the real advantage of chemometrics.

"Simplicity favors understanding – reality ensures understanding and applicability".

Be prepared, be organized and know your stuff

Why: Having short time makes no time for brushing up on certain topics so knowing as much as possible in advance is essential in a short course.

How: Being an experienced teacher helps me to get around the questions I get during the course and allows me to reflect on the questions almost before I answer. For a semester course the teacher can be less prepared for the very last sessions but in a short course the teacher must have prepared and deliver several lectures on the same day. How to deliver this can be a challenge as participants will get tired of listening to the same voice and teaching style for many hours. To get around this I mix up the lectures with practical and theoretical examples, include the participants and I am aware of not using the same voice level all the time. Preparing yourself for questions is a difficult job and I have realized that only through mastering the technicalities and having a large experience can make you be really prepared for a short course. This makes the teacher skills an important part of a short course; more important than in semester courses where the teacher can develop skills and experience over time.

"Being prepared and organized is mandatory and cannot be debated for a short course"

Outcome: The interactive nature of a lecture can be highly improved when the teacher is skilled and prepared and this will allow for a better discussion of also subjective (individual) concerns put forward by the participants. The main challenge with interactive lectures is that they can be more time consuming so how to fit them into a short course needs some consideration.

In a short course the material used becomes even more important

Why: With little time available what is presented must be carefully thought through and presented using material that supports the teaching strategy.

How: In the short course I prepare my slides (I will only comment on my slides in this project) so they are catchy, fun, provocative and will leave some space for an individual interpretation of a topic (examples of this can be seen Appendix B-E). The latter could be a prepared figure illustrating a certain topic (e.g. a key element) – a topic that can be explained in several ways. By not providing the answer in text I set the scene for a dialogue for what the figure illustrates. This motivates the participants and allows them to write down their own understanding of the figure established through a dialogue guided by not only the teacher but by everyone. The challenge is here to make sure all participants takes part in the dialogue and understand the figure as (several) tests are difficult to carry out in a short course due to the limited time

Outcome: Preparing slides so they are not complete force the participants to (re)think, discuss and reflect on elements derived and explained. From a didactical point of view this provides a higher impact (i.e. improved learning outcome); an impact that is impossible to get from a teacher monologue or a slide filled with (teacher decided) text! However, the teacher must be aware that incomplete slides cannot be less emphasized (or ignored) but always need full attention (and time).

Let the participants derive key elements of the course

Key concepts in the course can be explained in a monologue (by the teacher) but are far better introduced as a part of examples and cases where the participants derive the teaching goals (i.e. see, understand and discuss the ideas behind the key concepts). Cases ensure that the participants learn key elements in a short time and that they are able to build on top of the concepts very fast (which is needed in a short course).

Example I

To understand the difference between causality and indirect correlations and from this let the participants derive another key element (a latent factor – i.e. something not measured but is within data – the sun and time in Appendix B and C, respectively).

Why: Correlation is a key element in my chemometrics course. It is of utmost importance to understand the concept and know the difference between causality and indirect correlations. If the participants are not aware of the difference they might end up with wrong interpretations from otherwise sound data/models and would miss several aspects later in the course. I would like the participants themselves to come up with the reason(s) for indirect correlations. This reason (called a latent factor) is another key element that is being used throughout the course.

How: One way to get around this is by explaining the concept very well and posing a few questions. An example of a slide used for this can be seen in Appendix B. However, this rarely gives the participants enough time to think about this concept before giving the answer. Thus, the learning outcome is my idea and understanding of the concepts and not something derived and thought through by the participants (no common agreement). A better way of doing this (which I have found ideal for short courses with limited time between lectures) is to present the concept with a case with three small examples that they have to discuss in groups (see Appendix C). They will discuss the nature of the correlation (what causes this, can we trust this or is it a coincidence etc.) and will be forced to think of the reason behind indirect correlations. Afterwards we discuss this in plenum to come to a common agreement of what is behind the key concepts (the overall understanding will be aligned but individual views will still exist).

Outcome: The three examples and the discussion will ensure that the participants develop their own understanding of correlation and the concept of a latent factor. With this rather simple case I prepare them to work more independently, increase their confidence before introducing the new methods and they will be able interpret correlations and latent factors in other situations as well (see example II).

Example II

To be able to use data correctly and to be critical to the data origin (linked to what the participants learn in example I).

Why: Without being critical to the data origin and the interpretation of found correlations the participants can be lead to making false conclusions. I would like the participants to see the point in being critical to data and to what is reported from the data – two other key elements in chemometrics.

How: In example I we get to a common agreement about correlations – this is not the intention with example II. This is more a discussion of as-

pects related to data in general. I put forward two topics; be critical and use data correctly. From this I would like to take the discussion in many other directions as well; directions guided by the participants. One way to get around this issue is by presenting a humoristic case with the development in sperm cells for men (see Appendix D). I could focus on explaining why it is important to consider data before making interpretations and that being critical will ensure that data are being used correctly. However, this often turns out to be a monologue! If I on the other hand start presenting this as a case dealing with statements that are contradictory and why this is a problem; a problem we need to discuss and solve together. To make this work I have selected some relevant newspaper and internet articles, which show that milk can affect the development of cancer in both a positive direction and a negative direction (Appendix E). From this we discuss the data validity based on the already learned concepts of correlations and latent factors.

Outcome: In a short course conflicting statements are perfect didactical tools to quickly motivate the participants to start a good discussion. From this the participants obtain skills, knowledge and competences useful for discussing the validity of data on their own or with other participants and come up with arguments for what could be the reason behind conflicting statements. As the discussion is open we might also touch upon other aspects taught later in the course, which I believe is further strengthening the learning outcome.

Be flexible and have the courage and will to make changes

Why: To be able to change the way you teach according to the participants special needs/interests is crucial in a short course. The changes could be repeating key elements, using more examples from real-life, using my experience to bring more clarity of a certain topic, skipping a section if not interesting for the audience, using experiences from the audience etc.

How: To have the possibility to be flexible is to me related to being prepared, organized, and experienced but also be able to sense the atmosphere in the audience. Besides this the teacher must also have will and courage to change certain things in an otherwise very tight course agenda. To get around this, I always have some lectures that can be shortened, lengthened or even skipped. E.g. I often end a workshop with a test of the acquired skills (only for fun) and this can be made into a very simple or a more comprehensive test depending on the progress in the course and the skills of the participants. An important aspect concerning flexibility is that it must be

handled in a professional way. This means that the course must still seem very organized despite the detours. I try to solve this by explaining the detours taken (why we do it) but without debating if we should do it.

"If changes are needed during a short course don't ask for acceptance from the audience – explain why you change, then do it and trust your instinct"

Outcome: Being flexible only works if you keep in mind the overall learning goals of the course. The outcome will be increased learning, more relaxed participants and a better learning atmosphere. This leads to participants being more active and willing to get into a dialogue.

Outro and final remarks

A short course is a fast and efficient way to teach new concepts but it often requires special skills from both the participants (e.g. motivation and dedication) and the teacher (e.g. skilled and prepared) to make the course run smoothly to provide superior impact and learning outcome. In this project I have touched upon some of the teaching strategies that I have found useful for short courses from a didactical perspective. There are several other elements of a short course that can be taken into consideration (how to make it profitable, will it also work for master students, should the course material be presented before or during the course etc.) and the interested reader is referred to the given references for more information.

A

Appendix A

Basic Chemometrics – course description

Background:

Chemometrics can be used to solve problems involving large amounts of data. This is relevant within fields such as development/research, process-monitoring and control and laboratory analysis.

Audience: The course is intended for people handling problems where chemometrics can be applied or people who have general interest in learning more about chemometrics and its applications. Some mathematical and statistical expressions will be used in the course and a variety of data (e.g. sensory and spectroscopic data) will be used as examples. Teaching material in English will be handed out at the course and consists of slides. Please note that the exercises will be performed in groups of two. Lectures will be in Danish or English (if foreigners are present).

Teacher: Thomas Skov

B

C

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Case 1 – Correlation/causality

For the three examples discuss what type of correlation you think is being visualized.
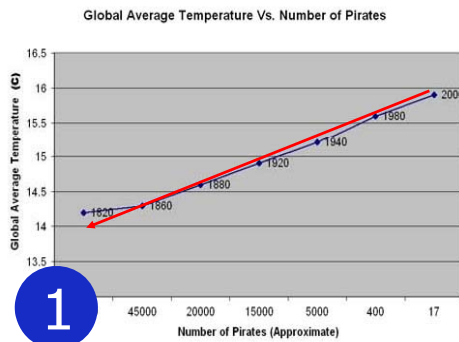
Use the definitions of causality and indirect correlation listed below.

Try to come up with suggestions why you see a correlation.

UNIVERSITY OF COPENHAGEN
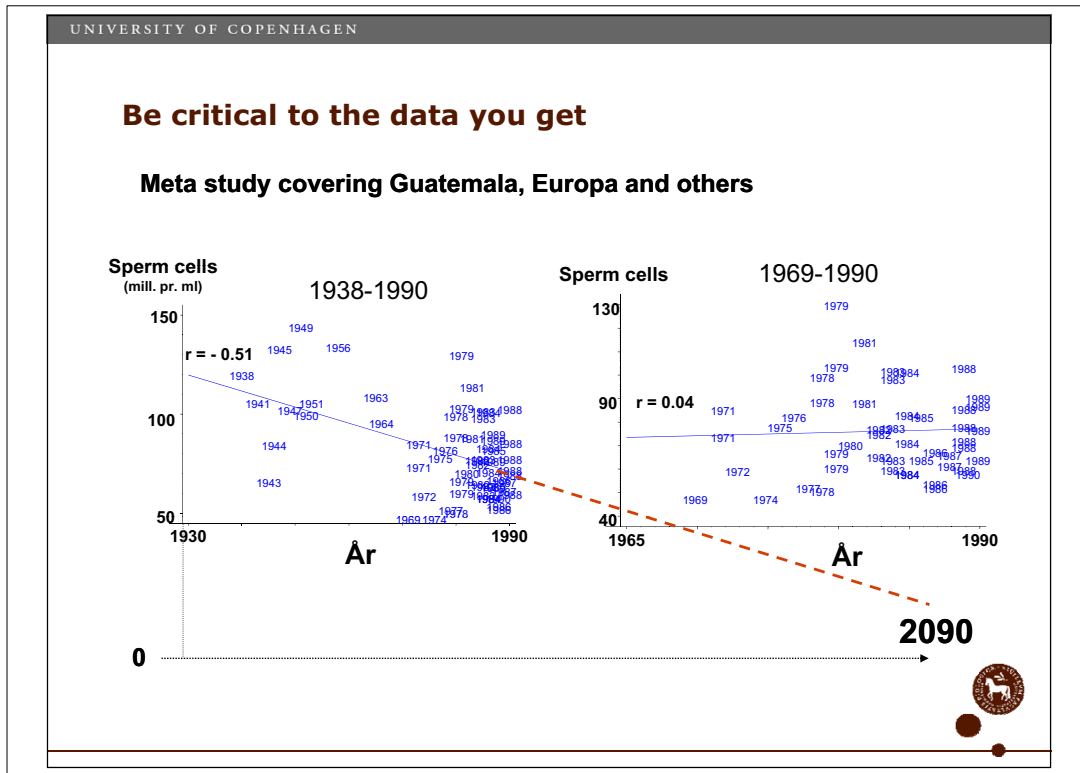
Case 1
Correlation/causality

Causal correlation: If A changes then we know B changes!
Indirect correlation: If A changes we cant say if B changes!

D

E

5

Constructive Alignment in the Course "Mathematics and Optimization"

Henrik Holm

Department of Basic Sciences and Environment, University of Copenhagen

The present manuscript, written in July 2011, is my final pedagogical project for the *Higher Education Teaching Programme* ("Adjunktpædagogikum") 2010/2011, which is a one-year programme for assistant professors and postdocs organized by the Department of Science Education, Faculty of Science, University of Copenhagen.

The project is aimed at reporting on, analyzing, and developing my own teaching in *Mathematics and Optimization*, which is a 7.5 ECTS course for students at the Faculty of Life Sciences (abbreviated LIFE) that was held (in Danish) for the first time[1] in block 3, 2010/2011.

Mathematics at LIFE

I imagine that all teachers, no matter the subject which they teach, encounter many of the same problems and challenges in their teaching. One might think that mathematics, being so logically structured as it is, would require a minimal effort to teach. Indeed, mathematical textbooks are renowned for proving and explaining every little detail. However, it seems to be an unfortunate fact that many students have difficulties comprehend-

---

[1] While it is true that Mathematics and Optimization is officially a new course, it is based on the predecessor *Mathematics and Planning*. This course was held for the first time in 2007/2008.

ing mathematics. This seeming contradiction was a topic of reflection as early as in 1908 in Henri Poincaré's[2] book on scientific methodology:

> *"One first fact must astonish us, or rather would astonish us if we were not too much accustomed to it. How does it happen that there are people who do not understand mathematics? If the science invokes only the rules of logic, those accepted by all well-formed minds, if its evidence is founded on principles that are common to all men, and that none but a madman would attempt to deny, how does it happen that there are so many people who are entirely impervious to it?"*
>
> Henri Poincaré (Poincaré 1908, p. 47)

I believe that mathematics is as easy, or as difficult, as any other subject, but it certainly depends on the way it is presented and taught.

Until 2007, I was employed at mathematics departments at the universities of Aarhus and Copenhagen, where I taught courses in abstract mathematics primarily for math students. Teaching mathematics to math students is, in some sense, easy since they are usually quite motivated, and since the material is expected to be presented in the same traditional and rigid way, going through definitions, lemmas, propositions, and theorems (with rigorous proofs). In my experience, the challenge of teaching math students tends to be more mathematical (e.g. answering perceptive questions) than pedagogical (e.g. figure out how to present a topic).

Since 2007, I have been employed at LIFE. The students at this faculty are focused on topics such as animals, environment, health, agriculture, economics, forests, and biotechnology, and certainly *not* abstract mathematics. Such students see mathematics only as a tool, and their motivation (if any) for learning it lies in the desire, or need, for a better understanding of the more technical aspects of their main subject. Teaching mathematics to this kind of students is, in my opinion, a considerable, important, and interesting pedagogical challenge.

In order for a mathematics course at LIFE to be successful it must, in my experience, be based on concrete examples which relates mathematics to real life problems of relevance for the students in the class. The course Mathematics and Optimization is developed with this is mind, for example, a typical problem of interest would be as in figure 5.1.

---

[2] Jules Henri Poincaré was a French mathematician and a philosopher of science who lived 1854–1912.

A farmer wants to grow potatoes (P) and tomatoes (T) in some combination on his field, which has an area of 10 acres. He must consider the following restraints:

Profit: 1 acre of potatoes $\sim$ 3000 DKK
             1 acre of tomatoes $\sim$ 2500 DKK

Contract: Must produce at least 2 acres of tomatoes

Workload: 1 acre of potatoes $\sim$ 2 hours/week
              1 acre of tomatoes $\sim$ 0.5 hours/week

The farmer can spend up to 12 hours per week on cultivating his land. Thus, in order to optimize his profit, the farmer needs to solve the following problem:

$$\begin{cases} Q(P,T) = 3000P + 2500T = \text{Max!} \\ P + T \leqslant 10 \\ T \geqslant 2 \\ 2P + 0.5T \leqslant 12 \\ P, T \geqslant 0 \end{cases}$$

Fig. 5.1. A typical problem of interest in the course Mathematics and Optimization.

To actually solve this problem, the students need to learn about Dantzig's simplex algorithm.

Organization of the Course

Mathematics and Optimization is a small course at LIFE with 10–15 students; in 2011, twelve people signed up. The course is organized somewhat traditionally. Lectures, problem sessions etc. were divided between the following three teachers, according to a detailed teaching plan.

- Henrik Holm (HH) $\sim$ 50%,
- Henrik Laurberg Pedersen (HLP) $\sim$ 25%,
- Thomas Vils Pedersen (TVP) $\sim$ 25%.

The weekly course activities were as follows:

Time	Tuesday	Thursday
8–10	Lecture	Lecture
10–12	Problem session	Problem session
13–17		Project

Each week the students were given a detailed work sheet, like the one in Appendix A, containing, among other things, a reader's guide to the textbook and a list of exercises to be solved. In the next section, we shall describe how the students worked, and how they were intended to learn, in the various types of course activities.

Course materials (slides, projects, solutions to exercises, work sheets, syllabus etc.) were distributed via the course's homepage.

After the course had ended, the students evaluated various aspects of it via LIFE's standard online questionnaire. I followed up on this evaluation with an interview of the class which took place on 5 April 2011 from 9–11 am.

Planning for Constructive Alignment

Constructive alignment – which is devised by Biggs and described in Biggs & Tang (2007) – is a principle used for devising teaching and learning activities, and assessment tasks, that directly address the students learning outcomes. I strove to make sure that the course Mathematics and Optimization was constructively aligned; below is explained how.

Intended Learning Outcomes (ILOs)

When I wrote the outline for Mathematics and Optimization, I made sure that it included the intended learning outcomes for the course[3]. Here are three concrete examples of ILOs:

> After completing Mathematics and Optimization, the student is expected to be able to do the following (within the scope of the course):
> 1. Selecting between optimization methods to find the one which is relevant for solving a given problem.
> 2. Solve concrete optimization problems.
> 3. Give mathematical descriptions of linguistically formulated (simple) real life optimization problems.

---

[3] As written in the guidelines from the Danish Ministry of Education, I divided the intended learning outcomes into knowledge, skills and competences.

I tried to think about the level of complexity of the ILOs in terms of the SOLO taxonomy[4], and this was actually quite helpful when preparing lectures, exercises etc. For example, the first ILO described above is SOLO 4 (comparing), the second is SOLO 3 (doing algorithms), while the third is more like SOLO 4–5 (analysing and reflecting).

It is also important for the students to know the level of complexity I expect from their understanding. I was actually not particularly explicit about this; instead I hoped that my written solutions to exercises and projects would illustrate the thoroughness and depth of understanding I expected.

Teaching and Learning Activities (TLAs)

I aimed to ensure that the teaching and learning activities I designed for Mathematics and Optimization reflected the intended learning outcomes. To illustrate how, I describe below four different kinds of TLAs from the course.

(i) *Lectures*. I suppose that my lectures were quite traditional. Below is a sample slide from the course which directly address the second ILO stated above ("solve concrete optimization problems"): It demonstrates how to apply Dantzig's simplex algorithm to solve an LP-optimization problem.

---

[4] The SOLO (Structure of Observed Learning Outcomes) taxonomy was developed by Biggs and Collis (1982), and is described in Biggs & Tang (2007). The taxonomy describes level of increasing complexity in a student's understanding of a subject through five stages: 1–prestructural 2–unistructural, 3–multistructural, 4–relational, and 5–extended abstract.

Rutediagram for simpleksalgoritmen.

START

Opstil tilladt udgangsskema

Er alle $d_j \leqslant 0$? ——JA——> x° er minimalpunkt ——> SLUT

NEJ

Vælg pivotsøjle med $d_j > 0$

Er alle $c_{kj} \leqslant 0$? ——JA——> Q er nedad ubegrænset ——> SLUT

NEJ

Opstil hjælpesøjle, vælg pivotelement

Udfør pivotoperation

Dias 29/48 — Henrik Holm (IGM) — Simpleksalgoritmen — 17. februar 2011
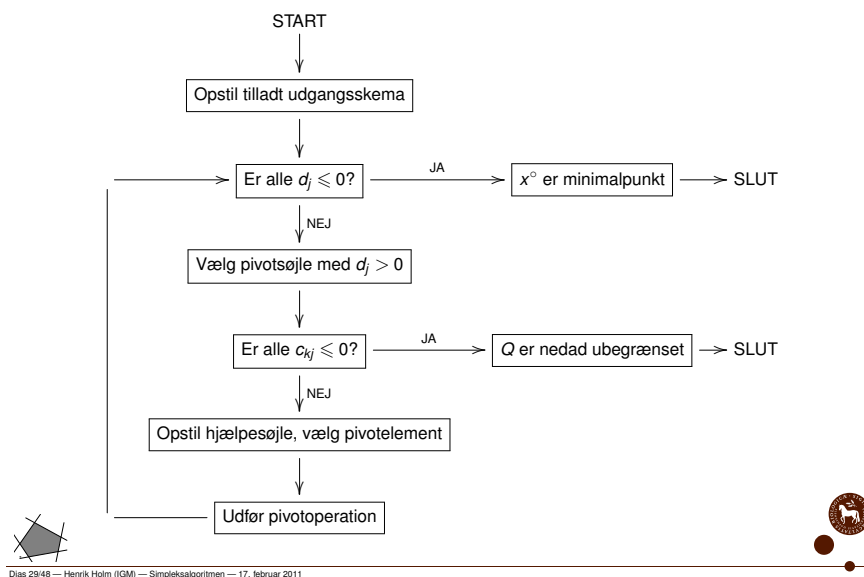
(ii) *Mini-Exercises.* During lectures, I frequently paused and made the students do a five minutes mini-exercise. The purpose was to keep students active and to facilitate their understanding of the material just explained in the lecture. Below is a sample mini-exercise from the course, designed to practice how to do a *pivot operation* (which is the basic mechanism in the simplex algorithm).

Mini-Exercise B

Do the following pivot operation:

	x_1	x_2	
y_1	-1	0	3
y_2	4	$\boxed{2}$	4
	1	-3	-4

$\curvearrowright$?

(iii) *Problem sessions.* Lectures were succeeded by problem sessions where the students solved a number of problems under my supervision. Below is a sample exercise from the course which directly addresses the first ILO stated above ("selecting between optimization methods"): Part of the exercise is to determine which method to use to solve the given optimization problem (in this case, a variant of the Kuhn–Tucker method, and not, for example, the simplex algorithm).

> **Exercise K15**
>
> Solve the following optimization problem:
>
> $$\begin{cases} Q(x_1, x_2) = 6x_1^2 + 9x_2^2 - 14x_1x_2 + 3x_1 = \text{Min!} \\ x_1^2 + 2x_2^2 + 2x_1x_2 - 4x_1 \leqslant -3 \\ 2x_1 + 3x_2 \leqslant 12 \\ x_1, x_2 \geqslant 0 \end{cases}$$

(iv) *Projects.* The students were divided into study groups of 2–4 members. Every week, each group answered a project in writing. It was no secret that some of the exercises in the projects were similar to those the students could encounter in the written exam. Below is a sample project exercise from the course which directly addresses the third ILO stated above ("give mathematical descriptions of real life optimization problems").

> **From Project C**
>
> Five types of feed for pigs (A, B, C, D, and E) contain two types of nutrients (I and II) in the following doses (units per kg):
>
> | Type of feed | A | B | C | D | E |
> |---|---|---|---|---|---|
> | Nutrient I | 1 | 1 | 2 | 2 | 2 |
> | Nutrient II | 1 | 2 | 1 | 0 | 4 |
>
> The prices (in DKK) of the five types of feed are as follows:
>
> | Type of feed | A | B | C | D | E |
> |---|---|---|---|---|---|
> | Price per kg | 3 | 8 | 9 | 8 | 14 |
>
> A breeder has 250 pigs. Each pig must consume at least 0.6 units of nutrient I and 1.2 units of nutrient II per day.
>
> Formulate a mathematical optimization problem which describes how to minimize the breeder's expenses for feed.

Complementarity in TLAs

The complexity and the nature of mini-exercises, exercises, and projects in the course Mathematics and Optimization described above were deliberately very different. For example, mini-exercises were operational whereas project exercises were more structural.

Sfard (1991) discusses how notions in mathematics can be conceived in two fundamentally different ways: structurally–as objects, and operationally– as processes. These two approaches, although ostensibly incompatible, are

in fact complementary. Sfard argues that the processes of learning and of problem-solving consist in an intricate interplay between operational and structural conceptions of the same notions.

Exam

In any course, it is crucial that the exam reflects the intended learning outcomes (ILOs) as well as the teaching and learning activities (TLAs). In the course Mathematics and Optimization, I strove to make sure that this was the case. Below is a sample exercise from the written exam, which directly addresses the third ILO stated above ("give mathematical descriptions of real life optimization problems"), and which the students were trained to do in the planned TLAs (such as in Project C described above).

From Exam (Exercise 2)

A farmer can buy three types of NPK fertilizer (types I, II, and III), whose contents of nitrogen, phosphorus, and potassium (measured in appropriate units) per kg fertilizer is as follows.

	Nitrogen	Phosphorus	Potassium
Fertilizer type I	2	2	4
Fertilizer type II	2	4	2
Fertilizer type III	5	3	2

The farmer's crops need certain minimum doses of each of the three nutrients:

	Nitrogen	Phosphorus	Potassium
Minimum dosis	25	20	40

The price for 1 kg of fertilizer type I, II and III is 10 kr, 6 kr, and 10 kr, respectively.

(a) Formulate a mathematical optimization problem which describes how to minimize the farmer's expenses for fertilizer, considering that his crops must have the required minimum doses of each of the three nutrients.

Student Evaluations

As previously mentioned, the students evaluated various aspects of the course Mathematics and Optimization via LIFE's standard online questionnaire. On 5 April 2011, I followed up on this evaluation with an interview of

the class. The interview was not recorded, but I took rather detailed hand-written notes. The main conclusions from the students' evaluations are presented below. In the last section, I will comment on them and discuss how they might improve future editions of the course.

I would say that, in general, the students found Mathematics and Optimization to be constructively aligned to a high degree. For example, in the online questionnaire all students agreed or completely agreed with the statement:

> *1.4. I find that the course activities reflected the learning outcomes/competences described in the course outline.*

Responses from the interview generally supported this. Furthermore, the students found the course to be very well organized and logically structured. However, there were three main points of critique:

The Textbook

The interview with the class revealed that the students do not read the textbook as suggested and described in the reader's guide on the weekly work sheets, cf. Appendix A. In fact, they seem to consult the textbook mostly for exercises and their solutions. To acquire the actual theory and the examples, it sufficed for them to read the slides from the lectures. The students told me that they found the textbook to be "too mathematical" and very hard to read. Actually, a colleague of mine (Søren Eilers from SCIENCE) pointed out to me some weeks ago that perhaps the textbook I use is not really suited for LIFE's students.

I encourage my students to skip all mathematical proofs in the textbook, but I certainly expect them to read the statements, algorithms, ideas, examples etc. Apparently, this was generally not the case.

The Projects

During the course, the students handed in seven written projects. The projects were meant to prepare them for the written exam at the end of the course—and I told this to the students already from day one. The projects were not graded on the 7-scale, but formative feedback was given instead.

On the positive side, the students liked the formative feedback on the projects, and no one expressed the desire for an actual grade. They also felt

that the projects did, in fact, prepare them for the written exam, in the sense that exam exercises were easier than project exercises.

On the negative side, the students found the projects to be way too technical. Many of them spend hours on mathematical details from which they "learned nothing", and which—to the surprise of some students—were not even tested on the exam. Some students suggested fewer projects with more time reserved for counseling; others suggested simply to downgrade the technical level, as it was too high compared to what was needed to pass the exam.

The Contents

A few students felt that the contents of the course did not really reflect the course description and the introductory lecture (given on 1 February 2011). These students expected the course to be more "case based" and less theoretical. I got the impression that they liked the course, but were a bit surprised of the direction in which it went.

Conclusions

A common theme in the students' evaluations were the mathematical/technical level found in the textbook, projects etc. As mentioned previously, the course is based on the philosophy that it should relate mathematics to real life problems of relevance to the students. It seems like this philosophy is right on the money, but apparently my choice of topics, textbook etc. does not support this philosophy as well as I had hoped. The textbook is quite mathematical, and perhaps not as contemporary in style and exposition as it should be. Since the course ended, I have been looking at alternative textbooks which might better comply with the students' needs. Two alternatives which should definitely be investigated further are *Introduction to Applied Optimization* by Urmila Diwekar (2008), and *Optimization—Theory and Practice* by Wilhelm Forst and Dieter Hoffmann (2010).

In retrospect, I think that I might have downplayed the theoretical/technical aspects of the course in the description and in the introductory lecture – not to "cheat" anyone, of course, but rather to emphasize the more applicational aspects. I will consider to adjust next year's course description accordingly, so that the students will find no "surprises" in that department.

Since Mathematics and Planning – the predecessor of Mathematics and Optimization – was first held in 2007/2008, I have been wondering if the written exam is the optimal way to evaluate the students taking this course. Furthermore, it seems a bit excessive to produce a written exam for only 10-15 people. In the interview with my class, I specifically asked for their opinion on the examination form. Most students actually found the written exam to be well-suited for the course, but one student suggested that a "portfolio exam"—based on the students' projects – might be more appropriate. I can certainly understand this student's point of view, that is, to orally examine each student in one of his/her projects (randomly chosen). However, to do so would require some adjustments in the type of problems posed in the projects – some of these are simply way to technical to present orally in a meaningful manner. Adjusting the projects by replacing some of the technical aspects by more conceptual ones would also accommodate the students' critique on this point.

A Sample Work Sheet

Matematik og optimering
2011
Ugeseddel 3
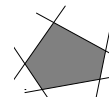
Tirsdag den 15/2 2011 kl. 8–12: *LP–problemer og simpleksskemaer*   Husk computer!

Program
8–10:   Forelæsninger og miniøvelser
10–12:   Øvelser

Læsevejledning til [hs]
Generelt kan beviser overspringes! Eksempler med "X" findes i [tvp].
Overheads kan hentes fra kursushjemmesiden.

Sidetal	Emner	Anbefalede eksempler
1–6	Introduktion	0.1, 0.2, 0.3, X1(a-b), X2(a)
7–11	Lineær algebra, konvekse mængder	
14–18	Formulering af LP–problem	2.1, 2.2, 2.3, X1(c-d), X2(b)
19–28	Hjørner og basisløsninger	2.6, 2.8, X4(a-b)
29–38	Basisform, opstilling af simpleksskema	3.1, 3.3, 3.5, 3.6, 3.7, X5(a-e)

Miniøvelser
Miniøvelser (med løsninger) kan hentes fra kursushjemmesiden.

Øvelser
opg. 1 (`LPgraphic`), øv. 3.1, øv. 3.2, opg. 7 (`LPgraphic`), opg. 12, opg. 10 (tjek med `Vertex`).
Skriftlig aflevering til torsdag den 17/2 2011: øv. 0.1 (`LPgraphic`), opg. 11(1)–(5).

Torsdag den 17/2 2011 kl. 8–12 og 13–17: *Simpleksalgoritmen*   Husk computer!

Program
8–10:   Forelæsninger og miniøvelser
10–12:   Øvelser
13–14:   Installation af, og øvelser med, `LP-KVL` (ved Thomas Vils Pedersen)
14–17:   Gruppearbejde med Projekt B (hentes fra kursushjemmesiden)

Læsevejledning til [hs]
Generelt kan beviser overspringes! Eksempler med "X" findes i [tvp].
Overheads kan hentes fra kursushjemmesiden.

Sidetal	Emner	Anbefalede eksempler
42–49	Pivotoperationer	3.9, X4(f), X5(f)
50–58	Simpleksalgoritmen	4.1, 4.2, 4.3, 4.4, X4(g-h), X5(g)
39–41	Matrixformler for basisform	3.8
60–62	Den reviderede simpleksalgoritme	4.6, X4(i-j)

Miniøvelser
Miniøvelser (med løsninger) kan hentes fra kursushjemmesiden.

Øvelser
øv. 4.1, opg. 13, øv. 4.3 (kun første problem), øv. 4.5, opg. 18, opg. 23(1) (`LPgraphic`).
Benyt gerne `LP-KVL` hvor det er relevant.

Projekt
Projekt B (Simpleksalgoritmen og `LP-KVL`). Afleveres tirsdag den 22/2 2011 kl. 8.

Henrik Holm (hholm@life.ku.dk)
12. februar 2011

Constructive Alignment of the E-learning Course Introduction to Dairy Technology

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In constructive alignment focus is on the coherence between intended learning outcomes (ILO) of the course, teaching learning activities (TLA) and assessment tasks (AT). Constructive aligned teaching is based on the hypothesis that students use the teaching learning activities to construct their knowledge or teaching outcomes. It is therefore important to actively use the ILOs and the TLAs to tell the students what they should learn and how they should lean it. The goal is to provide good teaching in a positive learning environment, through the use of constructive alignment to ensure increased learning outcomes and deeper learning (Biggs & Tang 2007).

Problem formulation

The objective of this project is to analyse the constructive alignment of e-learning course introduction to dairy technology and how the intended learning outcomes (ILO), the teaching learning activities (TLA) and the assessment tasks (AT) are related and balanced. This analysis will form the basis for reflections on what actions that can be taken to improve the course.

Description of the course

The e-learning course introduction to dairy technology is an MSc course in the program of Food Science and Technology, at University of Copenhagen. The course objective is to give an introduction to dairy chemistry,

dairy microbiology, dairy equipment, dairy processing and dairy product quality. The course is an introduction course and it is therefore important that the students get a basic knowledge of the terminology within dairy technology. However, it is also important that the students learn to use this knowledge for discussions and reflections. They should be able to apply their knowledge and evaluate factors of importance for the quality and production of dairy products: from milk production to the final product. The course took place for the first time as e-learning in block 1 (September-November) 2011.

The course was designed based on the 5-stage model for online teaching developed by Salmon (2004): Stage 1 – access and motivation, Stage 2 – online socialisation, Stage 3 – information exchange, Stage 4 – knowledge construction and Stage 5 – further development of knowledge.

The model states that it is important to spend time on getting use to the online teaching learning environment before moving on to exchanging and constructing knowledge. This is the foundation for creation of a positive learning environment and the feeling of an online classroom. The central assumption for the model is that the students through the course should get to the point where they construct knowledge together (Stage 4/5).

Introduction to dairy technology consists of eight e-modules of one week duration each and then the exam. The first e-module focus on introduction, familiarisation with Absalon and online socialisation, this is followed by six subject specific e-modules for information exchange and knowledge construction, one e-module with project work focusing on construction and further development of knowledge and then the exam.

I have been the main responsible for designing the e-learning course but in close collaboration with the course responsible, the teachers for the individual e-modules and the IT-learning center at LIFE. As part of the development of the course I updated the ILOs, changed the TLAs, the ATs and worked with the use of different learning resources. The course has now been running for the first time as e-learning and it is time to evaluate the alignment of these elements. When the course was running my specific teaching responsibilities were related to three of the e-modules and then I acted as e-guide through out the course. The overall key role for the e-guide was to ensure a positive teaching learning environment, follow the students performance and check whether they met the defined deadlines and take action of they did not.

Intended learning outcomes (ILO) course level

The ILOs for introduction to dairy technology is divided into knowledge, skills and competences. The course ILOs are unistructural to extended abstract in terms of SOLO levels. It is intended that the course ILOs can be operationalised into ILOs for the different e-modules and the TLAs. In the teaching team we have discussed the use of the verb 'discuss'. We have decided that it should belong to the relational level of SOLO terms as we think that you have to be able to explain causes, analyse and relate topics when you are discussing. After completing introduction to dairy technology the student should be able to:

Knowledge

- *Sum up* the chemistry of milk constituents
- *Sum up* the various unit operations in milk processing
- *Reflect* on the factors affecting milk production, milk composition and milk quality
- *Reflect* on how the dairy industry interacts with the surrounding world

Skills

- *Apply* principles from colloid chemistry and physics to analyse processing of dairy products
- *Apply* principles, theories and frameworks to case studies relating to dairy processing
- *Evaluate* quality of scientific literature and resources

Competences

- *Argue* coherently and think critically within the framework of dairy processing
- *Reflect* and *discuss* factors of importance to dairy product quality from milk production to final products
- *Reflect* on the role of dairy production and processing in society

Under knowledge the basics of what the student should know after course are given and it is both of declarative and functioning nature. The

focus is on the basic knowledge of the chemistry of milk and the unit operations used in milk processing. The use of 'reflect' show that the students should be able to bring their knowledge to the level of extended abstract as well. Under skills the focus is on the students ability to 'apply' principles from their basic knowledge and 'evaluate' the quality of learning resources. Under competences the focus is on what the students can use the knowledge and skills from this course for in other connections. The use of 'argue', 'reflect' and 'discuss' shows that the students should have the competences to use their knowledge in a broader context within the subject field of dairy technology but also in a broader context.

Comparing the course ILOs with the overall objective for the course the elements under knowledge do not relate to the entire curriculum. Missing are statements relating to dairy microflora and factors in relation to quality of dairy products, which is a part of the basic knowledge with in dairy technology that they get introduced to in this course. I would therefore add the following bullets to the course ILOs under knowledge:

- *Describe* the microflora of milk and dairy products
- *Describe* factors of importance for the quality of dairy products

The remaining ILOs correspond reasonably with the objective for the course. However, discussions are the main TLAs and this could be stated more clearly in the ILOs by using the term 'discuss' more explicit. In this way a better alignment with the TLAs could be obtained and it would also result in a stronger focus on the importance of the discussion activities.

We have also developed ILOs for each e-module on the basis of the operational terms used in the course ILOs. Below is an example of the ILOs for e-module 7 focusing on cheese.

- *Describe and classify* cheese
- *Summarise* the unit operations and processes for manufacturing of cheese
- *Discuss* the chemistry behind the cheese curd formation and the syneresis
- *Discuss* how the essential processing steps influence cheese quality

From my point of view these ILOs are well aligned with ILOs for the course but also to the TLAs where 'describe', 'classify' and 'summarise' links to the activities in the questionnaires and the 'discuss' to the discussions in the e-module.

Teaching and learning activities (TLA)

The course TLAs are designed to meet the e-learning environment and the resources available on Absalon. The TLAs are questionnaires, discussions, project work and the dairy vocabulary. The dairy vocabulary is used as a reflection task, where the students are asked to reflect on what they have learned in the individual e-modules by identifying central dairy technology terms and their definitions. These terms and definitions are then collected throughout the course and a common vocabulary created. The discussions are the main TLA in this course but also where I as teacher was challenged the most. In the course evaluation the students also suggested that we worked with the improvement of the discussions. In the next part, I will therefore the focus on the discussions as a TLA.

During the course I experienced that the students got tired of the format of the discussions and that it was challenging to bring the discussions from exchanging knowledge to a level where the students took more responsibility and built something together. This observation was further confirmed by the course evaluation where the students specifically stated that they did not benefit from the discussions in the way we had intended. One of the students wrote in the evaluation:

> *"To be honest, I find it difficult to relate to the way the discussions are going on. Often it seems as if (we) the students just summarize some of what we have read to make a post – and then I have trouble seeing the discussion in this . . . But it must be said that it has been very different ways in which different teachers have managed to keep the discussions going/moderate the discussions."*

As teacher I also experienced that some students contributed to the discussions only because they had to, and that their posts was based on repetitions, had at a low level of relevance and did not in anyway contributed to the development of the discussions. This is probably the backside of the forced participation in the discussions. However, the IT-learning centers experience from previous courses is that the students do not participate in the discussions if they do not have to.

We have in the teaching team discussed this situation about the discussions. The students did not reach stage 4/5 in the 5-stage model of Salmon (2004) as we had intended when designing the course. Overall, we agreed that a discussion is a very suitable TLA in an online teaching learning environment and that is was relatively well aligned with the ILOs and ATs in

this course. We agreed on focusing on the following areas to improve the discussions; 1) Evaluating our own role as teachers, 2) Changing the format of the discussions and 3) Prepare the students for the discussions.

Evaluating our own role as teachers

The concept of dialog based online teaching is challenging and a discussion with the teaching team showed that we all felt the same way. The best tool to help oneself keeping the discussions on track was to make a plan/guide for which areas should be covered in the discussions. But also that the questions put up for discussions are open ended and can be viewed from more than one side to open the discussions for the students. Furthermore, it is important to show ones presence by commenting and participate in the discussions on a daily basis to ensure development and to add value by institutionalise the subjects. To keep the students motivated it is important to interact with each student personally, to acknowledge and give them feedback on their contributions – formative feedback.

Changing the format of the discussions

The format of the discussions especially in the late part for the course i.e. e-module 5-8 could be developed to improve the teaching learning situation. The discussions could be made in a way where the students have to work more together so they get obligated towards each other and therefore contributes to the development of the discussions in a more constructive way. This could be done by structuring the discussions in activities such as: discussion in groups with different roles i.e. consumer, farmer, dairy company vs. authorities, writing statements/discussions posts in an essay-like style, let the students make i.e. spoken PowerPoint presentations to each other and the use of peer-assessment between the students.

Prepare the students for the discussions

The students could also be trained in making better posts for discussions. An activity could be added to the introduction e-module, where the students together should reflect over and discuss what a good post in a discussion should contain to add value, bring the discussion further and what elements that can be used to recognise the contributions from fellow students. Furthermore, they could also touch upon their expectations to their own level

of activity and to the contribution from their fellow students. Overall, resulting in a didactic agreement for the discussions. Maybe it would even be possible to let them make the evaluation criterions for the student performance in the discussions them self (see section on assessment tasks).

Assessment tasks (AT)

The ATs is designed to test both declarative and functioning knowledge and consists of continuous assessment as well as a final summative assessment. The final grade is based on 50% from the students performance in the e-modules and 50% from the final exam. This setup was selected to ensure activity from the students in the online TLAs. In this part, I will focus on the criterions for the evaluation of the students performance in the e-modules, where they were evaluated on their completions of questionnaires and their contributions to discussions.

The questionnaires were designed mainly to test the students basic knowledge of terminology and concepts within dairy technology. To pass at least 75% of the answers had to be correct in each questionnaire. We did not want the student to have the feeling of an exam at these questionnaires. They were therefore given: three permitted tries to answer, a PDF file with the questions beforehand and a discussion thread where they could discuss "questions and comments about the questionnaire". I had the preconception that the students would use such a discussion for giving each other the specific answers for the individual questions, but that was not the case at all. In stead the students asked questions like this instead:

> "Hi!! Has anyone tried the first test? I had some problems especially with two questions, the ones which are about aerobic sporeformers that spoil the dairy products and psycrothrophic bacteria important in dairy products. Does anyone know where I can find more information about the role of bacteria in dairy products?"

Indicating that at least some of the students really tried to work in depth with their understanding of the curriculum. I also got the feeling that the student did not see these questionnaires as exams.

The students performance in the discussions were evaluated on the basis following criterions:

- Posts must contribute to the discussion in a meaningful way and address the given tasks

- Posts must add new content/perspectives to the discussion
- Posts must contribute to the development of the discussion
- Posts must demonstrate that associated learning outcomes have been achieved
- Posts must be based on your own words and arguments (please read the document Referencing, Citation and Plagiarism)
- Reply on comments from teachers and fellow students throughout the discussions
- Post a minimum of two separate times throughout each discussion
- Make correct citations to sources you have used
- Respect the word limit on 150 words per post

I found these criterions very use full when evaluating the student performance in my e-modules. I think they are well aligned with the purpose of the discussions as a TLA and the ILOs for the individual e-modules. However, the criterions were set by the teaching team. They were therefore not the students rules for assessment of good quality posts in the discussions. To increase the students knowledge of how such criterions are used in the course and to increase their motivation to deliver high quality contributions to the discussions it could be relevant to let them come up with these criterions them self. It could i.e. be a part of the new activity for e-module 1 on how to contribute to discussions in a meaning full way that they should formulate these criterions together.

6.1 Conclusion

The course is relatively well aligned, but as changes can be implemented to develop the course – adjustment of the course ILOs but also the format of selected TLAs and ATs. Actions that can be taken are:

- Align the course ILOs with the overall objective for the course and add the following bullets under knowledge:
  - Describe the microflora of milk and dairy products
  - Describe factors of importance for the quality of dairy products
- Improvement of the discussions, through:
  - Evaluating our own role as teachers
  - Changing the format of the discussions
  - Prepare the students the discussions

– Letting the students define the criterions for the evaluation of their performance in the discussions. Resulting in a didactic agreement for the discussions.

These suggested changes should contribute to increased learning outcomes and a deeper learning for the students.

De studerendes opfattelse af brugen af gæsteundervisere plus én gennemgående underviser: pædagogiske og faglige overvejelser

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Brug af gæsteundervisere eller flere faste undervisere inden for samme fag i universitetsregi er almindelig praksis på Det Sundhedsvidenskabelige Fakultet. Rationalet bag brugen af mange undervisere på samme fag er, at specialiseringsgraden er meget høj, og udgangspunktet for undervisningen er, at den skal være forskningsbaseret, selvom sidstnævnte punkt ikke nødvendigvis betyder, at det er specialisten, der skal undervise. Derfor bliver det – for at give de studerende den bedst tænkelige (faglige) undervisning – betragtet som en fordel eller måske ligefrem en nødvendighed set fra udbyderens (den faglige ansvarlige, afdelingen, instituttet eller fakultetet) side at gøre brug af flere undervisere. Derimod bliver der fra udbyderens side – med det kendskab indeværende forfatter har til universitetssystemet på Det Sundhedsvidenskabelige Fakultet – ikke gjort pædagogiske overvejelser i forhold til brugen af flere undervisere inden for samme fag. I hvert fald hvad teoretisk klasseundervisning angår.

Ifølge en arbejdsgruppe om undervisningskvalitet nedsat af Videnskabsministeriet betyder det, at universiteterne skal yde forskningsbaseret undervisning imidlertid ikke, at den pædagogiske og didaktiske forskning har "stor indflydelse på den forskningsbaserede undervisning, der udbydes på universiteterne" (Ministeriet for Videnskab 2006). Det skyldes, at det kun er adjunkterne, der skal deltage i undervisningspædagogiske og didaktiske kurser (Nielsen 2008), så som KNUD. Lektorer og professorer samt PhD-studerende og post-docs er frataget denne forpligtelse. Vægten er derfor ikke overraskende på det faglige (indhold) frem for det pædagogiske (præsentation, forståelse, eksamensform) som det ser ud lige nu. Dette er

tilfældet, selvom ovennævnte arbejdsgruppe i sin rapport har fastslået, at universiteterne til stadighed har til opgave at udvikle ny viden om universitets pædagogik og didaktik, og dette skal prioriteres højere af universitetets ledelse (Ministeriet for Videnskab 2006).

Med baggrund i eget valgfag og brugen af gæsteundervisere heri har nærværende forfatter med indeværende opgave valgt at undersøge, hvorledes brugen af multiple undervisere – det vil sige en slags ekspert tilgang med udgangspunkt i det faglige niveau – har påvirket de studerendes opfattelse af undervisningen set fra en pædagogisk (præsentations- og forståelsesmæssig) og faglig (indholdsmæssig) synsvinkel. Som delelement til opgaven hører, at indeværende forfatter som faglig ansvarlig var til stede i hele undervisningsforløbet. Kvaliteten af denne gennemgående tilstedeværelse – igen set fra en både pædagogisk og faglig synsvinkel – er der desuden blevet spurgt ind til. Opgavens resultater er baseret på et spørgeskema udarbejdet til indeværende opgave.

Beskrivelse af valgfaget "Etnicitet og kroniske sygdomme i et globalt perspektiv"

Valgfaget (30 timer (15 dobbeltmoduler af 2x45 min.), 10 ECTS) udbydes på Institut for Folkesundhedsvidenskab (IFSV) én gang årligt. Det engelsksprogede valgfag ("Ethnicity and chronic disease in a global perspective") udbydes på kandidatniveau, men er åbent for studerende på bachelordelen. Der afsluttes med en mundtlig eksamen, hvor der gives karakter efter 7-skalaen. Nærværende forfatter er kursusansvarlig og har i øvrigt selv udviklet valgfaget, der i det netop overståede forårssemester blev udbudt for anden gang.

Faget tiltrækker både danske og udenlandske studerende, og de kommer fra forskellige studiegrene. Hovedparten er FSV-studerende (fra både KU og SDU), men i år var der også studerende fra Biologi, Human Ernæring og Antropologi. Dertil kommer udenlandske studerende på bachelordelen, der endnu ikke har specialiseret sig.

Valgfaget er tematiseret fra gang til gang, men der tilstræbes en "rød tråd" således at undervisningen bliver set eller opfattet som horisontal frem for vertikal. Ud over den kursusansvarlige underviser ti gæsteforskere på valgfaget – alle i deres faglige specialer. For at kunne binde temaerne sammen – og sikre et horisontalt fag og oplevelse – har den kursusansvarlige

været til stede i samtlige dobbeltmoduler (på nær én grundet konference-deltagelse).

For en mere deltaljeret beskrivelse af valgfaget, se appendix A der er en udvidet formålsbeskrivelse, som blev præsenteret for de studerende under det første dobbeltmodul.

Metoder

Af de i alt ti gæsteundervisere på faget, blev en enkelt brugt to gange. Tre gæsteundervisere forelæste blot en enkelt lektion (45 min) hver.

Den enkelte gæsteunderviser blev bedt om at undervise inden for et af den kursusansvarlige på forhånd fastlagt tema, som lå inden for gæsteun-derviserens specialeområder. Den pædagogiske linje var deduktiv, det vil sige underviserstyret. Dertil kommer, at den enkelte gæsteunderviser blev gjort opmærksom på, at de studerende var sammensat af danske og uden-landske studerende, studerende på kandidat samt bachelor niveau, og de kom fra forskellige studieretninger (som angivet foroven), og der skulle ta-ges hensyn til disse forhold. Det kom i praksis til at betyde, at den enkelte gæsteunderviser valgte at bruge mere tid på at forklare specielle fagtermer i forhold til undervisning af studerende, hvor alle kommer fra samme studi-eretning. Den gennemgående metode var teoretisk klasseundervisning med Power Point forevisning som normen samt dertil brug af tavlen. De stude-rende blev fra gang til gang bedt om at læse to til tre videnskabelige artikler som forberedelse til undervisningen. Den kursusansvarlige stillede på lige fod med de studerende spørgsmål, når der var en gæsteunderviser til stede for at sikre kursets sammenhængskraft.

Resultater

I alt 30 studerende fulgte kurset, hvoraf de 26 gik til eksamen. Heraf valgte 23 at svare anonymt på spørgeskemaet (Appendix B) på i alt 18 spørgsmål, som blev lagt ud på Absalon, og som blev udfærdiget specifikt til in-deværende opgave på engelsk.

Alle spørgsmålene kunne enten besvares på en point-skala fra 1-5, med 1 som den laveste og 5 som den højeste score, eller som et kategorisk JA eller NEJ svar. Tilvalgsfaget fik den overordnede bedømmelse 4,22 point

(spørgsmål 5). De studerende var overvejende danske, kvinder og kandidatstuderende. Gennemsnitsfremmødet i de 15 dobbeltlektioner var 12,7 (min. 5 – max. 15) dobbeltlektioner (Fig. 7.1).

Spørgsmål nr.	Information	Fordeling
1	Nationalitet	
	Dansk	18
	Udenlandsk	5
2	Køn	
	Kvinde	20
	Mand	3
3	Uddannelsesniveau	
	Bachelorstuderende	8
	kandidatstuderende	15
4	Gennemsnitligt fremmøde i de 15 dobbeltlektioner	12,7

Figur 7.1. Baggrundsinformation om studerende på valgfaget "Etnicitet og kroniske sygdomme i et globalt perspektiv" (n=23)

Læringsmålene og den gennemgående tilstedeværelse af den kursusansvarlige blev bedømt med en score på henholdsvis 3,95 point (præsentation) og 100 % positiv tilkendegivelse af at læringsmålene blev opfyldt samt en langt overvejende (ja/nej-spørgsmål) positiv tilkendegivelse af den kursusansvarliges tilstedeværelse under hele kursusforløbet (Fig. 7.2).

Bedømmelsen af undervisningen fik høje scorer både bedømt som form (tematisk) og bedømt som sammenhængende undervisning. Brugen af gæsteundervisere blev udelukkende set som en fordel, og i forhold til de studerendes tidligere erfaring med gæsteundervisere fik indeværende valgfag desuden en høj score (Fig. 7.3). På spørgsmålet om hvorvidt valgfaget blev oplevet som horisontalt (tematisk sammenhængende) eller vertikalt (tematisk usammenhængende), svarede 19 sammenhængende og 4 usammenhængende (spørgsmål 16). Det pædagogiske niveau (spørgsmål 17) og den pædagogiske sammenhæng (spørgsmål 18) fik en score på henholdsvis 4,30 og 4,43 point.

Spørgsmål nr.	Information	Bedømmelse (Ja/Nej eller pointskala)
6	Præsentation af læringsmål	3,95
7	Blev læringsmålene opfyldt?	Ja=23 Nej=0
9	Øget forståelse af faget som følge af gennemgående tilstedeværelse af kursusansvarlige	Ja=23 Nej=0
10	Øget værdi af faget som følge af gennemgående tilstedeværelse af kursusansvarlige	Ja=23 Nej=0
11	Var kursusansvarliges gennemgående tilstedeværelse essentiel for faget?	Ja=15 Nej=8

*5-point skala: 1 er laveste og 5 højeste bedømmelse

Figur 7.2. Bedømmelse af læringsmål og den kursusansvarliges gennemgående tilstedeværelse. Ja/Nej eller gennemsnit fra pointskala*

Spørgsmål nr.	Information	Bedømmelse (Ja/Nej eller pointskala)
8	Bedømmelse af tematisk undervisning som undervisningsform	4,14
15	Hvordan oplevede du den overordnede sammenhæng?	4,27
13	Var brugen af 10 gæsteundervisere en fordel?**	Ja=22 Nej=0
14	Baseret på tidligere erfaring, hvordan vil du score brugen af 10 gæsteundervisere?	3,95

*5-point skala: 1 er laveste og 5 højeste bedømmelse

**Én undlod at besvare spørgsmålet

Figur 7.3. Bedømmelse af undervisning (tematisk og sammenhængsmæssigt) og gæsteunderviserne. Ja/Nej eller gennemsnit fra pointskala*

Diskussion

Generelt blev valgfaget positivt bedømt, og alle delpunkter – af pædagogisk eller faglig karakter – blev ligeledes bedømt positivt. Selvom spørgsmålene ikke formår at kunne besvare og bedømme, i hvor høj grad undervisningen har haft en positiv indflydelse på de studerendes læring eller forståelsesniveau, så kan besvarelserne give en pejling af de studerendes oplevelse af undervisningen på et pædagogisk og fagligt niveau. Dette skal ses i lyset af fagets mange gæstelærere samt den kursusansvarliges gennemgående tilstedeværelse og aktive medvirken.

At det pædagogiske niveau og den pædagogiske sammenhæng i valgfaget lykkedes kan ses af de meget høje pointscorer, disse udløste (henholdsvis 4,30 og 4,43). De flotte bedømmelser – de højeste der blev givet – må skyldes en blanding af de enkelte underviseres pædagogiske indsats samt en blanding af disse og den kursusansvarliges gennemgående og aktive tilstedeværelse.

Den tematiske og overordnede sammenhæng fik en næsten lige så høj bedømmelse (henholdsvis 4,14 og 4,27 point), hvilket desuden viser, at faget både pædagogisk og fagligt – begge punkter er omfattet af spørgsmål 17 og 18 – hang fint sammen. Det bakkes op af, at der var 100% enighed om, at brugen af de ti gæsteundervisere var en fordel.

Hvad og hvordan fungerede undervisningen i praksis? Her er det vigtigt at pointere, at de i alt 30 studerende (ca. 25 mødte i gennemsnit op til undervisningen per gang) placerer valgfaget i kategorien "små klassehold" (Biggs & Tang 2007). Nøjagtig som det bliver beskrevet, var der hos alle undervisere i valgfaget åbent for spørgsmål undervejs i undervisningen. På intet tidspunkt foregik undervisningen som striks envejskommunikation, men levede derimod op til den gode interaktive undervisning, der som beskrevet af Biggs & Tang (2007) "nevertheless requires on-the-spot improvisation in response to events as they occur". Endvidere beskriver Biggs & Tang, at "questions and comments from students can be the basis for rethinking and reconstructing new and exciting ideas, if the ball is picked up and taken in an appropriate direction". Førstnævnte citat er vejen til at levere god respons på spørgsmål fra de studerende, som i sagens natur ikke kan forudsiges. Det handler fra underviserens side om viden, erfaring, åbenhed og vilje samt mod for at kunne få det optimale ud af den interaktive undervisning. De små hold giver på den facon også mulighed for en dynamik i undervisningens interaktivitet, som det er svært at matche i un-

dervisning af større hold, hvor mange studerende er tilbageholdende med at stille spørgsmål.

Den sammenhængskraft, der var formålet med, at den undervisnings-ansvarlige var aktivt til stede i alle undervisningsforløbne, så også ud til at lykkes bedømt på de studerendes svar. Både forståelsen og værdien af undervisningen blev af samtlige studerende betragtet som værende forøget. At kun to tredjedele mente, det var essentielt, at den undervisningsansvar-lige var til stede i alle undervisningstimerne tolker nærværende forfatter således, at nogle gæsteundervisere var fremragende – pædagogisk som fag-ligt – og at den undervisningsansvarliges tilstedeværelse derfor var mere eller mindre overflødig. Nogle af gæsteunderviserne kunne derfor tænkes at have levet op til Bains (2004) seks fælleskarakteristika, der fremhæves i en videnskabelig og professionaliseret tilgang til universitetsundervisning og udvikling af denne, jævnfør *scholarship of teaching and learning*-modellen (Bain 2004). I overskriftsform bygger disse på viden og forståelse; forbe-redelse; forventninger; undervisning; samspil med de studerende; udvik-ling og evaluering af indsats. Det gælder også selvom sådanne undervisere ifølge Bain (2004) ikke altid har succes med deres undervisning.

Konklusion

Afslutningsvis skal det understreges, at spørgeskemaet, som nærværende opgave bygger på, ikke direkte kan afspejle kvaliteten af de studerendes læring, men blot give en pejling af de studerendes oplevelse af undervisnin-gen – på det pædagogiske som på det faglige plan. I det omfang en sådan pejling kan oversættes, må valgfaget siges at have været en succes på alle niveauer.

A Fagbeskrivelse for valgfaget "Etnicitet og kronisk sygdom i et globalt perspektiv"

Ethnicity and chronic disease

Externally: 10 ECTS/30 lessons

The course relates to social and health science but has a biological focus

Language: English if attended by international students

Course responsible:

Dirk Lund Christensen, Department of International Health, phone 35 32 76 26 and email: dirklc@sund.ku.dk

Aim and content of course:

The aim of the course is to explore to which degree chronic diseases emerge in different ethnic groups on a global level. Main emphasis will be put on diabetes, hypertension and heart disease. The course will provide the participants with a definition of the concept of ethnicity/race followed by investigations in different populations globally in order to show that some diseases are more prevalent in specific populations. Studies in Europeans (Caucasians) will be used as a reference. Different questions will be addressed such as: are there biological differences between ethnic populations? Are the WHO definitions of for example overweight applicable in all populations? Do changes in lifestyle have the same effect in all populations? The concepts thrifty genotype, thrifty phenotype and the metabolic syndrome will be defined and discussed. Further, the course will make an attempt to look ahead and give a qualified guess with regards to the association between disease and susceptibility due to genetic admixture as a result of migration and urbanisation on a worldwide scale. Finally, the course will address the association between chronic and communicable diseases which is highly prevalent in developing countries.

Entry requirements:

The course will primarily have a biological approach. Further, the course fits well into studies such as public health and medicine as well as nutrition and human biology. The course will be open to BA-students.

Exam:

Oral exam with internal review and grading 7-scale

Literature:

A series of scientific articles will be available through the Department of International Health as a compendium. Examples of articles are:

1. Jørgensen, M.E., Christensen, D.L. Ethnicity and obesity: why are some people more vulnerable? Int Diab Mon, 20, 202-209, 2008

2. Gower et al. Using genetic admixture to explain racial differences in insulin-related phenotypes. Diabetes, 52, 1047-1051, 2003

3. Geissler, C.A., Aldouri, M.S.H. Racial differences in the energy cost of standardised activities. Ann Nutr Metab, 29, 40-47, 1985

B Spørgeskema

Evaluation of elective course "Ethnicity and chronic disease in a global perspective"

(Course Responsible version)

1. Nationality information   Danish student____   Foreign student____

2. Gender information Female____   Male____

3. Educational level   Undergraduate____Graduate____

4. Of the 15 double-lectures in the course, how many did you attend? ____ lectures

5. On a scale from 1-5 (with 1 being the lowest and 5 being the highest rating), how would you rate the course overall? Rating ____

6. On a scale from 1-5, how would you rate the presentation of the learning objectives (orally and in writing)? Rating____

7. Did the course live up to the learning objectives? Yes____   No____

8. Overall, how would you rate – on a scale from 1-5 – the presentation of the sub-themes as a lecture form? Rating____

9. Did the presence of the Course Responsible (DLC) at all lecturers* enhance your understanding of the course content? Yes____ No____

10. Did the presence of the Course Responsible (DLC) at all lectures* add value to the course? Yes____ No____

11. Was the presence of the Course Responsible (DLC) at all lectures* essential?

    Yes____ No____

12. In your own words, how would you describe the presence during all lectures of the Course Responsible (DLC)?

8

Om at understøtte de studerende i at forstå og skabe en overordnet sammenhæng på et tema-baseret kursus. Med fokus på anvendelse af mindmaps som undervisningsredskab

Annemette Nielsen

Fødevareøkonomisk Institut, Københavns Universitet

Evalueringerne på kurset Sundhed og Livskvalitet, som udbydes på Fødevarevidenskab, har i flere år peget på, at de studerende har problemer med at følge sammenhængen mellem de enkelte kursuskomponenter set i forhold til kursets overordnede målsætninger. De studerende har bl.a. givet udtryk for at de mener at kurset er "for bredt" og derfor for "overfladisk", og at der mangler "en rød tråd" både til at kæde de mange forskellige forelæsninger (med forskellige undervisere) sammen indbyrdes og i forhold til at integrere øvelser med forelæsningerne.

Inden for den universitetspædagogiske litteratur fremhæves vigtigheden af et velstruktureret vidensfundament i forhold til at skabe en effektiv undervisnings- og læringskontekst. Et velstruktureret vidensfundament betyder at der skabes meningsfyldte sammenhænge mellem eksisterende og nytilegnet viden, således at indlæring af ny viden bygger på allerede etableret viden. Ikke bare i den forstand at den eksisterende viden på et givet felt udvides horisontalt (mere viden af samme slags), men også sådan, at den nye viden afstedkommer en reorganisering af den eksisterende viden, sådan at ny erkendelse opnås på et vertikalt højere niveau, f.eks. ved at de studerende bliver i stand til at forstå enkeltkomponenter i kraft af et fælles overordnet begreb (Biggs & Tang 2007, p. 93). På denne baggrund består en central udfordring især på temabaserede kurser i at kæde temaerne sammen indbyrdes ved f.eks. at lave krydsreferencer, opstille paralleller og pege på sammenhænge mellem de enkelte temaer. Hvis det temabaserede kursus ydermere er sammenstykket af biddrag fra mange forskellige

forelæsere, bliver denne udfordring med – på en velstruktureret måde – at placere ny viden i forhold til eksisterende viden yderligere skærpet. Projektet her forsøger at tage denne udfordring op på temakurset Sundhed og Livskvalitet.

Baggrund

Beskrivelse af kurset Sundhed og Livskvalitet

Bachelorkurset på Fødevarevidenskab, LIFE med titlen Sundhed og Livskvalitet har til formål at give de studerende: "en bred viden om sammenhængen mellem menneskers kost- og motionsvaner og sundhed, herunder hvilke fysiologiske processer som er involveret. Desuden vil den studerende opnå en forståelse af hvilke samfundsmæssige, sociale og kulturelle faktorer, som påvirker menneskers levevaner og livskvalitet". Kurset strækker sig over to blokke, hvoraf første blok består af forelæsninger og øvelser. Disse gennemføres primært af en række forelæsere uden ansvar for eller involvering i kursets tilrettelæggelse i øvrigt. Forelæsningerne var i år struktureret i forhold til fire temaer, nemlig "sundhed og livsstil samt danske vaner", "livskvalitet", "regulering, forebyggelse og sundhedsfremme", samt "særlige fødevaregrupper". Denne blok afsluttes med en to-timers skriftlig prøve, hvor de studerende skal besvare otte spørgsmål referende til pensum og forelæsninger. De må bruge alle hjælpemidler (dvs. kompendium, forelæsningsslides og egne notater). Den anden blok består af, at de studerende i grupper skal skrive en projektrapport ud fra en selvvalgt problematik inden for emnet. Kurset henvender sig primært til studerende fra Fødevarevidenskab, der gerne vil optages på kandidatuddannelsen i Human Ernæring, men nogle studerende fra Idræt og Biologi vælger også faget. I år var 38 tilmeldt temakurset.

Tilrettelæggelse af undervisningen

Ansvaret for kurset fordeler sig mellem to institutter, nemlig med 80% på IHE og 20% på FOI. I år blev kursusplanlægningen i forhold til blok 1 i praksis varetaget af tre personer. Ved indledende møder blev det diskuteret og aftalt hvilke overordnede ændringer, der skulle foretages i forhold til kurset sidste år. Dette skete i vidt omfang på baggrund af mundtlige evalueringer og med henblik på at imødekomme de studerendes kritik af manglende sammenhæng. Følgende afgørelser blev truffet:

- Alle forelæsere skulle bedes om eksplicit at forholde sig til undervisningsmålene for forelæsningen i løbet af undervisningen.
- Hvert tema skulle indledes af en kursusansvarlig og afsluttes med en opsummering i forhold til de forelæsninger, som temaet havde indeholdt.

Det blev lagt ud til de to af os, der i praksis skulle agere gennemgående figur på temaerne at vælge, hvordan indledning og opsummering skulle foretages. Dog gjorde jeg opmærksom på at det ville være fint, hvis vi ikke gjorde det samme, sådan at jeg bedre kunne evaluere effekten af de tiltag, jeg skulle afprøve, og som jeg ikke havde defineret præcist på det tidspunkt. Opbygningen af kurset byggede på kursusplanen fra sidste år, som blot var blevet tilføjet de nye, relevante datoer og time slots. På nær et par enkelte undervisere blev der lagt op til at kurset indholdsmæssigt skulle bestå af de samme forelæsninger som året forinden med tilhørende øvelser.

Teori

Midler til at understøtte et velstruktureret vidensfundament kan være at tilbyde de studerende "advance organizers" – det vil sige, begrebsmæssige strukturer og modeller forud for det egentlige undervisningsstof, som de kan forholde det stof til. Det er vigtigt at det er de studerende selv, der foretager struktureringen af viden, og derfor gælder det om at finde en balance mellem at overlade de studerende med kaos på den ene side og med en fiks og færdig struktur på den anden. Begge disse yderpunkter vil nemlig blokere for "deep learning". Målet er i stedet at tilbyde dem struktur nok til at gøre dem i stand til at skabe betydningsfulde sammenhænge i den viden, de præsenteres for (Biggs & Tang 2007, p. 94).

En mindmap er en grafisk eller visuel repræsentation af forbindelser mellem et centralt emne og begreber og ideer (Buzan 1995). Formålet med at arbejde med mindmaps kan være mange, f.eks. at forbedre de studerendes evner til kritisk tænkning, problemløsning og samarbejde (Willis & Miertschin 2006), men i denne sammenhæng skal det fremhæves at metoden er effektiv til at aktivere de studerende selv til at skabe en begrebsmæssig struktur til at forstå og løbende bearbejde de informationer, som kurset vil give dem i forhold hertil. Således kan mindmaps betragtes som et semantisk organiseringsværktøj (Beissner et al. 1993, Jonassen et al. 1998), der understøtter fortolknings- og forståelsesprocesser ved at hjælpe dem med at fokusere tanker og ideer (IARE 2003), og som gør de studerende

i stand til i sammenhæng at organisere og analysere det, de ved og det, de lærer. Brugen af mindmaps understøtter aktiv læring, der i den didaktiske litteratur opfattes som en central komponent i de studerendes opnåelse af "deep learning" eller "higher order thinking" (Gibbs 1981, Bonwell & Eison 1991). Derudover kan der argumenteres for at metoden er effektiv til at aktivere og opnå dyb læring hos en bred gruppe af studerende, idet den supplerer de fremherskende lingvistiske undervisningsmetoder (Willis & Miertschin 2006) og generelt appellerer til en bred vifte af forskellige læringsstile (Holland et al. 2003-4).

Motivation og læring er uløseligt forbundet (Biggs & Tang 2007). Motivationen for at lære er også afhængig af at den information, der formidles, kan placeres i en sammenhæng, der har værdi og giver umiddelbar mening for modtageren. Skabelsen af motivation hænger dermed sammen med en reference til allerede eksisterende viden eller erfaring hos den studerende. Midler til at motivere de studerende i skabelsen af et velstruktureret vidensfundament kan – udover at tilbyde dem en struktur at tænke i forhold til – være anvendelse af "grappers", som er elementer, der åbner de studerendes øjne for en strukturel sammenhæng ved at tale til deres følelses- og erfaringsverden i form af f.eks. humor, overraskelse eller chok. At skabe vedvarende motivation for undervisning på et kursus forudsætter desuden "alignment" af undervisningen: at kursets formål er vigtigt og at det er dette vigtige formål, som der faktisk undervises i og som de studerendes præstationer måles på.

Metoder

Jeg stod for at skemalægge temaerne "livskvalitet" og "regulering, forebyggelse og sundhedsfremme". Med henblik på at inddrage underviserne i at sikre kursets alignment opfordrede vi underviserne til at knytte undervisningens indhold tydeligt til de beskrevne undervisningsmål for de enkelte undervisningsgange. I forhold til at knytte de enkelte forelæsninger dels til temaet og dels til kursets overordnede læringsmål iværksatte jeg følgende tiltag:

- Brug af "grappers" i forbindelse med introduktioner til temaerne
- Brug af "advance organizers" i forbindelse med introduktioner til temaer og til enkelt undervisere
- Brug af mindmaps

På grund af pladsbegrænsning er kun brugen af mindmaps bekrevet her.

Brug af mindmaps

I forbindelse med introduktionen til hvert af de to temaer, blev de studerende bedt om i grupper af to at formulere tre spørgsmål som de mente var centrale at få svar på under dette specifikke tema set i relation til kursets overordnede læringsmål. Her skulle advance organizers anvendt i introduktionen til hvert af de to temaer hjælpe dem og sætte gang i deres tanker.

På tavlen blev starten på mindmappen lavet, idet de studerendes spørgsmål blev tegnet ind i forhold til temaet i midten, figure 8.1 viser den mindmap, der blev lavet som indledning til temaet livskvalitet.
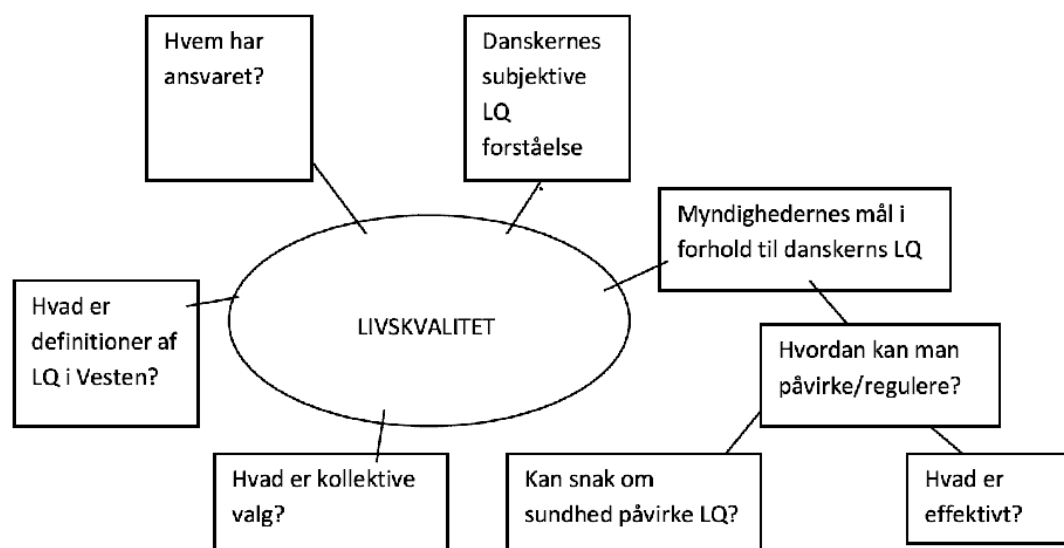
Figur 8.1. Mindmap lavet som indledning til temaet livskvalitet (LQ).

Som introduktion til hver enkelt forelæsning udpegede jeg på mindmappen (skrevet på tavlen), hvilke spørgsmål jeg forventede ville blive omhandlet af forelæsningen. På denne måde blev mindmappen også inddraget som advance organizer for de enkelte forelæsninger.

Efter hver forelæsning vendte jeg igen tilbage til mindmappen og indtegnede med de studerendes hjælp, hvilke centrale svar, pointer, begreber osv. undervisningen havde bidraget med i forhold til de forskellige spørgsmål. De studerende blev opfordret til løbende at arbejde videre med deres egne, individuelle mindmaps. Et eksempel på en udbygget mindmap efter en enkelt forelæsning er vist i figur 8.2.
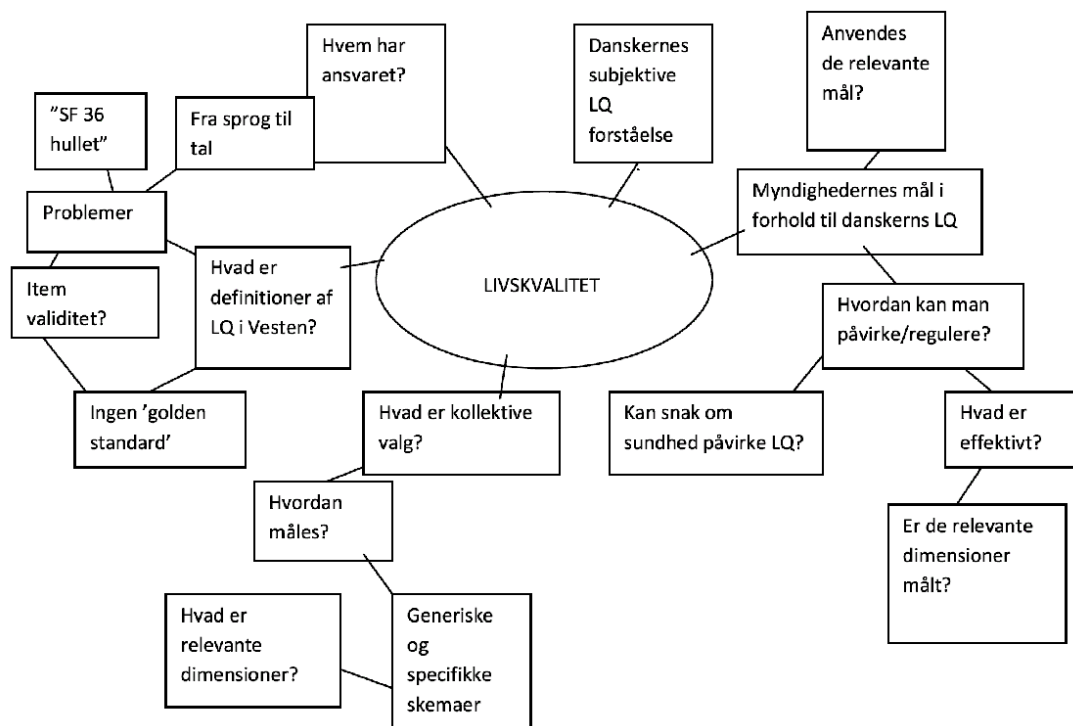
Figur 8.2. Mindmap udbygget efter en enkelt forelæsning.

Endelig tjente mindmappen som et centralt redskab i de tematiske op-summeringer, hvor de studerende i større grupper blev bedt om at samle op på deres notater og pensum i forhold til mindmappen. Her havde jeg på forhånd grupperet de studerendes oprindelige spørgsmål i undertemaer. Disse undertemaer tjente som nye mindmaps, som grupperne så blev ind-delt efter og fik ansvar på at udbygge. Resultatet af gruppearbejdet blev til slut præsenteret for de andre på holdet.

Brugen af mindmaps på ovennævnte måde indebar at jeg til forskel fra den ansvarlige på de andre kursustemaer var til stede ved al undervisning.

Metoder til at vurdere effekten af projektet

Resultatet af dette projekt set i forhold til at styrke de studerende i at ska-be en meningsgivende sammenhæng i kursets blok 1 blev forsøgt målt på forskellige måder.

Fokusgruppeinterview

Som afslutning på blok 1 tilrettelagde jeg et fokusgruppeinterview, hvor fire studerende deltog. Heraf var de tre fra Fødevarevidenskab og en fra Idræt. De var udvalgt tilfældigt ved at jeg spurgte, hvem der havde lyst. Disse fire deltagere blev oplyst om at interviewet handlede om deres vurdering af undervisningen med henblik på at evaluere og forbedre kurset. For ikke at præge deres udtalelser om min undervisning blev interviewet foretaget af en anden adjunktpædagogikumdeltager, som også er samfundsforsker og vant til at interviewe, men som de studerende ikke kendte. Interviewet var styret efter en tragtmodel, der fulgte en interviewguide, hvor der indledningsvist blev spurgt til deres oplevelse af kurset generelt og hvor de så ad flere trin blev ledt frem imod at evaluere de metoder, som jeg havde gjort brug af.

Evalueringsskema

Som afslutning på blok 1 blev der konstrueret et spørgeskema, som sigtede på direkte at måle de studerendes oplevelse af i hvor høj grad introduktioner og opsummeringer havde skabt større sammenhæng i kurset. Skemaet blev sendt ud sammen med den standardiserede kursusevaluering via Absalon.

Mundtlig evaluering på holdet

Endelig blev de studerende i forbindelse med den mundtlige evaluering bedt om at tilkendegive, om de havde været tilfredse med kursets indhold og opbygning, hvad de eventuelt havde været utilfredse med, og om de ønskede forandringer af opsummeringerne. Den mundtlige evaluering blev gennemført af de kursusansvarlige fra IHE.

Resultater

Resultaterne fra de tre evalueringsformer pegede i lidt forskellige retninger, men viste også overordnede tendenser mod en positiv effekt af de anvendte tiltag.

Kun 29% (11 af 38 studerende) besvarede den skriftlige evaluering. I den standardiserede evaluering blev brugen af mindmaps og løbende opsummeringer fremhævet som positive træk ved kurset. Blandt de 11 studerende, der besvarede det specifikke skema, var der dog stor forskel på,

hvorvidt de mente at henholdsvis introduktioner og opsummeringer havde bidraget til at skabe en større sammenhæng mellem de enkelte forelæsninger.

I forbindelse med den mundtlige evaluering af blok 1 blev der i ret stort omfang givet udtryk for tilfredshed med kurset som helhed, ligesom der heller ikke var de store forslag til ændringer eller forbedringer. Dette var meget anderledes i forhold til kurset det foregående år, hvor de kursusansvarlige oplevede en stor kritik af kurset. Et stort flertal af de studerende tilkendegav at de syntes at introduktioner og opsamlinger efter hver forelæsning skulle videreføres på kurset fremover. Derudover blev der fra de naturvidenskabelige studerendes side (i alt 10 studerende fra idræt og biologi) givet udtryk for at mindmaps var en for flyvsk metode for dem.

Resultaterne fra fokusgruppeinterviewet pegede på at de studerende fandt kurset meget godt organiseret i forhold til at skabe en overordnet struktur og sammenhæng. Introduktioner og opsummeringer i forhold til temainddelingen blev fremhævet som afgørende elementer i at opnå dette. Ligesom det blev fremhævet som en stor hjælp, når underviserne eksplicit forholdt sig til læringsmålene og gerne fulgte op på dem til sidst.

Metoden med mindmaps var blevet registreret som noget særligt af de studerende. Således blev metoden fremhævet flere gange som en styrke også inden der blev spurgt direkte til den i interviewet:

> "Jeg synes også styrken ved det [mindmaps] det var at det var sådan løbende. [andre siger 'ja']. Det var sådan, at HVER gang så tog vi den op. Hvorimod at nogen af de andre gange vi har samlet op, ligesom i dag for eksempel under temaet Særlige fødevaregrupper, der har vi evalueret på den måde, at FØRSTE gang der har vi sagt, hvad forventer vi at få ud af det her? Og så er det først, når det HELE er slut, så tager vi det op igen.
>
> YY: Man kan ikke engang huske, hvad man sagde første gang.
>
> XX: Nej, præcis – eller hvad konteksten var. Og der synes jeg det var rigtigt fint med mindmaps, fordi det hele tiden gjorde en obs på, hvad er det egentlig det handler om det her? Hvad er det vi vil finde frem til, og sådan… Det synes jeg var meget mere sammenhængende"

Resultatet fra fokusgruppeinterviewet viste ingen negative erfaringer med eller holdninger til arbejdet med mindmaps fra de deltagende studerendes side.

I forbindelse med de temaer, jeg havde haft ansvaret for blev det derudover fremhævet som en fordel at jeg havde været til stede ved al den undervisning, som de studerende skulle opsummere på.

Konkluderende refleksioner

I ovenstående projekt blev flere undervisningstiltag iværksat med det formål at understøtte de studerende i at skabe sammenhæng mellem de enkelte kursuselementer. Målet hermed var at danne basis for et velstuktureret vidensfundament, som er afgørende for at undervisningen resulterer i dyb frem for overfladisk læring. Nogle af tiltagene blev iværksat på kurset som helhed, mens andre – herunder brugen af mindmaps – blev iværksat på to af kursets temaer, som jeg havde ansvar for.

Erfaringerne fra projektet tyder på at indsatsen bar frugt. I forhold til evalueringen af kurset sidste år, udtrykte de studerende langt større tilfredshed med sammenhængen i kurset, både direkte ved at fremhæve den gode organisering af kurset i temaer med introduktioner og opsummeringer, og indirekte ved *ikke* at kritisere kurset for en manglende rød tråd, som det var tilfældet ved tidligere evalueringer.

På baggrund af de anvendte mål på effekten af indsatsen kan det være svært at afgøre effekten af de separate tiltag. I den skriftlige evaluering var vurderingen af opsummeringer og introduktioner delt i forhold til deres biddrag til at skabe sammenhæng. Men både i den mundtlige evaluering og i fokusgruppeinterviews blev disse elementer generelt meget positivt vurderet. Til trods for overvejende positive tilbagemeldinger afslørede den mundtlige evaluering også lidt delte meninger om introduktioner og opsummeringer på de temaer, jeg stod for, og brugen af mindmaps i den forbindelse. Fokusgruppeinterviewet derimod resulterede i meget positive vurderinger af disse elementer.

Mine egne erfaringer med projektet og i den forbindelse brugen af mindmaps giver anledning til nedenstående refleksioner vedrørende en fremtidig anvendelse af metoden på lignende undervisningsforløb.

En overordnet refleksion og konklusion går på, at en optimal brug af mindmaps forudsætter at redskabet indgår som et planlagt undervisningselement i hele kursusforløbet. Det betyder at der allerede i kursets planlægningsfase skal overvejes og besluttes, hvilken rolle brugen af mindmaps

skal spille i undervisningen og hvilke ressourcer der af hensyn hertil må afsættes til arbejdet. Brugen af mindmaps som undervisningsredskab bør herunder reflekteres i den måde bedømmelsen af de studerendes præstationer tilrettelægges.

Planlægning af tidsrammerne

I forbindelse med det her beskrevne kursus besluttede jeg mig først for at anvende mindmaps efter at kursusplanen var lagt. Som følge af at forelæsningsplanen fulgte de afsatte "time slots" fra året forinden, blev der afsat 30 minutter til introduktionen til temaet Livskvalitet, mens der kun var afsat 15 minutter til introduktionen af temaet Regulering, forebyggelse og sundhedsfremme. Til opsummeringerne blev der afsat én time under temaet Livskvalitet og 25 minutter under temaet Forebyggelse, regulering og sundhedsfremme. Anvendelsen af mindmaps (og andre advance organizers) måtte således tilpasses de forskellige tidsrammer og varierede derfor mellem de to temaer. Hvor deltagerne f.eks. i forbindelse med opsummeringen på temaet Livskvalitet fik mulighed for at præsentere resultaterne af deres arbejde med mindmaps for hinanden fra tavlen, og der var tid til at kommentere og supplere deres præsentation, var der kun meget begrænset tid disse processer ved opsummeringen på det andet tema. Et andet problem i forhold til tiden var at selvom jeg ret konsekvent bad de enkelte undervisere om at efterlade 5-10 minutter til en fælles opsummering af deres undervisning fra tavlen og viste dem mindmappen, som jeg brugte hertil, var det langt fra alle undervisere, som respekterede dette ønske eller var i stand til at strukturere deres egen undervisning, så der var den fornødne tid til sidst. Dette bevirkede en ret stor forskel i hvor hurtigt og hvor grundigt pointerne fra undervisningen kunne relateres til mindmappen og frem for alt en stor forskel i, hvor meget jeg formåede at få de studerende på banen i forhold hertil.

Ved brug af mindmaps i et fremtidigt kursus skal der i kursusplanen eksplicit afsættes tid til at de studerende både kan arbejde med mindmaps som kollektiv og som individuel proces og både i samspil med underviser og kursusansvarlig og i samspil med de andre studerende. På dette kursus havde det været ønskeligt, hvis der konsekvent havde været afsat f.eks. ti minutter til i dialog med den enkelte underviser at opsummere pointerne fra undervisningen i forhold til mindmappen på tavlen. Man kunne derudover overveje at afsætte f.eks. fem minutter til at de studerede enten parvis eller individuelt kunne arbejde på at udbygge deres egne noter og mindmaps.

Introduktion af metodens anvendelse og formål

Som følge af den sene beslutning om at anvende mindmaps på kurset blev underviserne ikke orienteret grundigt om formålet med dette og kunne derfor ikke forventes f.eks. at ville prioritere tiden fra deres i forvejen planlagte undervisning til at forholde sig til dette instrument. På det aktuelle kursus var det derfor kun de undervisere, der på forhånd kendte til eller var motiveret for brugen af mindmaps, eller dem som nemt kunne afsætte tid til den afsluttende opsummering, hvis involvering i den opsummerende fase for alvor blev konstruktiv i udformningen af mindmappen.

De studerende blev introduceret for formålet med at bruge mindmaps ganske kort i forbindelse med introduktionen til det første tema. I denne introduktion blev der dog lagt vægt på, at mindmappen var et tilbud til dem, et arbejdsredskab, som jeg vurderede, de kunne have gavn af, men som det var deres eget valg, om de ville anvende udover det arbejde med mindmaps, som foregik på holdet. Jeg vurderer at denne italesatte valgfrihed resulterede i vidt forskellige praksisser blandt de studerende, som igen resulterede i vanskeligheder, når noterne skulle samles i de mindmaps, som gruppearbejdet i forbindelse med tema opsummeringerne skulle resultere i. Dette kunne dels skyldes at motivationen for at anvende dette redskab var forskellig, men det kunne også skyldes noget mere studieteknisk. Især mange af de studerende, som noterer på computer i løbet af undervisningen, synes at have svært ved at udbygge deres individuelle noter i form af mindmaps, når de blev opfordret til det, fordi formen ikke passer ind i deres elektroniske notesystem.

Især resultaterne fra fokusgruppeinterviewet pegede på at de tilbagevendende introduktioner og opsummeringer i forhold til hver enkelt forelæsning havde hjulpet de studerende til at skabe en sammenhæng i kurset. For at dette skal fungere optimalt bør både undervisere og studerende dog informeres grundigere om hensigten med at anvende dette redskab og hvad deres egen indsats kan være i denne forbindelse. For at de studerende for alvor kan mærke udbyttet af gruppearbejdet med mindmaps, kræver det at de hver især er motiverede for løbende at arbejde med dette redskab i deres individuelle notatarbejde. Denne motivation kan dels skabes ved at forberede dem bedre på, hvordan og hvorfor mindmaps bruges til at lære gennem. Dels ved at gøre det til en obligatorisk del af arbejdet på kurset og ved i den forbindelse at evaluere dem på deres indsats. Dels kunne motivationen for en bredere gruppe måske styrkes ved at tilbyde dem et computerbaseret

mindmapping-redskab, som bedre matchede deres elektroniske notatpræferencer (se f.eks. Holland et al. (2003-4)).

Brug af mindmaps i forbindelse med eksamen

En effektiv kursus-alignment indbefatter, at der er nøje sammenhæng mellem et kursusformål (ILOs), de læringsaktiviteter (TLAs), der anvendes til dette formål, samt det som de studerende i sidste ende måles på (Biggs & Tang 2007). Hvis mindmaps indgår som en central aktivitet, hvorigennem de studerende forventes at opnå en læring, der svarer til kursets formål, bør produktet af denne aktivitet – altså læringen – også være en del af det, som de studerendes præstation måles på. Eksaminationen af de studerende kunne f.eks. indbefatte at de studerende med udgangspunkt i mindmaps gjorde rede for deres forståelse af stoffet i form af beskrivelser, analyser og kritiske refleksioner over sammenhænge mellem centrale begreber. Mindmapping kunne også inddrages i formative bedømmelser undervejs i kurset (Biggs & Tang 2007). Her kunne de studerende sættes til at kommentere hinandens mindmaps og reflektere videre over deres egne på den baggrund, eller den formative proces kunne foregå i samspil mellem kursusansvarlig og den enkelte studerende.

Part II

Evaluating and revising existing courses or units – course development

9

Social Science Courses at a Life Science Faculty: How to adapt a Sociology Course to Landscape Architects

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The course 'urban sociology – human, place and city' is a relatively new course. It is an optional course for landscape architects. Two years ago a colleague and I developed the course from scratch because many landscape architectural students called for a course dealing with the 'human dimension'. The goal of the course is to give the students different perspectives on peoples' lives and use of urban areas. My colleague and I both have backgrounds in social sciences and developed a course building on sociological and geographical theories and concepts to the understanding of urban areas.

The students attending the course counts landscape architectural students but also a growing number of students from outside. The course was initially built up very traditionally of lectures, text presentations, and then an essay in the end. Much like we knew it from our backgrounds. However, it was clear after the first year that it was the students coming from outside that were most satisfied with the course and generally succeeded better in the final essay. Our task was clear; we needed to adapt the course better to the intended target group – the landscape architects. This essay concerns the adaptation process. It analyses the course to pinpoint core problems and focus two main initiatives to improve the course; thematic restructuring and reflection papers. These initiatives are then discussed and evaluated. The analysis and evaluation is based on experiences and observations during the course, student evaluations, both oral and written and the KNUD pre-project that was based on a focus group interview with students from this course.

Pinpointing the problems

Different kinds of knowledge

The intended learning outcomes (ILOs) of the course are that the students should get an overview of and be able to account for the most important research traditions and domains within urban sociology, be able to relate them, and critically apply and evaluate their applicability in the analysis of different urban problems or concrete cases. The ILOs are inspired by the steps in the SOLO taxonomy displaying stages in the learning process (Biggs & Tang 2007). The quantitative stages of learning where students increase their knowledge take place first and then learning changes qualitatively as students start to see the big picture. The ILOs of the urban sociology course work through the levels from describing and accounting for to relation, evaluation and synthesising. Biggs & Tang (2007) similarly distinguish between deep learning and surface learning. Surface learning is the collection of facts and detail where deep learning is the grasping of the main points and messages. This course and the ILO's primarily focus the deep learning.

The course can be said to be aligned at the overall level. The ILOs are evaluated in an essay and 'learned' through the teaching and learning activities (TLAs) of lectures, text reading, group discussions and presentations. However, especially the skills higher in the SOLO taxonomy of relation and evaluation were not reached by many students the first year and it was clear that our TLAs of lecturing and text presentations were not sufficient for all students to obtain the ILOs. We could see from reading the essays that several students read their texts with a 'surface approach' stating some facts and details but not grasping some overall points and relating these to other points and arguments from other texts or course themes. So how could we promote deep learning better in our course?

Different kinds of students

According to Biggs & Tang (2007) the scene for university teaching is changing exemplified in the 'Robert and Susan problem' (Biggs & Tang 2007, p.8). The problem is that teaching mainly is designed for Susans – the academically committed students. But there are also Roberts in the universities today. They attend classes to obtain qualifications for a decent job. Roberts are in higher proportions in today's classes. This distinction in

students seems like a valuable distinction also in the course of urban sociology to explain the success of some students and the difficulties of others. Some students are very self-motivated, where others are more reluctant. The teaching and learning activities (TLAs) in this course of lectures, reading and presentations might be enough for the Susans that practically learn by themselves where the Roberts need some other elements to engage them in the subject matter and setting the stage for deep learning.

The students attending the course are made up of mainly landscape architects but also a substantial part from other institutes mainly geographers and students from social science educations at Roskilde University (RUC). It is clear that these students from outside are much more used to the course set-up of lectures, reading and presentation/discussion and a written essay. They do not question the format and in the end also succeed well. So are they all Susans? Probably not, but they are all used to courses like ours with the rather traditional course set-up of lectures and presentations. So the distinction between Susans and Roberts in this case, is also something to do with what the students are used to from their other courses and educations. It is notable that opposite the students from outside, the landscape architects are not feeling familiar with the format and TLAs, particularly the text reading and essay writing. The evaluations showed that they found the texts too difficult and abstract. The reading they had done before, had mainly been for facts or insights on a particular issue. They also stated that they were not used to writing and it was a major barrier for them.

In landscape architecture, as in other design domains, design is learned primarily by experience through the practice of designing. Heylighen et al. (2005) describes it as 'learning in action'. Students learn through the practice of designing without being aware of what is learned. It is more a kind of tacit knowledge learned through a master-apprentice relationship. Students design and the teacher gives feedback and critique and the students design again and so forth. This way of learning is very different from our course. In our course, it was through text analysis and plenary discussions that feedback was given.

Course evaluations and the focus group interview showed that our course could not 'compete' against these other kinds of courses with continuous deadlines and feedback. It was too easy to skip the course and first put efforts in at the end for the essay. This was a reason given why some students did not participate in our course on a regular basis. This is a vicious circle for the students because when they do not attend, they do not get to 'practice' text analysis and miss out on the big picture presented in lectures

and discussions making relation and evaluation difficult when writing the essay.

Different ways of improving

The landscape architects can be separated into those who attend an urban design line and some more traditional landscape architects with a stronger focus on design and plants. It is clear that the urban designers are much more used to both reading and writing than the more traditional landscape architects. But for all the landscape architectural students, the main problem stated in the evaluation the first year was that the course was too abstract and not easy to relate to their everyday life and subject matter. So building better on what they already knew both in format, way of learning and subject matter was the challenge we had to address. And as Biggs & Tang (2007) so rightly says promoting deep learning is all to do with encouraging an active response from students and developing teaching building on what the students already know.

We had expected the students to be self-motivated throughout the course without direct continuous feedback and without them being as active as they were used to in their other courses. Being active meant something different in our course and so did feedback. Activities were to read, discuss and present and the feedback was the discussions and comments after presentations. More student activity and also feedback or deadlines had to have a more prominent part in the course.

We had expected them to know how to read in depth already and analyse a text and we also expected them to be used to formulating themselves in writing. Therefore obtaining such more generic skills in text analysis and writing skills had to become part of our intended learning outcomes as well as activities.

After the first year we felt like skipping the course altogether but we still believed that the designs and plans of the landscape architectural students could really benefit from a wider set of perspectives and understandings of societal changes and peoples' everyday life. And the evaluation and the essays still showed that even writing and texts were difficult and frustrations with these overshadowed the positive for some landscape architectural students. The students had been challenged by the new perspectives and found them interesting.

The changes

Structure and themes

The changes we made after the first year was to strengthen the connection to the field of landscape architecture. We focused the course around some key themes like 'place and sense of place', 'public places', 'everyday life and mobility', 'communities' (see appendix A, the course plan and figure 9.1). These themes could both relate to the more physical design and planning activities that the landscape architects were used to but also to themes in sociology and geography. Within these fields we then added on with different insights from sociology and geography to widen their understanding and perspectives. The intention was to make it easier for them to see the connection and the value of the sociological approach and insights by looking at familiar themes in a new light. This way we could build on what they already knew while giving them new tools and perspectives to go deeper into the theme.

Each theme had a similar set-up running over three course days. The first year we used two course days a week (of three hours) for confrontation and the last day were left free for reading etc. (at LIFE this is called module B). The second year we decided to spend all three days a week the first six weeks to have room for different new activities, making more free room in the end of the course for essay writing.

Each theme were made up of three different kinds of lectures; one giving the overview and the overall perspectives of the theme. Another, a 'kick-in', was a short lecture focusing on a thinker, a study or a particular perspective, and then the last one was a guest lecture bringing in the real world with a person using sociological insights in planning, design or decision making. Around these lectures the students read 1-2 general texts and student texts they had to discuss in groups and present. The text discussions were guided by text introductions from us and questions guiding the text analysis. The course then ended up in a week where students worked with formulating essay subjects in collaboration with us. This process was more formalised than the year before and the essay writing were followed up by supervision to address the difficulties in writing.

The evaluations and also the quality of the essays were markedly improved after the first year. Not just for landscape architectural students but for everybody. The group of students not attending regularly had also become relatively smaller but it was still a feature in the course. Especially

CONTENT
INTRO TO (URBAN) SOCIOLOGY
SOCIAL DIFFERENTIATION IN THE CITY
MOBILITY, EVERYDAY LIFE AND PRAXIS
PLACE AND SENSE OF PLACE
PUBLIC SPACE
COMMUNITY AND SEGREGATION
OUTRO – AND ESSAY FORMULATION
WRITING AND SUPERVISION

Fig. 9.1. Overall course themes

the days when we had text discussions were not that well attended, even if it was the text discussions that were brought forward in the evaluations as positive and interesting. So there were still room for improvements. The barrier of writing was still mentioned in the evaluation and also some essays were still of such bad quality showing that the students had not gone into depth with the texts and the course themes.

Reflection papers and peer feedback

This year we have introduced a new feature in the text discussions: the reflection paper. It is an individual written paper of 1-2 pages analysing a student text and discussing it in relation to planning/urban life. Similar to the year before we have prepared some questions to guide the text analysis and suggest points to discuss in relation to planning and design. The students are divided into six groups of 4-6 students. Each text is then read by two groups. One group discusses and presents the text in plenary as before and the other group writes reflection papers on the text. This adds up so each student has to be involved in three text presentations and make three reflection papers (see appendix A course plan). The handing in of the three

reflection papers is a precondition for going to the exam (writing the final essay).

Introducing written assignments in the course without putting more workload on us for commenting and giving feedback was a concern. We have a limited amount of hours for a course and these are already spend on confrontation and essay reading. Here the experiences from elsewhere with peer assessment encouraged us. Peer assessment can, based on several examples (Morrow 2006, Cho & MacArthur 2011), be introduced without necessarily increasing the workload. It is important to stress that we use peer feedback and not assessment as such, where students have to give grades or report back to the teacher. The benefits of peer feedback are that the student and also the 'assessor' get deeper into the subject matter and also obtain a better understanding of what is a good text. Peer feedback is also an important alternative to instructor evaluation and feedback because when peers communicate their comments, they use the same 'language' without using professional jargon and student writers may understand peer comments more easily than expert comments because peers also share problems and knowledge (Cho & MacArthur 2010).

The obligatory reflection papers are introduced to make it 'worthwhile' to come to the text discussion days, start the writing process earlier in the course and use peer feedback to enhance text comprehension and also on what is a good text. The students that write reflection papers get the opportunity to get peer feedback on a written piece by other students that have also read the text, discuss the written piece and the text and then get to hear the texts presented by another group and act as opponent on the text presentation. All this giving them a good basis for the final text analysis and individual writing of the reflection paper.

Introducing this new element into the text discussions has definitely worked on the attendance of text discussions. This gives a larger critical mass for discussions and hereby again making it worthwhile and also interesting to come. The actual peer feedback has not worked out exactly as intended. The frame given for the feedback sessions was that students write a draft text at home and bring it on the day of text discussions in order to get feedback on the draft written piece. However, students read the texts at home and take some notes also in written form. Mostly they do not write these notes into a coherent text they can interchange and get feedback on. They use the notes as a basis for group discussion and say that these notes are not in a form where actual feedback on the written format would make sense. Therefore the peer feedback stays on the level of a group discussion

on the text messages and not on the actual writing. However, many students say that the process of discussion and hearing the plenary presentation give them a very good basis for writing their reflection paper and they will use the group later in the writing process for feedback.

Discussion

In the evaluation of the course, students rated the reflection papers positively. It was helpful to write as it gave room for reflection and pushed students to express themselves in writing not just at the end of the course, but throughout. However, students found it too "structured" that we wanted them to write for every session. We see the point made by the students who ask why spend much time on writing before they have discussed and heard the presentations. The feedback on writing is more worthwhile later. So we will work on facilitating text feedback later in the process because students are already asking us whether we will give them feedback on their reflection papers when they have them ready. – And this was not the intention. We targeted the reflection papers to the situation of the landscape architects so they could get a forum for writing and receiving feedback from students from outside who had tried it before. But it is clear that the students from outside are used to less formalised ways of teaching, leaving more room for themselves to do as they find suitable. Therefore they first start writing after text discussions in class.

Another interesting point has come up during the last month of the new course. Are we putting too much into the course now leaving no time for the student preparation? This year we have kept the structure of using three days a week for lectures, discussions and texts, but at the same time seized some of the free essay writing time in the end of the course also for discussions etc. Here at the faculty of LIFE sciences we have many hours in a module; nine hours a week. We have filled them up with activities and discussions to have room for students being active, with interesting lectures and discussions. 'Great' say some students but some students find it too much. It is especially students from outside that that are used to much less confrontation hours from their respective studies. They say they do not have time for all these activities. Also in the light of university restructuring, running courses with many confrontation hours might very well be something of the past; a way of teaching done at LIFE but not feasible within a new faculty made up of both LIFE and Natural Sciences.

We have now developed a structure for the course that brings into play themes from landscape architecture and urban design that we can add new perspectives to. We can most probably sort in the perspectives, streamline and find the most important ones, and hereby cut some time from lecturing while still keeping the discussions and activity of students high. We have an inhomogeneous group made up of landscape architects, urban designers and a growing number from outside. As it was important to adapt the course to include more student activity and generic competences for the landscape architects it is also important to keep up the number of students from outside. We will have to find a middle way.

A Course plan

DATO	INDHOLD	PENSUM	
	INTRO TIL (BY)SOCIOLOGIENS KERNEEMNER	Generelt	Til diskussion
MAN 21.NOV 9-12	*Temaformål: Bysociologiens start, dets kerneemner og –metoder, dets udvikling via Chicagosociologerne samt fagområdets senere forgreninger.* Introduktion til kurset: formål, opbygning, aktiviteter og produkter (LIHE). Bysociologi og byudvikling. Sociologiens grundlæggere og deres interesse for samfundsstudier via det urbane (TAC)	Giddens (1998a)	
TIRS 22.NOV 13-16	De klassiske studier af Chicagoskolen og overblik over tiden efter Chicagoskolen og bysociologiens forgreninger (TAC) Introduktion til nyere begreber som globalisering, refleksivitet, individualisering og udlejring (LIHE) Introduktion til tekster og spørgsmål til studenterdiskussion og refleksionspapirer (LIHE)	Alexander & Thompson (2008a) Rasmussen (1995)	
	SOCIAL DIFFERENTIERING		
FRE 25.NOV 9-12	*Temaformål: Man kan begribe sociale forskelle via et klassemæssigt og økonomisk/ressource-perspektiv. Inklusion af kulturelle forskelle kan bidrage til en mere nutidig måde at forstå forskelle på.* Social differentiering er et kernefelt for sociologiske analyser af samfundets hierarkier. Klasseanalyser med inspiration fra marxismen har været det dominerende (TAC). Inspiration fra antropologien har rettet fokus mod kulturelle værdifællesskaber, livsformer og livsstile. forskellige gruppers brug af byrum, inkl. Burgess' og Gehl's differentieringer (TAC)	Giddens (1998b) Faber (2009)	
MAN 28. NOV 9-12	Diskussion grupper/plenum: fællesskaber, individ og urbanitet (LIHE) Introduktion til tekster og spørgsmål til studenterdiskussion og refleksionspapirer om social differentiering (LIHE)		Tönnies (2007) [1887] gruppe 1 p + 2 r Simmel (2007) [1903] gruppe 3 p + 4 r Wirth (2007) [1938] gruppe 5 p + 6 r
TIRS 29. NOV 13-16	Gæsteforelæsning (13-14): Gertrud Ølgaard, NIRAS – om livsformer, livsstile og sociale differentieringer. Bourdieu – et eksempel på en måde at differentiere på (LIHE)		

FRE 2. DEC 9-12	Diskussion grupper/plenum: Social differentiering (LIHE)		Dahl & Øllgaard (2004) gruppe 4 p + 1 r Pløger (2002) gruppe 2 p + 5 r Holm & Jæger (2008) gruppe 6 p + 3 r
	MOBILITET, HVERDAGSLIV OG PRAKSIS		
MAN 5. DEC 9-12	*Temaformål: Hverdagslivet i byerne er forandret over tid. Analyser ud fra kapitalistisk verdensorden viser visse træk (Giddens), analyser efter den teknologiske revolution viser andre vilkår for socialitet (Urry). Hvad betyder disse udviklinger for hverdagsliv, daglig socialitet, menneskelig handling og fællesskab?* Menneskelige handlinger mellem rutiner og strategier. Hverdagslivsbegrebet introduceres via (TAC) Introduktion til tekster og spørgsmål til studenterdiskussion og refleksionspapirer om mobilitet, hverdagsliv og praksis (LIHE)	Jacobsen & Kristensen (2005)	
TIR 6.DEC 13-16	Mobilitetens sociologi – Mobilitet, som nyt grundvilkår (LIHE) Lefebvres tanker om hverdagsliv og kapitalisme - cyklisk tidslighed og rutiniserede praksisser overfor lineær tidslighed (TAC)	Jensen (2011)	
FRE 9.DEC 9-12	Diskussion grupper/plenum: Mobilitet, hverdagsliv og social praksis (LIHE/TAC) Gæsteforelæser (11-12): Malene Freuendal-Pedersen (RUC) om studier om mobilitet i hverdagslivet.		Beck-Jørgensen (2002) gruppe 5 p + 4 r Goffmann (1959) gruppe 3 p + 2 r Freudendal-Pedersen & Hartmann-Petersen (2006) gruppe 1 p + 6 r
	STEDER OG STEDSTILKNYTNING		
MAN 12. DEC 9-12	*Temaformål: Sted var tidligere kun et begreb i geografien, men bruges i dag også af sociologer o.a. Den stigende mobilitet i det moderne tid har medvirket til at det fysiske sted har mistet sin betydning. Flere mener dog at sted og stedstilknytning er blevet vigtigere for det moderne menneske.* Hvad er sted og stedstilknytning? Kan man skabe et sted og hvad betyder globaliseringen for stedstilknytning og findes der lokale og globale steder? (LIHE) Introduktion til tekster og spørgsmål til studenterdiskussion og refleksionspapirer om steder og stedstilknytning (TAC)	Cresswell (2009) Jensen (2009)	
TIR 13. DEC 13-16	Gæsteforelæsning: Svava Riesto. Om perspektiver på stedet, stedets produktion og kompleksitet – med Carlsberg-grunden som case. Indspark: Folk i Wilmslow - Et studie i Nordengland af stedstilknytning, mobilitet og social differentiering sammen (LIHE)		

FRE 16. DEC 9-12	Diskussion grupper/plenum: Steder og stedstilknytning (LIHE/TAC) Introduktion til tekster og spørgsmål til studenterdiskussion og refleksionspapirer om offentlige byrum(TAC)		Sommer (1997) gruppe 2 p + 1 r Massey (1994) gruppe 4 p + 3 r Mazanti & Pløger (1999) gruppe 6 p + 5 r
	DET OFFENTLIGE BYRUM		
MAN 19. DEC 9-12	*Temaformål: Byen er forandret, sociale relationer og hverdagslivet er forandret, tid økonomiseres og sociale kontakter segregeres, internettet har revolutioneret. Er der stadig behov for offentlige byrum? Konsekvenser for planlægningen?* Offentlige rum gennem tiden og temaer i dag (TAC) Gæsteforelæsning (11-12): Lasse Liebst, Sociologisk Insititut - om urbanitetstolerance-hypotesen	Valentine (2001b) Hajer & Reijndorp (2001)	
TIRS 20. DEC 13-16	Diskussion grupper/plenum: det offentlige byrum (LIHE/TAC) Gæsteforelæsning (15-15.30): Yoko Harada – on urban space and local communities in Japan		Jacobs (2007) [1961] gruppe 1 p + 4 r Holston (1999) gruppe 5 p + 2 r Sennett (1992) gruppe 3 p + 6 r
	JULEFERIE		
	FÆLLESSKAB, LOKALSAMFUND OG SEGREGATION		
MAN 2. JAN 9-12	*Temaformål: om hvordan fællesskabstanken er blevet forvaltet i planlægningen via lokalsamfundstanker. Lokalsamfund, ghetto og segregering, og om hvordan moderne fællesskaber stiller sig mellem det globale og det lokale.* Lokalsamfundstanken i planlægningen (TAC) Introduktion til tekster og spørgsmål til studenterdiskussion og refleksionspapirer om fællesskab, lokalsamfund og segregation (LIHE)	Valentine (2001a)	
TIRS 3. JAN 13-16	Om moderne fællesskaber mellem det globale og lokale (LIHE) Gæsteforelæsning: Marie Louise Hartvig Widding, Gribskov kommune - om social kapital i boligområder	Jørgensen (2008)	
FRE 6. JAN 9-12	Diskussion grupper/plenum: Fællesskaber og lokalsamfund (TAC/LIHE) Om at skrive opgave: formål og formalia – brug weekenden til at tænke over emner og problemer		Mumford (1954) gruppe 4 p + 5 r Widding (2007) gruppe 2 p + 3 r Bauman (2002) gruppe 6 p + 1 r
	OUTRO – SKRIFTLIG OPGAVE		

MAN 9. JAN 9-12	Fremlæggelse af essayemner i mindre grupper: Emne, problemformulering, litteratur og indhold		
TIR 10. JAN 13-16	Opsamling af kursets hovedpunkter og problematikker (LIHE) Mulighed for individuel vejledning omkring essayemner og endelig fastsættelse af problemformulering		
FRE 13. JAN 9-12	Individuel vejledning og endelig fastsættelse af problemformulering (deadline for at uploade de tre refleksionspapirer)		
	SKRIVNING OG VEJLEDNING		
MAN 16. JAN 9-12	Selvstændigt arbejde – mulighed for vejledning		
TIR 17. JAN 9-12	Selvstændigt arbejde – mulighed for vejledning		
FRE 20. JAN 9-12	Selvstændigt arbejde – mulighed for vejledning		
	AFLEVERING AF SKRIFTLIG OPGAVE		
MAN 23. JAN KL 23.55	Deadline for aflevering af skriftlige eksamensopgaver (Oploades på Absalon)		

10

Restructuring a University Course – from Chaos to Control

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It is old news that students cannot keep focused during 45 min's of one way communication and thus not surprising that this type of teaching does not create room for deeper learning (Biggs & Tang 2007). However lecturing is still the type of teaching many teachers tend to use or fall back to using, probably because "it is what I have always done" and because it seems easy and less time-consuming. However all the classic arguments for keeping lectures as the most common teaching method are being disqualified very thoroughly by G. Gibbs (1981) in his "Twenty terrible reasons for lecturing". Several teachers have investigated ways to activate students to keep them awake and induce deeper learning in the class room (e.g. Mazur (1997)) and have shown that it is indeed possible. So it is about time to change!

Based on the tools I have learned during my participation in "Adjunkt-pædagogikum" and especially during Introduction to University Pedagogy (IUP) I here present my suggestions on how to restructure a specific course and how to implement these "new" teaching methods to assure deeper learning. The course will not be offered again until fall 2012 (six months after I have handed in this assignment) and by that time the new structure will be tried out – so as I am writing this I cannot say anything about the effect the suggested changes will have on the outcome of the teaching and learning. However I am confident that it will have a positive effect if the teachers manage to go true with the changes.

Facts about the course

ETCS 7.5
Level Master
Offered every $1\frac{1}{2}$ year; last time spring 2011; next time fall 2012
Number of teachers in 2011 7 (2 professors, 3 assistant professors, 2 PhD
     students)
Planned number of teachers in 2012 7-8 (2 professors, 3 assistant profes-
     sors, 1 Post Doc, 2 PhD students)

Methods

Since this is a course I never took or taught myself the first step was to
gather all available information about the course. This was given to me
in the form of a) course description (Appendix A, Danish), b) a course
syllabus (Appendix A) and c) a course plan (Appendix A). Furthermore, I
had an interview with a professor teaching on the course as well as with the
associate professor who is responsible for the course. After this I decided to
make a questionnaire (Q1, Appendix B) to get an idea of the other teachers'
impression of the course. I also tried to get hold of student feedback from
pervious courses however this was not available. Last time the course was
given no students filled out the questionnaire and any answers prior to 2011
apparently are hand written and for unexplainable reasons out of my reach.
So in my questionnaire (Q1) I decided to include a question about how the
teachers perceived the students impression of the course.

     After restructuring the course based on the input and tools I learned dur-
ing "Adjunktpædagogikum" and IUP I invited all former and future teach-
ers on the course to a meeting where I presented the ideas for the new struc-
ture, got input and feedback and discussed content, ILO's and rewriting of
the course description. Finally I gave them a second questionnaire (Q2,
Appendix B) to gather information about their views on the new structure,
the efforts involved with carrying it out and their willingness to meet these
criteria.

Results

Old structure

From interviewing the two professors I got an impression of a course that was totally without structure both concerning academic content and teaching format. They both said that the course lacked structure, continuity in the lectures and that they would like to change the exam format from a written 4h exam into a more continuous evaluation form followed by a final oral exam. The feedback from the other teachers based on questionnaire Q1 confirmed this impression as seen below in figure 10.1.

The students did learn some things, but they could have learned a lot more and gained much stronger competencies. They seemed interested enough but also confused and frustrated due to the lack of structure on the course – this was clear to everyone.

	Question		Summary of answers
A	What is your impression of the course in its old format? What is good / Less Good?	Good	Research oriented based on scientific litterateur and articles. The intension is good - but due to lack of planning/structure it is not working.
		Less good	Nothing is good! There is a lack of structure and planning, too much overlap, too many teachers, too few practical exercises, and the requirements are not very different from what they have had before on other courses.
B	What is your impression of the students? Did they learn what you expected? Do you have any ideas about what they thought about the course?		The students did learn some things, but they could have learned a lot more and gained much stronger competencies. They seemed interested enough but also confused and frustrated due to the lack of structure on the course - this was clear to everyone.
C	What would you like different?		Much more structure and a better teaching plan. More practical exercises and instruction on how to read scientific articles. More student activation teaching and preferably an oral exam instead of a written one and a way to measure the participation during the course.

Fig. 10.1. Summary of interviews and feedback on questionnaire 1. The course did not follow any specific structure or plan.

Approaches to changing the structure

Based on the information I now had on the course I sat down and brain-stormed on possible methods, teaching techniques and approaches to change the structure, content and teaching format (Fig. 10.2).

	Brainstorm; How to make this course better!
1	Structure each class in a similar way, so students know what to expect and prepare for.
2	Have clear ILO's for each teaching
3	Let all teachers present the ILO's for each other so any unnecessary overlap can be removed
4	Use much more student activating teaching such as: let them present, discus in groups, use buzzing questions, concept questions, quizzes, exercises and written assignments (electronic?), let students make their own Wikipedia on Absalon use peer review on the assignment, and presentations.
5	Give the students a solid introduction on "How to read a scientific article" and hand out good abbreviation lists and lists of difficult scientific language to each article.
6	Change the exam format to an oral exam, based on the written assignments.
7	Arrange meetings or other ways of information and communication between the teachers along the way!

Fig. 10.2. Brainstorming; ideas on how to change the course.

New structure and teaching format

To ensure that students know what to expect and what to prepare for I have introduced a consistent class structure (Fig. 10.3). This means that each teacher should follow this structure within certain flexibility. During the first class it is very important to give a solid introduction and explanation to the new format and to make it clear to the students what expectations and benefits this structure gives them. The expectations include active partici-pation during all classes and assignments and this will be valued a certain % of their grade to the exam (if this is possible, I have not been able to get a confirmation on this). During active participation and involvement in e.g. the assignment (see bullet point 4 below) they should benefit strongly

once they start preparing for the exam as each assignment will constitute an exam question.

Group work

Since the number of students participating in the course is between 12 and 24 students the possibility of changing the teaching format from lectures to discussion classes should be very straight forward. The students will be divided into 4-6 groups, and since the content of the course mainly includes scientific papers the idea is to have a rolling schedule (Fig. 10.3) where each group swops between different tasks:

1. One group presents key issues from the paper, everyone in the group should be active.
2. Another group is assigned to lead the discussion and thus prepare a list of questions, to which they also think about possible answers. Again it is important to state that each person in the group should be active (if there are more than four groups, there will be more question groups focusing on different parts or areas of the paper).
3. The third group focuses on pin pointing weaknesses in the paper, they will be given a list of questions to help them look for this.
4. Last group is responsible for writing the assignment for that particular week/topic. The assignment is to write a summary of the topic no longer than one A4 sheet. This paper is to be published on Absalon within a week after the last presentation/discussion round on that topic. Hereafter each group/student should comment and give written feedback to the assignment, this can be monitored by the teacher on Absalon. After another week the final outcome of the summary should be handed in. This assignment will then be used as a topic for the oral exam.
5. One group (if more tasks are needed) could be asked to design an experiment to answer a given problem.

Class structure

The first class will as mentioned above focus on introducing the format, structure, expectations and benefits to the students. To make the expectations clear there will be a "demo" of how to read a paper and how to

	Day 1. (1x3 hours 9-12) TOPIC 1	Day 2. (possibly 2 x 3 Hours 9-12 + 13-17) TOPIC 1

Week 1	**45 MIN:**
	Detailed intro to:
	Course ILOs and structure
	Expectations and structure for
	- group work, presentation, discussions, written assignments (summaries) and question techniques.
	
	Intro: How to read a scientific article.
	
	Exercise: read a short article and discuss in groups based on a hand out with questions.
	
	BREAK
	45 MIN:
	Exercise continues - and is wrapped up by the teacher for the last 20 min.
	        What did you learn from this article?
	
	        Go true words, definitions, methods – perhaps use concept questions.
	
	BREAK
	45 MIN:
	Background to topic 1.
	REVIEW article + other background material.
	
	Next week's article is handed out and teacher is present for questions – also on Absalon.
	
	Wrapping up last 15 min:
	Contextualize, answer questions…etc.
		45 MIN:
		Presentation from **group 1**
		Discussions **(group 2,3)**
		Questions and answers
		(should be send to the teacher the day before)
		
		Feedback to **group 1.**
		
		BREAK
		45 MIN:
		Wrap up with teacher:
		        What did you learn from this article?
		
		        Go true words, definitions, methods – perhaps use concept questions.
		
		BREAK
		45 MIN:
		Background to topic 2.
		REVIEW article + other background material.
		
		Next week's article is handed out and teacher is present for questions – also on absalon.
		
		Wrapping up last 15 min:
		Contextualize, answer questions…etc.
		
		(Demonstration can be used to show key methods or key points.)

Week 2	= Group 2 / Article 2 / Topic 2	= Group 3 / Article 3 / Topic 2
Week 3	= Group 4 / Article 4 / Topic 3	= Group 5 / Article 5 / Topic 3
Week 4	= Group 6 / Article 6 / Topic 4	= Group 1 / Article 1 / Topic 4
Week 5	= Group 2 / Article 2 / Topic 5	= Group 3 / Article 3 / Topic 5
Week 6	= Group 4 / Article 4 / Topic 6	= Group 5 / Article 5 / Topic 6
Week 7	= Group 6 / Review / Summary	= Contextualization and summary on all topics

To be able to go to the Exam	Activity	Assignment + Exam
1) Active participation throughout the course. (If possible let this be valued 20% of the grade) **2)** Oral exam – based on weekly hand ins (summary of each subject).	Students will be evaluated on their activity level during presentations, question/answers etc.	**Summary:** Each week one A4 paper with a summary of the topic is handed in online and all others should comment on this until its final format is handed in. **Exam** Each of these summaries will then cover all 6 topics and the content of the course, and will be used as the base for "drawing" at the exam. However all other subjects within the content can of cause be included at the discussion for the exam.

Fig. 10.3. Schematic overview of the new structure.

prepare for the different assignments (table 3,upper left column). The last 45 minutes or so of all classes will be used to introduce the topic for the next class – in a lecture format using various teaching and learning activities such as buzzing questions, concept questions and what else the teacher finds supportive to his or her teaching.

After this each class will more or less (depending on the teacher) follow the structure outlined in figure 10.3, upper right column. This means that during the first two thirds of the class the paper is presented by one group and the discussions are lead by the question groups first focusing on general questions then pinpointing weaknesses as described above under group work followed by a wrap up from the teacher where further questions can be discussed and the teacher can strengthen the intended learning outcome (ILO) by a few tasks, buzzing questions or by explaining methods or key points more thoroughly and contextualizing the topic.

Scientific content

My aim was to include in this assignment a new and final course description, course syllabus and course plan. However I have not been able to get the needed feedback from the course responsible and thus I am not capable of doing this. Instead I have chosen to attach my suggestions to a reformulation of the course description (Appendix C) and pinpoint weaknesses and how to assure alignment between course description and actual outcome (Appendix C). Also attached is a combined suggestion on how to plan and structure the content (Appendix C) in order to avoid unwanted overlap when a course involves several teachers. This can be used when the teachers meet again to discuss their ILOs and structure the final content and literature for the course.

Feedback on the new structure

After brainstorming and restructuring the course as describe above I invited all former and future teachers on this course to a meeting. My intension was to introduce, discuss and get feedback on my suggestions to the new structure and to coordinate the teaching plan and course content as well as to rewrite the course description. I thus send out an invitation with a very strict agenda and clearly stated preparation tasks for the participants (Fig. 10.4).

We had a very constructive discussion about the structure and I got a lot of useful feedback and suggestions on the planning, teaching and how to activate the suggested group work. The summary of the answers to questionnaire 2 can be seen in figure 10.6.

Meeting invitation:

Important: Preparation time for you before the meeting approximately 30 min.

    I)   Please send me feedback on the attached course description.
    II)   Take a look on the new structure and suggested guidelines for the syllabus.
    III)   Decide on the topic you would like to focus on during your teaching in this course and find the necessary background literature and scientific paper for the students.
    IV)   Write the Intended Learning Outcome for your topic and prepare to present them in 5 minutes.

Fig. 10.4. Extract of meeting invitation. Expected preparation time.

Meeting invitation:

Meeting agenda:

    1)   Short intro to the new structure (max 20 min / Ulla)
    2)   Discussion and feedback about this (30 min / everyone)
    3)   Course description (30 min)
          a) Teaching format and content.
          b) Competence description.
          c) Aim / Criteria (for grade 12)

    4)   Academic content (60 min)
          a) How do we change the academic content so the students learn as much as possible.
          b) What would you want to include, please present your ILOs (intended learning outcomes) and literature.
          c) Topics and course syllabus outline.

Fig. 10.5. Extract of meeting invitation. Agenda.

What do you think about the suggested changes to the course? What is possible what is challenging?	Possible	The suggestions are good and constructive. The group work is a good way to activate deeper learning and make the students engaged during the course.
	Challenging	To ensure that the students get/have enough background knowledge to each topic to solve the assignments and to create a red line in the content since we want to cover quite different topics.
What does it take for the teachers, to meet the new structure?		That the all follow the structure and use the group works assignments. That each teacher has clear ILO's that is communicated to the other teachers to avoid unnecessary overlap and to make good use of any expected overlap. More interaction and communication among the teachers. That it is stated clearly to the students what is expected of them.
Are you ready to meet the demands you mentioned above? If not what would it take to make it possible?		YES! Everyone who filled out the questionnaire answered a clear YES to this question. Unfortunately the key-person(s) did not participate in the meeting and did not respond to the questionnaire (a professor and the course responsible.)

Fig. 10.6. Summary of answers to questionnaire 2 (Q2).

Discussion, conclusion and learning points

It has been a very interesting process to reorganize this course. Coming up with the ideas and restructuring the course was a fairly easy task based on all the information and tools I had been presented to and read about during "Adjunktpædagogikum" and IUP. The hardest part was to get the involved teachers to respond to my inquiry, find time to answer questionnaires, and prepare for the meeting. The six teachers who did respond, answer the questionnaire and showed up for the meeting were all very positive, engaged and motivated.

Future perspectives

It is the intension to follow the new structure as described in this report when the course is offered again during fall 2012. It thus remains to be seen what effect the structural changes will have on the student activity and learning, and whether or not the teachers will be able to carry it out.

A Old course description, syllabus and plan

Udgave:	Forår 2011 NAT
Point:	7,5
Blokstruktur:	3. blok
Skemagruppe:	A
Varighed:	8 uger
Uddannelsesdel:	Kandidat niveau
Skema- oplysninger:	**Tid:** Tirsdag og torsdag kl. 9.00-12.00
Undervisnings- form:	Forelæsninger, demonstration.
Formål:	At give forskningsmæssig forståelse for den menneskelige hjernes funktion og evne til at tilpasse sig nye krav.
Indhold:	I kurset lægges vægt på en forståelse af hvordan den menneskelige hjerne og rygmarv fungerer i sammenhæng med omgivelserne. Særligt fokuseres på plasticiteten i neurale netværk.
	Kurset vil give et indblik i det neurobiologiske grundlag for ændringer i motoriske funktioner, sensorisk bearbejdning, indlæring, hukommelse, søvn og sprog. Studier fra dyre- og humanforsøg inddrages.
Kompetence-beskrivelse:	**Faglig kompetence:**
	Kendskab til plasticiteten i menneskets centralnervesystem. Indsigt i nogle af de grundlæggende principper i neurobiologiforskning og forståelse af en række nøgleforsøg indenfor feltet neuroplasticitet.
	Anvendelseskompetence:
	Kunne anvende neurobiologiske kundskaber til udførelse og tolkning af neurobiologiske forsøg.
	Omverdenskompetence:
	Kunne sætte faget i relation til samfundet og tage stilling til biologisk-etiske problemer.
	Personlig kompetence: Grundlæggende neurobiologisk indsigt.
Målbeskrivelse:	Deltagere på kurset skal:
	☐ Opnå forskningsmæssig forståelse for den menneskelige hjernes funktion og evne til at tilpasse nye krav.
	☐ Opnå kendskab til plasticiteten i menneskets centralnervesystem.
	☐ Få indsigt i nogle af de grundlæggende principper i neurobiologiforskning og forståelse af en række nøgleforsøg indenfor feltet neuroplasticitet.
	☐ Kunne anvende neurobiologiske kundskaber til udførelse og tolkning af neurobiologiske forsøg.
	☐ Kunne designe og udføre (simple) eksperimentelle forsøg der tester en problemstilling relateret til neuroplasticitet.
	☐ Kunne formidle eksperimentelle forsøgsresultater og perspektivere/diskutere disse i forhold til eksisterende frysiologisk viden (indenfor pensum og relevant udvalgt litteratur).
	Kriteriebeskrivelse for karakteren 12:
	Evaluering af eksamensopgave vil ske ud fra nedenstående kriterier. Karakteren 12 gives når:
	☐ Eksaminanden har demonstreret en overbevisende evne til at kunne præsentere, analysere, sammenfatte/konkludere og desuden har taget kritisk stilling til avancerede problemstillinger og kan perspektivere/diskutere disse i forhold til pensum og relevant udvalgt litteratur.
	☐ Eksaminanden har demonstreret sikker anvendelse af fagets repræsentationsformer og standarder for rapportering.
	☐ Eksaminanden har demonstreret beherskelse af kursets centrale emner, evne og overblik i forhold til de udvalgte problemstillinger.
	☐ Besvarelsen fremstår som en helhed.

| | Lærebøger: | Vil fremgå af kursushjemmesiden. |

Lærebøger: Vil fremgå af kursushjemmesiden.

Faglige forudsætninger: Bachelorgrad

Eksamensform: 3 timers skriftlig eksamen med alle hjælpemidler. Bedømmes efter 7-trinsskalaen. Ekstern censur.
Re-eksamen: Som ordinær eksamen.

Eksamen: Skriftlig prøve den 7. april 2011.
Reeksamen: Skriftlig prøve den 1. september 2011.

Bemærkninger: Kan være på dansk, hvis ingen udenlandske studerende er tilmeldt.
Valgfrit modul på den Humanfysiologiske kandidatuddannelse.

Sidst redigeret: 15/11-2010

Dato	Titel
01.09.09	**Praktisk om kurset**
	(absalon, eksamen, forelæsninger)
	Historisk oversigt
03.09.09	**Cellulær og Molekylærbiologi**
08.09.09	**Cellulær og Molekylærbiologi**
10.09.09	**Cellulær og Molekylærbiologi**
15.09.09	**Gliacellers betydning for Neuroplasticitet**
17.09.09	**Plastiske ændringer i rygmarven/Spasticitet**
22.09.09	**Motorisk indlæring - cortical mapping**
24.09.09	**Visuo-motorisk indlæring - adaptation**
29.09.09	**Konsolidering, Transfer og Interference**
01.10.09	**Neurorehabilitering**
06.10.09	**Immobolisering**
	Mental træning
08.10.09	**Styrketræning**
	Afrunding

B Questionnaire 1 and 2

Questionnaire 1 (Q1)

Name:

For my adj. pæd. course assignment I need your answer to the questions below, thank you:

a.   What is you impression of the course in its old format? What is good / Less good

b.   What is your impression of the students? Did they learn what you expected? Do you have any idea about what they thought about the course?

c.   What would you like to change?

Questionnaire 2 (Q2)

Name:

For my adj. pæd. course assignment I need your answer to the questions below, thank you:

d. What do you think about the suggested changes to the course? What is possible what is challenging?

e. What does it take for the teachers, to meet the new structure?

f. Are you ready to meet the demands you mentioned above? If not what would it take to make it possible?

C Suggestion to new course description, plan and syllabus

Color codes on how to read this text:
In blue = suggested text to new course description.
In red = further suggestions to changes.
In black = translated directly from the old course description, or not translated at all as I found it to be irrelevant for this assignment.

Course description, suggested

Point:	7,5
Blokstruktur:	Bloch 1 or 2
Skemagruppe:	A
Varighed:	8 Weeks
Uddannelsesdel:	Master level
Kontaktpersoner:	

Skema- oplysninger:	**Tid:** Tirsdag og torsdag
Teaching format:	Student activating teaching using presentations, problem solving, written assignments, group work, and to a lesser extent, lectures and demonstrations.
Goal:	To give a research related insight to the function and ability of the human brain to adjust to new demands (plasticity) by working with scientific literature and other relevant syllabus.
Content:	During the course students will learn how the human brain and spinal cord works focusing especially on plasticity (ability to adjust to new demands) of neuronal networks. The aim is to build up the students' insight to the neurobiological processes that lay behind changes in motor function in reference to scientific literature from animal- and human experiments. This part should be aligned with the ILO's once they are written.
Competence description:	By going through some of the key experiments in neuroplasticity the course provides basic neurobiological insight. From this students will be capable of describing basic principles in neurobiological research and plasticity in the human central nervous system. Furthermore the students will be able to read scientific literature, extract the main points and take a critical stand point to the topic as well as to use their knowledge to design and interpret neurobiological experiments. They will be able to present difficult comprehensible material and to relate the knowledge to society and take a stand point to biological-ethical problems Will they? Is this really an aim, this last sentence? Questions that I believe should be answered in this section: What should they be able to do afterwards? Make a list so they can check afterwards: Can I do this!? Such as: Students should be able to: Design small experiments. Ask the "right" questions, to take a critical stand point to the literature.
Aim:	Participants on the course should: • Gain scientific understanding of the function of the human brain and capability to adjust to new demands. • Gain insight to plasticity in the human central nervous system. • Gain insight to some of the basic principles in neurobiological research and understand some of the key experiments within the field of neuroplasticity. • Be able to use neurobiological knowledge to carry out and interpret neurobiological experiments. • Be able to design and execute (simple) experiments that tests problems related to neuroplasticity. • Be able to present experimental results, discuss and put them into a perspective related to the

existing physiological knowledge (within the course syllabus and other relevant chosen literature).

I think the aims should be much more specific especially the first 3 are very unspecific. The last 3 can be modified so they become more concrete, specific and aligned to the ILO's.

Criteria for getting the grade 12:

The grade 12 is given when (Danish):

• Eksaminanden har demonstreret en overbevisende evne til at kunne præsentere, analysere, sammenfatte/konkludere og desuden har taget kritisk stilling til avancerede problemstillinger og kan perspektivere/diskutere disse i forhold til pensum og relevant udvalgt litteratur.

• Eksaminanden har demonstreret sikker anvendelse af fagets præsentationsformer og standarder for rapportering.

• Eksaminanden har demonstreret beherskelse af kursets centrale emner, evne og overblik i forhold til de udvalgte problemstillinger.

• Besvarelsen fremstår som en helhed.

It is difficult to be very precise here but again I believe that with clear ILO's this part could be aligned and become more specific.

Litterature and books: Scientific litterateur and relevant chapters form textbooks.

Faglige forudsætninger: Bachelorgrad [..]

Exam: Passing the course demands an active participation in the classes and during group work, presentations, discussions and assignments. Your active participation will be valued 20% for your exam grade. The short written assignments will make up the exam questions, but you can be asked questions in the full syllabus during the final oral exam.

Course Syllabus and Course Plan

To avoid unwanted repetition and use any overlap in a constructive way it is important that all teachers meet to discuss their ILO's and their topic. In this way they can quickly and easily get an overview of each other's teaching and thus coordinate the content between them.

Syllabus:
I suggest that each teacher specify the ILO's they find important for their topic. Based on this they decide on the literature which meets these criteria (they can also do it the other way around.). It is important to keep in mind that reading papers is demanding and time consuming, especially for beginners. So good abbreviation- and word lists are important to motivate the students and give them a good experience when reading scientific literature. Consider if review articles are good or bad and make sure that the content varies significantly from that given in courses on the bachelor part.

Topics: (inspired from former syllabus):
1   Molecular and Cellular level: what happens at this level to induce neuroplasticity?
2   Plasticity in the Spinal Cord: Development of spasticity, other effects of a Spinal Cord Lesion.
3   Systemic levels: Motor- and Visio-motor learning and adaptation.
4   Consolidation.
5/6 Rehabilitation in the brain and spinal cord. Immobilization, mental training, strength training.
7   Designing experiments: given the methods and insight the students have gained, they are given a set of questions that needs to be answered. They have to choose applicable methods and argue for the design of the experiment.

Course Plan (see also Table 3):

Week .Day	Teacher(s)	ILO's	Topic:	Literature	pp
1.1			Intro to the course + demo. Topic 1		
1.2			Topic 1		
2.1			Topic 1		
2.2			Topic 1		
3.1			Topic 2		
3.2			Topic 2		
4.1			Topic 3		
4.2			Topic 3		
5.1			Topic 4		
5.2			Topic 5/6		
6.1			Topic 5/6		
6.2			Topic 5/6		
7.1			Topic 7		
7.2			Historic overview used to summarize and contextualize the syllabus.		

Mixed Lecture-exercise Teaching to increase Student Activation

Peter L. Langen

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Objective

To investigate the potential for higher student activation through a less clear division between lecture and exercise elements in the teaching. Specifically to answer the questions:

- Are the students activated to a higher degree in the mixed-type teaching than in the classical divided lecture-exercise teaching?
- Do the students appreciate this mixed-type teaching and do they feel that they learn more efficiently?
- How much more demanding of the teacher is this type of teaching (if at all) than the classical type?

The project is based on the course *Geofysisk Fluid Dynamik* which was taught single-handedly by the author in Block 2 2011-12.

Introduction

Previous evaluations of the course *Geofysisk Fluid Dynamik* have motivated a restructuring of the lecture-exercise division. I had concluded that I generally wanted more exercise time but have also been occupied with finding ways to get students more activated during the lecture elements of the class. One way of doing this is to include buzz groups and concept questions with clickers in the lectures but perhaps even more drastic measures

can be taken. If the division between lectures and exercises is less clear, so that all hours are just called "teaching" and are basically a mixture of lectures and exercises, the students will not have the long periods of one-way communication during which their level of activation can be lowered. Quoting Gibbs (1981): *Where there is scope for the negotiation of student goals, and for the negotiation of meaning, there will be a greater likelihood of students at least trying to learn what you want them to. Lectures offer little such scope.*

During the KNUD program, I was at one point tasked with answering the question "When should the teaching be parted into lectures and exercise classes?". I found that, according to Gibbs (1981), the answer is probably never! At least not with lectures in the traditional form. However, even Mazur (e.g., 1997) seems to have a lecture and exercise structure. The lectures follow the Peer Instruction (PI) model (Mazur 1997) but they are, nevertheless, lectures. In addition to these comes time where focus is on the students' work with problem solving. In fact, he concludes that their problem solving skills improve with the increasing conceptual understanding associated with the PI lectures.

One of the main, but perhaps rather surprising, conclusions from the pre-project work that was done during the KNUD program was that the students love structure – almost above all. They want schedules to be adhered to and they want to know when we are doing what. An implication of this is that teaching an entire course as a series of similar hours that each combine lectures (even in a modern form) and exercises (even in a modern form) may be too messy and unstructured for the students' taste. Especially for courses with an attendance larger than what can be managed by one teacher in terms of walking around helping groups in problem solving may the combined lecture-exercise model become unwieldy.

A structure of divided lectures, in a modern form (e.g., PI (Mazur 1997) or active thinking activity (Schneider 2007)) and exercises, in a modern form (Rump n.d., Alexander & McDougall 2001, Splittorff 2006), could thus appear to have the following advantages:

1. it lives up to the students' demands for structure
2. it breaks the monotony so that a long eight-hour block structure stretch is sub-divided into different components.
3. it lets the teacher and students have time where focus is on the concepts and underlying understanding and time where the details are put

to work. The concept-oriented lectures are thus not polluted with or confused by the typically detail-oriented exercises.

This needs to be tested and the proposed project will take an approach similar to that of Sandelin (2008), with the exception that here lectures will be mixed with pen-and-paper exercises rather than computer labs. The number of students in this year's run of the course was around 25, so the concern of too unwieldy a class-size was not relevant. The above advantages of the divided-type teaching may, in fact, be applicable to a mixed-type teaching as well. The students' demand for structure could be catered for if there is a clear, pre-defined structure of each hour and of the daily or weekly content. The concepts vs. details may also be kept divided by dedicating some of the mixed-type hours to one and some to the other. This will also have the effect of breaking the rhythm.

The report is organized as follows. The next section discusses certain aspects of the course intended learning outcomes to put the chosen teaching-learning activities into the proper context. This is followed by a description of the method used in the project, the results of the questionnaires and a discussion of these along with some of my own reflections. The last section concludes the report.

Intended Learning Outcomes

Before proceeding with a description of the mixed-type teaching, a couple of comments on the course intended learning outcomes (ILOs) are in place to put the tested teaching-learning activities (TLAs) into the proper context.

In my opinion, the students should – after having completed the course – know the background for and the derivation of the different terms in the governing equations for geophysical fluid motion. They should, in my opinion, not memorize all the details but they should know where the terms come from, describe which physical processes are behind them and discuss the assumptions that were made in their derivation. When an equation exists in several forms depending on different assumptions, the student should be able to describe these differences and choose the right form for a particular application.

The course ILOs, as they are given in SIS (Appendix B, in Danish), reflect this ideal to some extent. There are, however, some points where they could have been more optimal or to the point. A couple of examples are:

"*Write up and describe the momentum equations for the atmosphere and ocean given on a rotating Earth*". In line with the above, I do agree that the students should be able to describe were the terms come from. I do not believe, however, that the students should be able to recall all the details and this is certainly not something we assess at the exam, which is open-book written. Having assessment tasks (ATs) aimed at testing this would simply invite to copying from the textbook. In a broader interpretation of this ILO, where the intent is to have abilities in deriving new results, we do currently test it as exam questions routinely have elements of independent derivations.

"*Understand the concepts circulation, vorticity and potential vorticity and solve simple exercises involving these quantities.*" I agree that these concepts should be *understood* although this word is somewhat vague. With regard to the part about solving simple exercises I am a bit in doubt: At first glance, it seems wrong to have as an ILO to be able to solve simple exercises, but as the course is presently, it is quite well-aligned with the TLAs and ATs. It is to large extent what we do in class and at the exam and they are akin to the typical situation of "a point mass on an infinite and friction-free table" often used in classical mechanics. The argument for this is that these simple exercises are good for illustrating concepts and assessing the student's understanding thereof. The simple exercises should thus perhaps not be an ILO in itself but enter as a tool both in the TLAs and ATs.

In light of these considerations, constructive alignment of the TLAs with the ILOs and ATs requires that the students themselves work with both the derivations of the central results as well as with simple (and sometimes not-so-simple) applications thereof.

Method

The alternative to the classical division between lectures and exercises, that I tested in this project is a mixed type teaching (MTT) where short (15-20 min) runs of theory introduction are interleaved with only slightly longer (20-30 min) exercises pertaining to this and previous theory. In some instances the student-active exercise stretches consist of the students performing some of the derivations that I would otherwise have done on the blackboard during the lecture. The above time allotments are to be thought of as being quite flexible. Sometimes longer exercise stretches are necessary.
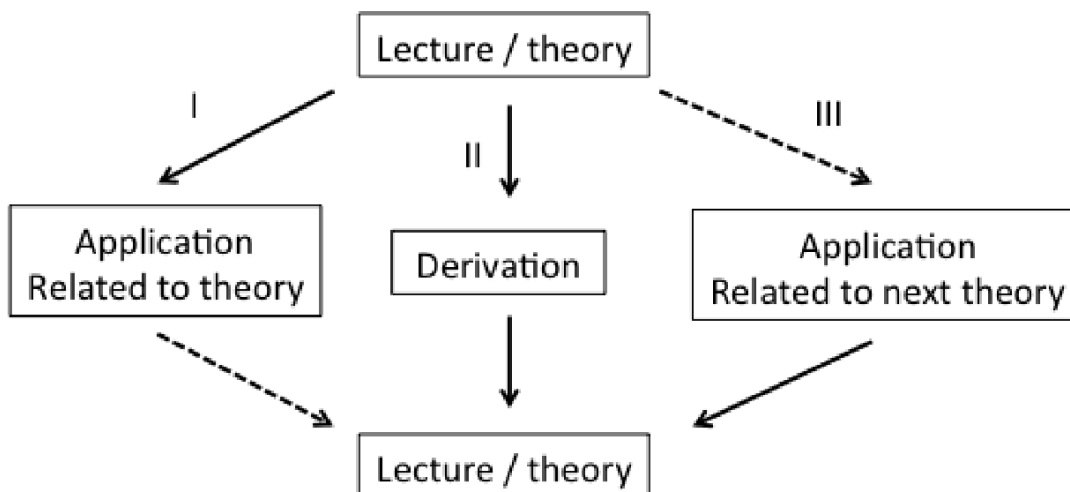
Fig. 11.1. Schematic of an MTT cycle showing how a lecture or theory stretch is followed by either I) an application related directly to the material just covered, II) an intermediate student derivation session or III) an application or exercise used to motivate or lead up to the next theory stretch. The solid arrows signify transitions between student inactive and student active sessions that are directly linked while the dashed arrows signify transitions that are less directly linked.

Figure 11.1 illustrates how an MTT cycle can take several forms. Simply put, student inactive theory or lecture stretches are followed by student active sessions of exercises/applications or derivations. The latter are illustrated by the middle route (II) and link the theory stretches together directly because they all work toward the same final result. The exercises or applications may be somewhat digressive in the context of teaching theory but they do serve to either illustrate or motivate it. The two outer paths show this: either the application pertains to the theory just covered (I) or it is used to motivate or lead up to what is coming next (III). All three of these MTT cycles are tested in the teaching.

To secure a proper flow of the MTT cycles, the student active derivation steps and exercise stretches should have relevance to the topic of the hour. While this is fulfilled per default in the derivation steps (route II), it may be a bit more challenging in the other two forms and requires careful planning. Moreover, repetition of previously taught material is more difficult to fit into the MTT exercise stretches as it may remove focus or confuse the conceptual picture the teacher is trying to convey. It should thus be included where possible as tools used in the problems pertaining to the current topic. An alternative is to have a softer structure, where an hour or two during

the week is devoted to pure exercises where repetitions would fit in more obviously. While not practiced in this project, this could be done in the long eight-hour day, where the afternoon could have longer exercise stretches to make it a little less intense.

The second week of the course Geophysical Fluid Dynamics 2011-12 took the MTT form. This constitutes the experimentation part of the project. Important in the assessment of the effectiveness of the format is a week of (hopefully) well-executed teaching in the classical divided lecture and exercises format. The entire experiment thus fell in the following two steps:

Step 1: Teach one week in the classical format – with the adjustments to the lecture vs. exercise load that I would have made anyway. This week ends with a questionnaire on the perceived efficiency and student activation of the format.

Step 2: Teach one week in the MTT format. Ends with another questionnaire that compares the two formats, probes for the proposed strengths and weaknesses of the MTT and asks for comments.

In the evaluation it is also necessary that I assess the (added) workload for the teacher.

Results and discussion

Results of the pre-questionnaire

After the first week of teaching, I gave the following questionnaire to the class via the online Absalon system. Four questions were asked and to each the student could declare him/herself to "agree fully", "agree", "neither", "disagree" or "disagree fully". 15 students answered the questionnaire and the results are given below. The numbers have been rounded off so the total is not always 100%.

1. I feel activated in class when the teaching is divided into lectures and exercises.

Agree fully	Agree	Neither	Disagree	Dis. fully
47%	40%	13%	0%	0%

2. I stay attentive throughout lectures.

40%	47%	7%	7%	0%

3. I stay attentive throughout exercises.

40%	53%	7%	0%	0%

4. I would prefer a structure where lectures and exercises are combined over one where they are clearly divided.

47%	20%	27%	7%	0%

The conclusion from these four questions which were meant to serve as a basis for comparison with the results after the MTT experiment in week 2 is that the students seem quite unambiguously to feel activated in the classical format and to stay attentive throughout both lectures and exercises. Nevertheless, there is also a clear preference for the MTT format – even before they have tried it (or, at least, my version of it). The reason for this is unclear; one might have expected question 4 to be negative if the others were positive or vice versa. It has to be said though, that this class is especially motivated. They really are very alert and attentive and when given a task or a question they start right away and do exactly as asked. With this kind of group, the classical format may appear to be working for them but they may still feel that something else could work even better.

Results of the post-questionnaire

After the MTT experiment of week 2, the following questionnaire was given and 12 students completed it. Note that 8% corresponds to one student. Question 9 asks for comments and the five comments given are repeated in full in Appendix A.

1. I was more attentive when we did exercises than in normal exercise hours.

Agree fully	Agree	Neither	Disagree	Dis. fully
33%	50%	8%	0%	8%

2. I was more attentive during lecture stretches than in normal lecture hours.

17%	42%	33%	0%	8%

These first two questions compare the level of attentiveness experienced by the students in the MTT relative to the classical format. For both lecture and exercise stretches, more than half "agree fully" or "agree" to being more attentive in the MTT. This positive result is most pronounced for the exercise stretches and this surprises me somewhat: one of the main reasons why I expected the MTT to be efficient is that it limits the lecture stretches to about 15-20 minutes which is the maximum that attention can be held during lectures (Biggs & Tang 2007, p. 110). Exercise hours are student-active also in the classical format and I would thus have expected the major increase in attentiveness to have been in the lecture stretches. It seems that the direct relevance to theory of the student-active sessions increases the level of attentiveness and this is an unexpected bonus for me.

3. I experience the teaching to be more unstructured in the MTT than otherwise.

8%	17%	50%	8%	17%

One of the major concerns with the MTT is that the structure so adored by the students is sacrificed in a format where the student is continuously tossed between active and inactive. The response to this question indicates, however, that even if this is the case, it is not experienced as being more pronounced than in the classical format. We did adhere to the 45 minute classes, breaks were respected and it was clearly communicated where we were in the MTT cycle, i.e., student active or inactive. This appears to have given adequate structure to the teaching.

4. It is an advantage of the MTT that new material is brought to application in exercises right away.

67%	25%	0%	0%	8%

All but one of the respondents "agree fully" or "agree" to it being advantageous that new material is brought to application right away. This is as expected and the major surprise is actually that one disagrees fully. One of the respondents who gave comments did not find the MTT to promote deep learning and he/she has some very well-articulated reasons for this. One may speculate that the one respondent who disagrees fully here is this same student and I will refer to my thoughts on his/her comments.

5. The MTT gives too long stretches without breaks or variations.

0%	0%	42%	42%	17%

The long series of MTT cycles, for instance, eight hours of it on Thursday, was another of my major concerns with the MTT. With all classes being the same mixed format, the long day may become an unending succession of monotony. None of the respondents agreed (or agreed fully) to the MTT giving too long stretches without breaks or variations so either my concern was irrelevant or the question was understood differently than I had intended. In either case, lack of variation seems not to be something to be concerned about based on these responses.

6. I feel more activated in the MTT than otherwise.

17%	58%	17%	0%	8%

Three out of four students "agree fully" or "agree" to feeling more activated in the MTT than otherwise. Along with a similar result in question 8 this is what I take as the major indicator of the MTT experiment being successful. Having employed a format that activates that many students more (or, at least, lets them feel more activated) was exactly what I was hoping for.

7. Broad concepts are more often buried in details in the MTT than otherwise.

8%	8%	50%	33%	0%

This question relates to the third concern with the MTT discussed in the introduction, namely the risk that concepts are lost because the theory is so quickly applied. Applications tend to involve a lot of mathematical calculations and algebraic manipulations not directly related to the theory and could therefore pollute the clear-cut conceptual message. More than 80% either disagrees that this is the case or says "Neither". This indicates that this concern is not a massive problem for the format. It is, nevertheless, something I think one should stay aware of.

8. I experience the MTT to be a more efficient way of learning than the classical way.

17%	58%	17%	0%	8%

This is the major success parameter: More than three out of four find the MTT a more efficient way of learning. Whether they actually did learn more efficiently or they just experienced that they did so is not measured here, but given the comments discussed next it really does seem that this format may mobilize a higher level of attention and clarity.

9. Please give extra comments and thoughts on the MTT vs. the classical format.

See Appendix A for the individual comments (five answers).

One thing that three out of the five comments agree on (students 1, 4 and 5) is that doing some of the intermediate derivations (route II in Figure 1) works well. They say that it gives a deeper understanding of the applied equations and it forces you to think over the math and not just nod and think that you understand. Student 5 feels safely guided through the material and has a sense of getting more of it.

Another student (number 2) notes that the MTT keeps him/her focused such that one does not doze off as is not uncommon after lunch in a classical lecture.

Student 3 does not find the MTT to promote deep learning and argues very well for his/her case. In a nutshell, the major problem with the MTT is that the student-active sessions are too short to allow the student to properly delve into the problem and the physics. The time allotted should be spent going the direct way pointed out by the teacher without detours or else there is too great a risk of not finishing. For this student, and for many others, I would suspect, there is a lot of learning in starting a problem, getting stuck, starting over in a different way and getting through with a few hints here and there. The MTT does not as easily cater for this type of process because of the rather quick turnover necessary for the next cycle to start. He/she also points out that preparing the exercises beforehand is almost stupid in the MTT.

My own reflections

The route II (Fig 11.1) type of exercise element, where derivation of sub-steps in the lectures were made by the students, worked particularly well. I feel that having worked with the details of the derivations, the students were more alert and more clear on all the definitions in the subsequent discussion of how this fits into the bigger picture. The institutionalization step thus becomes more relevant for the individual student because he/she has a larger degree of ownership over the results that are institutionalized.

The timeliness of the student-centered work is of the essence here and is perhaps less pronounced for exercises that subsequently show applications of the theory (route I). Of course, the student also here sees the practical consequences of the theory but this might work equally well in a subsequent dedicated exercise session (classical format).

In fact, I found that the many route I applications that I did employ were not nearly as interesting as the two other routes, despite the fact that an overwhelming majority of the respondents found the direct application to be an advantage of the MTT. An example of a particularly efficient use of route III, where an application is used to motivate the next theory, is the consideration of the Coriolis force on two metal balls rolling toward each other:

The exercise was an application of a result we had derived earlier of the magnitude of the Coriolis force on an object moving in a rotating coordinate frame (as the Earth) and the task was to determine the velocity the balls must have in order to just avoid hitting each other. This went fine and seemed like a straightforward (and very idealized) application of previously derived results. After we had discussed this exercise, I asked the class in a Concept Question manner whether the balls would hit each other or miss each other if they were started with larger initial velocity. The trick here is that with a larger velocity there is a larger Coriolis force so one might think that they miss each other, but since they travel faster the force has shorter time to act and the result is actually that they are deflected less and hit each other. The class' initial response was about 50-50 between the two options but in the ensuing buzz, many looked closer at the calculations in the exercise and realized the travel-time trick. The result was an almost unanimous count on the correct result in the second round of questioning. The institutionalization of this result circles about the fact that the Coriolis force is more important for slow, large-scale motions than for fast, small-scale motions. This led naturally to the introduction of the so-called Rossby number, a non-dimensional number fundamental to meteorology which measures the importance of the Coriolis force in terms of the characteristic velocity- and length-scales of the motion.

With only one week of the MTT and placed early in the course, I did not feel a large need to have exercises that took up material from earlier in the course. All exercise/derivation steps thus pertained to the theory just covered or about to be covered. Later on in the course, there is a need to tie things together with and to recapitulate earlier theory. This is easily done by having the students do old exam problems since these are often of a more

general and overarching character. Including such problems in the MTT may have the downside of taking focus away from the particular theory being taught this week. A solution may be to have longer general exercise sessions (say 2 hours) combined with the MTT. This may also help to alleviate the problems pointed out by student 3, because it gives exactly the time for individual pondering that he/she called for.

In fact, one should perhaps consider taking the consequence of the popular route II and focus mainly on this type of student-active session in the MTT stretches and then have the applications mainly in devoted exercise hours. Unless, of course, there are particularly timely and relevant route I or III applications such as in the above example.

Two issues concerning the practical execution of the MTT were discussed with my department and pedagogical supervisors: i) When have sufficiently many come sufficiently far in the problems for us to proceed? and ii) How do I proceed? Do I do the entire problem/derivation on the board or do I just sketch it? Do I get students to do it?

With regard to issue i), my experience is that we cannot wait for all to finish everything, otherwise a large part of the class will have to sit and wait for the slowest. The teacher needs to find a point where enough have come through or close to before proceeding. I have monitored the progress of the students and found that when the general noise in the class begins to change character from being focused on the problem to being focused on other things, it is time to move on. This is, of course, a sliding scale, but I feel that I have been reasonably successful at finding the point. To improve my intuition on when the point has been reached, the supervisors suggested that I start making a mental note to myself of why I tend to stop at the times I do. This will help to make it more deliberate than just a gut feeling. It does come from a gut feeling in the first place, however, so the point is to try to make the criteria that tend to produce that gut feeling more clear.

With regard to issue ii), the risk of having a student do the exercise is that it takes longer (and we have already spent time on the derivation having them sit and work with it) and they might do it in a less clear or well-organized way such that a possible institutionalization may be partially lost. This leads to the more fundamental question of why I want them to go to the blackboard, and this is perhaps not of paramount importance since they do get a chance to work with it. Either having come all the way through or getting stuck halfway is enough, in my opinion, that seeing the teacher do the problem or derivation will be much more relevant to them. Having said that, if time permits, I would still prefer to have a student come

up and do it. Their presentation may not be so well-polished as what the teacher would do, but it would be presented in more student-like-terms. This will then give the teacher a chance to gauge what level of understanding this particular student has and to show the entire class, how the same basic solution could/should be presented in the "proper academic terms". An oral presentation is not formally part of the course ILOs but they do include something about "writing up and discussing/describing the basic equations". That aside, I may have a hidden ILO that has to do with educating them in the use of academic language, argumentation and reasoning. Fulfillment of this, I think, comes about through setting an example during lectures, exercises and one-on-one discussions, but also through helpfully and cheerfully helping to hone the arguments of a student at the blackboard. This helps the entire class, since the rest might (hopefully) be thinking "Hey, I would have said it the same way as the student, but Peter's way does sound clearer".

The MTT did take longer to prepare because relevant problems had to be found for every 20 minutes of lecturing. It also took time to find the proper level for the student derivations and to estimate the time needed for each of these. The comparison is probably not completely fair: For the classical divided teaching, I could re-use my lecture notes and exercises from previous years and when they were planned, time went into choosing the right exercises and the level of difficulty for them. Starting from scratch in both formats, my guess is that one is not significantly more demanding than the other. In fact, a format where MTT sessions focus mainly on route II augmented by longer exercise sessions, will definitely not take much more preparation.

Conclusions

Two weeks of teaching were compared. In the first, a classical approach was taken where there was a clear division between lecture classes and exercise classes. In the second, a mixed approach was taken where short (about 20 minutes) lecture stretches were interleaved with similarly short exercise stretches. The latter could either be application of the theory just introduced (route I), derivation of intermediate results of the lectures (route II) or applications meant to motivate the theory to be covered next (route III).

The mixed type teaching (MTT) was very popular with the student respondents. In particular, they found the direct application of theory to be an advantage of the MTT and they felt more attentive in both lecture and exercise stretches (especially the latter). Three potential problems with the MTT, with less structure, long stretches without variations and concepts being buried in details, did not seem to be cause for concern. In general, the students felt more activated and found the MTT a more efficient way of learning.

Something that I myself found particularly successful – and which was also pointed out in the comments of several respondents – was the route II derivations of intermediate results in the lectures. In short, if the lecture goes from A to B to C to D, the students are simply tasked with deriving the B-to-C-step. This seems to give much more value to the institutionalization step in C-to-D. In fact, in light of the discussion of the course ILOs, inclusion of such derivation steps offers an easier and more straightforward alignment of the TLAs to the ILOs. Carrying the alignment over to the ATs is another matter and beyond the scope of this project.

Focusing mainly on this type of student activity in the MTT and having separate dedicated exercise hours may also answer a couple of concerns encountered along the way. It gives the students ample time (during the exercise hours) to struggle sufficiently long with the problems without the time pressure of having to finish before the teacher continues with new theory (a concern raised in a student comment). Moreover, it provides time for more general exercises (perhaps old exam questions) that take up the broader picture and older theory without taking focus away from the theory of the current MTT session.

The nutshell-conclusion is thus that the MTT was very popular with the students and both they and I experienced it as a more efficient way of organizing the TLAs. It was also found, however, that augmenting the MTT classes with dedicated exercise hours may give the optimal combination.

A Comments from post-questionnaire (in Danish)

Student 1

Det er godt, at vi bliver sat til at lave nogle af udledningerne, så man selv lærer at tænke på matematikken og ikke bare forstår og nikker. Hands on, super godt.
Student 2

Jeg synes i høj grad at jeg vedbliver at være fokuseret i det blandede format. Man sidder ikke og døser hen som man måske kan have tilbøjelighed til at gøre under to timers forelæsning i træk (eksempelvis efter frokost).

Øvrigt kan det bemærkes at der på det blandede format måske skal være "ekstra"-opgaver til de, der bliver "hurtigt" færdige, så de ikke bare sidder og laver ingenting.

Student 3

Jeg føler ikke at det virker for mig at skulle omstille hovedet mellem at modtage info og regne opgaver hele tiden. Det er selvfølgelig en smagssag. Men jeg følte mig en anelse irriteret over at forelæsningen hele tiden afbrydes, man mister hurtigt kontekst.

En af de større ulemper er at det på det nærmeste er dumt at forberede regneopgaverne hjemmefra.

Regner man hjemmefra vil man i de tidsrum hvor opgaven regnes (forudsat man har kunne lave den) blot sidde og vente på at de andre bliver færdige, fordi det ikke kan nås at finde en ekstraopgave man kunne have lyst til at lave, som det ellers kunne have gjort hvis undervisningen var skarpt opdelt.

Jeg har i løbet af ugen også opdaget at de opgaver jeg ikke har kunne regne har jeg ikke fået lært ordentligt i undervisningen. Hvis jeg er gået i stå i en opgave, lærer jeg mere ved at få små hints til at komme videre for så (stort set) selv at klare opgaven. Det syntes jeg fungerer bedre end at få hele opgaven gennemgået på tavlen på kort tid. Men denne metode fungerer ikke i den korte tid vi regner opgaver i. Hvis man går i stå har man ikke meget tid til at sidde og overveje det problem man arbejder med. Det bliver på den måde (desværre) hurtigt et spørgsmål om at få regnet opgaven for at være klar til den videre undervisning, frem for at forstå fysikken i problemet.

På den måde får man nemlig ikke "tingene i hånden" på samme måde og kommer dermed ikke ligeså grundigt rundt om tingene.

For at opsummere kort, syntes jeg det største problem er at der simpelthen ikke er tid nok i de små "regneperioder" til at sætte sig ordentligt ind i problemet og forstå fysikken og det desværre, i stedet, kun bliver et spørgsmål om at nå at regne opgaven.

Student 4

Det er rart selv at få udledt de ting som man ellers bare tager for givet når de står i bogen

Student 5

Jeg synes, det giver god dybdegående forståelse af de anvendte ligninger, når vi selv sættes til at udlede dem.

Desuden føler jeg at det er trygt at blive guidet gennem stoffet på den måde og jeg har følelsen af, at få mere med. Når vi er så lille et hold føler jeg ikke, der er den store forskel, men jeg kunne forestille mig, at det ville være kanon til at aktivere studerende på større hold, hvor det ellers er let at "gemme sig".

B Course ILOs (in Danish)

1. Opskrive og beskrive bevægelsesligningerne for atmosfæren og oceanet givet på en roterende Jord.
2. Operere fortroligt med differentialoperatorerne gradient, divergens og rotation på todimesionelle vektorfelter og skalarfelter.
3. Beskrive de grundlæggende antagelser bag de primitive ligninger, shallow water ligningssystemet og det Boussinesq'e ligningssystem.
4. Opstille ligningerne bag og forklare geostrofisk balance, cyklostrofisk balance, inerti-bevægelse og gradientvindbalance.
5. Opstille ligninerne i forskellige vertikale koordinatrepræsentationer.
6. Beregne geostrofisk vind / strøm og gradientvind ud fra trykfeltet samt vurdere under hvilke antagelser, disse er gode approksimationer til vinden / strømmen.
7. Forklare "Ekman spiralen" og analysere betydningen af Ekman pumpning i forbindelse med cyklonale og anticyklonale strømninger i atmosfæren og oceanet samt anvende begreberne i simple opgaver.
8. Forstå begreberne cirkulation, vorticity og potentiel vorticity samt regne simple opgaver hvori størrelserne indgår.

Improving Constructive Alignment and Deep Learning: Integrating Multiple Learning Activities

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Problem Definition

How can I change the format of a traditionally lecture-based and problem-solving Astronomy Bachelor course to create an inspiring deep-learning environment that both satisfies the intended learning outcomes (ILOs), provides student engaging teaching/learning activities (TLAs), and contributes to a constructive alignment between TLAs and course evaluations (exams, project reports, etc) and between this course and the Bachelor education in physics with specialization in astronomy?

I made several changes to this course in 2010 with the purpose of improving student active participation and their deeper learning. What are these changes and how did they work in the classroom? Were the intended learning outcomes fulfilled? How did the students react to these activities and were they satisfied with the course format and their learning? This project will address these issues as well as further improvements to be applied for increased constructive alignment and student learning in future executions of this course.

Introduction and Brief Background

The bachelor level astronomy course *Galaxies* is offered in block 1 of year two following a more theoretical course on Cosmology in year 1. The course is mandatory for students specializing in astrophysics. In the new course structure the students learn about the largest structures (cosmology,

evolution of universe) first and progressively move to smaller structures (galaxies, our Milky Way, and stars) as they advance in their studies. The idea was to capture the students' interest and fascination for the subject instead of starting with the 'boring' tools of basic astronomy. The course is taught by two instructors: one teaches the curriculum on the Milky Way and its chemical evolution during the first tree weeks ($\sim$30% load) and the other covers the remaining lectures and is responsible for the four hour computer sessions each week ($\sim$70% load). The course has traditionally been divided into standard lectures followed by problem-solving sessions. The computer sessions include a larger project on astronomical data processing and analysis. The approved computer report and a written assignment of four solved problems constitute the student's exam eligibility. These requirements were instituted partially to force student retention. As the course responsible I had the opportunity to shape the course to a certain degree when I took over this course in 2010.

Challenges in Teaching This Course

This course is the only mandatory course on the topic of Galaxies for the Master's degree. The only other course on this broad topic is an elective course on chemical evolution in galaxies at the Master's level. Consequently, *Galaxies* should provide all the compentences that a Bachelor in Physics with specialty in Astronomy need on the topic of galaxies and mass structures in the universe in order to do research projects at the Master's level.

Students taking *Galaxies* have not had courses on atomic physics, quantum mechanics, optics, or stellar physics. In fact, atomic physics is no longer a mandatory course, adding to the complexity. Thus, the students' background alone does not allow for much more than a surface level understanding of the material when picking up a textbook or monograph on 'Galaxies'. How can the students understand galaxies without knowing what stars are, their observed properties, their life cycles and the importance of these cycles for the galaxies? How can they understand interaction between light and matter, so crucial for astronomy, without the proper background? An improved constructive alignment of the course with respect to the Bachelor education will help but will not solve all issues. With the limited background of the students, the curriculum for this class greatly

increases since it must include these additional background topics to allow deeper learning of the course topic itself.

There is no suitable textbook on the marked aimed at starting bachelor students that also addresses the course goals. The assigned textbook, "Galaxies in the Universe", (Sparke & Gallagher III 2007)Sparke & Gallagher 2007) is aimed at upper level (third to fourth year) bachelor students with the necessary background in physics and astronomy detailed above. Finally, the block teaching structure dictates very long class sessions of three to four hours at a time. These are the challenges of this course.

What Should the Students learn?

The course objective and learning goals are published[1] and aim at both declarative and functional knowledge (e.g. Biggs & Tang 2007, Ch. 5)). The course Intended Learning Outcomes (ILOs; e.g. (Biggs & Tang 2007, p. 79)) mostly cover the three bottom levels of the SOLO taxonomy (uninstructural, multistructural, and relational). For example, at the 'uninstructural' level the students can identify a galaxy type by the imaging and spectropic data. At the 'multistructural' level they can describe the properties, structure, and internal dynamics of galaxies and larger mass structures, and at the 'relational' level they can explain the observed properties of the mass structures at small and larger scales, plus relate issues across the curriculum. Specifically, how the properties of the galaxies are affected by the properties and lifetimes of stars is important to understand at a level where the student can account for the consequences of varying the individual property or the composition of the materials making up the galaxy. However, the students do start to reflect and analyze at the top SOLO level (extended abstract level), in particular in the computer projects implemented in 2010.

In addition, the students should obtain operational skills ('functional knowledge'; (Biggs & Tang 2007, Ch. 5)) in use of the IDL software to access, display, and manipulate data, and to make the necessary (relatively simple) computations required for this course. The students need these skills in their later course work and for research projects. Further skills, not mentioned, that I see important include the students' ability to critically explain the content of gas phase (and temperatures) and stellar populations.

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[1] For 2010: http://sis.ku.dk/kurser/viskursus.aspx?knr=120360&sprog=1& inframe=0.

Also, they should be able to reasonably well identify a stellar type from its spectrum[2]. In my opinion, this course should also enable the students to relate to new research by giving them a background to understand the issues on galaxies and their evolution, the astrophysical reasons for them, and to enable them to critically assess basic parts thereof, including the methods for obtaining the necessary observations. The students should be able to follow and understand half, if not most, of scientific talks on the topic and to read and discuss short letter style articles on this and bordering topics. They should have an overview of the main hot research topics within this field and their scientific justification.

Evaluation of Previous Incarnations of this Course

In my preparation for this class I looked into the existing scope and curriculum, talked to previous instructors, and read the student evaluations. In summary I learnt two things. First, somehow the introduction to the IDL software early in the Bachelor study failed. A third year astronomy course instructor reported that even at this late stage many students were unable to work with the IDL software.

Second, *Galaxies* included a large computer project on how to process and analyze astronomical imaging data. Three sessions of three hours were allocated. However, two different past instructors reported that some students needed significant help to pass this part and that it was difficult for many. The course evaluations clearly conveyed the frustration of the students with this activity that seemed disconnected from the rest of the course. Since the learning outcome was rather limited, I concluded that this TLA was unsuccessful. In my own experience it takes at least one to two months of intense training to learn how to process data well[3]. In my humble opinion it is too early to introduce data processing at the start of the 2nd astronomy course when the students have limited overview of what astronomy is or whether it is something they want to seriously pursue. My suspicions were soon confirmed when I started teaching: Most students were novices on programming. Indeed, considerable changes were needed.

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[2] An approximative ID is sufficient since some stars have almost similar spectra.

[3] During my studies we had a dedicated course at the Master's level; I also taught this course as a PhD student so I know this is not a simple exercise.

Changes to Course Format in 2010: Student Activities

When I took over as the teaching responsible for *Galaxies* I decided to make some changes of both structural and didactical nature[4], partly motivated by the evaluation just described. I also took the opportunity to change the format of the part of the course for which I was to teach to be more aligned with my own teaching philosophy. I describe these changes and their justification next.

Main Changes Implemented in 2010: Computer Sessions

Extended IDL Introduction

At course start a new and more extended introduction to Unix and IDL was given. The aim was to allow the students to become more confident with computer programming before they were given a larger project. To practise using IDL for computations and writing of small programs the students were asked to make simple calculations that simultaneously gave them a sense of dimensions of our solar system and our galaxy, what the resolution of known telescopes scales to, and they were to graphically display known relations between stellar properties with the aim of giving them a better understanding of these properties. The students were to submit the computer code and a simple listing of the results of their calculations; no formal report was required.

New Computer Project I

The computer project on data processing was substituted with a new project where the students are to add up stellar spectra so to reproduce the spectra of two galaxies of unknown identity, investigate the uniqueness of their model, the distribution of stellar types, stellar ages, and discover the age-metallicity degeneracy. The student are to use their knowledge on stars and galaxies to identify the galaxy types in various phases of the project. The

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[4] Changes were made to within the a priori set framework: the general scope of the learning goals, curriculum, and the textbook were already locked in when I took over the class. Major changes need to be approved significantly in advance by the University Board of Studies. I was able to make minor changes to the course description before course start and thereby provide better alignment with the curriculum and the new computer projects.

students need to use what they know about stars and galaxies and get the opportunity to revise their conclusions as new information becomes available. An important part of this project is that the students *must* work in groups, *must* discuss the strategy with their group, and *must* use their astrophysics to *argue* and *justify* their choices, actions, and conclusions. They are to submit a genuine report with supporting figures, captions, and conclusions. Approval of the report constitutes exam eligibility.

New Minor Computer Project II

I generated a new small computer project on identification of emission lines in a quasar spectrum, determination of the quasar redshift, and the mass of the central black hole. This activity is short enough to finish in class in a couple of hours but let the students work with actual quasar spectra and understand its contents.

The Didactical Reasons for the Changes

The main goal was deeper learning of both the IDL software and the nature of stars and galaxies. The students need a shallower learning curve compared to earlier years to become comfortable with software programming and to build confidence and functional knowledge. Problem-based learning (PBL) (or learning by doing) is the didactical method employed here (e.g., (Biggs & Tang 2007, Ch. 3.6)) in the form categorized as 'PBL for epistemological competence' (Savin-Baden 2000) which means that the students obtain competence in problem-solving contexts building mostly on a declarative knowledge-base[5]. The computer project (I) on modeling galaxy spectra moreover trains the students' skills in collaboration, organizing a project, data analysis, and scientific justification. The nature of the project forces the students to gain deeper understanding of the characteristics of stars and galaxies and their spectral data.

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[5] Other PBL categories (or 'models' as defined by Savin-Baden (2000)) are relevant for interdisciplinary, transdisciplinary, and professional fields such as the health-care fields. While scientific topics such as the expansion of the Universe and Dark Energy are indeed interdisciplinary, this particular computer project mostly employs one discipline.

> *Example of brain-storm session: I pose the issue to the class: "Spend 2 minutes considering that we may like to know about galaxies - what types of scientific questions do we possibly want to pose? Then we'll do a brain-storm of your suggestions." With my back to the students (giving them anonymity) I write their suggestions uncensored. At the end we discuss each item, consolidate or elaborate as is fit. For example, on the suggestion "How much gas is in the galaxy?" follow-up questions from me would be: "Why would we want to know that? What would this tell us?", "What type of gas are you interested in? Does it matter?", and "Does the gas phase matter? Why? What can we learn from each phase? How?". The students in concert help answer these questions.*

Fig. 12.1. Example of brain-storm session.

Main Changes in 2010: Lectures/Problem-Solving Sessions

First I abandoned the specific problem-solving sessions because the students obtain a deeper broader learning by confronting and using what they know (Mazur 1997, Biggs & Tang 2007) and because the exam does not test their problem-solving skills. Then I changed the traditional lecture format to include a suite of different activities, partly to test their effectiveness at motivating student engagement and partly to vary the activities in class. These activities can grossly be categorized as brain-storming sessions, group-work and presentations, short computational problems followed by discussion, or flash-card activity. The main didactical reasonings behind these activities were to keep the students constantly actively processing the material during our three or four hour sessions; passive students do not learn much. This is the essence of 'constructivism' (founded by Piaget 1950) that states that the students construct knowledge via their own activities. What matters is what the students do, not what the teacher does (Piaget 1950, Steffe & Gale 1995).

Learning Climate

The class room atmosphere is crucial for motivating the students to actively participate in the TLA (e.g., (Biggs & Tang 2007, Ch. 3)). Creating a climate where the student is comfortable asking and answering questions without the sense of embarrasment is a first key step towards deeper learning by most students; the self-motivated, talented students (the "Susan"s; e.g. (Biggs & Tang 2007, Ch. 1)) will learn well in most environments.

Problem Solving (10 mins)

To illustrate the significance of the $M - \sigma$ relation, compare the following after calculating each one for gE M87:

Hint: What is the sphere of influence, R(soi), of its black hole?

1) The Schwarzschild radius of the black hole in km and parsec
2) The radius where σ_e is measured: R_e=96"
3) The ratio of the gravitational force of the black hole at R(soi) and R_e
4) Compare R(soi) to the radii of 1) and 2).

Problem Solving (5 mins)

Calculate:
1. The amount of accreted matter in Msun per year needed to retain the luminosity of a quasar
($L \sim 10^{45} - 10^{46}$ erg/s)
2. Make the same calculation for a Seyfert galaxy ($L \sim 10^{43} - 10^{44}$ erg/s)

Fig. 12.2. Sample 'short calculations'. *Left:* This calculation shows that the black hole gravity is insignificant at the scale where the galaxy mass is measured and that the latter scale is significantly larger than the sphere of influence near the black hole: The M-sigma relation is an amazing fact, not an artifact. *Right:* By dividing two numbers it is clear just how efficient the mass to energy conversion is in black hole accretion: less than 2 solar mass of gas per year is needed to power the most luminous quasars in the Universe!

McGregor (1960) described the perfect climate as one where the students can be fully trusted and the learning outcome is higher ('Theory Y').

At the start of the course I discuss with the students the different class format and what they gain from active participation. In the first couple of weeks I continue to emphasize that it is more important that they answer than the correctness of their answer: everyone in class learn more (deeply) by discussing the wrong answers and the justifications than just hearing the right answers. I use the brainstorming sessions as ice-breaker and warm-up when students in the beginning are still shy (example given in Fig. 12.2). While the students often do not see the point of this exercise, I do find that it breaks the initial barrier. The students experience first hand that it is OK not to have a polished or correct answer and the group is more responsive after that.

Short Calculations

This activity was adopted to give the students the experience of self-discovery and to emphasize important points that would otherwise typically go unnoticed. I give two examples in figure 12.2. The students get 5-10 minutes to compute the numbers and we discuss the results, their meaning and
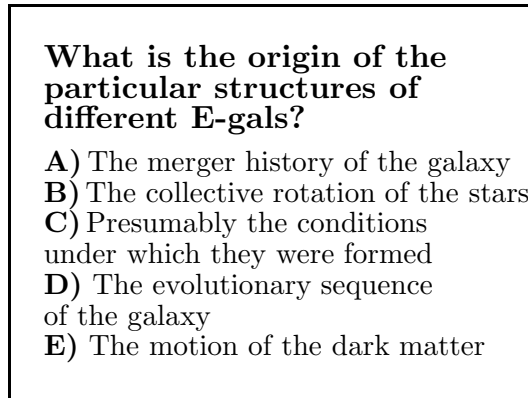
What is the origin of the particular structures of different E-gals?

A) The merger history of the galaxy
B) The collective rotation of the stars
C) Presumably the conditions under which they were formed
D) The evolutionary sequence of the galaxy
E) The motion of the dark matter

Fig. 12.3. Sample peer instruction question aimed at motivating discussion in class. Each of the topics (A − E) had been addressed earlier in the course. The students had to use scientific reasoning to answer this question. A good discussion came of it as individual students had different ideas of what is more important in this case. The discussion clarified that many of these issues could play a role.

implications afterwards. In the left example the students get to see first-hand that by no means can the central black hole in galaxies gravitationally affect our measurements of the galaxy mass farther out: the observed relationship between the masses of the black hole and of the galaxy is real. They also discover just how insignificant the gravitational pull of the black hole is away from the center: the supermassive black hole will never be able to swallow the entire galaxy − something that many students do ponder on.

This activity typically spawned some wide-eyed reactions from the students – telling me that the intended goal of learning through self-discovery was generally fulfilled. I got comments like: "Did I make a mistake?", "Wow!?", and "That just cannot be – it's not much gas needed!" But, in the beginning the students were a bit hesitant to start this type of activity. The students were likely unsure about what to do – some because they had not read before class. It was clear that I had not defined the didactical contract with the students well enough. One improvement to make is to prepare the students at the start of each class for the types of activities to come. On the positive side, some students possibly realized the advantage of having read before class. The ideal activity would inspire the students to take responsibility for their own learning.

Group-work and Presentations

The rate of information in a traditional lecture can be quite high. Group-work offers both a break in the information packed lecture and offer deeper learning as students are kept active and directly work with the material (e.g. (Biggs & Tang 2007, Ch. 2)).

As an experiment I had the students read primary literature in class with the aim of presenting and discussing it with their peers. I selected three four-page articles on a topic that covered an active and important research area with significant updates since the book was published. With this activity the students are acquainted with hot research topics and their scientific justification, explore the research methods, and hone their analytical and critical assessment skills. Each group of three or four was given a different paper with the key text high-lighted and a set of questions to consider (Fig 12.4). After 70 minutes of discussion internally in the group and with me, each group presented the high-lights to the class for discussion of the results, the reasons of these studies and how they are connected.

Questions for group-work on primary literature:
1. *What are the main results of the paper?*
2. *Why did the authors undertake the study? E.g., did they want to test a specific hypothesis?*
3. *Which parameters are involved and how were they measured? Just provide an overview - significant detail is not needed.*
4. *Do the authors compare their results with others? Which? Why?*
5. *Do you see a connection with one or more properties of galaxies or observational results that you already know?*
6. *What do the main results mean? What could they potentially mean?*
7. *Burkert & Tremaine paper only: Is it difficult to understand the connection they see? Why (not)?*

Fig. 12.4. Questions for group work on primary literature.

The students took well to this activity and dived into it with enthusiasm. After a first reading some students found it (right-fully) non-trivial to read but after a short discussion with me where I re-stated the goals of the activity and asked a few leading questions they were back on track. All groups seemed satisfied with this activity. From discussions with individual groups

I saw many of the students be more engaged than usual, reaching a deeper understanding of the topic and being able to connect the issues brought up. However, the discussion time available was a little shorter than optimal for a satisfactory institutionalization of the discussion at the end.

Flash-card activity

This activity is heavily inspired by Prof. Eric Mazur of Harvard University (Mazur 1997) who used this peer instruction activity mainly to test the conceptual understanding of the students. In *Galaxies* I have primarily used it to activate the students and discussions in class, to hone their reasoning skills, and to help place the material in larger context. I pose a multiple choice question on a power-point slide (example shown in figure 12.3. The students consider the question for 1-2 minutes. Then they vote on my cue with a colored flash card (showing the letters A, B, C, D on different background colors). The colors of their cards gives me a quick overview of whether the students grasp the idea or not. If the majority answer incorrectly, I need to explain the issue or concept again in a different manner. If there is a division of correct and in-correct answers I tell them: "Find someone who disagrees with you and convince him or her that you are right!" After some discussion we re-vote. I vary the procedure a little depending on the question. Sometimes the students may discuss with their neighbor before voting. At the end I institutionalize and our discussion then includes why some answers are not as correct (or complete) as other answers. Instead of explaining or stating the right or wrong answers I enter a dialog with the students. The goal is for the students to explain to their peers why some answers are better than others.

In figure 12.5 I show an example of a question without preset answers: "Just inspecting this galaxy image and knowing its typical size and hence the light-travel time across the galaxy, what can we infer about the galaxy and the stars in it?" Students are confronted with their knowledge and practise reasoning. Through what is by some referred to as "Socratic questioning" (i.e. a dialog that guide the students to reason the right answer; see e.g. Prather et al. 2008[6]) in concert we converge at the conclusion: "The light-travel time is 100,000 years. Since the distribution of stars, both red and blue, is even, this shows that either both blue and red stars live longer than

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[6] See   http://astronomy101.jpl.nasa.gov/teachingstrategies/teachingdetails/ ?StrategyID=9

[h!]

Fig. 12.5. Sample peer instruction question without preset answers. Again, the students need to use their reasoning skills to answer this question. They realize the power of astronomical methods: we do not need complicated data to learn about the cosmos.

100,000 years and/or stars are continuously forming. Otherwise we would see a change in stellar colors from front to back. The back would be redder since blue stars live briefer lives."

After the first couple of questions the discussions were quite lively; this indicates that the questions were at the appropriate level and open enough to motivate student engagement. Thus, this activity is appropriate to expand upon.

Instructor Evaluation of Activities

In general, the students seemed to receive these activities well even if they were a new experience for most students. The majority of the students participated ($\sim$15 of the $18 - 19$ in class). All students typically participated in the flash-card activity, while a couple of students were more reserved/hesitant during the discussions. However, the overall activity level in the class was generally high. This suggests that the students like the activities or are not strongly opposed to them. Some improvements can be made to optimize the implementation and the learning outcome.

Are the ILOs fulfilled?

The evaluation of the students' written reports on the Computer Project (I) to model and analyze galaxy spectra showed that the majority of the stu-
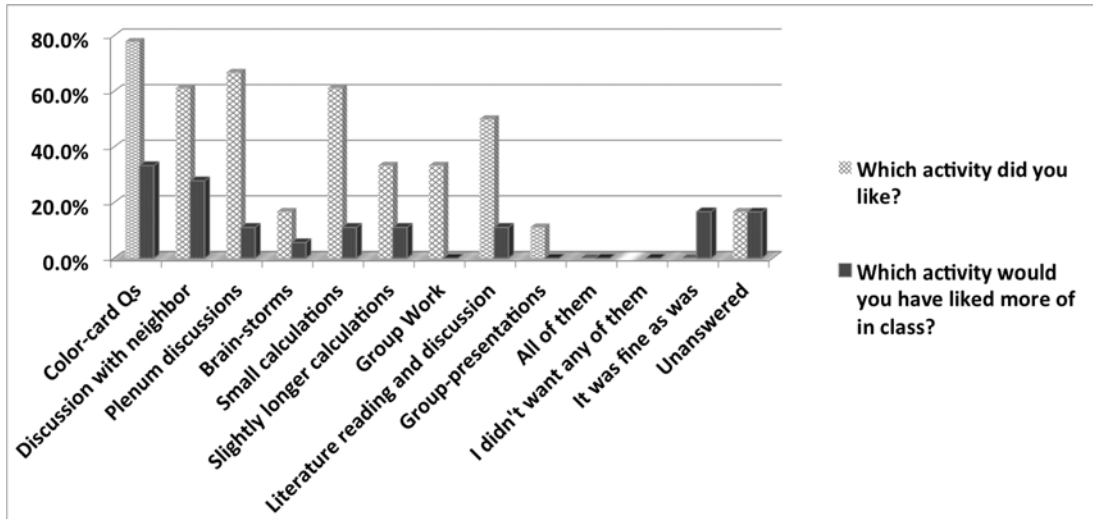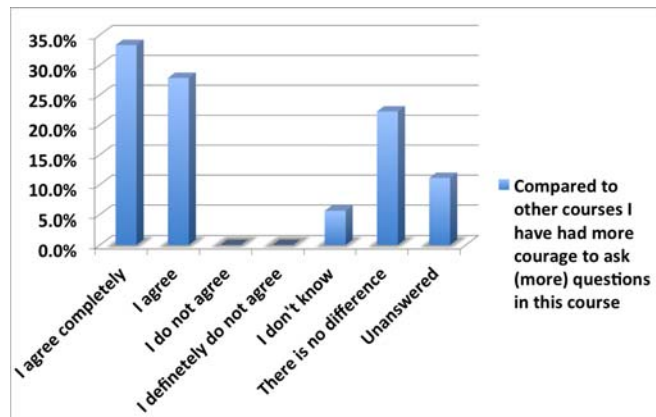
Fig. 12.6. Student activity in class.

Fig. 12.7. Courage among students to ask questions.

dents had gained the expected deep declarative and functional knowledge associated with the spectral properties of stars and galaxies, not to speak of their ability to access, display, and manipulate data with the IDL software. All students delivered a high-quality report: 17/18 (8/9 reports) scored above 90% and 1/18 (1/9 reports) scored 79%. The reports also demonstrated the students ability to use scientific justification. The activity in the computer room demonstrated the students ability to organize, collaborate, and discuss the task and the science. My own impressions from the lectures and the final exam are that the ILOs are generally fulfilled. In particular, for the students that actively participated in the open discussions the intended learning outcome (including reaching the highest SOLO level) was

obtained. However, improvements still need to be made to ensure the quiet, shy or hesitant students also obtain a high learning outcome. This is more difficult to evaluate given their quiet nature. The final exam evaluates this somewhat, but is not a direct measure, partly due to its different context.

Student Evaluation of Course Activities and Format

Before (and after) the final exam I gave the students an on-line, anonymous course evaluation in addition to the one administered by the University[7]. Due to the breadth of the survey and the many open questions I will here only focus on a few key points. Eighteen students responded out of 18 participating in computer sesssions, typically 13-17 participated in lectures (all passed).

Evaluation Question: What did you like the best about the lectures?
- *"The discussions have made a difference for me, I really feel I have learnt a lot from them. The way the material is covered in the slides is less tiring."*
- *"It works just fantastic with the use of power point (slides)"*
- *"That you are presented the material in a different way, makes it easier to place in perspective. The discussion with the teacher and other students makes you more certain that you have understood the material correctly."*
(Students' comments translated by author)

Fig. 12.8. Evaluation question I.

The students liked most of the lecture activities (Fig. 12.6), and felt the climate in class motivating for asking (more) questions (Fig. 12.7). However, the comments also showed that the smaller class size was a motivating factor for some students. The comments showed that typically the students felt they learned a lot from lectures (Fig. 12.8 and 12.9), although some students pointed out their dislike of group presentations. Some felt they learned nothing from the other students' presentations.

The students did not find the level of computer sessions too high (Fig. 12.11 and 12.10) – although they were challenged they also reported to have learned a great deal compared to other computer courses (Fig. 12.14).

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[7] Due to the length of these three evaluations, they are not shown in their entirety here.

Evaluation Question: What specifically did the lectures do for you?

- *"I feel I have gotten the maximum possible out of the 3-4 hours we are there. That is, I have obtained a good understanding for galaxies, gas and my physical intuition is improved."*
- *"I retain the material much better, when we have worked with it and had it presented. I gained a lot from the presentation, illustrations and explanations from the lecturer, but also by discussing the material with the other students."*
- *"Overview. Insight into the methods and thought-process of astrophysicists. Gotten the loose ends under control. Obtained stronger interest in astronomy in general. Hopefully I'm smarter."*
- *"Better understanding"* (half the students made this comment)

(Students' comments translated by author)

Fig. 12.9. Evaluation question II.

I am very pleased to see that the students themselves found their hard work rewarding and their competences useful in multiple regards (representative comments are reproduced in figure 12.10). Notably, their computer reports also showed that they nicely rose to the challenge, so I conclude that the level was appropriate.

Question: "List the most positive about the Computer sessions"

- *"The level was not too high, which means you get to dig into the IDL functions you work with and understand them properly. This is contrary to Astro 1 where all possible foreign programming terminology and functions are thrown in your face for the first time and somehow you are expected to grasp them the first time or to know them beforehand."*
- *"That the pace was slow. We were not thrown into something we have no clue about [...] In this course we took one step at a time, which made us remember things better and obtain a better understanding for how to approach things"*
- *"The enormous competences that we have obtained"*
- *"It actually helped to understand the material"*
- *"To get a feel for the work of a 'real astronomer'. We also gained better control of the material we had read [...]"*
- *"The positive was the structure of the problems and that they had to be submitted forced one to get them done."*

(Students' evaluation comments translated by author)

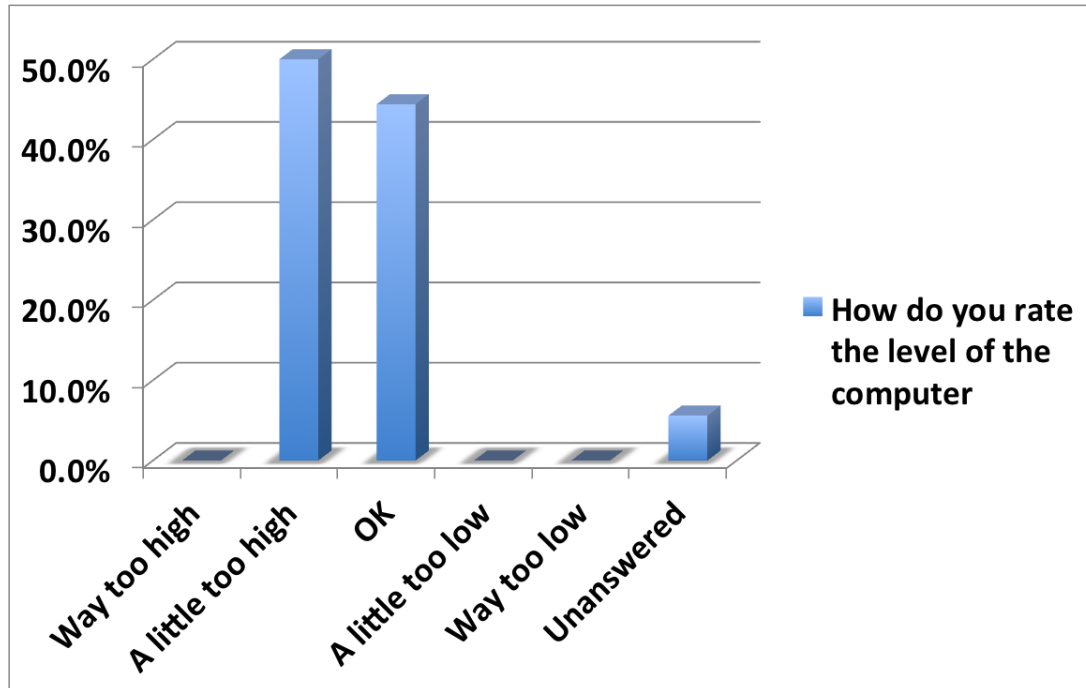**Fig. 12.10.** Evaluation of computer sessions.

Fig. 12.11. Evaluation of level of computer sessions

The negative comments (Fig. 12.13) include the little relevance for the exam, that it required work outside of class (note: some students took it literally that they needed to work on it at home – as oppose to working in the computer room). In general, the students did find the IDL introduction too long. I agree.

Some students did not like the thought of needing to work outside of class (see e.g., Fig. 12.13 and 12.15). Many prioritize their lives outside their study (Fig. 12.15). On the question "How many hours did you actually spend on the computer projects outside of our sessions in the computer room?" one student commented: "4 hours spread over the course. Pulled serious teeth, and I think it was too much compared to how large the computer session are of the course. During a short period it resulted in that I did not have time to prepare for the lectures." The typical load of the students was three to five hours per week, fluctuating from week to week. The students also saw little relevance in the computer projects after completing project I (Figs. **??**, 12.10). This explains the decreasing attendance during the last computer sessions.

The comments show that the IDL introduction needs to be adjusted and there is a disconnect in the didactic contract with the students and in
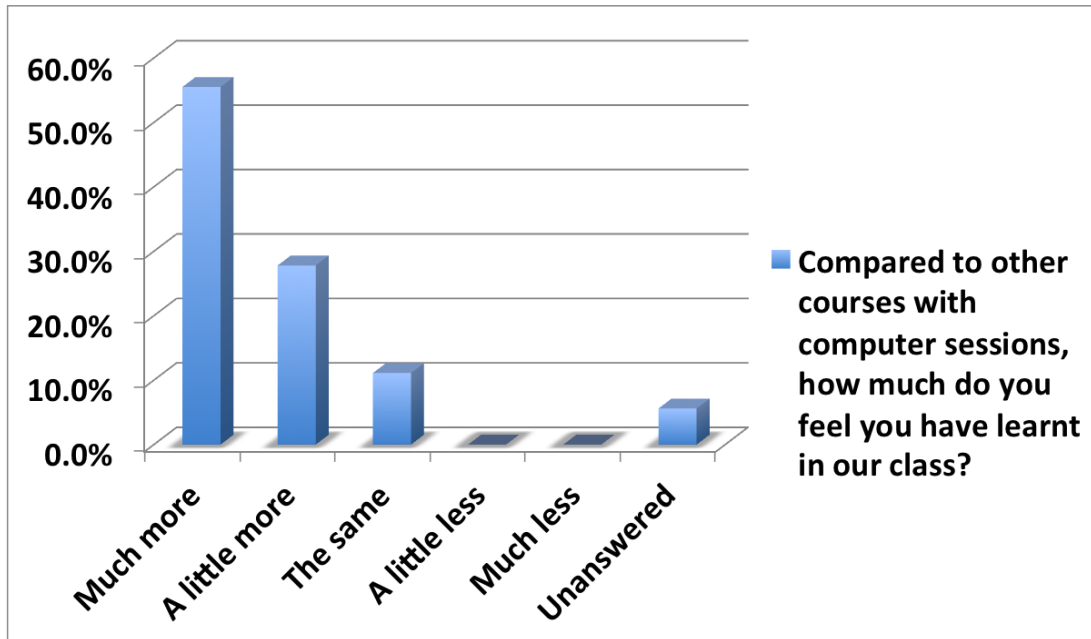
Fig. 12.12. Students relative evaluation of outcome of computer sessions

the constructive alignment between activities and the exam. Otherwise, the work-load for the mandatory computer project was reasonable. When the IDL introduction is shortened, the average load will be better. However, overall the students found that the course was inspiring (questions 39 and 40; not shown here), increased their interest in the subject, and that they learned a lot. (I quote one student: "I have NEVER during my studies attended lectures this much".) They felt the outcome was worth the work.

Looking Ahead: Concrete Changes to be Implemented

The two main areas that needs improving are the textbook and the IDL Introduction project. An alternative to the traditional student presentations is also desired. I propose solutions to these issues in this section. While there is also room for improvements for the TLAs that worked well, I choose here to focus on discussing the textbook and student presentations only; the IDL introduction simply needs to be shortened and the few exercises therein made more effective in regard to learning outcome. In future course offerings I will continue to expand on the discussions inspired by the colored-card votings, the short calculations, and reading and discussing primary literature on hot research topics.

Question: "List the most negative about the Computer sessions?"
- "They took way too much time!!"
- "Too much programming, especially in pc task 1, it was much the same"
- "[...] (especially the first task) was WAY too much busy-work. You spend a lot of time on something very easy [..] you spend a lot of time learning very little. This was both with regard to subject contents and programming-wise. Project 1 [IDL introduction, author comment] I feel was very off with regards to the learning contents. [..]"
- "It is TOO much to expect that we were to do large parts of the programming at home, especially when you don't have IDL on your own computer"
- "That they are such a large part of the course without direct releance for the other parts of the course and especially the exam. Moreover, it is not possible to down-prioritize them, if you feel you don't have time for it all."
- "The questions were sometimes to complex/too broad/too difficult to understand which meant that I often spend longer time to get the overview and understand the problem than the actual solution."

(Students' evaluation comments translated by author)

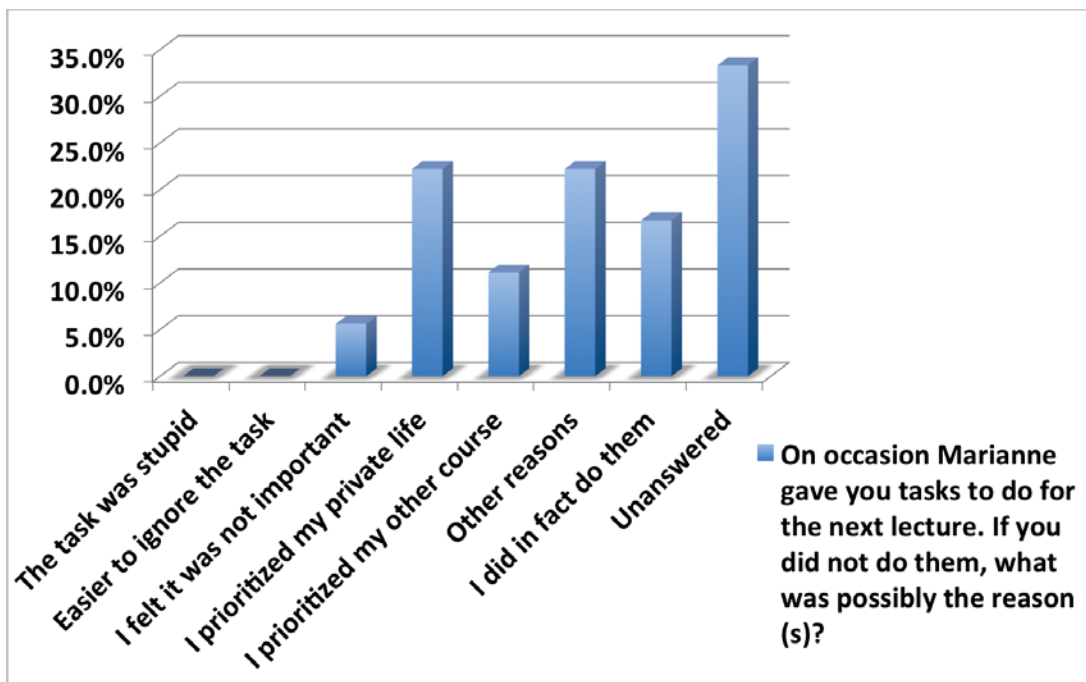**Fig. 12.13.** Evaluation of computer sessions.

Fig. 12.14. Why task was not done.

The Didactical Contract

For the activities to work well, the students have to buy into the new course format from the start. The student evaluations reveal that it is common for the students to feel it is not or should not be necessary to do much work outside of class despite the emphasis from the instructors to the contrary. While I typically asked the students to consider one or two questions on the next day's reading and to formulate two questions for me (so to help them focus), most students didn't do this. This suggests that the didactical contract was not established well enough from the start. The students have to agree to it and see the benefits of all the activities. I plan to enter a dialog with the students about their own experiences of how they learn best, advices from prior students (from student evaluations), and statistics of last year's students activity level and their final grade. While the final grade does not guarantee deep learning, the grade is, afterall, a strong motivator for most students. There is also a need to remind the students about the didactical contract and review it occasionally.

The Textbook

The students find the textbook hard to read because it fluctuates between giving an overview of galaxy properties to providing rivers of facts and details. The latter is mostly repetition for students with a background in stellar astronomy, but is overwhelming for the beginning students that take *Galaxies*. While I will be on the look-out for a different textbook I know the options are very limited. The current solution is to help the students to read the book by way of activities that help to extract the essense and outline what is important in concert with the other TLAs. The didactical reason for these small exercises is that they are the type of questions a naturally self-motivated student (a 'Susan'; e.g. (Biggs & Tang 2007, Ch. 1)) would ask of herself. Her notes for class would include these considerations. These discussions are also good upon which to build the lectures of the day.

Selected home-work/group-work tasks

Sample home-work tasks to be applied in 2011 are listed below. The full list is shown in Appendix A. The results of the home-work tasks will be discussed and summarized at start of class, at times combined with discussions within student groups of three, as indicated.
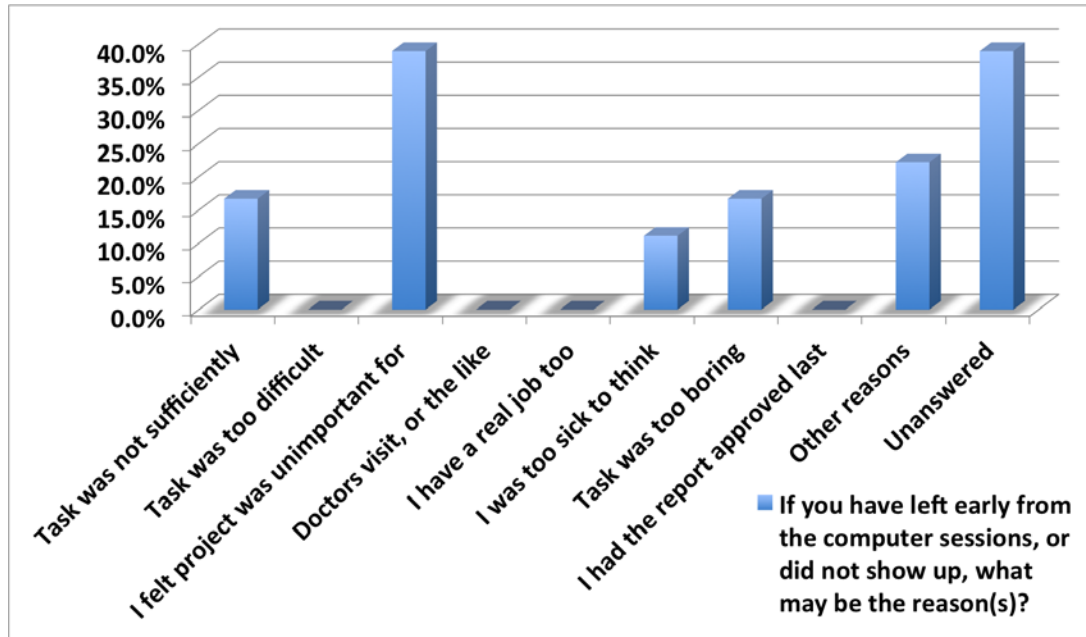
Fig. 12.15. Reasons for leaving early from computer sessions.

Spiral Galaxies II: *Home-work A:* "Which components of spiral galaxies contribute to the rotation curves? Why do each of them have the specific radial profile we see?" In-class group work will place special emphasis on the last question plus these: "Why must we conclude the presence of dark matter? Explain the physical reason for its radial profile."

Home-work B: "What is the Tully-Fisher relation and how is it useful?"

Elliptical Galaxies II: *Home-work:* "List the differences between spiral and elliptical galaxies. Who can find the most?" In-class group-work: "Discuss: what are the physical reasons for these differences." The summary discussion will include addressing the potential effects of evolution.

Early Universe and Young Galaxies: *Home-work:* "List the various methods to find proto-galaxies and young starforming galaxies. How does each method work?" In-class group work: "What physics is involved here?"

In class the students spend some time in groups of three to compare notes and discuss any new questions. To motivate participation among all groups, each group will contribute with a subset of the answer at random. The results will be the basis for follow-up discussions and institutionalization of the issue.

Group-work and Student Presentations

Student presentations is one way of motivating the students to actively participate in group-work. However, as the student evaluations suggests many students may not learn anything from the presentations of the other students. On solution is to have all groups work on the same issue (group-work tasks in this course have centered around different topics for each group) and present parts of the result. The students then help validate the results and supplement what other groups have presented. The presentations then become a plenary discussion. In addition, an alternative way to summarize, institutionalize, and provide formative feedback to each student is to require a short 1 page essay to be submitted before next class. Next, I give examples of topics − although in these cases topics are typically different for each student but the students need to assimilate the information for their report.

For example, I will start group-discussions based on the following questions: "Which are the different methods for measuring the mass of galaxy clusters and how do they work?" After a 5 minute brain-storm/discussion, the groups report back and in concert we generate an overview of the problem and the possible solutions (in this case three methods exist). Then each group picks one mass-measuring method to investigate further. After 1 hour's work each group provides a summary. If multiple groups work on a single sub-topic, each group provides part of the solution. The other groups act as opponents/validators and will supplement information.

Another group-discussion question is: "How does the distance-ladder work and how is it calibrated?" In this case I will adopt an alternative, fun implementation, namely a role-play. Each group of three are astronomers, expert in a particular distance determination method. The overall aim is for each group to try to solve the puzzle of how to calibrate the distance ladder to use it for the most distant objects. The groups are to exchange information since each group is only experts in one method. Internally in the group the students are to assimilate the information and determine how one can calibrate the distance ladder. When a group believes it has cracked the riddle, it presents its hypothesis to the class whereafter the other groups validate and judge the proposal based on scientific reasoning. If rejected, any other group gets the opportunity to propose a solution. The game aspect of the role-play is engaging and motivating to most students. I have seen first hand how such an activity can turn otherwise passive, introverted engineering students into a lively party. This in itself validates the success

of the activity: the students are actively processing the material, they use their scientific reasoning, and will, no doubt, remember this activity.

Regardless of the implementation, the students are to submit a one-page summary of the solution. This report is a means to provide formative evaluation (feedback) on their understanding of this topic. Also, this report can also be the basis for one of the questions on the final oral exam.

Improving the Constructive Alignment

Course Activities and the Exam

The final oral exam is currently based on questions, known to the students, that cover the entire curriculum of the textbook. The computer report is not directly assessed during the exam; it is graded and approved three weeks before the exam. Some students saw little relevance of the computer projects to the rest of the course and the exam. As an additional motivator, I will include all the computer projects except the IDL introduction in the exam. The large project would the an exam question of its own, while the smaller projects (done in class) will be part of the curriculum for the questions on their topics. The write-up of the projects can be optional, yet if submitted the students will obtain formative evaluations. Like-wise, the 1-page summaries based on group-work can also be made part of the exam curriculum. While from a didactical viewpoint one would aim towards all oral exam questions to be based on students projects/work, my experience tells me that this format needs to be introduced a little at a time. Next time I teach *Galaxies* I will make all computer projects part of the exam curriculum and also pick one group-work project that forms the basis of one of the exam questions. Although many students dislike the group presentations they cannot be discarded since the students need to practise expressing themselves for the oral exam.

Galaxies in Context of the Bachelor Education in Astronomy

The current background of the students is poor on stellar astrophysics and the physics of radiation and its interaction with matter. The constructive alignment of this course in the Bachelor education thus needs to be improved. Simply moving *Galaxies* to the 3rd year does not resolve all issues. Atomic physics is no longer a mandatory course so the students will only learn what I teach them on the topic. And while having a background in

stellar physics would clearly help, changing the order of the astronomy courses is not possible[8] So what are the options? To achieve the ILOs the curriculum has increased so to address the missing background of the students. A non-appealing option is a significant cut in currriculum, leaving *Galaxies* to be only a bare-bone introductory course. To exploit the natural appeal that astronomy often has to many, this course should not loose the ILO related to the students obtaining an overview and understanding of the cutting edge research areas and of what astronomy research is. These activities contribute to the official competences of the Bachelor education as defined by University of Copenhagen. These aspects can be retained by the following idea that grew out of a discussion with a colleague.

Better alignment between the four astronomy courses may be obtained if a simple reshuffling of the curriculum is made: the topic of star-formation can be moved from course 3 (planetary physics and interstellar medium) to course 4 (stellar astrophysics and evolution). At present both courses touch on this topic, but it can be better coordinated. Course 3 already addresses the interstellar medium of the Milky Way. Extending that curriculum to other Milky Way issues like chemical enrichment models, measurements of gas and stellar dynamics, etc., currently taught in course 2 (*Galaxies*), is appropriate. This would free up time in *Galaxies* to provide the relevant background, allow TLAs that hone the reasoning and analysis skills, and to address the ILO related to current hot research topics. My colleague and I are proposing this minor change to the astronomy teaching faculty.

Conclusions

Teaching the *Galaxies* course with the aim of optimizing the student learning outcomes involves a multitude of challenges. This project describes the changes I made to the original format of traditional lectures: I mixed power-point presentations with a suite of student activities and changed the computer projects to allow the students to learn IDL programming at an appropriate pace and to use it to obtain deeper understanding of the material taught in this course.

The students liked most of the activities and found them helpful to their learning. They learned more during the computer sessions than they had in

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[8] The stellar astrophysics course requires a background in advanced physics and is therefore a third year course. Offering all astronomy courses late in the third year is not possible.

previous courses and they were generally happy with the course which they felt was inspiring and increased their physical intuition.

The overall conclusion is that most of the activities implemented in 2010 are generally successful and with further improvements to, especially the IDL introduction and use of the textbook, this course format and structure has the potential of optimizing the learning outcome for the students. This can be further improved by a better constructive alignment of the course within the Astronomy Bachelor education.

Acknowledgements

A Home-work Tasks for Focused Textbook Reading

The home-work and group work tasks to be applied in 2011 are listed below. The solutions will be discussed and summarized at start of class, at times combined with discussions within student groups of three, as indicated.

Spiral Galaxies I: *Home-work A*: "List the characteristiscs and properties of spiral galaxies. Include how you identify this galaxy type on images."
Home-work B: "Spiral galaxies have spiral arms. What are they? What is happening there? Are they rigid? Explain your answers."

Spiral Galaxies II: *Home-work A:* "Which components of spiral galaxies contribute to the rotation curves? Why do each of them have the specific radial profile we see?" In-class group work will place special emphasis on the last question plus these: "Why must we conclude the presence of dark matter? Explain the physical reason for its radial profile."
Home-work B: "What is the Tully-Fisher relation and how is it useful?"

Elliptical Galaxies I: *Home-work A:* "List the characteristiscs and properties of elliptical galaxies. Include how you identify this galaxy type on images." *Home-work B:* "List the properties that astronomers can measure on elliptical galaxies. Include the measurement method."

(Elliptical) Galaxies II: *Home-work:* "List the differences between spiral and elliptical galaxies. Who can find the most?" In-class group-work: "Discuss: what are the physical reasons for these differences." Summary discussion will include the potential effects of evolution.

Galaxy Groups and Clusters: *Home-work:* "Jot down the main characteristics that define groups and those that define clusters. Compare them: how are groups and clusters similar, how are they different?" In-class discussion: "Why do we see these differences? What are the physical reasons for them?"

Active Galactic Nuclei I: *Home-work:* "Make a bulleted list of the measurements that support the Unified Model, namely that different AGN types are separated only by source orientation."

Active Galactic Nuclei II: In-class group work: ' Draw a model of the central engine of quasars. Label each physical component with the type of emission it generates. Which part of the spectral energy distribution does that component contribute to?"

Large Scale Structure: *Home-work:* "Draw in a pie diagram the types of structures we see on large scales and label them. Make a list of uncertainties and artifacts that are inherint in the redshift surveys." In-class group-work: "What are the consequences of the uncertainties and artifacts of redshift surveys?"

Early Universe and Young Galaxies: *Home-work:* "Make a bulleted list of the various methods to find proto-galaxies and young starforming galaxies. How does each method work?" In-class group work: "How does each method work and why?"

In class the students will spend some time in groups of three to compare notes and discuss any new questions. To motivate participation among all groups, each group will contribute with a subset of the answer. The results will be the basis for follow-up discussions and an institutionalization of the issue.

Constructive re-alignment af kurset "Lægemiddelpolitik, -økonomi og -etik"

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Det obligatoriske kursus "Lægemiddelpolitik, -økonomi og -etik" på kandidatdelen på farmaceutstudiet på Det Farmaceutiske Fakultet (FARMA) fandt sted første gang i efteråret 2010. Kurset er en delvis sammensætning af to tidligere kurser på FARMA "Lægemiddeløkonomi" og "Etik", hvorimod der ikke tidligere har fundet undervisning af kandidatstuderende sted i lægemiddelpolitik.

Udfordringerne for de kursusansvarlige bestod både i det fagligt indholdsmæssige med hensyn til, hvordan man kan integrere de tre til dels uafhængige akademiske discipliner i hinanden samt det formmæssige, eftersom vi som kursusansvarlige vidste, at der kun var ganske få kompetente lærerkræfter til rådighed. Dette var en selvstændig udfordring på grund af den nye blokstruktur på Københavns Universitet, hvor alle studerende skal undervises på samme tidspunkt.

Den bærende undervisningsform på kurset blev meget hurtigt besluttet at være en kombination af forelæsninger direkte efterfulgt af case-øvelser af to eller seks timers varighed. Da antallet af lærere var begrænset, var klasseundervisning til de ca. 200 studerende til at understøtte case-arbejdet således udelukket, hvorfor nye interaktions- og feedback-former måtte introduceres til case-arbejdet. Disse indbefattede internet-supervision og aflevering af case-opgaver undervejs i forløbet, hvor stikprøvevurderinger blev anvendt til mundtlig gennemgang af mønsterbesvarelser, som de studerende kunne spejle egen besvarelse i.

Der var derfor en række helt nye elementer indholdsmæssigt og formmæssigt, som vi som ansvarlige ikke havde erfaringer med, før vi gik i gang med selve undervisningen. Vi havde derfor ikke en sikker fornemmelse af,

hvordan de studerende ville opleve disse nye tiltag. Vi er nu efter endt kursusforløb inklusiv eksamen blevet klogere ikke mindst på baggrund af den såvel mundtlige som skriftlige evaluering, de studerende har udført. Ved syn på den hidtidige fagbeskrivelse er det endvidere åbenlyst, at en række præciseringer er nødvendige for at beskrive det faktiske og ikke forventede indhold af kurset, ligesom en revidering af kurset er nødvendig grundet de studerendes evalueringer af især formen af kurset, hvor de fandt flere af de nye tiltag suboptimale i forhold til deres ønskede læringsudbytte.

Formålet med dette projekt er derfor at foretage en re-aligment af kurset "Lægemiddelpolitik, -økonomi og -etik" ud fra principperne i "Constructive Alignment". Udøvelse af Constructive Alignment er med til at sikre, at de beskrevne og forventede indlæringsmål for et givent kursus hænger sammen med det undervisningsmiljø, de studerende oplever undervejs i kurset samt at måden de studerende bliver testet (eksamensform) er i stand til at verificere og graduere de tillærte kompetencer i forhold til de beskrevne indlæringsmål (Biggs & Tang 2007). Det specifikke formål med projektet er derfor at revidere og aligne kurset "Lægemiddelpolitik, -økonomi, og -etik" på baggrund af de indhøstede erfaringer fra såvel underviser- som studenterside for at øge de studerendes læringsmæssige udbytte. Revideringen vil på baggrund af principperne bag Constructive Aligment fokusere på:

1. Om indlæringsmålene som beskrevet i fagbeskrivelsen svarer til undervisningens faktiske indhold. Da vi som ansvarlige nu ved, hvad vi er i stand til at undervise i indholdsmæssigt, kan indlæringsmålene præciseres, så de stemmer overens med kursets faglige indhold.

2. Om indlæringsmålene som beskrevet i fagbeskrivelsen hænger sammen med det undervisningsmæssige miljø ved at inddrage de erfaringer, vi har opnået, gennem hvilke kompetencer de studerende er i stand til at erhverve sig gennem de introducerede former. I tilfælde af at de studerendes generelle læringsniveau findes acceptabelt på baggrund af de indleverede eksaminer, vil jeg under dette punkt afstemme de beskrevne indlæringsmål på baggrund af viden om de studerendes tillærte kompetencer i forhold til de udøvede undervisningsformer, det vil sige en præcisering af, hvilke kompetencer vi kan afkræve de studerende, når vi udsætter dem for netop dette undervisningsmæssige miljø. Hvis de studerendes generelle læringsniveau findes uacceptabel, må det til gengæld overvejes, hvordan undervisningsmiljøet kan udvikles for at understøtte de ellers præciserede indlæringsmål gennem punkt 1. Dette gøres i nogen grad på et mere teoretisk niveau ved en vurdering af

nye undervisningsformers betydning for muligheden for at tilegne sig de beskrevne kompetencer i fagbeskrivelsen. Dette er således ikke muligt reelt at vurdere de nye undervisningsformer inden for projektets tidsramme, idet kurset først kører igen i efteråret 2011.

Fordelen ved at præcisere indlæringsmålene for et kursus er, at man som underviser helt fra kursets start kan redegøre over for de studerende, hvilke konkrete kompetencer de forventes at tillære sig undervejs, hvilket kan støtte de studerende positivt i deres udvikling, eftersom de har klare pejlemærker at styre efter. Dette synes ikke mindre relevant efter at evalueringen af sidste års undervisning i "Lægemiddelpolitik, -økonomi og -etik" viste, at kun 42% af de studerende, der havde udfyldt evalueringsskemaet følte sig "helt enig" eller "enig" i, at de følte sig klar til at gå til eksamen. Dette til trods for, at eksamen direkte afspejlede de øvelser og cases, de studerende havde arbejdet med gennem kursusforløbet.

Problemformulering

Hvordan kan studerendes læringsmæssige udbytte af kurset "Lægemiddelpolitik, -økonomi og -etik" forbedres ved at revidere og præcisere kursets indlæringsmål samt til dels undervisningsformer på baggrund af opnået viden fra studerendes og undervisere om kursets gennemførelse i efteråret/vinteren 2010/2011?

Det konkrete udbytte af aligment-øvelsen bliver en revidering af fagbeskrivelsen for kurset, der efter debat i undervisergruppen skal indsendes til såvel Undervisningsudvalget på Institut for Farmakoterapi og Farmakologi, FARMA samt Studienævnet på FARMA til godkendelse.

Materialer

Den opnåede viden om kursets reelle indhold samt om studerendes erhvervede kompetencer, som ligger til grund for revideringen af kurset, er opnået dels gennem personlige erfaringer som underviser på kurset og sideløbende diskussioner med de øvrige undervisere, de studerendes mundtlige og skriftlige evalueringer af kurset samt de indleverede og rettede eksamensbesvarelser. Endelig inddrages den hidtidige fagbeskrivelse i opgaven som udgangspunkt for revideringen.

Teori

Til udførelse af selve alignment-opgaven søges flere pædagogiske koncepter, som beskrevet og anbefalet af Biggs og Tang, integreret. Forfatterne beskriver en alignment-proces som bestående af fire processer (Biggs & Tang 2007):

1. Beskriv læringsmål i form af verber, indhold samt konteksten for læringen. Konteksten tolker jeg som en beskrivelse af, hvorfor netop de beskrevne læringsmål er vigtige
2. Skab undervisningsmiljø baseret på verber og indhold præciseret i læringsmål
3. Udøv bedømmelse baseret på samme verber
4. Transformer bedømmelserne til gradueringer af en standard eksempelvis karakterer

Af ovenstående kan ses, at det at udtrykke læringsmål gennem verber, det vil sige beskrive hvilke aktiviteter studerende skal være i stand til at udøve, er et centralt forhold til at sikre alignment. Dette skyldes at en præcisering af, hvilke aktiviteter studerende bør være i stand til at udøve, muliggør en sammenhæng til de undervisningsformer, der skal understøtte læringsprocessen. Dette ses i modsætning til mere traditionelle former for beskrivelse af læringsmål med fokus på beskrivelse af kursusindhold samt hvor meget af indholdet, der skal forstås. Sådanne beskrivelser vidner nemlig ikke om, hvordan de studerende skal tillære sig det beskrevne stof, hvilket vanskeliggør en refleksionsproces hos kursusledere om, hvilke undervisningsformer og bredere endnu, hvilket undervisningsmiljø der vil være mest optimalt for at understøtte den ønskede læringsproces hos de studerende. Et eksempel herpå kunne være at den hidtidige fagbeskrivelse for "Lægemiddelpolitik, -økonomi og -etik" beskrev, at studerende skulle være i stand til at "kunne udvise grundlæggende forståelse for måder at adressere etiske og lægemiddelpolitiske problematikker på samt kunne anvende disse inden for relevante etiske kontekster" uden på nogen måde at afsløre, hvordan dette læringsudbytte ville kunne opnås. I den reviderede fagbeskrivelse er det derfor specificeret, at forståelsen handler om at kunne applicere specifikke gennemgåede etiske teorier hensigtsmæssigt og begrunde valget heraf på specifikke cases (se resultater punkt 3 – udarbejdning af ny fagbeskrivelse).

Ved revidering af fagbeskrivelsen for "Lægemiddelpolitik, -økonomi og -etik", vil jeg således søge at beskrive indlæringsmål ved at fokusere på

brug af verber til beskrivelse af hvilke aktiviteter, studerende ønskes at være i stand til at udføre efter endt kursus, foruden beskrivelse af kursusindhold samt enkelte betragtninger over konteksten for kurset. Til præciseringen af læringsmålene, vil jeg tage udgangspunkt i en flere af de supplerende verber, der er foreslået af Biggs og Tang til at erstatte beskrivelsen af især et verbum som *forstå* for at beskrive indlæringsmålene for "Lægemiddelpolitik, -økonomi og -etik" så præcist og uddybende som muligt (Biggs og Tang, 2007).

Analyse

Alle analyser er enten baseret på kritisk common sense-fortolkning som beskrevet af Kvale (2005) eller ved at reflektere over alignment af kurset ved at inddrage teoretiske betragtninger af Biggs og Tang 2007.

Analysen er for overskuelighedens skyld inddelt i følgende processer:

1. Refleksioner over egne erfaringer fra kurset angående mulige læringsmål – hvad har de studerende mulighed for at lære set i betragtning af hvad vi er i stand til at undervise i. Her inddrages især eksamensresultaterne fra sidste år.
2. Gennemgang af de væsentligste kritikpunkter fra de studerende fra forårets evaluering og udarbejdning af forslag til evt. nye undervisningsformer
3. Udvikling af en revideret fagbeskrivelse ved at omsætte mulige læringsmål og nye undervisningsformer jævnfør punkt 1 og 2 til verber, indhold og kontekst

Resultater

Refleksioner over hvad vi er i stand til at hjælpe de studerende til at lære baseret på sidste års undervisning og eksamination

Eksamensresultatet var fra de kursusansvarliges side meget tilfredsstillende idet 161 ud af 168 studerende bestod eksamen, og en del studerende afleverede rigtigt fine opgaver. Det vil sige, de studerende var på baggrund af den måde, vi testede dem på, samt det materiale vi havde undervist dem i, i stand til at formidle til os, at de var tilfredsstillende dygtige til at udøve følgende aktiviteter:

- udvise kritisk sans, være i stand til at udfolde nuancer omkring forskellige aktørers ofte divergerende interesser i en specifik problemstilling inden for lægemiddelområdet
- være i stand til at applicere præsenterede redskaber inden for økonomi, politik og etik på en specifik problemstilling inden for lægemiddelområdet på en tilfredsstillende måde
- være i stand til at redegøre for hensigtsmæssige beslutninger, der bør udføres på baggrund af analyser af økonomiske, politiske, og etiske aspekter, hvori præsenterede redskaber appliceres

Herudover mener jeg, følgende ekspliciterede læringsmål kunne være relevante for kurset for at fremme dybdelæring, det vil sige undgå en bevidstløs applikation af præsenterede redskaber og teorier uden reelt at indse meningen hermed ved endvidere at opstille følgende mål:

- være i stand til at vælge hensigtsmæssigt mellem forskellige økonomiske modeller til at foretage relevante beregninger af specifikke økonomiske problemstillinger indenfor lægemiddelområdet (der bliver kun gennemgået få redskaber indenfor politik og etik, hvorfor det at vælge aktivt mellem forskellige redskaber ikke giver mening indenfor disse del-discipliner)
- være i stand til at begrunde relevansen af at applicere et specifikt økonomisk, politisk eller etisk redskab indenfor en specifik problemstilling på lægemiddelområdet

Gennemgang af de studerendes væsentligste kritikpunkter fra den udøvede undervisning

En såvel skriftlig som mundtlig evaluering af undervisningen viste, at de studerende var meget utilfredse med formen af undervisningen, hvad angår feedback, og de var rimeligt tilfredse med indholdet. Hvad angår formen, fandtes det især utilfredsstillende for de studerende kun at kunne få vejledning af de seks timers lange caseopgaver gennem en chatfunktion på nettet, der ofte ikke fungerede. Samtidigt virkede det demotiverende for de studerende at skulle indlevere opgaver, som de ikke fik individuelt rettet. Der udøvedes en såkaldt gennemgang af stikprøver, 10 opgaver ud af ca. 40 dannede grundlaget for gennemgang af en god besvarelse af en case i plenum. Fire af sådanne cases skulle i løbet af kurset afleveres for at kunne gå til eksamen. Endelig ønskede de studerende materialet til forberedelse af kurset ud i bedre tid.

Udfordringen i at udbedre de kritiske undervisningsformer ligger som beskrevet i meget begrænsede ressourcer, især hvad angår lærerkapaciteter inden for faget samt indførelsen af blokstruktur. Det er således ikke muligt at udøve klasseundervisning, fordi det ikke er muligt at finde syv undervise-re, der kan undervise i eksempelvis lægemiddelpolitik samtidig. En mulig-hed for at imødekomme kritikken, som må siges at være berettiget i forhold til at de studerende kan opnå optimalt læringsudbytte af undervisningen, er at hver case-sektion afsluttes med en fælles session i auditoriet, hvor dagens case gennemgås af underviseren, og de studerende kan få besvaret tvivl om-kring opgaven. Hermed gøres op med studerendes manglende mulighed for at få feedback på uklarheder omkring, hvad der forventes i forhold til at besvare opgaven fyldestgørende.

Arbejdet med cases efter forelæsningerne bibeholdes således. For det første har de studerende udtrykt tilfredshed med case-arbejdet som form. For det andet synes formen af kombinationen af forelæsninger og case-arbejde at kunne hjælpe studerende til at opnå passende læring jævnfør eksamensresultatet fra sidste år. Det synes derfor i forhold til aligment at være hensigtsmæssigt for opnåelse af læringsmålene, at de studerende ar-bejder aktivt med problembaseret læring i form af en dagsaktuel case fra den virkelige verden, der omfatter problemer af sundhedsøkonomisk, po-litisk og/eller etisk karakter, hvor studerende skal identificere aktører og deres interesser samt analysere casen i forhold til præsenterede redskaber. Det vil være vigtigt i den fremtidige undervisning at sikre, at de studeren-de gennem case-arbejdet får mulighed for at træne deres færdigheder inden for de nyligt foreslåede læringsmål også ved at bede dem diskutere rele-vansen af de applicerede redskaber, og i tilfælde hvor det er muligt at træne dem til at vælge det mest hensigtsmæssige redskab for at løse opgaven samt begrunde valget heraf.

Det overlades så til de studerende at arbejde seriøst med casen mellem de introducerende forelæsninger og den afsluttende gennemgang af opga-ven uden nogen form for kontrol, der ville afkræve, at man afleverede et produkt. Her kunne man frygte, at mere uengagerede studerende ikke laver casen undervejs, men blot møder op til gennemgangen af casen og dermed får svaret serveret. Omvendt, hvis eksamen og læringsmål afspejler en dyb-delæring, der kun kan opnås ved at arbejde med stoffet seriøst, kan de stude-rende måske med tiden indse vigtigheden i at arbejde selv med stoffet frem for at få færdige løsninger serveret. En gennemgang af en case som afslut-ning på case-arbejdet kunne desuden foretages interaktivt, så de studerende fremkommer med deres løsninger på svar, som læreren så kommenterer på.

Dette kan måske udvikle sig en smule ustruktureret med deltagelse af 200 studerende, men kan måske undgås ved at underviseren har forberedt nogle centrale pointer, der ønskes berørt for at have udført en tilfredsstillende opgave, og som sikres diskuteret og repeteret undervejs. Endelig kunne denne form understøttes af, at studerende læser opgaven grundigt inden de sendes ud i grupper for at løse casen for at afklare umiddelbare spørgsmål, og at underviseren er fysisk tilgængelig undervejs i case-arbejdet. Sådanne initiativer understøtter ligeledes, at studerende kan få den hjælp, de har behov for for at løse opgaven og dermed opnå hensigtsmæssig læring, den nye fagbeskrivelse taget i betragtning.

Udarbejdning af ny fagbeskrivelse

Ved gennemgang af den eksisterende fagbeskrivelse ses et omfangsrigt brug af begrebet "forståelse" under blandt andet formål, hvilket ifølge Biggs og Tang ikke er en særlig præcis term til beskrivelse af, hvilke aktiviteter studerende skal være i stand til at udføre på baggrund af læring opnået gennem kurset (Biggs & Tang 2007). Dette bør som tidligere beskrevet tilrettes. Samtidig er de specifikke eksempler under formål ("optimering af lægemiddelanvendelse, lægemiddelpolitiks indflydelse på lægemiddelforbrug og sundhedsøkonomiske udfordringer i eksempelvis sygehussektoren") enten ikke præsenteret eller ikke præsenteret særligt i forhold til andre temaer på kurset, og bør derfor tilrettes, så de ikke har forrang frem for andre måske mere centrale temaer.

Konteksten for kurset fremgår ikke på trods af betydningen af denne for formålet med kurset. Dette bør fremgå. Ved konteksten her, fremhæves den samfundsmæssige betydning af, at farmaceuter er i stand til at udøve faget i praksis, altså at kunne "bidrage til optimal løsning af problemer inden for lægemiddelområdet"..."på baggrund af øget prioriteringer i samfundet inden for sundhedsområdet". Endvidere var det i 2010 tænkt at udvikle et meta-reflektorisk redskab, der kunne samle økonomiske, politiske og etiske aspekter til en samlet forståelse af et givent problem, hvilket ikke helt fandt sted, hvorfor omtale af dette redskab bør udgå.

Målbeskrivelsen omformuleres så den tager udgangspunkt i verber og indbefatter de præsenterede læringsmål i afsnittet "Refleksioner over hvad vi er i stand til at hjælpe de studerende til at lære...". Det skal overvejes, hvilke mere tematiske forhold de studerende bør have indsigt i (indhold), og på hvilken måde indsigten skal afspejle sig udover at kunne applicere relevante redskaber inden for hver af deldisciplinerne for kurset.

Nogle bud på *obligatoriske* temaer kunne være: regulering af udvikling og anvendelse af lægemidler herunder tilskudssystemet, apotekervæsenets struktur, brug af dyr i lægemiddelforsøg og ressourcemangel i sundhedsvæsenet. En form for afspejling, som de studerende ville kunne testes i, er at skulle redegøre for centrale elementer inden for temaerne så som apotekssektorens struktur samt dennes betydning for en specifik problemstillings opståen og/eller måder at løse et bestemt problem på. Disse føjes dermed til læringsmålene i målbeskrivelsen.

Distinktionen mellem forskellige typer forelæsninger: tema- eller redskabsorienterede, kan beskrives under indhold i fagbeskrivelsen for at tydeliggøre de forskellige komponenter af kurset, som de studerende er ment at skulle tilegne sig og dermed fremme læringsprocessen. Punktet *Indhold* under fagbeskrivelsen ændres endvidere til at inkorporere de foreslåede undervisningsformer. Endelig revideres eksempler af temaer i undervisningen, så de følger forelæsningstemaerne fra første år, og dermed er realistiske i forhold til reelt at blive gennemgået En række af de oprindeligt foreslåede temaer så som: EU-direktivers betydning for nationale love, kvalitet og akkreditering samt patientinformation er ikke blevet gennemgået og slettes derfor.

Eksamensformen foreslås ikke ændret umiddelbart, da den som beskrevet synes at være rimeligt alignet med læringsmålene, men selve opgaven bør ændres, så den tester de studerende i ikke bare enkelte, men flest muligt af de opstillede læringsmål. Dette indbefatter som beskrevet blandt andet at bede de studerende begrunde relevansen af de anvendte redskaber samt anvende forudsat baggrundsviden inden for et specifikt emne til at udfolde økonomiske, politiske og etiske aspekter omkring særlige lægemiddelfaglige problemstillinger.

Diskussion

Der er nu præsenteret en række ændringsforslag til den eksisterende fagbeskrivelse i kurset "Lægemiddelpolitik, -økonomi og -etik", som i første omgang skal diskuteres i undervisergruppen for kurset, og som anført siden forelægges Undervisningsudvalg og Studienævn til godkendelse. Revideringen af fagbeskrivelsen blev baseret på teori om "Constructive Aligment", der dels er fokuseret på at skabe læring for studerende ved at eksplicitere læringsmål i form af verber og aktiviteter, som studerende skal være i stand til at udføre samt at tilrettelægge undervisningsformer, undervisningsmiljø

og eksamensform på en måde, der understøtter, at læringsmålene kan indfries (Biggs & Tang 2007). Denne tilgang sikrer, at ikke kun slutresultatet i form af opnået læring, men også processen til at opnå brugbar og handlingsorienteret viden bliver gjort til genstand for pædagogisk refleksion.

Inden for pædagogiske sammenhænge skelnes mellem deklarativ og funktionel viden, hvor den første type angår det at vide noget om specifikke fænomener, teorier og discipliner, og den anden type er rettet mod at kunne udøve kontrol over problemer og beslutninger inden for et specifikt område (Biggs & Tang 2007). Undervisningen inden for kurset er klart rettet mod det funktionelle vidensområde gennem det at applicere redskaber og søge at danne beslutninger på baggrund af udførte analyser frem for at beskrive og kategorisere viden om fænomener i virkeligheden inden for eksempelvis sundhedssystemets ombygning. Man kunne dog i fremtiden forestille sig, at den funktionelle type viden kunne styrkes videre ved at lade cases og eksempelvis eksamen være langt mere problemorienteret end nu. Man kunne således forestille sig cases, hvor de studerende skal forestille sig at antage en særlig position eller aktør, eksempelvis at være farmaceut-fuldmægtig i Lægemiddelstyrelsen, der bliver udstillet for et særligt problem, der skal løses. Det er så op til de studerende at vurdere, hvilken af de præsenterede redskaber i undervisningen, de kan anvende til at skabe klarhed om problemets karakter og omfang, udføre selve analysen og foretage beslutninger, de skal kunne argumentere for på baggrund af de resultater, som er fremkommet gennem analysen. Den mere deklarative viden kunne her integreres aktivt, hvorved begge typer læring søges styrket. Dette kunne gøres ved, som beskrevet at diskutere specifik gennemgået viden om centrale elementer inden for et givent tema i forhold til, hvordan et problem på lægemiddelområdet kan løses – at fremhæve kontekster og strukturers betydning for de løsninger, der kan finde sted og hvordan de er med til at generere problemerne.

Ifølge ovenstående er læringsmålene og den ønskede form for opnået viden på et relativt højt niveau. Inden for SOLO-taksonomien svarer dette til det relationelle niveau, hvor studerende skal være i stand til at sammenligne, forklare årsager, analysere, relatere og applicere (Biggs & Tang 2007). Dette er forholdsvis strenge krav at sætte til farmaceutstuderende, der er skolet især inden for naturvidenskaber og ikke samfundsvidenskaber. Spørgsmålet er på sigt, om disse typer færdigheder reelt kan opnås på et tilfredsstillende niveau? I øjeblikket er omfanget af præsenterede redskaber meget begrænset, hvilket er en måde at sikre, at de studerende bliver gode til at anvende netop de redskaber, de præsenteres for. Men spørgsmålet

er, om de efter endt uddannelse er tilstrækkeligt rustet til at indgå i prioriteringer på sundhedsområdet som ønsket? Kan de præsenterede redskaber dække de problemstillinger, de studerende bliver udsat for efter endt uddannelse og hjælpe dem til nemmere at tilegne sig nye redskaber? En senere evaluering af, hvordan de opnåede færdigheder på et relationelt niveau om end inden for et stærkt begrænset område kan omsættes reelt i en erhvervsmæssig kontekst, kunne således være formålstjenlige at udføre.

Opgaven har styrket mig som adjunkt i at kunne begrunde valg af relevante læringsmål, samt hvordan de bør beskrives, og hvordan cases og eksamen bør formes tilsvarende for at kunne rumme og teste de netop anførte læringsmål. Konstruktiv diskussion af forslagene med de øvrige kursusansvarlige kan forhåbentlig føre til en endelig fagbeskrivelse, der kan styrke og understøtte de studerendes læring optimalt til glæde for såvel studerende som det øvrige samfund, der har behov for dygtige og kompetente farmaceuter til at foretage prioriteringer i sundhedsvæsenet.

Konklusion

Fagbeskrivelsen af kurset "Lægemiddelpolitik, -økonomi og -etik" på kandidatdelen på farmaceutstudiet på FARMA er blevet revideret ud fra principper om "Constructive Alignment". Processen har givet anledning til en række pædagogiske refleksioner omkring, hvordan det optimale læringsbytte for studerende kan sikres gennem eksplicitering af læringsmål, omlægning af visse undervisningsformer samt forslag til evaluering efter endt uddannelse.

14

Essay som eksaminationsformat – evaluering af sammenhængen mellem kompetencemål og evalueringsform på kurset "Bysociologi – menneske, sted og by"

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Denne opgaves overordnede formål er at overveje og vurdere sammenhænge mellem kompetencemål, eksamensform og de studerendes læring. Dette sker ved at tage udgangspunkt i et specifik kursusforløb. I projektet belyses og evalueres de hidtidige høstede erfaringer. Projektet vil ende ud i en række generelle og konkrete forslag til kursusforbedringer.

Opgaven tager udgangspunkt i kurset 310077 "Bysociologi – menneske, sted og by", som jeg er kursusansvarlig for. Ansvaret for kurset deler jeg med en kollega, og vi har sammen opbygget kurset fra grunden. Kurset er nyoprettet og blev udbudt første gang i Blok 2 november 2009. Det er således foreløbigt blev afholdt to gange – fra nu af Version 1 og Version 2. Kurset er et såkaldt "Fælleskursus" og kan tages af trejdeårs studerende på Landskabsarkitektur og Bydesign samt af ældre studerende. Den typiske studerende læser på fjerde år. Kurset holdstørrelse er 20-30 studerende. Undervisningssproget er dansk.

Kurset er nyoprettet og har behov for restrukturering. Da kursusbeskrivelsen blev udformet skete det med en hurtig skelen til Blooms taksonomi (Biggs & Tang 2007), men uden systematisk sondring mellem forskellige kompetencetyper og læringsniveauer, vel vidende at den ikke var fyldestgørende og ville skulle justeres efterfølgende. Min deltagelse på adjunktpædagogikum har muliggjort et rum til mere systematisk refleksion over, om kursets læringsmål er de rette, og hvordan det kan sikres, at disse nås.

For at kunne analysere kursets indre sammenhænge er alle brikker vigtige. Dette er dog for omfangsrigt at gennemgå, og i denne opgave har jeg sat fokus på relationen mellem kompetencemål og eksamensform. Det betyder dog ikke, at jeg udelukker overvejelser om undervisningsaktiviteter m.m.

Undervisningen består af to elementer: dels er der forelæsninger (inkl. gæsteforelæsere) med studenterinteraktion og dels læser, diskuterer og fremlægger de studerende mundtligt tekster i grupper eller plenum. Kurset afsluttes med et essay, hvor disse færdigheder skal demonstreres skriftligt. Et vigtigt formål med kurset er at opøve færdigheder inden for tekstanalyse og kritisk refleksion i en fagspecifik kontekst – de såkaldte ILOs (Intended Learning Outcomes). Spørgsmålet er, om essay er egnet til at evaluere disse ILOs, og om der er brug for andre evalueringsformer til erstatning eller supplement.

De foreløbige erfaringer viser, at langt fra alle studerende er i stand til at skrive opgaver, hvor disse ILOs demonstreres. Dette er ikke tilfredsstillende og kan tyde på at kurset ikke i tilstrækkelig grad sikrer, at de studerende kan opøve de ønskede ILOs.

Fra vores dialoger med de studerende i kursusperioden ved vi, at essayformen ikke er uproblematisk; i bedste fald finder de studerende den udfordrende, i værste forvirrende. Desuden har min kollega interviewet nogle af vores studerende (i forbindelse med sit adjunktpædagogikum) og nærmere undersøgt deres oplevelse af kurset. Dette har yderligere underbygget de kritiske røster angående eksamensformen, hvorfor der er behov for at granske dette nærmere.

Problemformulering

Ved hjælp af et eksempel (310077 "Bysociologi – menneske, sted og by") vil dette projekt analysere de didaktiske og bedømmelsesmæssige udfordringer, der er forbundet med at basere et kursus' summative evaluering på et skriftligt produkt indenfor den frie genre, essays.

Opgaven har til formål at analysere og vurdere om kurset er konstruktivt aligned, det vil sige, hvorvidt der er sammenhæng mellem kursets læringsmål, undervisningsaktiviteter og bedømmelse. Dette sker med henblik på at restrukturere kurset så særligt sammenhængen mellem læringsmål og evalueringsform forbedres.

Metode

Projektet er udarbejdet ved en analyse af kursets nuværende læringsmål samt egne erfaringer og observation med undervisning og eksamination på kurset, som er drøftet nærmere med sparringspartnere (kollegaer, censorer, med flere). Analysen fokuserer på relationen mellem kursets kompetencemål, og den måde de studerende modtager essaygenren, samt hvordan den bliver evalueret.

Først vil jeg se på kursets målbeskrivelse og identificere punkter til forbedring. Dernæst analyseres erfaringer med de studerendes essay-skrivning og eksaminationen af disse, for derigennem at indkredse hvorfor og i hvilket omfang essaygenren volder problemer. I sidste del af opgaven præsenteres forslag til forbedring af såvel målbeskrivelse som evalueringsformer, summative såvel som formative.

Analyse af nuværende målbeskrivelse og eksamensform

Målbeskrivelse – Hvad skal de studerende lære på kurset?

Grundlæggende set opereres der med læringsmål – ILOs – på to niveauer. Dels er der et specifikt og detaljeorienteret, hvor man fokuserer på læringsmål i tilknytning til de specifikke undervisningsaktiviteter, for eksempel i forhold til de enkelte kursusgange. Dels er der en overordnet tilgang, hvor man ser på kursets læringsmål i forhold til det samlede kursusforløb. De to niveauer er dialektiske, det er derfor vigtigt at overveje læringsmål på begge niveauer. Denne opgave fokuserer på kursets overordnede læringsmål: viden, færdigheder og kompetencer, hvor viden omhandler kursusindhold og -stofområder, færdigheder drejer sig om dekontekstuelle teknikker, metoder og fremgangsmåder, og kompetencer betegner den individuelle og kontekstafhængige anvendelse af færdigheder og viden.

Disse sondringer kan ikke genfindes i den nuværende målbeskrivelse, hvor for eksempel viden og kompetencer blandes sammen og overlapper (se Appendix A).

Udover at lave den rette sondering mellem forskellige typer læringsmål skal kompetence-niveauet også være præcist defineret (Herskin 2001). Her kan man grundlæggende sondre mellem to forståelsesformer – situationel og dyb (det Biggs kalder for "functional" vs. "declarative" knowlegde). Den situationelle forståelse omfatter faktaviden og evnen til at redegøre

for stoffet med egne ord. Dyb forståelse er karakteriseret ved evnen til at anvende viden på nye situationer, selvstændig analyse og vurdering af disse. Herskinds forståelsesformer er baseret på Blooms videnstaksonomi, der består af seks niveauer: faktaviden, forståelse, overførsel, analyse, syntese og vurdering (Bloom, 1956, som summeret i Herskin (2001)). (Fakta)viden repræsenterer evnen til at replicere stoffet, forståelse afspejles i, at den studerende med egne ord kan redegøre for stoffet, men ikke kan anvende det i nye sammenhænge. Ved overføring kan den studerende relatere stoffet i forskellige kontekster. Analyse, syntese og vurdering er de højeste niveauer i Blooms taksonomi og beskriver gradvist stigende niveauer i analytisk forståelse gående fra at bestemme, at konklusion og til at evaluere (Dolin 2007).

Et af kursets læringsmål er at lære de studerende at forholde sig kritisk og nuanceret til problemstillinger indenfor fagområdet. Så spørgsmålet er, hvordan, man som underviser, bedst opnår målsætningen med at uddanne kritisk reflekterede studerende – hvordan tilrettelægger man understøttende undervisningsaktiviteter og finder en eksamensform som også måler de studerendes kritiske refleksioner.

Angående målenes operationaliserbarhed i forhold til planlægning af undervisning er de ikke særligt præcise, hvad angår viden. Det er formuleret i brede vendinger, og spørgsmålet er, om de bør gøres mere præcise. I kursusbeskrivelsens prosatekst (kursusindhold) beskrives de forskellige centrale temaer, kurset er opbygget af, og disse formuleringer justeres fortsat i takt med, at kurset er ved at finde sin form.

Hvad angår målene for færdigheder og kompetencer repræsenterer de relativt præcist de måder, vi ønsker, de studerende omsætter viden-delen til, det vil sige, hvad de studerende skal øve sig og bedømmes på. Alle mål er forsøgt defineret på et højt SOLO-taksonomi-niveau (se Biggs & Tang (2007)) uden det dog fremgår stringent. Målene er relativt operationelle, i forhold til hvad de studerende skal øve sig på i kurset, og de signalerer relativt klart, hvad de vil blive bedømt på til eksamen, men rummer samtidig plads for forbedringer.

Eksamensform – måler essayet de studerendes læringsudbytte?

Hvad skal de studerende ifølge målbeskrivelsen i kursusbeskrivelsen kunne efter kurset? Signalerer de klart, hvad de skal bedømmes på til eksamen? I hvilken udstrækning bliver målene bedømt i eksamen?

Eksamen på Bysociologi bygger på bedømmelse af en skriftlig opgave – et essay. Ifølge kursusbeskrivelsen er essay, det produkt: "hvor den studerende bruger sin opøvede viden og færdigheder til argumenteret at identificere og sammensætte de relevante teorier og begreber til at belyse et bysociologisk emne, som den studerende selv formulerer i samarbejde med underviseren."

Det følgende vil være refleksioner over og erfaringer med bedømmelsesformatets konsekvenser for:

- de studerendes læring
- censor og eksaminators evaluering – reliabilitet
- opfyldelse af kursets kompetence mål – validitet

Essayformatets konsekvenser for de studerende

Støtter det valgte bedømmelsesformat (essayet) de studerendes læring?

Formen for essayet er stillet ret åbent (se Appendix B). I Version 1 fremhævede vi over for de studerende, at formen var fri, men forsømte måske samtidig at understrege, at det er påkrævet, at de bruger de udpegede tekster analytisk og grundigt. Der var eksempler på fine analytiske essays, hvis struktur var langt løsere end en normal universitetsopgave. Der var eksempler på essays med kvaliteter i form af fin personlig prosastil, der glider godt, men som samtidig har en tendens til at skøjte hen over teksterne uden at gå tilstrækkelig kritisk i kødet på dem. En erfaring var, at en personlig stil kan resultere i for meget personligt navlepilleri. I nogle tilfælde lå der implicit tekstinspiration bag, men det kunne være svært at afgøre, når det ikke var ekspliciteret. I Version 2 fremhævede vi derfor, at det er vigtigt, at teksten er gennemarbejdet og sproget skarpt, og at personlig stil IKKE er ensbetydende med navlepilleri og "frit fra leveren". Dette har dog ikke rettet op på nogen grundlæggende problemer, som vi senere skal se.

De studerende tager imod essaygenren på forskellig vis. Nogle synes det er rart med frie rammer, og andre udtrykker usikkerhed og forvirring.

I Version 1 var kun tre af kursets i alt 29 eksaminerede studerende eksterne. De studerende var en homogen gruppe med overvejende samme faglige baggrund: landskabsarkitekt- eller bydesign-studerende på 3.-5. årgang. Fælles for dem var, at essaygenren var et uprøvet eksaminationsformat på deres universitetsstudie.

I Version 2 var de studerende en noget mere heterogen gruppe. Ti ud af kursets 20 studerende kom fra andre fakulteter og universiteter og med

mange forskellige faglige baggrunde (geografi, arkitektur, pædagogik, sociologi). Adspurgt ved kursusstart angav alle eksterne studerende at være fortrolige med essay-formatet, hvorimod det for alle interne studerende var en uprøvet genre.

Generelt udgør de eksterne studerende en ekstra engageret gruppe, som aktiv har valgt kurset til af interesse, og de klarer sig godt til eksamen. I Version 2 stod de eksterne studerende for alle top-karakterer (alle tre 12-taller, seks af elleve 10-taller). De fleste studerende fra denne gruppe er vant til at læse og forholde sig til samfundsteori, og i det store hele voldte essaygenren ikke dem problemer. De mestrede essay-genren på forhånd, hvorimod de interne studerende ikke på tilsvarende vis var fortrolige med de frie rammer for essayskrivning.

Som nævnt har min kollega interviewet nogle af vores studerende om deres oplevelser med kurset, og i den sammenhæng bliver essaygenren problematiseret som for udefineret, og de studerende efterspørger en klarere defineret ramme at skrive indenfor. De fleste vælger at skrive en relativt klart struktureret opgave, men det er vores oplevelse, at der undervejs investeres en del ressourcer i at finde frem til et foretrukket format.

Denne usikkerhed er der også klare indikationer på i forbindelse med vejledningen. De studerende brugte vejledningen til at rydde den sidste rest usikkerhed angående essayformatet af vejen. Typiske spørgsmål var i stil med: "skal jeg bruge alle tekster lige meget?", "skal jeg også inddrage de aspekter i teksten som ikke er relevante for problemstillingen?". Det er dog langt fra alle de studerende, som henvender sig for vejledning. I Version 2 registrerede vi, at knap en fjerdedel af de studerende opsøgte os for vejledning.

Essayformatets konsekvenser for censor og eksaminators evaluering – reliabilitet

Giver formatet for censor og eksaminator flere fordele end ulemper?

Hvorvidt bedømmelsesformatet er adækvat for censor og eksaminators evaluering angår bedømmelsens reliabilitet, det vil sige, at bedømmerne kan blive enige og have en fælles forståelse af betydningen af vurderingskriterier.

I erkendelse af at kursusbeskrivelsens målbeskrivelse ikke er tilstrækkelig operationaliserbar har vi udarbejdet et supplerende dokument, der beskriver kursets evalueringsprincipper, som er blevet uddelt til censorerne

og dannede udgangspunkt for bedømmelsen. Til Version 1 var overskrifterne Selvstændighed, Tekstbearbejdelse, Analyse, Form, Inddragelse af øvrig pensumlitteratur. Vi reviderede denne i Version 2 med præciseringer angående Format, Struktur, Tydeliggørelse af faget bag. På grund af disse præciseringer gik bedømmelsen i Version 2 en smule lettere end i Version 1, så de ekspliciterede evalueringsprincipper styrkede bedømmelsens reliabilitet.

Grundlæggende er der behov for at forbedringer. Det springende punkt ligger et andet sted – noget der peget tilbage på formen, og her løser eksplicitering af vurderingskriterier ikke de fundamentale problemer.

Essayformatets konsekvenser for opfyldelse af kursets kompetencemål – validitet

I hvilken udstrækning bliver kompetencemålene bedømt i eksamen? Hvordan kan det valgte bedømmelsesformat (essayet) bedømmes i overensstemmelse med kompetencemålene? Kommer de ønskede kompetencer i spil i dette bedømmelsesformat?

En bedømmelse med høj validitet handler om man har de rette måleinstrumenter til at vurdere den faktiske læring. Spørgsmålet er om essayformatet tillader censorerne at vurdere kursets kompetencemål og de ekspliciterede vurderingsprincipper. Selvom diverse evalueringsprincipper er eksplicitte kender censor ikke kursuspensum i sin bredde og helhed, hvilket kan blive afgørende i en vurdering, når de forskellige bedømmelsesprincipper skal vægtes mod hinanden.

En garvet censor ud i skriftlige opgaver har på rygraden, at man skal se på strukturen og sammenhængen i en opgave: er der et klart formål, en relevant diskussion og er opgaven afrundet; diskuteres der ordentligt og selvstændigt, hviler diskussionen på påstande, er de underbyggede og læses teksterne kritisk og er brugen af dem konsistent. Som sådan overtrumfer solid erfaring et krav om grundigt tekstkendskab. Men dette kræver et opgaveformat, hvor det er tydeligt at vurdere, om påstande er underbyggede, og tekster bruges konsistent. Denne eksplicitering forsvinder let i essaygenrens løsere struktur.

Et af de vigtige punkter handler om, hvordan man evaluerer de kritiske og analytiske aspekter i et essay. Kardinalpunkter til diskussion med censorer var de utydelige analyser. I de relativt få tilfælde, hvor der er opstået uenighed i bedømmelsen, har omhandlet essays skrevet i en løs struktur.

Uenighederne opstår, fordi de kritiske og analytiske elementer har en tendens til at blive meget implicitte og utydelige i en løs ramme. Vi, som eksaminatorer, kan styrke vores evaluering på grundigere tekstkendskab samt kendskab til den studerendes analytiske præstationer i løbet af kurset; en mulighed censorerne ikke er forundt.

Essaygenren kan føre til, at den studerende især bedømmes som skribent frem for analytiker. Hvorvidt man kan være en god essayist og en dårlig analytiker er et åbent spørgsmål. Pointen i denne sammenhæng er dog, at hvis reliabiliteten lider under formatet, så er det svært at opretholde argumenter for netop dette format.

Det åbne format fører til nogle ret så forskelligartede essays, som kan være svære at bedømme ensartet.

Det vil uden tvivl være nemmest at bedømme essays' kritiske tekstanalyser, hvis de er skrevet ud fra en veldefineret struktur.

Et andet vigtigt punkt handler om, hvorvidt essayene reflekterer faget bag. De studerende vælger et eller flere af kursets temaer til at tage udgangspunkt for sin formulering af essayopgave. De kan således i princippet nøjes med at opøve færdigheder inden for en delmængde af kursusstoffet og alligevel få en god bedømmelse. Man behøver med andre ord ikke at demonstrere overblik over kursets spændvidde, endsige følge hele kurset, hvilket er et problem for den konstruktive alignment. Desuden er en af de høstede erfaringer, at det i nogle essays er svært at se, at essayet var skrevet på netop vores kursus – og dette problem angår indholdet frem for genren. Med andre ord var den kursusmæssige kontekst ikke synlig. Problemet har vi (i Version 2) forsøgt at afbøde ved at pointere over for de studerende, at vi lægger vægt på, at de inddrager andre tekster fra pensum, hvor det er relevant, og på denne vis demonstrerer et større overblik over kursets temaer. Kursustemaerne er alle tæt relaterede, så det er en relevant øvelse at gøre i alle typer essayopgaver. Desuden er pensum til Version 2 forbedret, blandt andet med dette formål for øje.

Forslag til forbedringer af målbeskrivelse eksamensform

Målbeskrivelse – justeringer af hvad skal de studerende lære på kurset

Kursusbeskrivelsen skal redigeres, således at læringsmålene bliver defineret systematisk i forhold til Blooms taksonomi (Dolin 2007), hvilket ikke

var sket konsekvent i den nuværende målbeskrivelse (Appendix A). Derfor er adfærdsverberne blevet gennemgået, så de anvendes konsistent og mere præcist afspejler det ønskede læringsniveau. Desuden er sproget blevet skærpet, hvilket har ført til mere præcise og korte sætninger. I figur 14.1 er læringsmålene blevet reformuleret i forhold til de ønskede læringsniveauer analyse, syntese og vurdering, som alle er i den kvalitative fase (Biggs & Tang 2007).

Endvidere har det været nødvendigt at sondre mellem, hvad de enkelte læringsmål beskriver, da den nuværende målbeskrivelse (se Appendix 1), blandt andet sammenblander viden og kompetencer og ikke klart nok udkrystalliserer færdigheder. Desuden er det blevet tilføjet, at man også skal øve sig på at udtrykke sig analytisk og kritisk på skrift.

Hvad angår præcisering af viden, er det forsøgt at indkredse nærmere, hvilke bysociologiske genstandsfelter (jævnfør Appendix A), der er i fokus for kurset. Her er forslaget blevet "samspillet mellem menneskers brug af offentlige byrum og sociale processer". Men dette kan givetvis præciseres mere i takt med, at kurset finder sin form.

Disse justeringer vil præcisere på hvilket læringstaksonomisk niveauer, de studerende forventes at være og gøre det tydeligere, hvad de studerende vil lære på kurset, hvilket kan bidrage til at forbedre såvel det skriftlige produkt som bedømmelsesprocessen.

Eksamensform – justeringer til måling af de studerendes læringsudbytte

De fleste af de ønskede kompetencer står allerede i kursusmålene. Selvom der er plads til mange forbedringer i forbindelse med at præcisere kursusbeskrivelser, vil dette ikke kunne sikre, at de studerende også lærer at udtrykke sig kritisk og analytiske i skrift. Her bliver man nødt til at vende blikket mod undervisningsaktiviteterne (TLAs – Teaching and Learning Activities) og vurdere, om de i tilstrækkelig grad træner de studerendes kompetencer godt nok, for som bekendt drives læring af, hvad man gør.

Der er gode grunde til, at vi har valgt at basere eksaminationen på et skriftligt produkt. Kurset skal stimulere netop de skriftlige færdigheder. Kurset ligger, lige før de tredjeårs-studerende skal i gang med deres første store skriveopgave, bacheloropgaven. Tilsvarende står de kandidatstuderende overfor at skulle i gang med specialet. Kursets nuværende TLAs opøver kompetencer i primært mundtligt at formulere sig selvstændigt, diskuterende og analytisk, men de bør tilrettelægges efter TLA, så de også giver de

Viden:

- bestemme samspillet mellem menneskets brug af offentlige byrum og de sociale processer, der er med til at skabe byer og steder.

- kategorisere og sammenligne nøglebegreber der beskriver, hvordan sociale processer påvirker og er påvirket af byen og stedet

- differentiere grundlæggende teori-traditioner og vurdere deres bidrag til analysen af menneskers liv i byen, samt deres anvendelighed i analyse og planlægning af byliv og offentlige byrum.

Færdigheder:

- analysere, differentiere og vurdere – i skrift og tale - sammenhænge mellem udvalgte teorier relevante.

- anvende og differentiere mellem nøglebegreber i forhold til fagspecifikke problemstillinger.

- relatere teoretisk forståelse til væsenstræk i konkrete eksempler.

Kompetencer:

- selvstændigt identificere og bearbejde bysociologiske emner samt udvælge relevante teorier og begreber til deres belysning.

- kritisere, vurdere og bedømme forskellige teori-traditioner og vurdere deres anvendelighed i planlægning og analyse af konkrete offentlige byrum.

- diskutere og analysere samspillet mellem menneskets brug af offentlige byrum og de sociale processer, der er med til at skabe byer og steder.

Figur 14.1. Forslag til forbedringer af kursets målbeskrivelse – viden, færdigheder, kompetencer.

studerende muligheder for at optræne disse analytiske færdigheder skriftligt, fremfor blot mundtligt som for nuværende. Kurset vil blive mere "aligned", hvis der er bedre sammenhæng mellem, hvad de skal øve sig på, og hvordan de bliver bedømt.

Tekstdiskussionerne er et velfungerede og vigtigt element for underviserne til løbende at vurdere, hvordan færdighederne i kritisk refleksion udvikler sig. Vi vil i Version 3 introducere små skriftlige temaopgaver (kaldet refleksionspapirer) undervejs i kursusforløbet, som skal supplere de nuværende tekstdiskussioner og -fremlæggelser, der foregår først i små grupper og senere i plenum. I forbindelse med at vi præsenterer de tekster, som de studerende gruppevis skal diskutere, giver vi dem en række spørgsmål, de hidtil har skullet besvare mundtligt med afsæt i deres gruppediskussio-

ner. Disse spørgsmål kan danne afsæt for små skriftlige opgaver, der skal besvares individuelt og afleveres (oploades til Absalon) forud for diskussioner i gruppe eller plenum. På denne vis kan den studerende øve sig på for eksempel at syntetisere en læst tekst (max $\frac{1}{2}$ - 1 side) og redegøre skriftligt for, hvordan dagens kursustema (som går igen i de læste tekster) relaterer sig til det forrige kursustema, øve sig i at lave en problemformulering m.m. Disse øvelser vil dels styrke den studerendes skriftlige færdigheder og eventuelt kan noget af det allerede skrevne indgå i den endelige eksamensopgave. Dels vil små opgaver i at reflektere over kursets temaers indbyrdes forbindelser være en måde at rette op på det identificerede validitetsproblem angående de afleverede essays' manglede tydeliggørelse af kursuskonteksten.

Refleksionspapirerne kan indgå som en skriftlig portfolio, der giver adgangsbillet til eksamen, for eksempel i form af et krav om, at tre af fire skal være afleveret.

Evaluering af refleksionspapirer sker først i grupper, hvor man har læst de samme tekster, som temaopgaverne tager udgangspunkt i, men hvor man har haft forskellige opgaver til besvarelse. Her træner man den mundtlige formidling af det skriftlige produkt og får den første feedback. Dernæst modtager den studerende feedback fra blandt andet underviserne i plenum, og eventuelle fejl og mangler bliver diskuteret og skal derefter korrigeres.

Det er vurderingen, at essay-formatet volder såvel de studerende, censorer og eksaminatorer flere ulemper end fordele.

De forskellige tiltag, vi har gjort til at dæmme op for problemerne med det usikre essayformat, har kun delvist kunne løse problemerne. Som led i bestræbelserne på at tilstræbe en mere entydig forståelse af eksaminationsformatet omdøbes den skriftlige opgave, der skal eksamineres, til slet og ret en "eksamensopgave", der i udgangspunktet er strammere struktureret. De fleste studerende ender med at vælge at skrive en relativt klart struktureret opgave, men investerer undervejs en del ressourcer i at dechifrere formatet; ressourcer der med fordel kan kanaliseres over i at opøve de forventede kompetencer.

Konklusion

Denne opgave har identificeret to primære problemer som modarbejder, at kompetencemål og eksaminationformat på kursus 310077 "Bysociologi – menneske, sted og by" er på linje (aligned).

For det første modarbejder essaygenren kompetencemålene (ILOs). Den gør det besværligt at vurdere, om der ligger et ordentligt analytisk og kritisk håndværk bag det skriftlige produkt og gør vurderingen for lemfældig, hvor det er eksaminators generelle vurdering af den studerendes formåen, der bliver det afgørende tunge på vægtskålen.

For det andet sørger de tilrettelagte undervisningsaktiviteter (TLAs) ikke i tilstrækkelig grad for at opøve de studerende i de kompetencer som de bliver eksamineret for: nemlig skriftlige analytiske kompetencer.

Identifikationen af disse to problemer mundet ud i tre forslag til forbedringer af kurset, som vurderes at skabe en bedre konstruktivt alignment i kurset som helhed – hermed ikke sagt at de foreslåede ændringer løser alle alignment-problemer. Men de er et vigtigt bidrag.

For det første revideres kursets målbeskrivelse, så de forskellige læringsmål differentieres og præciseres. Hermed kan kursusbeskrivelsen fungere som en bedre ledestjerne for dels de studerende og dels fungere mere tilfredsstillende i eksamensøjemed. Desuden suppleres kursusbeskrivelsen med de vurderingskriterier, som censorerne får udleveret, så alle forventninger til den skriftlige opgave bliver ekspliciteret.

For det andet skifter eksamensformatet navn. Essayopgaven omdøbes til eksamensopgave. Det nuværende dokument, der beskriver rammerne for essayskrivning (Appendiks B) erstattes af en ny beskrivelse, som nedtoner den frie form og betoner de centrale elementer der vurderes: kritisk og analytiske tekstanalyse.

For det tredje ændres kursets TLAs til også at indeholde opgaver i at formulere sig skriftligt i forbindelse med tekstanalyser og diskussioner. Disse skriftlige produkter – refleksionspapirer – integreres i de nuværende tekstdiskussioner i grupperne (peer-assessment) og vil være genstand for yderligere feedback – også af undervisere – i plenumdiskussionerne.

A Uddrag af eksisterende kursusbeskrivelse (målbeskrivelse) for 310077 "Bysociologi – menneske, sted og by".

Viden:

- gøre rede for bysociologiske genstandsfelter samt udvise overblik i de vigtigste grundlæggende forskningstraditioner og deres bidrag til analysen af centrale bysociologiske emner.

- identificere og udvælge de relevante teorier og begreber til at belyse et givet centralt bysociologisk emne.

- udvise overblik over centrale aspekter af, hvordan sociale processer påvirker og er påvirket af byen og stedet, samt kunne gøre rede for væsentlige teorier og begreber der knytter sig til disse.

Færdigheder:

- analysere, diskutere og vurdere sammenhænge mellem væsentlige teorier og begreber og hvilke perspektiver disse giver anledning til.

- relatere og inddrage relevant empirisk materiale og diskutere sammenhænge mellem byer, steder og sociale processer.

Kompetencer:

- sammensætte, konkludere samt kritisk vurdere og bedømme forskellige faglige forklaringer, teorier og metoder og deres anvendelighed i analyse og planlægning af det offentlige rum .

- forstå og teoretisere over det komplekse samspil der eksisterer mellem mennesket, dets brug af byen, dets parker, offentlige rum og de sociale processer, der er med til at skabe byer og steder.

B Uddrag af dokument der beskriver rammerne for essay-skrivning på 310077 "Bysociologi – menneske, sted og by".

Essay på kursus i bysociologi 2010/11

Hvad er et essay?

Essay kommer af det franske ord 'essayer', altså at forsøge eller at prøve sig frem.

Essayet er som *genre* en blandingsform mellem en *personlig*, en *konkret*, en *almen* og en *abstrakt* tilgang, hvori man skal forholde sig personligt ræsonnerende til det angivne tema og konkret til det materiale, der knytter sig til opgaven.

I essayet inviterer forfatteren læseren til en fælles undren. Et essay vil ikke først og fremmest oplyse eller overbevise, men dele tanker om en given sammenhæng. I et essay søger man sandheden. Forfatteren fremlægger argumenter for og imod et givet tema, finder eksempler og modeksempler og afprøver forskellige løsninger.

I essayet tages der udgangspunkt i en forelagt tekst, hvis centrale pointer den studerende slår ned på og bruger eksplicit sine iagttagelser og overvejelser. En vigtig forudsætning er derfor først at analysere teksten grundigt og kritisk. Essayet deler et gråzoneområde med den opgavetype, der stiller krav om redegørelse og diskussion. I essayet er den studerende, der sætter dagsordenen frem for teksten.

Hvad skal et essay på dette kursus kunne?
Den studerende skal bruge og demonstrere sin opøvede viden og færdigheder til kritisk at identificere, vurdere og sammensætte de relevante teorier og begreber, der kan belyse et bysociologisk emne med relevans for kurset. Essayet må gerne relatere sig til beslægtede kursustemaer og inddrage anden kursuslitteratur og ad den vej demonstrere et overblik over pensum og kursets spændvidde.

Hvad indgår i et essay?
Essay skrives individuelt på dansk eller engelsk. Omfang: max 10 sider á 2400 tegn.
Den studerende skriver et essay om et tema fra kurset. I essayet indgår minimum 3 tekster: 1-2 tekster fra pensum, og minimum 1 ny tekst, der udleveres ved essayskriveperiodens start. De nye tekster kan være af teoretisk karakter, debatindlæg fra fagtidsskrifter og dagblade eller omhandle empiriske eksempler m.v. Den studerende må gerne inddrage yderligere ønsket materiale såfremt det sker med klare henvisninger og kildeangivelser.

Eksamen – evaluering
Essayet vurderes og karaktergives af eksaminator og censor og karakteren offentliggøres. Det er muligt at få en begrundelse for karaktergivning efter nærmere aftale.

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Organisering af et eksperimentelt fysikkursus i blokstrukturens rammer

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Indledning

Dette projekt er baseret på et undervisningsforløb udarbejdet i samarbejde med lektor Jesper Nygård af kurset "Nano3 – Kvantefænomener i nanosystemer" på Nanoteknologiuddannelsens andet år på Københavns Universitet. Projektet ønsker at undersøge, hvordan det obligatoriske eksperimentelle fysikkursus Nano3 optimalt kan planlægges i blokstrukturens rammer, og hvordan den nye kursusstruktur har forbedret (hypotese) de studerendes indlæringen af tre vigtige kvantefænomener baseret på fire eksperimentelle forsøg.

Først vil overvejelserne i forbindelse med planlægningen af kurset præsenteres, hvor specielt ulemperne i forbindelse med den hidtidige struktur vil blive klarlagt. Dernæst fremlægges evalueringen af omstruktureringen, som bygger på:

- Sammenligning af dette og sidste års studenterevalueringer (spørgeskemaer og kommentarer).
- Eksamenskaraktersammenligning mellem dette og sidste år.
- Diskussion af underviseres forbedrede muligheder for at strukturere stoffet.

Sidst vil der med udgangspunkt i dette års kursus gives forslag til yderligere forbedringer af kurset ved at samle op på elementer af kurset, som har virket godt eller dårligt.

Konklusion på denne analyse er, at de studerende er mere glade for kurset og er mere tilfredse med kursets struktur og læringsudbytte. Specielt

sammenhængen mellem de forskellige undervisnings- og læringsaktiviteter gives der positiv feedback på i forhold til tidligere år. Karaktergennemsnittet er (lidt overraskende) en lille smule lavere efter omstruktureringen (7.1 versus 7.8), hvilket dog ikke nødvendigvis behøver at afspejle læringsudbyttet. Faktorer som højere bedømmelsesniveau til eksamen eller forskelligt niveau af de studerende fra år til år kan spille ind. Ydermere har det været nemmere for underviserne, at strukturere stoffet med god sammenhæng mellem teori og de eksperimentelle øvelser. Denne struktur er derfor klart at foretrække, men den vil have sine udfordringer, hvis antallet af de studerende bliver stort (30-50 i modsætning til omkring 20 i år).

Planlægning og implementering

Kurset har indtil i år været organiseret med et teori- og et eksperimentelt forløb, som kørte uafhængigt af hinanden oprindelig på grund af for mange studerende (omkring 50) til for få forsøgsopstillinger. Det vil sige, at første forsøgsgang involverede alle fire øvelser påbegyndt af forskellige studentergrupper. Ugen efter øvelsen skulle grupperne aflevere en rapport. Denne opbygning er meget uhensigtsmæssig, idet de studerende højst sandsynlig ikke har haft teorien og de tilhørende opgaver inden forsøget og rapportskrivningen[1].

På grund af denne ikke optimale struktur og kritik fra studenterevaluering i 2010, har vi forsøgt at ændre strukturen af kurset for at lave en god sammenhæng mellem teori og eksperimenter. De kritiske studenterevalueringer lød blandt andet:

> 2010-1: "Jeg er klar over problematikken med koordination af eksperimenterne i forhold til teorien. Men jeg synes virkeligt det var et stort problem og svaghed ved kurset, at man ikke havde teorien før rapporterne skal skrives."

> 2010-2: "Jeg tror hellere jeg ville have haft presset de syv teoriforelæsninger ind de første 2 uger af kurset, hvis det så kunne lade sig gøre at nå at have øvelserne efterfølgende..!?"

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[1] Om teori før øvelse er en bedre undervisningsrækkefølge til indlæring af nye fænomener er en diskussion i sig selv, men i dette tilfælde vil jeg mene, at den mere traditionelle undervisning med præsentation af det fysiske fænomen herunder teori og herefter udførelsen af forsøget er mest hensigtsmæssigt for indlæringen givet tidsrammen i dette kursus (se også kommentar i konklusionen).

2010-3: "Jeg synes at det ville være smartere at ligge mere teori først.. især omkring de enkelte forsøg.. for så først senere at udføre dem... det var svært at forstå øvelserne ordentligt før efter at vi havde lavet dem.. og det var helt klart ikke optimalt."

Kursusuge/tema	Man (8:15-12 D411)	Tir (13:15-17 D317)	Fre (8:15-12 A110)	Øvelse
Båndstruktur #1 (31.-4.Feb)	Baggrundsstof	Baggrundsstof	Baggrundsstof	Øvelse A: Fabrikation
Kvante Hall effekt #2 (7.-11. Feb)	Teori Øvelse B	Teori Øvelse B	Teori Øvelse B	Øvelse A: Fabrikation
Øvelsesuge (B) #3 (14.-18 Feb)	Intro Øvelse B: Måleopstilling, rapporter, pre-lab note			Øvelse B: Kvante Hall Effekt
Kvanteøer #4 (21.-25. Feb)	Teori Øvelse C		Teori Øvelse C	
Friuge				
Øvelsesuge (C) #5 (7.-11 Mar)	Intro Øvelse C:			Øvelse C: Kvanteøer
Kvantepunkt kontakt #6 (14.-18. Mar)	Teori Øvelse D		Teori Øvelse D	
Øvelsesuge (D) #7 (21.-25. Mar)	Intro Øvelse D: Nano3 opsamling			Øvelse D: Kvantepunktkontakt
Læseuge #8 (28.-1. Apr)	- Læsefri -	- Læsefri -	Spørgetime 9:15 A110	
Eksamensuge #9 (4.-8.)			Tor og Fre: Mulige eksamensdage, D411	

Figur 15.1. Skema for den nye struktur af Nano3, et eksperimentelt fysikkursus.

Figur 15.1 viser kursusplanen for Nano3 (i blok 3, 2011), som prøver at implementere ovenstående pointer med i alt fire eksperimentelle øvelser (A-D) a hver fire timer. Da blokstrukturen kun strækker sig over otte uger, og der skal være en uge efter hver af øvelserne til at udarbejde i alt tre rapporter, er det ikke muligt at reservere en hel uge til hvert eksperiment. I stedet valgte vi, at udføre eksperiment A uden for timeblokkene reserveret til Nano3 (sådan en løsning kræver dog at de studerende er imødekommende – det viste sig heldigvis ikke at være et problem). Det kunne også kun lade sig gøre, da eksperiment A ikke inkluderer væsentlig teori, og at der i dette tilfælde ikke skal udarbejdes en selvstændig rapport. De sidste tre øvelser fik derimod hver reserveret en øvelsesuge, hvor de studerende i grupper af tre til fire personer kunne vælge formiddage (8-12) eller eftermiddage (13-17) til eksperimentet. Med 19 personer og fem hold fungerede valg af tidspunkter overraskende problemfrit.

Sideløbende med eksperiment A kunne vi derfor starte med et intenst teoriforløb med generel baggrundsteori for kurset i uge et. Dernæst forløb de næste seks uger med en uges forberedende teori til det eksperiment, som alle studerende ville gennemføre den følgende øvelsesuge. For at kunne forberede de studerende optimalt på ugens eksperiment holdt vi stadig lektioner mandag formiddag i øvelsesugerne med fokus på den mere praktiske del af eksperimenterne. I de uger med rapportskrivning reducerede vi antallet af timer til to tredjedele for at de studerende havde mulighed for at arbejde grundigt med rapporterne. Den overordnede kursusplan for Nano3 kan ses i Figur 15.1, hvor de mørkegrå felter repræsenterer øvelsesuger.

Det skal også nævnes, at Nano3 i år havde 13 blokke med forelæsninger og regnetimer af hver to timer (se figur 15.1). Dette skal sammenlignes med 2010, hvor der kun var otte tilsvarende blokke [2].

Effekt af omstruktureringer

Studenterevalueringer

Den ovenfor beskrevne omstrukturering af kurset ligger tæt op af de studerendes ønsker, og hvad vi tænkte ville være hensigtsmæssigt. Det vil derfor være interessant at sammenligne dette og sidste års kursusevalueringer (2011 og 2010). Kursusevalueringer repræsenterer ikke nødvendigvis alle de studerendes holdninger, da det desværre kun er omkring halvdelen af de studerende, som evaluerer kurset. Materialet er derfor ikke helt fyldestgørende, men på basis af dem som har svaret (lidt under halvdelen 2010(2011): 8(9) ud af 19) er det stadig interessant at drage konklusioner af de 15 multiple choice spørgsmål og de studerendes individuelle kommentarer. Fordelingen af svarene på de mest relevante spørgsmål i evalueringen vil blive analyseret nedenfor.

Figur 15.2 viser histogrammer med svarene på spørgsmålet stillet ovenfor diagrammet. Venstre og højre side af en figur viser antallet af studerende for henholdsvis 2010 og 2011, som er "Helt enig" til "Helt Uenig" i spørgsmålets udsagn. En klar forskel på 2010 og 2011 kan blandt andet ses i figur 15.2a, hvor der er sket et væsentligt skift af de studerende hen mod "Helt enige" i at der er "en god sammenhæng mellem de forskellige elementer forelæsninger, regneøvelser, laboratorieøvelser med videre, der

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[2] http://isis.ku.dk/kurser/index.aspx?kursusid=27981&xslt=simple6& param1=233313&param8=false
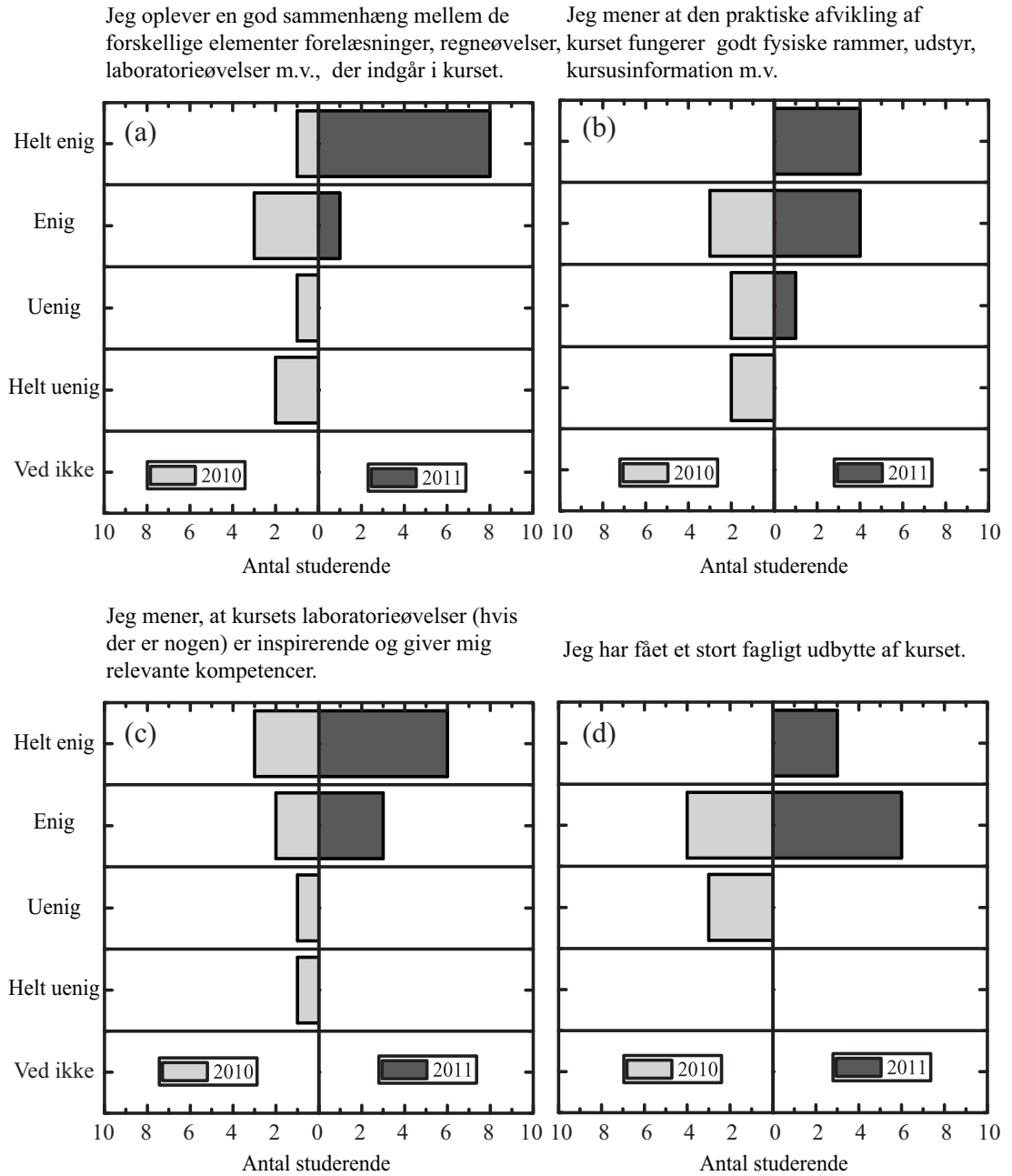
Figur 15.2. Histogrammer af svar på studenterevalueringer i 2010 og 2011.

indgår i kurset". Dette i denne sammenhæng meget relevante histogram bekræfter, at strukturen i kurset er blevet meget bedre (i de studerendes mening) ved ovenstående ændring. De andre tre spørgsmål er kun delvist relateret til omstruktureringen. For eksempel mener en overvejende del af de studerende i 2011, at den praktiske del af kurset fungerer godt, hvilket måske kan skyldes den mere strukturerede kursusplan end det tidligere år (det skal dog nævnes, at der var problemer med at få nogle øvelser til at virke i 2010, hvilket også kunne spille ind i svarene). Det kan også ses af Figurerne 15.2c og 15.2d, at de studerende har fundet laboratorieøvelser inspirerende og gode, og at kurset som helhed efterlader et positivt indtryk med et stort læringsudbytte – igen med en positiv udvikling i forbindelse med den nye kursusstruktur. Af besvarelserne for andre dele af kursuseva-lueringerne kan det for eksempel også ses, at de studerende som deltager i undersøgelsen generelt har været til forelæsningerne og i nogen grad til opgavetimerne.

En anden kilde til de studerendes mening om kursusstrukturen kan fås fra deres individuelle kommentarer. I 2010 var der en del kommentarer om den uhensigtsmæssige struktur af kurset som beskrevet ovenfor. Det kan som sagt delvist skyldes, at der var problemer med at få de eksperimentelle øvelser til at fungere. Denne del havde vi lagt stor vægt på i 2011, og vi havde heldigvis ingen problemer.

Det er tydeligt fra de studerendes kommentarer i 2011, at de synes, at kursusstrukturen fungerer godt. Der er ingen negative kommentarer, men derimod flere positive:

> S2011-1: "Det hænger godt sammen med at man får teori, øvel-se og rapport i en kontinuer sammenhæng. Så når man det hele igennem mens det stadig er friskt i erindringen."

> S2011-2: "Det er helt klart det bedste kursus jeg har haft på min uddannelse og så selvom at det kan være svært. :D godt med sam-menhængen gennem kurset. Undervisningen og specielt laborato-rieøvelserne har været rigtig gode. ..."

> S2011-3: "Jeg synes egentlig at kurset har været rigtig sjovt, un-derholdende og utroligt lærerigt. Det har været en rigtig god måde at blive introduceret til den mere eksperimentelle fysik og jeg har egentlig ikke de store kritikpunkter."

Disse kommentarer understøtter ovenstående histogrammer i, at kursus-strukturen er væsentligt forbedret, og man kan tænke, at det højst sandsyn-

lig smitter af på hele deres indtryk af kurset. Den øgede mængde forelæs-
ninger kan også have givet bedre forståelse af stoffet, som igen sikkert vil
komme positivt til udtryk fra de studerende. Ydermere passer ovenstående
evalueringer også meget godt med de kommentarer, vi har fået gennem kur-
susforløbet – specielt synes de studerende, at de eksperimentelle øvelser,
som virkeliggør tidligere kursers teoretiske læren, er virkelig interessante.
En skriver for eksempel:

> S2011-4: "Jeg synes at dette kursus er fantastisk i at give et indblik
> i kvantesystemer og giver en virkelig god forståelse af kvant, der
> ellers kan være meget højt flyvende at forstå.."

Dette var dog også en af de positive evalueringskommentarer i 2010, og
virker som en af kurset helt store styrker – den eksperimentelle del.

Karakterfordeling

En anden form for evaluering af kurset kan fås ved at sammenligne eksa-
menskarakter for 2010 og 2011. Umiddelbart ville det være nærliggende, at
de studerendes læringsbytte ville være højere, når kurset har fået en bedre
struktur og flere forelæsninger. Lidt forsimplet kunne man håbe, at de lidt
svagere elever (Robert-type ifølge Biggs (Biggs & Tang 2007)) ville blive
bedre, mens de dygtige elever (Susan-type (Biggs & Tang 2007)) ville kla-
re sig godt under begge strukturer. I så fald ville man forvente færre lave
karakterer som 2 og 4 i 2011. Det er også interessant at se, at de studeren-
de synes, at deres udbytte af kurset er blevet større under den nye struktur
ifølge figur 15.2d.
   Figur 15.3 viser eksamenskaraktererne fordelt på 12-skalaen for 19 stu-
derende i både 2010 (venstre) og 2011 (højre), hvor ub står for udeblevet.
Det kan her ses, at karaktererne faktisk ikke er bedre i 2011, og at der er
flere karakterer i den lavere ende af skalaen under den nye kursusstruktur.
Gennemsnittet er 7.8 versus 7.1 i henholdsvis 2010 og 2011. Den ene per-
son, som ikke bestod i 2011 trækker dog en del ned på 2011-gennemsnittet,
og det er derfor måske mere retvisende at sige, at karaktererne i 2011 er
nogenlunde på niveau med 2010.
   Den manglende forbedring af de studerendes kunnen bedømt via sum-
mativ evaluering i 2011 kan skyldes flere faktorer. De studerendes faglige
niveau kan variere fra år til år, og selvom vi var de samme tre personer (ek-
saminatorer og censor), som gav karakter for begge år, kan vores absolutte
bedømmelsesniveau godt have forrykket sig lidt.

Karakterfordeling
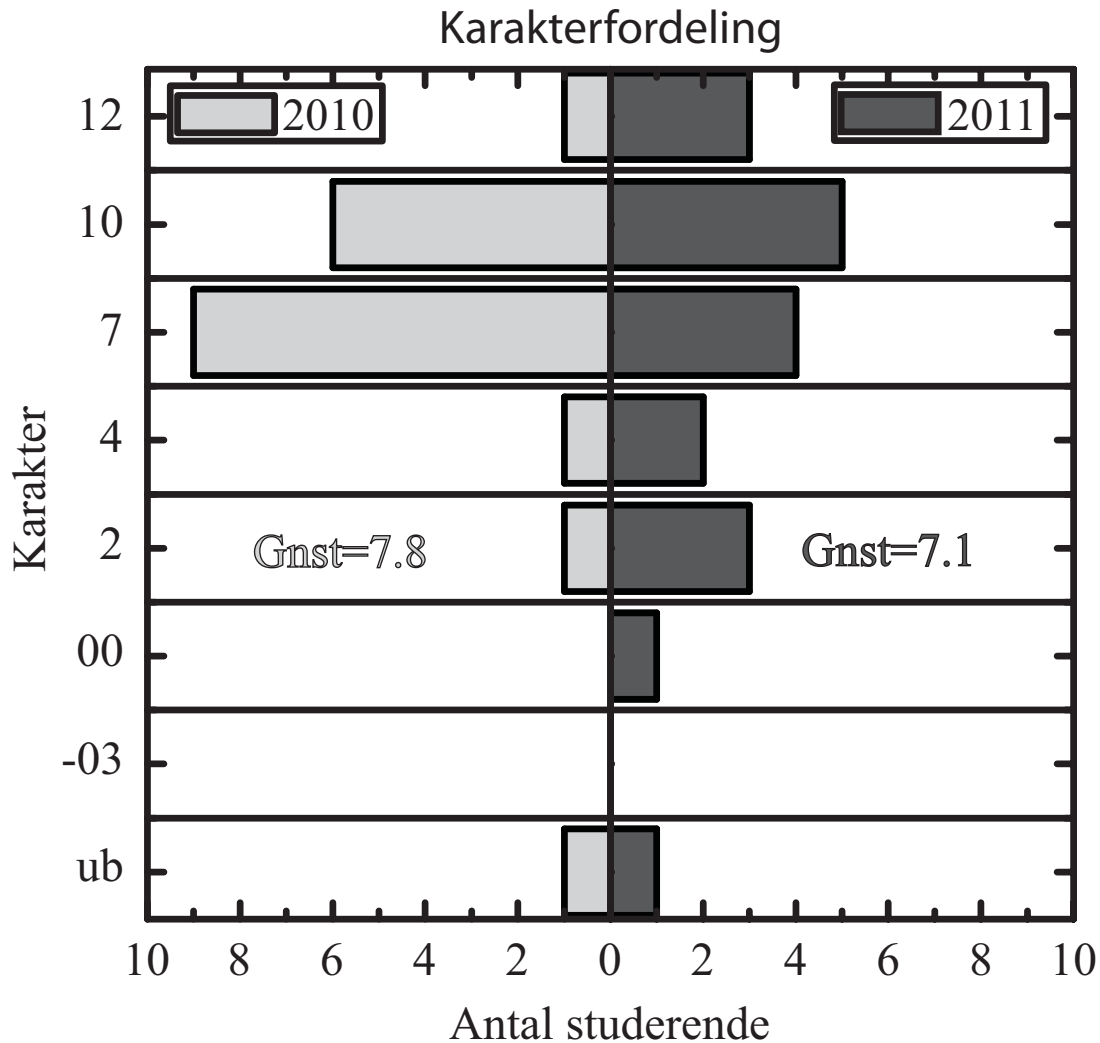
Figur 15.3. Karakterer givet til eksamen for 19 studerende både i 2010 og 2011.

I den forbindelse er det også relevant at lave en kvalitativ bedømmelse af de studerendes niveau og aktivitet. Til forelæsningerne i 2011 var der typisk over 85% af de studerende tilstede, og der var en livlig dialog med de studerende i undervisningen. Regnetimerne havde kun en tredjedel af de studerende som deltagere, og koncentration var enkelte gange ikke så høj. Alle studerende deltog i eksperimenterne. Jeg har ikke mulighed for at sammenligne med undervisningen i 2010, da det er første gang, jeg underviser i kurset, men generelt blev jeg overrasket over de studerendes engagement og deltagelse i undervisningen. Det passer godt med erfaringen fra

vores forprojekt [3], hvor vi lavede et fokusgruppeinterview med otte Nano3-studerende fra 2011. Her var vi også imponerende over deres engagement – både under interviewet og deres kommentarer om deres tilgang til det at studere. Det er derfor min kvalitative opfattelse, at den nye kursusstruktur med aktive studerende må være en fordel og have forøget de studerendes læring, selvom det ikke afspejles i karaktererne.

Undervisningsmuligheder med den nye kursusstruktur

Som underviser er den nye struktur også mere fordelagtigt, da man kan koncentrere hele sin indsats om den kommende øvelse/emne, som er relevant for alle studerende. Det giver også mulighed for at inddrage de studerende i forelæsninger og regnetimer på en anden måde end hvis mere en halvdelen har fokus på andre øvelser. Det er derfor også i denne henseende værd, at beholde ovenstående struktur i fremtiden.

Forbedringer af Nano3

Inspiration til forbedringer af Nano3 kurset kan også tage udgangspunkt i de studerendes kommentarer. Deres evalueringer viser, at den største utilfredshed var omkring vores regnetimer. Dette illustreres af et spørgsmål (ikke vist grafisk), hvor tre ud af ni er uenige i, at regnetimerne er inspirerende. Denne tendens underbygges af deres individuelle kommentarer, som tydeligt viser, at der skal arbejdes på en forbedring:

> S2011-5: "Regnetimerne har været rodede. Det er tildels pga eleverne i klassen, da ganske ganske få har haft set på opgaverne hjemmefra."

> S2011-6: "Regnetimerne gik lidt langsomt. Det ville være bedre med mindre tid per opgave eller flere opgaver til samme tid."

> S2011-7: "Regnetimerne var ikke altid lige vellykkede, både fordi halvdelen af klassen ikke kunne være til stede og fordi halvdelen

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[3] S. B. Metzdorff, L. R. Nielsen, and K. Grove-Rasmussen, *Fokusgruppe interview med nano-science studerende om deres forventninger og motivation til undervisning generelt og til et fremtidigt eksperimentelt fysik kursus Nano3*, forprojekt, adjunktpædagogikum (2010/2011)

af den anden halvdel valgte ikke at være der. Det sidst nævnte kan skyldes det tidlige tidspunkt, eller den manglende struktur og progression i timerne."

Der har dog været positive kommentarer i løbet af kurset om at selve opgaverne passede rigtig godt ind i forløbet, mens enkelte dog skulle formuleres klarere.

De studerende har den samme opfattelse, som vi undervisere. Regnetimerne kunne være forløbet mere struktureret, og de led under at kun en tredjedel mødte op (en tredjedel var dog forhindret på grund af skemaoverlap). Regneøvelserne var heller ikke en direkte del af evalueringen til eksamen, så en eventuel forbedring kunne være at lave denne undervisnings- og læringsaktivitet en del af det, som testes til eksamen. For eksempel kunne der laves 2-3 vigtige opgaver, som hver udgør et eksamensspørgsmål. Hermed ville alle dele af kurset (forelæsninger, regneøvelser, eksperimenter) indgå som en naturlig del af den viden som vægtes til eksamen. Hermed ville kurset blive endnu mere konstruktivt samordnet (Biggs & Tang 2007), *i.e.*, hvor der er en god sammenhæng mellem læringsmål, lærings- og undervisningsaktiviteter og det, som evalueres ved eksamen. En andet oplagt tiltag ville være at blande forlæsning og øvelser mere sammen (på grund af skemaoverlap for en del studerende undlod vi denne mulighed i dette års kursus).

Selve kursusmaterialet har også voldt de fleste studerende problemer, men det er svært at finde bedre kursusmateriale, som lige passer til Nano3-studerendes niveau.

De studerende mener, at forelæsningerne generelt var gode, men at der nogle gange kunne mangle retning. Det er derfor vigtigt, at gøre klart, hvor forelæsningen er på vej hen. Der blev også efterlyst en afsluttende forelæsning, hvor der samles op på alle eksperimenter samt at eksperimenter og kurset kædes sammen ("en slags kursus institutionalisering"). Selvom dette blev gjort i løbet af kurset og til sidst ved blandt andet at gennemgå læringsmålene for kurset, er det en rigtig god ide at gøre endnu mere ud af til næste år.

Det var også klart, at andetårs-studerende ikke helt præcist ved, at det også kræver teknik at gå til mundtlig eksamen. Det er vigtigt at få fremlagt emnet klart og præcist, og specielt at det hjælper rigtig meget at træne fremlæggelsen inden eksamen på tavlen. Vi skal gøre endnu mere ud af at viderebringe dette, samt hvad vi forventer til eksamen.

Evalueringerne viser også, at det er vigtig at have gode laboratorie-instruktorer (øvelserne blev styret af to ph.d.-studerende) og koordinere fremlæggelse af stoffet med instruktorerne, så der bliver en god sammenhæng mellem det, som bliver sagt til forelæsninger og øvelser. Vi prøvede at indføre en pre-lab note (en side, hvor de studerende skulle skrive øvelsens formål, hvad de gerne ville måle, etc.), som ville tvinge og inspirere de studerende til at forberede sig til øvelserne. Det var lidt svingende, hvor meget de studerende gjorde ud af det, men jeg tror, det har gjort en forskel for forberedelsen.

De eksperimentelle øvelser har dette år fungeret godt med gode prøver, som klart viser de kvanteeffekter, som er under behandling. Nogle år (for eksempel 2010) har eksperimentelle problemer eller mindre gode prøver vanskeliggjort dette aspekt, hvilket højst sandsynligt også påvirker, hvor meget de studerende får ud af og synes om kurset. En vigtig del af forberedelsen af kurset er derfor, at sikre at dette aspekt virker.

Perspektivering og konklusion

Den største målbare effekt af omlæggelse af kursusstrukturen (og forøgelse af antallet af timer) er at en større del af de studerende synes, at det er et godt (sammenhængende) og interessant kursus. Det kan også ses, at de studerende synes, at de har lært meget i kurset. Vi (underviserne) mener også, at deres læringsudbytte er blevet større med den nye struktur, og at undervisningen er mere struktureret, selvom førstnævnte ikke direkte afspejles i eksamenskaraktererne. Planlægningen af undervisningen er nemmere og eksperimentelle detaljer kan gives i plenum før hvert forsøg, da det er relevant for alle studerende. Antallet af undervisningstimer (forelæsninger og regnetimer), som er forøget med 63% i forhold til 2010, burde også bidrage væsentligt til en bedre forståelse af stoffet og dermed også til et bedre læringsudbytte og større tilfredshed med kurset.

Det kan diskuteres, om det nogle gange er bedre selv at opdage fysiske fænomener og derefter prøve at forklare dem i stedet for at få dem serveret (førstnævnte var konsekvensen af den tidligere struktur). I dette tilfælde med 3 kendte fysiske fænomener og den forholdsvis kompakte tidsplan, vil jeg vurdere, at det forbedrer læringsudbyttet at forudsige og forstå fænomenerne først for derefter at de studerende selv kan lave eksperimenterne.

Det har været en fornøjelse at forbedre dette kursus, og føle at det er tiden værd, da det blev vel modtaget fra de studerende. Derfor er det oplagt,

at holde denne struktur i de følgende år også selvom der kommer flere studerende. Eventuelle udfordringer med stort studenterantal kunne afhjælpes med at have flere forsøgsopstillinger, så flere hold kan lave samme øvelse i øvelsesugerne.

Improved Teaching by Changing Approach and Practice

Andrej Christian Lindholst

Forest and Landscape, University of Copenhagen

Compared to previous year's teaching performance, I attempted to improve this year's teaching performance by deliberative employment of a new set of teaching tools and changes as a part of a project in the adjunktpæda-gogikum course given at University of Copenhagen 2011. The tools and changes included problem based learning, careful review and update of materials and lectures, alignment between intended learning outcomes, student activities and evaluation, and employment of a broader set of student activities ranging from engagement in class-room discussions to group based exercises and student presentations. The performance was measured by successive student- and self-evaluations. The student evaluation indicated an improvement in my ability to communicate the course content clearly and precisely and my ability to motivate student reflections on course content. The self-evaluation, based on my perception of the teaching experience, also indicated that the employed changes sustained a higher and more rewarding teaching performance. Reflections upon evaluations also indicated further potentials for improvement.

Teaching at the UFUG course

Recurrently, I teach at the 15 ECTS master course 'Urban forestry & urban greening' (UFUG) offered by Forest and Landscape, University of Copenhagen. At the core of the UFUG course, the students are assigned a case-based task where they are required to elaborate a strategic development and management plan for a public park. The course has over the years been

successful in attracting an increasingly number of students. My lectures are focused on different inter- and multidisciplinary topics regarding management, policy, quality and services, organisation and governance of urban green structures and spaces. The topics are explored through lectures, readings and exercises. I basically approach my topics as they are situated within Public Administration as this is my educational and professional field. However, the topics are not at the core of students' main curriculum as they are a mix of landscape architects, forest engineers and urban planners. This is always challenging as the students typically has little or no initial knowledge or understanding of my professional field, applied perspectives and/or practical vocational experience.

Last year's teaching experience

My experience with teaching and engagement of students at the UFUG course has formerly been mixed. Sometimes I succeed in engaging students in the topics I taught. I am not sure why and how this happened, but it was clearly a more rewarding experience for the students and me when it happened. Other times the students seemed rather uninterested and unengaged in my teaching and the presented topics. I didn't felt that the students really learned anything in these sessions. This didn't felt good for me and affected me negatively at a professional and personal level. It also took up a good deal of energy and worries before entering the teaching situation.

Student evaluations of last year's UFUG course (2010) (Fig. 16.1) showed that not all students were equally satisfied with my teaching (Fig. 16.1, Q2) and my ability to engage them in 'deep learning' indicated by the level of student reflections (Fig. 16.1, Q3). However, the students still found that the topics I taught had importance and relevance (Fig. 16.1, Q1). Moreover, in comparison, the student evaluation of my teaching was the poorest among all teachers that taught regularly at the UFUG course in 2010[1].

Under and after the course I sometimes thought that not all of the students were truly motivated and/or able for learning at the high level required at the University. Other times I started to think that my teaching not really fitted the mix of student we got at the course or that my teaching skills and style simply wasn't that good. However, the poor evaluation also became a puzzle for me. I have made good presentations before and in another main

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[1] Student evaluation of other teachers are not shown

Question 1: I find that the material used by the teacher fits with the content of the course.			
Question 2: I find that the teacher was good to communicate the course content clearly and precisely.			
Question 3: I find that the teacher motivated me to reflect upon course content.			
Evaluation (score)	**Number of replies (weight)**		
	Q1 (N=17)	**Q2 (N=17)**	**Q3 (N=16)**
Totally disagree (1)	0 (0)	1 (1)	2 (2)
Disagree (2)	0 (0)	6 (12)	4 (8)
Neutral (3)	4 (12)	6 (18)	7 (21)
Agree (4)	6 (24)	1 (4)	1 (4)
Completely agree (5)	7 (35)	3 (15)	2 (10)
Average scores	***4,2***	***2,9***	***2,8***

Source: University of Copenhagen, Absalon, UFUG course evaluation 2010

Fig. 16.1. Course evaluation by students (UFUG 2010)

course (technical park diploma – a vocational training course) my teaching is normally received very well by the students.

Challenge to be addressed

With the outset of the mediocre teaching performance, indicated by the evaluation above, I addressed the following challenge for myself as part of the adjunktpædagogikum course:

"How can I improve my teaching in a way so that the teaching are more rewarding for all and engage the students in real learning where they improve their knowledge and competencies regarding the topics I teach"?

In order to address the challenge in a systematic way, I implemented prospective 'improvements' (changes and tools), based on insights from the 2011 adjunktpædagogikum course, in the 2011 UFUG course and observed the effect of these by comparing the 2010 evaluation with a the 2011 evaluation.

Documentation

I suspected that any improvements (or failures) should ultimately be indicated by changes in the students' evaluation of the UFUG 2011 course compared to the UFUG 2010 course and in my self-evaluation of the teaching experience. Student evaluation was available through the web-based learning environment 'Absalon' at LIFE, University of Copenhagen. Students

were asked in the end of each course to evaluation the course in general and each teacher's performance. In general, there are differences from year to year in the characteristics of the students (such as educational and personal background, their number, and group dynamics). These differences may influence how different teaching approaches are perceived and evaluated. I therefore combined the comparison of student evaluation with a self-evaluation of the employed changes and my experience of the students' engagement and learning.

Methods for change

In the past (2010 and before), I mainly used a mix of case-based materials and a more traditional teaching style. This included class-based 'mass lectures' where I presented and discussed various materials based on academic articles and high-level theory and concepts. The students have also been required to read course literature in advance. Lectures have been open for shorter Q&A sessions, but I have only to a minor degree used different techniques for activating students in the class room.

At the 2010 course I sometimes engaged the students by asking a question or tried to start a discussion in the class about perspectives I assumed to be important. I didn't try systematically to set up small group exercises or similar as a part of my teaching at the course. This was partly due to the inherited structure of the overall course and partly due to routine choices on my behalf.

In order to address the challenge, I adopted used insights from problem based learning (PBL), constructive alignment (CA), including various techniques for student activities, and sociological insights on the teaching situation such as shifting from level 1 ('blame the students') and 2 teaching ('blame the teacher') toward a level 3 ('improve the situation') focus in teaching (Biggs & Tang 2007, pp.15-21). PBL takes outset in a presented problem that can only be adequately solved by the students by further deliberation and search for knowledge. PBL was used in both individual lectures and for structuring activities running over several days. I used PBL as much as possible to spur learning and engagement instead of using traditional lecturing and presentation of general theory and assumptions. CA was mainly addressing student activities, learning intentions and formative evaluations by students. Due to the structure of the UFUG course, alignment of my part of teachings with the overall learning assessment at the end of the course

(summative evaluation) was only possible to address and change in a minor degree.

First of all, insights on the teaching situation gave me a framework for understanding myself, the students and our interactions in the educational context of higher education. It was helpful to get the ability to see the teaching situation as a part of modern mass education with different levels of student's motivations and capabilities while going beyond a 'blame the student and/or blame the teacher' attitude. The challenge was now to change the situation, improve techniques and adapting the teaching for a broader range of student's motivations and capabilities. These insights gave me the basis which upon I could see myself acting and changing my teaching in a rational and deliberative way. It allowed me to think differently about myself as a teacher and the students.

In 2011, I used more time for preparing each of my lectures and exercises in the course. I asked the course planner for a re-schedule of my lectures and exercises in order to fit in better with the overall program. It was also important for me to get a good first encounter with the students. For this purpose, I re-shaped a lecture and practical exercise on mapping recreational experiences in public parks (see appendices for course materials for exercise 1). Firstly, I reduced the level and amount of information and content in order to create a clear focus instead of a more comprehensive review as part of the introduction. The theory and planning methods in the literature on the subject was therefore not covered fully in the lecture. However, this gave me the advantage to go in depth with one planning method as an introduction to the overall literature and as a case of the basic challenge of recreational planning. The prospective student would still be able to dig into the literature in later self-studies or in thesis writing (or future vocational positions). The corresponding exercise was organised as a group task and also reduced in scope in order to let the students learn and discuss the material in greater depth. The lecture and exercise on recreational experience mapping were evaluated in the process as part of the learning through student presentations, this is, 'formative assessment' (Yorke 2003). The students were 'socially motivated' by the need to perform presentations in front of the class.

The example above illustrates my attempt to improve the teaching by utilizing a range of changes and tools. More generally for the 2011 course, I employed a broader and more diverse range of student activities across lectures and exercises. Before each teaching, I used time for carefully selecting and preparing student activities such as short talks in groups, using

familiar cases as reference for class discussions, open questions to the class. For one lecture, I also used audio-visual materials (a video) in organising a short group exercise and facilitate class discussions.

This year's teaching experience

If we look at the student evaluation in figure 16.2[2] compared to figure 16.1, there is indication of improvements in terms of clearer and more precise communication of course content (Fig. 16.1, Q2) and my ability to stimulate reflection upon course content (Fig. 16.1, Q3). The figures for Q2 and Q3 for 2011 and 2010 respectively indicate a change from a slightly below average performance to an adequate performance. There was no change in the students' evaluation of the materials' relevance and fit with the overall course (Fig. 16.1, Q1). In both 2010 and 2011, the materials were found relevant. However, the distribution in replies for Q2 and especially Q3 may indicate that some aspects in my teaching can be further improved. A few students disagreed in my ability to motive reflections upon course content while the majority agreed or strongly agreed. Thus, not all students were engaged in deep learning at the same level through my teachings.

Question 1: I find that the material used by the teacher fits with the content of the course			
Question 2: I find that the teacher was good to communicate the course content clearly and precisely.			
Question 3: I find that the teacher motivated me to reflect upon course content.			
Evaluation (score)	**Number of replies (weight)**		
	Q1 (N=12)	**Q2 (N=12)**	**Q3 (N=12)**
Totally disagree (1)	0 (0)	1 (1)	0 (0)
Disagree (2)	1 (2)	0 (0)	3 (6)
Neutral (3)	2 (6)	4 (12)	2 (6)
Agree (4)	3 (12)	4 (16)	3 (12)
Completely agree (5)	6 (30)	3 (15)	4 (20)
Average scores	*4,2*	*3,7*	*3,7*

Source: University of Copenhagen, Absalon, UFUG course evaluation 2011

Fig. 16.2. Course evaluation by students (UFUG 2011)

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[2] The course evaluation in 2010 and 2011 had different response rates. While almost all students evaluated the course both generally and for each teacher in 2010 only about one third evaluated the course at the level of each teacher in 2011. The low response rate in 2011 can partly be explained by occasional IT problems with the online web based platform. The general evaluation in 2011 was very positive by those who responded.

My main 'reflexive' student activity was placed at the same time as the students should prepare presentations for the course's major group project (a thesis used in the final course exam). The exercise was highly demanding as it was based on an open problem formulation, open methods and open answers (see appendices for course materials of exercise). This is what Ellström (2001) calls 'a creative exercise'. A creative exercise requires a high degree of 'framing', this is, responsibility on behalf of the students for selection of 1) content, 2) sequence, and 3) pace of learning activities. I believe that not all students found sufficient time or had the ability to focus equally on both activities as the needed to prioritize between the two activities. It is then indicated that improved planning and alignment of the different student activities within the overall course would be likely to improve the students' reflexive level in my part of the teachings.

Hints for the distribution in replies for Q2 may be inferred from my self-evaluation and student comments given as part of the evaluation. In 2010, there were several comments on my performance regarding a relatively poor oral presentation, slow pace of presentation, and lack of a more assertive and insisting approach. In 2011, this was not a major issue, but there was still one (minor) comment that suggested me to be more assertive in the class room. This comment seems to be in line with earlier comments and highlight an aspect that I need to be aware of and address in my teaching. After peer feedback and reflections, the lack of assertiveness may be interpreted as rooted in a need for a clearer goal direction. This may be handled by improving the explicit learning goals and their formulation for each lecture.

My self-evaluation for the UFUG 2011 course is based on my impression of and experience with the group of students. Clearly, this year I felt much more confident when entering the teaching situation as I was well-prepared and had a plan for my overall approach and individual lectures. As the course went on I felt confident in the teaching situation and in my interaction with the students. Not all lectures had the same level of engagement and intensity. I noted this was the case in presentations of more theoretical and unfamiliar (for the students) course content in research-led teachings, but these moments was clearly out-weighted by the more engaging and rewarding experiences. However, the experience with more research-led teachings, such as transfer of basic knowledge, also indicated an area that can be targeted for future improvements. Again, several options are available such as employment of 'peer-instruction' or 'think-pair-share' teaching techniques.

Conclusions

In general, I am content that the employed changes and tools seem to have improved my teaching performance and the student learning. It is not possible to say which part of the changes and tools that have contributed most to the observed improvements. However, the insight that I, as a teacher, can draw upon a flexible set of professional understandings and tools have given me a sense of empowerment, capacity and professionalism I didn't had before. This will hopefully also allow me to cope with new teaching challenges in the future.

A Exercise 1

Group no.
Find and tell about experiences in the park

Your key experience: Richness in species

RICHNESS IN SPECIES	SHORT INTERPRETATION	IMPORTANT CHARACTERISTICS/ACTIVITIES
	Sensation of richness in plants, insects and/or animals.	Presence of different or special plants, flowers, insects and/or animals. Possibility to gather mushrooms, fruits etc.

Exercise

- **Walk around** in Frederiksberg Garden. **Identify** differently located areas with the same **key experience** (experiential zones). They may be very different, but still stimulate the feeling / sense of the same key experience.
- You need to **tell the other groups** in the class **about one experiential zone** in a way that invokes the sensation of the same key experience for the listener. Select one zone and **create a short story** (max 4-5 minutes) that can do that. Use a description as an aid. Choose one in the group who can tell your story.
- **Description:** 1) Characteristics, features, facilities, possible activities and uses, and your personal sensations and impressions.

Map of Frederiksberg Garden

Your notes:

B Exercise 3

SKOV & LANDSKAB

Exercise 3 – Dealing with challenges in public management of urban green spaces

Learning aims:
- Knowledge of managerial options
- Understanding of how to act
- Ability to propose and discuss solutions

SKOV & LANDSKAB

You are:
- Full of green ambitions and possesses a true public ethos
- Endowed with a green heart and want to promote innovative green space service of highest standard for local communities, business, schools, health, environment and your city in general
- Graduated with the best educational background as a master in UFUG
- The newly employed head of the park department (you're the boss)

You got:
- An old and large green structure consisting of numerous city parks, local parks, forests, water fronts and surrounding nature areas.
- A prosperous city in growth with high pressures on land use and risk of urban sprawl.

…but the condition of your parks is…

SKOV & LANDSKAB

… and your managerial situation…
- Timeworn colleagues (average +25 years in the organization)
- Defensive attitudes toward park services among colleagues ('we take care of what we got – and that is it')
- Work environment characterized by lazy or stressed attitudes
- Rigid organisational culture based on professional competencies (no collaboration or communication among units and colleagues)
- The in-house maintenance provider have a huge budget and do what the like (i.e. nothing)
- External budget pressures: declining funds for staff, consultancy, investments and maintenance
- No explicit standards for the city's parks and green spaces
- Continuous increase in complaints from citizens (e.g. grass jumping in seed)
- No public involvement besides answering complains in the phone
- Negative or no local media coverage (only about anti-social behaviour)
- No political attention or support for green space service

SKOV & LANDSKAB

Your initial analysis tells you that you are caught up in negative dynamics

2 Poor quality and service levels

3 More complaints / dissatisfaction

1 Reduced budgets (Political decision)

4 Management focus on catching up

6 No awareness of green-space values

5 Lack of policies for high quality services

…and you are afraid that the city will end up with plenty of green deserts and ghost zones ripe for being converted into land for development

SKOV & LANDSKAB

What will you do to change it?

Each group need to present a '**rough managerial strategy**' that can change the situation.

The strategy should include and discuss:
- Which managerial tools and option to use – why these tools and options?
- A step by step sequence of actions – why these steps?
- A list of whom and how to engage – why or why not engage?
- Highlight possible trade-offs and priorities in alternative actions

C Manager's tool box – Inspiration for managerial actions and organizational change

Public involvement options

- Questionnaire
- Consultation process
- Citizen panel
- User panel
- Consensus conference
- Future workshop
- Internet based discussion fora
- (Focus group) interviews
- PR campaign
- Information materials

Governance options

- Politicians and policy-makers
- Managers and other professionals / experts
- Public at large, interest groups / users and non-users
- Landowners, media, businesses
- Jointly acting in the *Policy Arena*
- Stakeholder and interest analysis

Policy and strategy options

- New vision, mission, strategy, policy, aims, actions, status, support, relations
- Green space strategy / development plans

Valuation option

- Social, ecological, economic, and environmental benefits
- Cost-benefit analysis

Market and management options

- 'Hands on' professional knowledge (e.g. freedom to manage)
- Explicit standards and performance measures (defined services and quality)
- Emphasis on output controls (e.g. performance management)
- Organizational re-design / disaggregation (e.g. purchaser-provider split)

- Greater use of competition (e.g. contracting out, free choice)
- Private sector styles of management (e.g. TQM, PR, branding)
- Greater budgetary discipline (e.g. penalties)

Organisational reform options

- Change of structure, processes and culture

Branding options

- Marketing
- Service branding
- Place branding
- Local branding
- Internal/external branding
- Identity e.g. 'green city'
- Competition and attractiveness

Part III

Stimulating student activity and deep learning

Using conceptual questions and clickers – can it improve learning for environmental economics students?

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Introduction

In 2010 I became course responsible for the course "Economic Valuation Methods and Cost-Benefit Analysis" which is compulsory for students attending the master program in Environmental and Natural Resource Economics at LIFE. I have been teaching parts of this course for several years, but last year I took over teaching the entire course. There are about 25 students in the class of which approximately 60% are attending the master program, 30% are international students on short stay (half year), and 10% are guest students from other Danish universities/institutes.

The central themes of the course are the methodologies and techniques applied in economic valuation and cost-benefit analyses and the underlying economic theory. Economic valuation and cost-benefit analysis are being increasingly applied as support for environmental policy decisions. The many services provided by the environment contribute to human wellbeing directly as well as indirectly by supporting productive activities. However, the characteristics of environmental benefits imply that they cannot usually be traded in markets. The absence of economic incentives in terms of prices means that political intervention is required to guarantee a socially optimal supply of environmental services. Economic valuation methods and cost-benefit analysis provide tools to assess the benefits and cost of environmental policies and projects.

Teaching is in the form of classroom lectures and exercises. Lectures present the essential elements of the curriculum in a rather traditional way with relatively limited student activation. In the exercises the participants

are much more active as they get the opportunity to apply the methodologies and techniques introduced in the lectures and they work on actual environmental policy issues. The final summative assessment of students is in the form of a four-hour written open book exam that is constructed so as to test to what extent the intended learning outcomes (ILO) have been accomplished – also known as criterion referenced assessment (Biggs & Tang 2007).

Problem

Last year's exam in my course revealed that some important yet rather simple and basic concepts in the course material had been misunderstood by a surprisingly large proportion of students. Even though these concepts had been explained thoroughly in lectures and trained extensively in exercises, it was clear that these teaching/learning activities (TLA) had not sufficiently promoted a deep approach to learning (Biggs & Tang 2007). Hence, the aim of this project is to develop and test a learning activity that will hopefully engage students in deeper learning approaches and ultimately improve students' understanding of these basic concepts.

Theory and methods

It is generally recognized that motivation and activation are important drivers in promoting deep approaches to learning (Biggs & Tang 2007). Hence, I chose to test a TLA that involves a high degree of student activity and at the same time focuses on increasing the understanding of basic concepts.

In particular a "conceptual questions" session where clickers are used for obtaining real-time student responses is tested. The idea of using conceptual questions in teaching was originally developed by Eric Mazur at Harvard University for students in large physics classes (Mazur 1997, Foundation 1996). Conceptual questions 1) Focus on a single concept, 2) cannot be solved using equations, 3) are formulated as multiple-choice question, 4) are clearly worded, and 5) they are of intermediate difficulty. While until now the conceptual question technique has mainly been used in teaching natural sciences, especially chemistry and physics, there is no reason why the technique should not be equally useful in teaching economics.

Nevertheless, I have not been able to find any previously documented attempts in this regard, so this represents a first novel effort in that sense.

The first and, in retrospect, most time-consuming and challenging task was to develop the conceptual questions according to the five principles set out above. Initially, based on last year's exam, a number of "typical" conceptual misunderstandings among my students could be identified. However, as the actual TLA was planned to take place only two weeks into the eight-week course, a restriction was that the relevant curriculum should be covered in lectures and exercises before this TLA. As such, it was intended to serve as a review activity summing up the most important concepts presented in these first two weeks. Hence, using the experience from last year's exam eight conceptual questions relating to the first two weeks' curriculum was developed. See appendix A for an example of one of the conceptual questions used and how it was presented to students in class.

The TLA was planned to take one hour, and the process (also depicted in figure 17.1) was the following. The multiple choice questions were asked one at a time, displayed on a whiteboard using MS PowerPoint. A real-time voting clicker system from TurningPoint Technologies was used. Each of the 20 students present in class was given a clicker that enabled real-time recording of their answers. Students were instructed to look at the question posed on the whiteboard and then – without talking to their fellow students and without looking at their books or notes – give their individual answer using the clicker. Using radio technology to connect the clickers to a receiver plugged into the USB-port on the computer running the presentation, the TurningPoint add-in software to PowerPoint was then used to show the distribution of answers in the class immediately after the last of the 20 students had provided his/her answer (see appendix A for a screen-print showing an example of how the distributions were incorporated into the Powerpoint presentation). In seven of the eight conceptual questions, there was clearly disagreement among the students as to what the correct answer should be[1]. Hence, students were then given 1-2 minutes to discuss with their neighbor. In particular, they should try and explain to their neighbor why they think that the answer they just gave was the correct one. Mazur (1997) refers to this as peer instruction or "think-pairshare". During these neighbor discussions, the noise level in class reached new heights and

[1] It should be noted that for some of the questions there were more than one correct answer. While this is normally not recommended for multiple choice questions, in the current experiment it turned out to Ibe quite beneficial as it lead to really involved discussions among students.

I have not personally before experienced so much active discussion in class. After that (it took some time to gain control of the class and get the word again), they were asked to vote again, and in some of the cases the distribution of answers had markedly shifted towards the correct answer whereas in other cases where there was more than one correct answer, distributions only shifted slightly between the first and the second vote. After the second vote, I revealed what the correct answer(s) was, and I gave a brief explanation and invited them to comment on this, before proceeding to the next question.
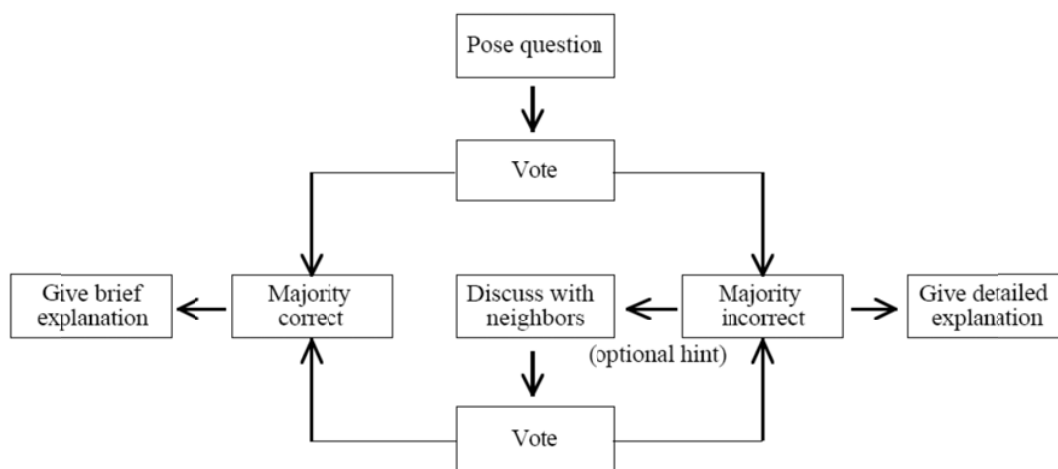
Fig. 17.1. Question flow.

Results

In order to assess the outcome of the TLA, immediately after the lesson students were asked to give their initial thoughts and comments on this type of TLA. Furthermore, during the following week they were asked to answer an evaluation questionnaire online in the Absalon system. The evaluation questionnaire is available in appendix B. Of course, a proper scientific assessment of the outcome would entail externally testing the students' knowledge in a more objective way, e.g. comparing scores in the final exam across two samples of students who have and have not been subjected to the

TLA. However, time restrictions do not permit this for the current project report.

The oral assessment

In the oral assessment, all students agreed that the TLA had been a success. Their comments circled much around the fact that they felt very engaged and active during the TLA, mainly because the nature of the TLA forces them to be active – but they did not actually feel being intimidated or coerced as they otherwise sometimes do when teachers force them to take active part in other types of TLAs. They also generally agreed that the clicker system enabling an instant overview of the answers in the class was not only fun and interesting, but also beneficial in the sense that realizing that quite a lot of heterogeneity in answers is present among your peers makes you reflect on your own answer – and especially having to argue why you think your own answer is right (and maybe also why your neighbor's is not) was mentioned as particularly fruitful.

Furthermore, their comments suggested that it was not perceived as a problem that some of the questions had more than one correct answer. Finally, they all agreed that the TLA had worked perfect as a review activity summing up on the important concepts taught in the previous two weeks of lectures and exercises, and it was suggested to do this type of TLA every two weeks throughout the course or even more often after each single curriculum topic.

The questionnaire assessment

Out of the 20 students present in class at the TLA, 18 have answered the questionnaire that was issued through Absalon about one week after the TLA. Out of the 18, only one student indicated to have had previous experience with TLAs using clicker systems, so in general it can be considered a "first time" experience for the majority of the students. In the following the distributions of the students' degree of agreement with the statements presented to them in question two are summarized[2].

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[2] Apparently, one student started answering the questionnaire but did not answer any of the statements in question 2, hence the 5% "Not answered" in all figures. This will be disregarded when commenting the results.

Figure 17.2 provides an assessment of the "discuss-with-neighbors" element of the TLA. The vast majority of students agree that it made them reflect and reconsider their initial response, and for most of them it actually made them change their initial answer to some extent when the vote was reopened. It is not surprising that not all agree with this since some of them could have been giving the correct answers initially in all questions. Nevertheless, it is somewhat surprising to me that it actually makes two out of three students change their initial response. Speaking highly in favor of the "discuss-with-neighbors" element, all students agree that it increases their own understanding. One thing that I was unsure of during the TLA was how much time should be allotted to this element. It seems however that spending 1-2 minutes on this part was sufficient as almost 50% find it to be sufficient. Even though 26% would have liked more time to discuss with neighbors, I do not think it would have been beneficial in terms of learning outcome to spend more time on this. It is not surprising to find some disagreement here, since some students generally like to discuss and talk more than others.

Figure 17.3 shows that the large majority of students felt more involved and active in the TLA than they otherwise feel in both the regular lectures as well as the regular exercises in my course. This is not surprising since the regular lectures are quite old-fashioned blackboard lecturing with only some student activity. It is however slightly more surprising that they also felt much more activated than in the regular exercises in which I would say the level of student activity is relatively high and where they are encouraged to discuss. An explanation could be that in regular exercises they also have to spend some time writing down their answers, thoughts and results and as such there are many more elements to it than just thinking-reflecting-discussing.

Figure 17.4 reveals again that the majority of the students felt that the conceptual questions helped them engage in deeper learning, and for at least half of the students this lead them to realize that they had actually misunderstood some of these very basic and important concepts and topics. This corresponds quite well to my knowledge from previous year's exam where it surprised me that quite a lot of students had misunderstood these basic concepts. Based on figure 17.4, I expect this to be less of a problem at this year's final exam.

While this type of TLA using conceptual questions could clearly also be conducted without the clicker realtime voting system, figure 17.5 suggests that using such a system is beneficial in the sense that it facilitates
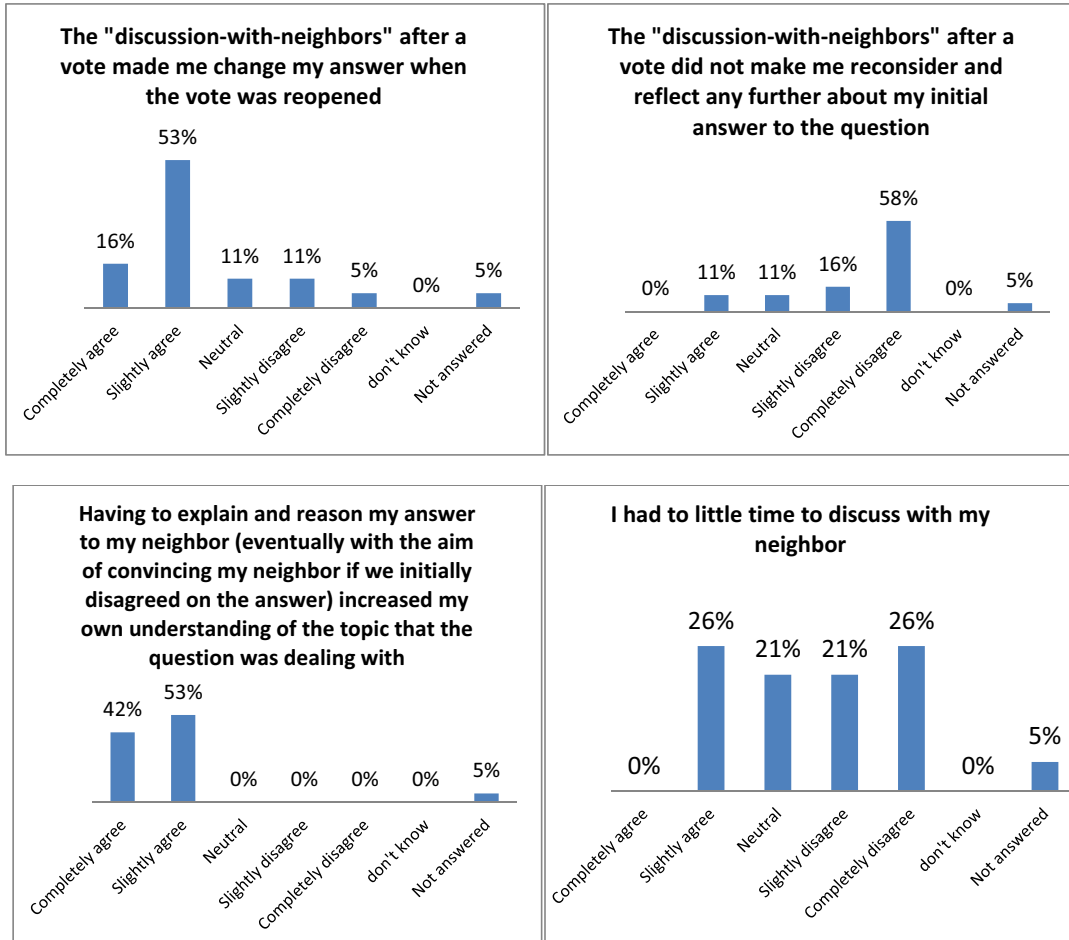
Fig. 17.2. Answer to questions 1, 2, 3 and 9 addressing the usefulness of the think-pair-share process.

and supports the "discussion-with-neighbors". Considering the importance of this particular element of the TLA as indicated by figure 17.2, using clickers or a similar real-time response system would seem highly recommendable. Furthermore, figure 17.5 suggests that it was not perceived as a major problem that some of the multiple choice questions had multiple correct answers. Only a couple of students found this annoying.

One important consideration in relation to this TLA is where it fits into the current structure of my course and the current TLAs in the course. Basically, my concern is whether this TLA could be seen as a replacement for some of the current TLAs or rather as a supplement. Figure 17.6 suggests that it should mainly be considered as a supplement since the majority of students agree to some extent that it cannot replace the regular TLAs in
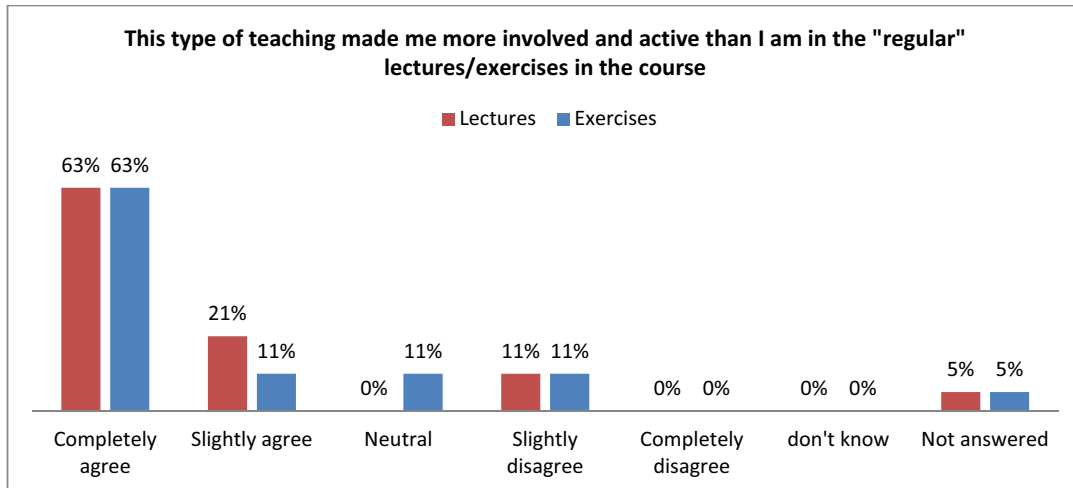
Fig. 17.3. Answers to questions 4 and 5 concerning activation and involvement.
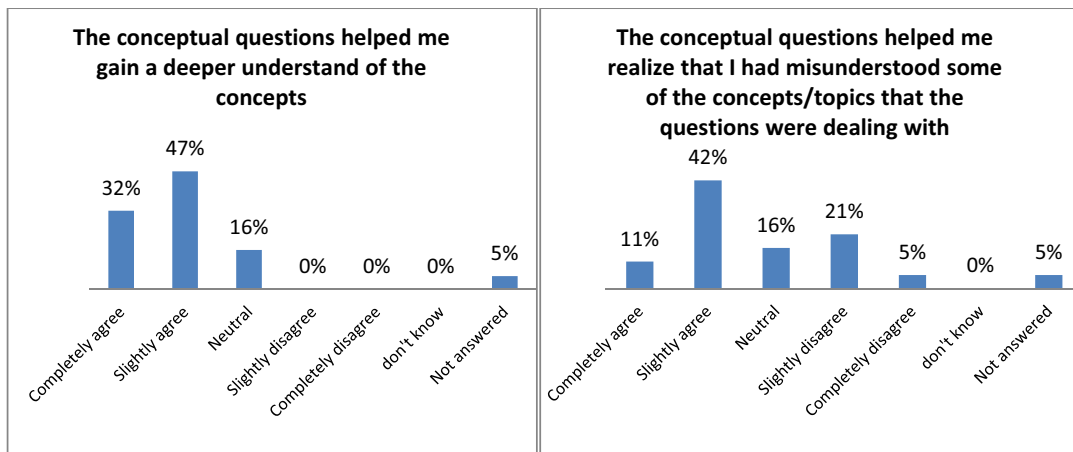
Fig. 17.4. Answers to questions 6 and 7 concerning students' understandings and misunderstandings.

the course. It is, however, evident that in order to introduce this new TLA on a regular basis in the course, something else has to go. Based on figure 17.6, it would seem most reasonable to replace some of the regular exercises with the new TLAs. Also considering the fact that the purpose of the regular exercises is quite close to the purpose of the new TLA, namely increasing students' understanding of the topics and concepts introduced in the lectures, this would seem a more relevant replacement to make than to replace some of the lectures with the new TLA.
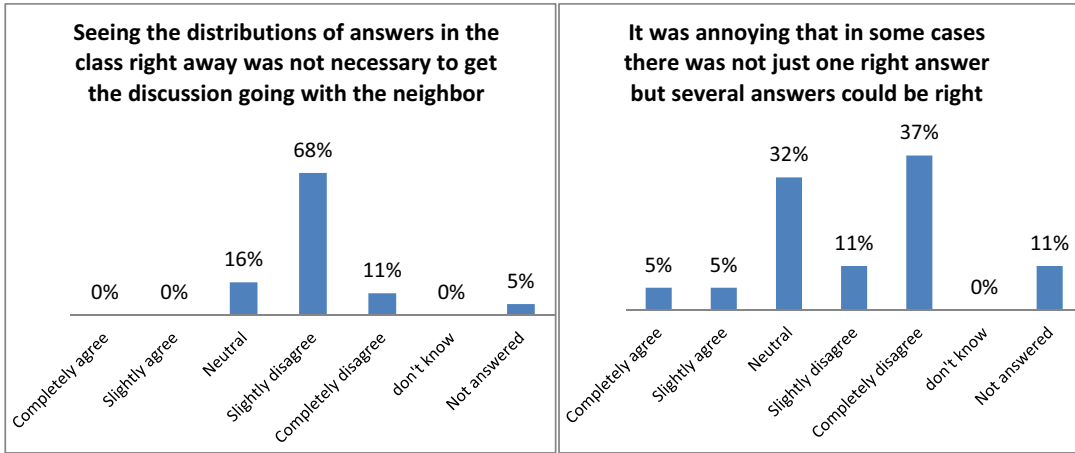
Fig. 17.5. Answers to questions 8 and 10 regarding the usefulness of seeing the answer distribution in class real-time and the atypical multiple choice format with more than one correct answer.
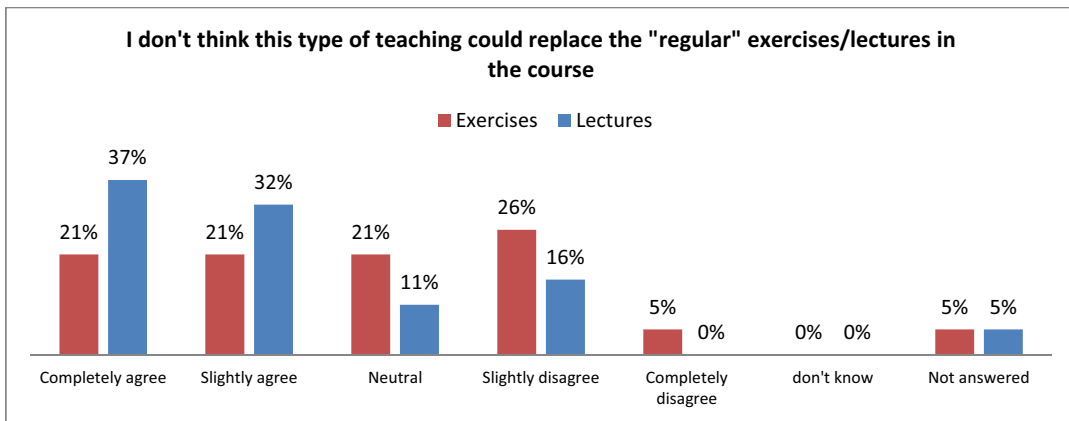
Fig. 17.6. Answers to questions 12 and 13 concerning to what extent this TLA could replace other TLAs.

Figure 17.7 summarizes the students' overall impression of the TLA, and again it is very clear that they like this type of TLA. All but one of them agree that it has increased their learning and understanding to some extent and they generally agree that this type of TLA should be used more. Of course one has to keep in mind whether it has actually improved their learning and understanding more or less than an hour of regular lecturing or exercises? In the current case the answer is most likely more. This is due to the fact that the TLA was conducted as a review activity, so they had
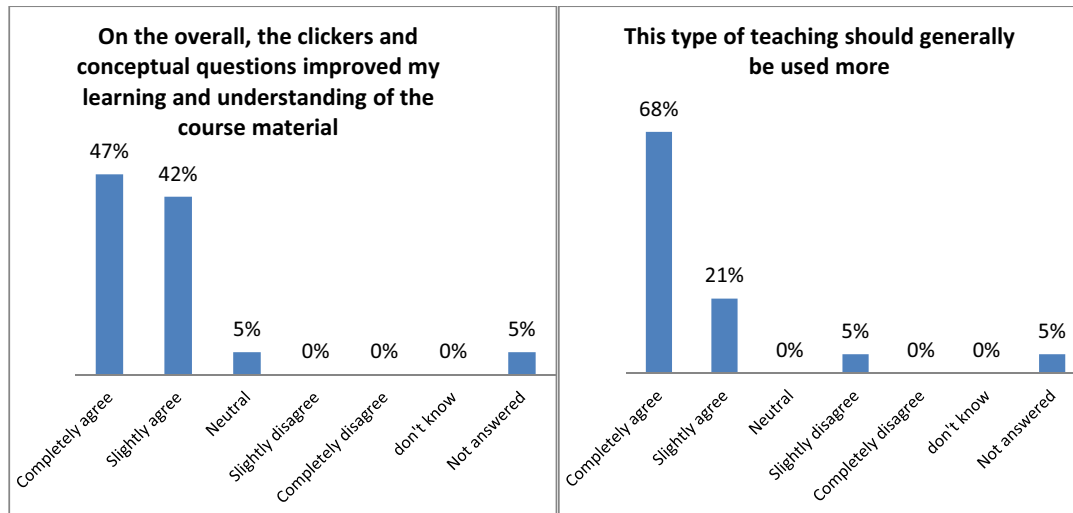
Fig. 17.7. Answers to questions 11 and 14 addressing the students' overall opinions about the TLA.

already been subjected to all the regular lectures and exercises that they would normally get before the final exam – relating to these concepts and topics. Hence, the students' answers indicate that the TLA has increased their learning and understanding beyond what they acquired through the regular lectures and exercises.

Conclusion

On the overall, testing conceptual questions and clickers as a review activity in my course has turned out very positive. My own impression from the discussions in class during the TLA was that the students benefitted greatly from it, and they were all activated and engaged to an extent I have not experienced previously. Judging by the oral as well as the written follow-up assessment, the students generally agree on this. Hence, my preliminary conclusion is that this type of TLA is extremely useful as a tool to improve learning and understanding of important topics and concepts – also for students in environmental economics, an area where this type of TLA, to my knowledge, has not previously been tested. Of course, the final exam will to some extent confirm or reject this conclusion. Another benefit of this type of TLA is that it also serves as a useful formative assessment that provides the teacher with an immediate view of student understanding in class.

Having tested this type of TLA, I am certain that I will from now on take it in as a regular TLA in my course. Ideally, I would like to conduct this TLA every two or three weeks throughout the course when larger overall topics have been dealt with in lectures and exercises and are supposed to be finished. In order to reach this goal, I see two obstacles to overcome. The first and most important is the workload associated with developing the conceptual questions. Of course, with experience everything gets easier, so it might not take two days to construct another ten conceptual questions for another topic, but it certainly will be time demanding. However, this will to a large extent be a one-off time investment. Once a proper set of conceptual questions has been constructed, it can be re-used with little additional time investment in the following years. In the greater perspective, a database of conceptual questions for environmental economics could be developed and made available to other environmental economics teachers, similar to what has been done in chemistry and physics teaching. The second obstacle is of a more technical character, namely acquiring a set of clickers or adopting another solution for real-time voting. My institute does not currently have clickers available, so I had to borrow them at another institute, and there is no guarantee that they will always be available. One solution is to convince my own institute to buy a set of clickers. Considering the financial crisis and economic cutbacks at the university, this might not be realistic. In a foreseeable future smartphones with instant voting apps would be a possible solution. While such apps are already available, not all students have smartphones, so this solution seems irrelevant at least for now. Another solution that I might pursue is to ask students to bring their own laptops to these TLAs. Instant voting web-based solutions are available that should be able to work just as well as the clickers and our students are expected to have laptops, i.e. teachers can ask students to bring their laptops and plan their teaching on this basis.

A Conceptual questions

Example of conceptual question as presented to students in class – here with graphical bar-chart illustration of the distribution of student responses collected real-time and shown to students immediately after last vote had been registered.
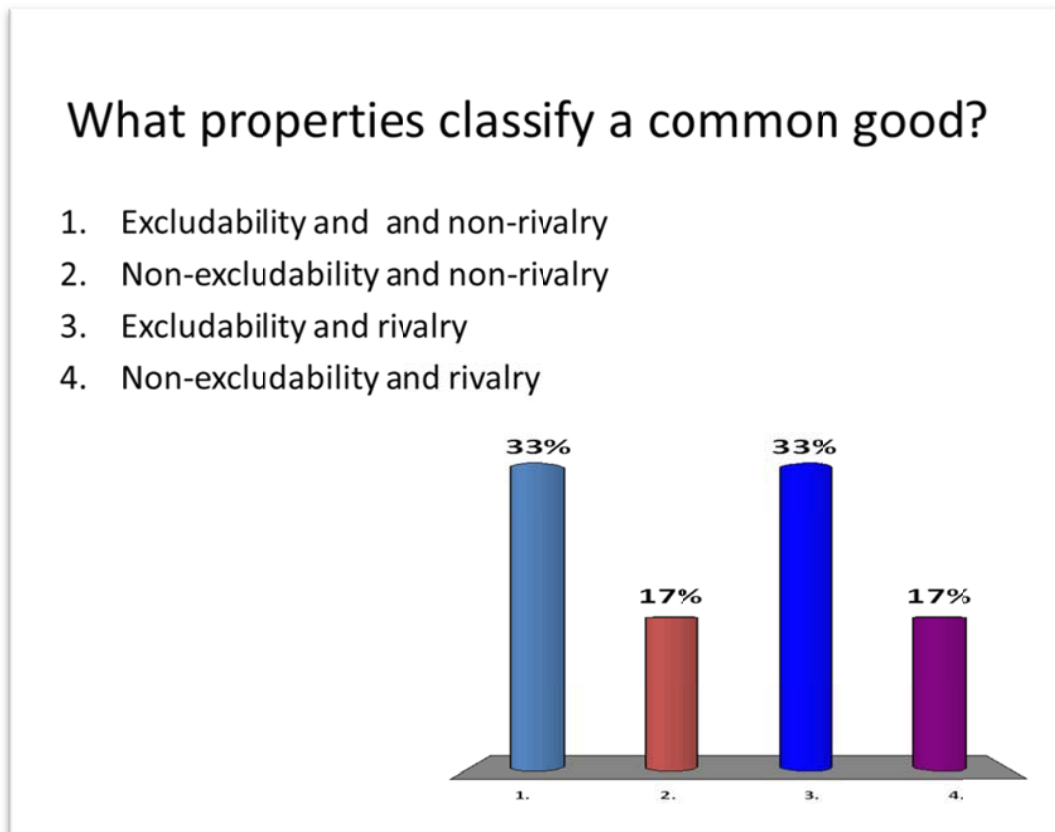
B Evaluation questionnaire

(1/3)

Have you previously experienced this type of teaching (i.e. where clickers or a similar instant voting system is used)

○ Yes

○ No

[Cancel] [Next]

(2/3)

To what extent do you agree or disagree with the following statements

	Completely agree	Slightly agree	Neutral	Slightly disagree	Completely disagree	don't know
The "discussion-with-neighbors" after a vote made me change my answer when the vote was reopened	○	○	○	○	○	○
The "discussion-with-neighbors" after a vote did not make me reconsider and reflect any further about my initial answer to the question	○	○	○	○	○	○
Having to explain and reason my answer to my neighbor (eventually with the aim of convincing my neighbor if we initially disagreed on the answer) increased my own understanding of the topic that the question was dealing with	○	○	○	○	○	○
This type of teaching made me more involved and active than I am in the "regular" lectures in the course	○	○	○	○	○	○
This type of teaching made me more involved and active than I am in the "regular" exercises in the course	○	○	○	○	○	○
The conceptual questions helped me gain a deeper understand of the concepts	○	○	○	○	○	○
The conceptual questions helped me realize that I had misunderstood some of the concepts/topics that the questions were dealing with	○	○	○	○	○	○
Seeing the distributions of answers in the class right away was not necessary to get the discussion going with the neighbor	○	○	○	○	○	○
I had to little time to discuss with my neighbor	○	○	○	○	○	○
It was annoying that in some cases there was not just one right answer but several answers could be right	○	○	○	○	○	○
On the overall, the clickers and conceptual questions improved my learning and understanding of the course material	○	○	○	○	○	○
I don't think this type of teaching could replace the "regular" lectures in the course	○	○	○	○	○	○
I don't think this type of teaching could replace the "regular" exercises in the course	○	○	○	○	○	○
This type of teaching should generally be used more	○	○	○	○	○	○

[Previous] [Cancel] [Next]

(3/3)

If you have any additional comments, suggestions, etc., please state them here:

[   ]

[Previous] [Cancel] [Finish]

Constructive Alignment in Practice – Integration of Theoretical and Practical Teaching by use of Clickers

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Given my earlier experience as a student and as a teacher, I had often experienced that the theoretical and practical components of teaching do not supplement each other and the two components are seen as two distinctively separate from each other. During the Adjunktpædagogikum course, my introduction to the paradigm 'Constructive Alignment' (Biggs & Tang 2007, Biggs 2003, Le & Tam 2007) aroused immense interest in me and I was motivated to try the concept within my own teaching context. Constructive alignment concept basically builds on two important tenets of learning: the teacher creates a conducive learning environment and the student constructs his own understanding of the knowledge based on his existing experience with the knowledge (Bowden 2004, Bowden & Marton 1998). Constructive alignment is the logical alignment of intended learning objectives (ILOs), actual theoretical teaching in the classroom, the teaching activities during the practical session and the assessment at the end of the course so that each component of the course supplements each other, to support the learning process of the students in their own ways (Bowden & Masters 1993). Diagrammatically, constructive alignment can be depicted as in figure 18.1 with learning process as the central element and the goal to be achieved by integrating different components (different circles in figure 18.1) supporting the learning process.

Clickers

Use of clickers is a proven tool as an effective means of teaching for active learning by students (CWSEI & CU-SEI 2009), where multiple choice concept tests (Mazur 1997) are answered by each student, followed by peer discussion (buzz groups) and a re-poll after discussion. The basic concept of the tool is that each student, with the help of a clicker, responds electronically to the concept test questions, ensuring participation from all the students, the result of which is then shown on a chart in a slide, providing the teacher an idea of the level of understanding of the taught theoretical concepts. If the chart shows poor results e.g more than 50% providing wrong answer, then a two-minute discussion is done with the neighbours sitting next to you, after which a re-poll is taken to see the benefits of the discussion with the neighbours. During the Adjunktpædagogikum course, I attended one session on use of clickers and I was fascinated by the benefits of the use of clickers and therefore, I developed interest to use the clickers in my own teaching to provide as far as possible effective learning environment. My reasons for use of clickers in a classroom environment are as follows:

- Keep the students active and motivated in a classroom environment
- Students take responsibility to prepare for the clicker questions to get the right answers
- Students can discuss and share the views with fellow students
- Students can check their answers anonymously encouraging participation

Overview of my teaching

I had teaching in the course 'Tropical crop production' an elective course at M.Sc. level, which can be taken during M.Sc. study year 1 or 2 and the students with an interest in tropical crop production in the context of developing countries, followed the course. Given that that the course has a strong focus on crop production in the developing countries, many of the students in the course came from the M.Sc. programme 'Agricultural Development'. The course details with block structure, credit points, assessment format and expectations of skills and competencies to be gained on completing the course are provided in appendix A. The course has been
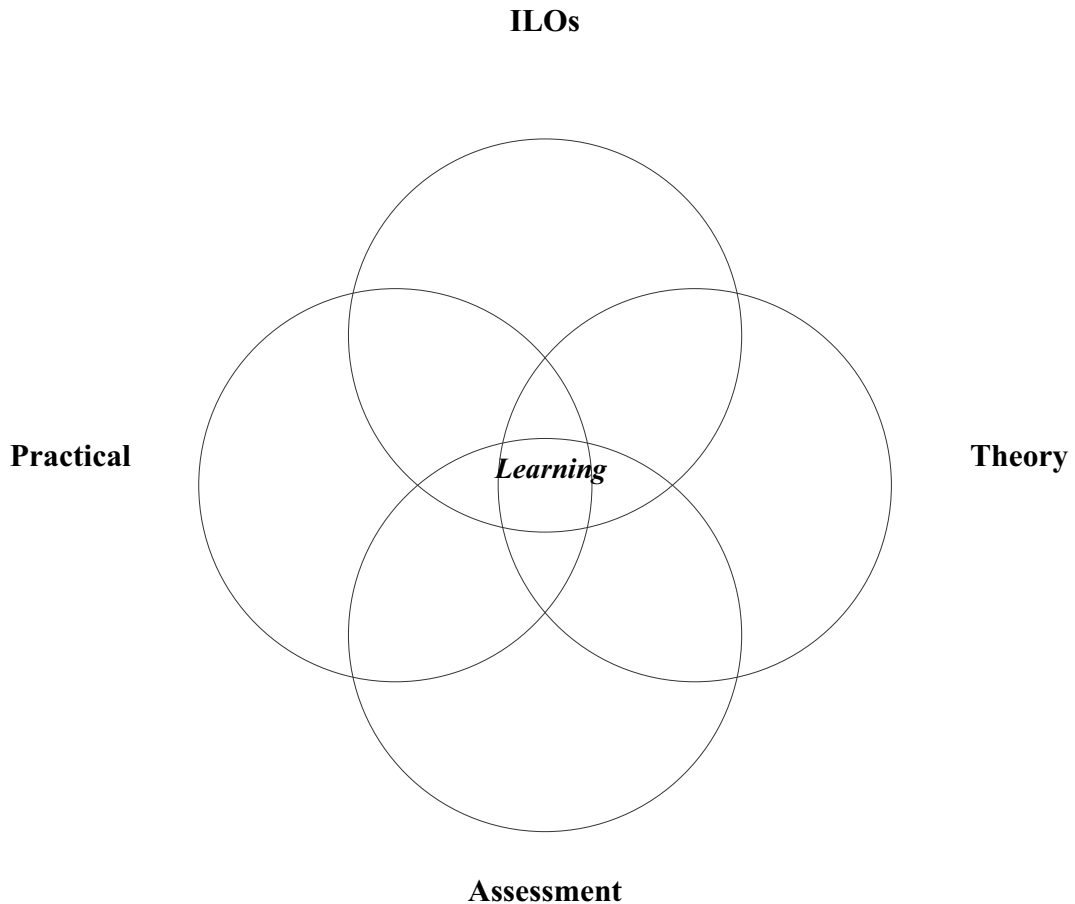
ILOs

Practical   Theory

Learning

Assessment

Fig. 18.1. Different components of constructive alignment and their inter-relationship for an effective learning environment

running for couple of years and I was responsible for two lectures. The first lecture was on 'Tropical maize production' which consisted of theoretical and practical components. There were 26 slides in total for the theoretical and the practical component. Of the total time allocated for the lecture of 2 hours and 20 minutes, the theoretical component consisted of 1 hour and 20 minutes and the practical component consisted of 1 hour. The theoretical part consisted of power point slide presentation with clicker sessions in between to create an interactive environment for discussion as well as to clarify the doubts that the students had during the lecture. In the practical component, an exercise was presented and the students worked in groups of 3-4 people, which had to be completed in a week and submitted to me. The second lecture was on 'on-farm trials' and I had a total of 27 slides: 16 slides for the lecture and 11 slides for the clicker session. The lecture

and the clicker session was organized in a way that the students grasped the concepts of on-farm trial types and design in the lecture and the clicker session was meant to test the students understanding of the teaching by solving a real life problem in designing a on-farm trial using two cultivars of rice with two levels of nitrogen fertilizer.

Problem formulation

During the second lecture on 'on-farm trial', my aim was to implement constructive alignment within a teaching session by integrating the theoretical teaching and practical session so that students can test their understanding of the subject matter taught in the theory by solving a real-life problem situation. I formulated the intended learning objectives (ILOs) with SMART principle, in mind and prepared the slides for the theoretical lecture and the practical/clicker session to far as possible match the ILOs and vice-versa. My objectives were to

- match ILOS, theoretical teaching and the practical/clicker session
- to test the combined use of clickers and buzz session to encourage enhanced participation and enriched understanding of the taught subject matter

Methods and Materials

The results provided here are based on the teaching on the on-farm trial (Appendix B) followed by the responses provided by 26 students to the six clicker questions; five clicker questions on the subject matter (Q1-Q5) and Q6 on the opinion of the students on the usefulness of the clickers for learning. The six questions were:
Q1: Which on-farm trial type do you suggest
Q2: Do you need a control treatment
Q3: How many treatments are required
Q4: How will you place your treatments
Q5: Which on-farm trial design do you suggest
Q6: Is use of clickers a good aid for teaching

Q6: Possible response choices

1. Excellent tool for learning
2. Helps me to learn by interacting with others
3. I like it just for fun
4. It is ok to use it
5. It distracts me

Each student had one clicker device and when a question (Q1, Q2, Q3, Q4, Q5) was presented on a slide, each student was asked to provide an answer to the question. The result for each question was shown on a chart with percentage of students providing different answers (multiple choices) for the question. The students were then asked to go into buzz groups of two each, with the fellow students sitting next to him/her in the classroom and discuss the answer. During the two-minute buzz session, each student tried to convince the other student his/her own answer by providing reasons for the answer. After the buzz session was over, a re-poll was done, where the students provided an answer to the question individually. The answers were charted and shown in a slide and the right answer was indicated in the chart so that students could see if they answered the question right. I recorded the number of students (responses) providing the right answer before and after the buzz session. Towards the end of the session, Q6 was asked with 5 different response choices (1-5) to provide the students an opportunity to evaluate usefulness of clickers in a learning environment.

Results

The results are provided in percentile of right answers before and after buzz session for each question. Before the buzz session, 60-80% of students provided the right answer, depending on whether the answers to the question could be directly extracted from the lecture or not. 80% of the students in the class provided the right answer when they are asked to answer on the type of trial design to be suggested (Q5) whereas only 60% answered right when they were asked if control treatments were required for the experiment (Q2) (Fig. 18.2). The reason for high number of students providing right answer in Q5 is that the students had already gone through the details of the trial treatments and the trial placement in the field (Q1-Q4), which provided them a good idea of the trial design, and so the answer could be taken directly from the theoretical teaching. However, Q2 was more a conceptual question and the answer could not be taken directly from the taught

lecture. In both situations, the advantage of the buzz round could be seen in significant improvements in number of right answers. After the buzz session, there was 10-20% increase in the number of students providing the right answers, as an outcome of the buzz session. The clicker session provided a clear picture of where the students had difficulty in understanding the theoretical concepts and in this teaching, I need to focus on control treatment (Q2) and its significance. So, the combination of clicker with the buzz session not only created an enabling environment for learning by discussing in buzz groups but also provided me a good picture of where I needed to focus on in the next teaching. In this way, the findings were useful for the students to know the benefits of the buzz group as well as to me in terms of how to improve and reflect on my teaching (e.g. control treatment in my teaching, Q2) where students had difficulty in understanding. To the question on how the student perceived the clicker as a teaching tool (Q6), 85% answered as 'excellent tool for learning' (response choice 1) and 15% answered as 'helps me to learn by interacting with others' (response choice 2) whereas none thought that it was distracting or not useful for learning (Fig. 18.3), which provided motivation for use of clickers.
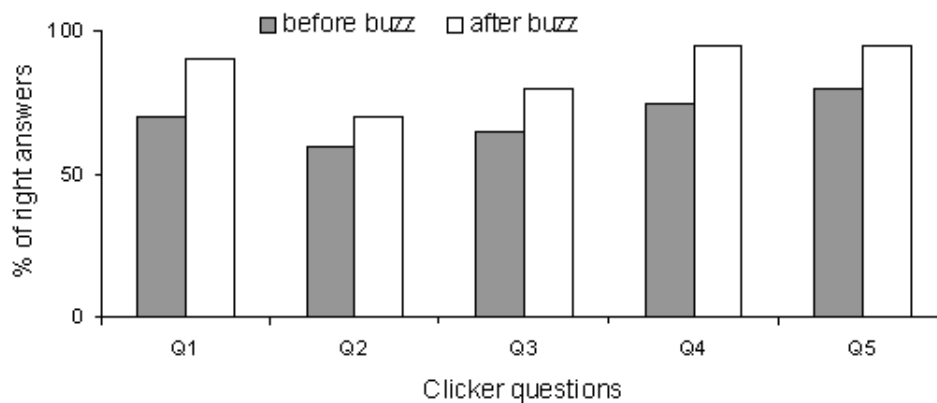

Fig. 18.2. Percentage (%) of right answers for different clicker questions (Q1-Q5), before and after the buzz round
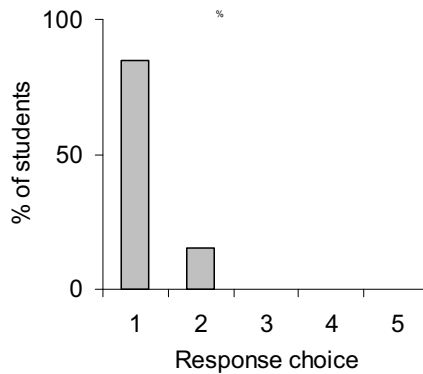
Fig. 18.3. Percentage (%) of students, who provided different response choices on the benefits of clicker use (Q6)

Conclusions

I think I have, to a certain extent, succeeded in matching the ILOs, theoretical teaching and the practical session during my teaching on on-farm trial. The findings that the buzz group discussion increased the number of right answers is evidence that peer-peer discussion helped in providing an enabling environment for learning and for the teacher to reflect and improve on the teaching based on the responses charted in the graphs. The students' overwhelmingly good response, with 85% stating that clicker is an excellent tool for learning and another 15% answering 'helps me to learn by interacting with others' are good indicators to justify the use of clickers for teaching. Some of the students also preferred to use the tool to evaluate a course as use of clickers would encourage participation by individual students and can be a potential tool for course evaluation, the outcome of which can be used by the teachers to improve the future teaching in those teaching sessions where students have difficulty in understanding.

A Course description, excerpt

Title: Tropical Crop Production – LPLK10367
Department: Department of Agriculture and Ecology
Credits: 7.5 ECTS
Level of Course: Msc
Examination: Final Examination, written examination, all aids allowed.

Course Content: The course focuses on capacity development in tropical crop production. The students will be exposed to the three major crop science elements that are instrumental to optimal crop production 1) Plant breeding and crop varieties, 2) fertilizer (organic/unorganic) and 3) crop protection. [. . .]

Teaching and learning Methods: The course combines lectures and theoretical and practical exercises. Lectures will outline the background and support the exercises.

Learning Outcome: Provide students, having a BSc-level background in agricultural sciences or equivalent, with a comprehensive understanding of the intrinsic properties of selected tropical crop species and their management in tropical rainfed and irrigated agro-ecosystems. Focus is on bio-physical related production constraints and human endeavour to optimize crop production in small-scale farming systems, within the context of poverty alleviation and sustainable crop production.

When students have completed the course they should be able to:
- **Knowledge**
  - Demonstrate knowledge of the principles of tropical crop production
  - Understand the characteristics of major tropical crops
  - Demonstrate overview of tropical farming systems in relation to agro-ecological and socio-economic conditions.
- **Skills**
  - Analyse and synthesize diverse types of information on tropical crop production
  - Design cropping calendars for selected major crops species
  - Develop tropical crop production plans in relation to given agro-ecological and socioeconomic conditions
  - Design, implement and analyze research projects in a tropical crop production environment
- **Competences**
  - Assess and formulate agronomic components of development support programmes
  - Advise extension and research institutions in tropical countries
  - Do statistical and graphical analysis of field experiments.

B On-farm trial – theoretical session

On-farm trials (tropical context)

Intended learning objectives:

- Differentiate between on-farm and on- station trials
- Describe and differentiate between different types of on-farm trials
- Apply an on-farm trial design based on the on-farm trial objective

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What is on-farm and on-station trial
 	
• On-farm trials
  – Field trials placed in farmers' fields
  – Testing of technologies after on-station evaluation
• On-station trials
  – Field trials in a research station/ university experimental farm
  – Testing of the technologies for the first time in the area/country/region
	Why on-farm trials
	
	• Common platform for researchers and farmers to communicate
	• Technology assessment by farmers
	• Technology evaluation under wide range of environments
	• Realistic production input and output information
	• Feedback mechanism for research priority setting to real farmer needs

Types of on-farm trial
 	
Three categories
  ❖ Researcher-designed and researcher-managed
  ❖ Researcher-designed and farmer-managed
  ❖ Farmer-designed and farmer-managed
	Researcher-designed & researcher-managed
	
	• Farmer involvement is minimum
	• Researcher takes control
	• Similar trial design rigor as on-station
	  – Control plot, replication, plot size
	• Representative of farmers' environment
	• Often involve renting land from farmers
	• Biophysical performance evaluation

Researcher-designed & farmer-managed • Researchers consult with farmers – Design and implementation • Test treatments are compared with control • Farmers follow same standard practice across the farms • Farmers responsible for field operations • Biophysical data and farmers assesment • Analysis of costs and returns	**Farmer-designed & farmer-managed** • Farmers are on their own • Farmers design trial without control • Plot size and management varies • Researcher monitor a sub-sample of trials • Realistic farmers assessment • Farmer-to-farmer visits to share experiences amongst farmers

Comparisons of on-farm trial types

Design	Researcher	Researcher	Farmer
Management	Researcher	Farmer	Farmer
Crop yield			
Cost/benefit analysis			
Farmers Assessment			

Suitability of on-farm trial types to gather data (Low, medium and high)

Key on-farm trial designs

- Completely randomised design
- Randomised complete block design
- Split plot design

Completely randomised design

- 2 maize cultivars (M1 and M2),
- 2 nitrogen levels (0 and 30 kg N ha^{-1})
- 3 replicates

M1, 0	M2,30	M2, 0
M2,30	M1,30	M1, 0
M1,30	M2, 0	M2,30
M2, 0	M1, 0	M1,30

Completely randomised design

- Each plot has equal chance of receiving a treatment
- Treatments assigned randomly to all plots
- Simple design to use
- Best suited with few number of treatments
- Best if experimental units are homogenous
- Usually, not ideal design for field trials

Randomised complete block design

- 2 maize cultivars (M1 and M2),
- 2 nitrogen levels (0 and 30 kg N ha^{-1})
- 3 replicates

Block 1	M1,0	M2,30	M1,30	M2,0
Block 2	M2,0	M1,30	M1,0	M2,30
Block 3	M1,30	M2,0	M1,0	M2,30

Randomised complete block design

- Equally sized blocks with all treatments
- Each block contains complete set of treatments
- Number of blocks are the number of replications
- Treatments are assigned randomly within the blocks
- Best suited for field trials due to heterogeniety in field characteristics

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Split plot design

• 2 main plot (irrigation treatments, W1 and W2)

• 2 subplots in each mainplot (2 maize cultivars, M1 and M2)

• 3 replicates

Block 1	W1M1	W1M2	W2M2	W2M1
Block 2	W2M2	W2M1	W1M1	W1M2
Block 3	W1M1	W1M2	W2M2	W2M1

Split plot design

• 3 layers in trial set-up
  – Block
  – Mainplots
  – Subplot
• Higher precision in subplots than mainplots
• Greater precision required for one factor relative to the other
• Practical limit for one factor is bigger than for other factor for comparison

C On-farm trial – practical/clicker session

Internship assignment

- IRRI is interested in evaluation of
  - 2 high-yielding rice cultivars (IR64 and IR8) with 2 nitrogen fertilizer rates (0 and 60 kg N ha-1)
- Both cultivars have been tested on-station and yield higher than local cultivar
- Cultivars need to be tested on-farm under farmers management
- Data on biophysical performance and farmers evaluation required

Farming environment

- Farmers have < 1 hectare rice fields
- Most farmers grow a local cultivar (Pita)
- Local cultivar yields are low (1-2 t ha^{-1})
- Farmers can provide 2 paddy terraces for testing the cultivars
- Each rice paddy is minimum 30 x 10 m^2

Q1: Which on-farm trial type do you suggest

1. Researcher designed and researcher managed
2. Researcher designed and farmer managed
3. Farmer designed and farmer managed

Q2: Do you need a control treatment

✔ 1. Yes
2. No
3. Maybe

Q3: How many treatments are required

1. 4
2. 8
3. 12
4. 6

Q4:How will you place your treatments	**Q5:Which on-farm trial design do you suggest**
1. Cultivar treatments in one paddy terrace and fertilizer treatments in another terrace ✔2. Each terrace is assigned to one fertilizer level 3. Each terrace is assigned to one cultivar	1. Completely randomised design 2. Randomised complete block design ✔3. Split plot design
Q6:Is use of clickers a good aid for teaching 1. Excellent tool 2. I like it very much 3. It is ok to use it 4. It distracts me	

Cooperative Learning i et eksperimentelt undervisningsforløb – et casestudie

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Indledning

Min undervisning på universitetet har ofte været af den form, hvor det er mig, der har haft ordet og videregivet min viden. De studerende har altid haft mulighed for at bidrage, kommentere og stille spørgsmål. Samspillet mellem de studerende og mig som underviser har altid eksisteret, men samspillet har oftest været repræsenteret af en dialog med en lille aktiv gruppe studerende. Dermed har en større gruppe studerende passivt modtaget undervisning.

Mit mål med undervisningen på "Biokemi 2" er, at alle de studerende på holdet i højere grad skal være aktivt deltagende. Hermed tænker jeg på, at alle de studerende i alle lektionerne skal være med til at formulere sig omkring den læring, der skal foregå. Jeg ønsker at sætte fokus på, at der i højere grad skal være en dialog mellem de studerende. Hertil vil jeg som underviser også i højere grad skabe mig mulighed for at kunne have dialoger og dermed vejledning med de studerende individuelt, i mindre grupper samt på hele holdet.

Introduktion

I en undervisningssituation foregår der et samspil mellem modtagere og underviser, der er afgrænset af læringsmål og læringsrum (Illeris 1999). Samspillet kan være mellem underviser og studerende, men det kan også være et samspil mellem de studerende. Underviseren skal være den retningsgivne

faktor i samspillet for at sikre, at læringsmålene bliver opnået. Underviseren er ansvarlig for at de opsatte mål opnås i undervisningen, og hertil sikre at de studerende får mulighed for at evaluere deres læring. Undervisning, der tilgodeser dette, kan foregå på mange forskellige måder og indeholde mange forskellige arbejdsmetoder. Underviseren kan vælge at forelæse og derved opnås en styring af, hvilket stof der gennemgås. En modsætning til dette vil være en undervisningssituation, hvor de studerende er aktive og deltagende i alt, hvad der foregår i læringsrummet.

Læring er det grundlæggende mål for undervisning og vejledning. Jeg tror at en optimal læring foregår, når de studerende er aktive, reflekterende, handlende, formulerende og på anden måde aktivt deltagende i undervisningen. Det vil sige, når der blandt andet er et samspil mellem alle parterne, der er involveret i en undervisningssituation.

Denne opgave har fokus på samspillet mellem studerende og den læring, som kan opnås ved at facilitere samspillet mellem de studerende i undervisningssituationen. Opgaven er et bevidst valg om at udnytte læringspotentialet i at lade de studerende kommunikere med hinanden.

For at opnå undervisningsmetoder der tilgodeser ovennævnte benyttes en række strukturer, der bygger på cooperative learning. Disse strukturer skal sikre at alle studerende deltager aktivt i undervisning og gruppearbejde og opnår læring i stedet for for eksempel at træde ind i en rolle som sekretær eller den stille passive type, der ikke bidrager med noget.

Konstruktivisme og socialkonstruktivisme

Konstruktivismens omdrejningspunkt er, at man erkender, forstår og erfarer sin omverden og sin virkelighed, som man selv ser og oplever den. Man reflekterer ved at sammenholde sine oplevelser med sin eksisterende viden og erfaring og konstruerer således en overbygning til eksisterende viden og erfaringer. Konstruktivisme arbejder altså ud fra en opfattelse af, at viden og læring er noget, man bygger op efter at udefrakommende input har adderet viden til ens egen eksisterende viden (Illeris 1999).

Denne konstruering under læringen kan tilføjes aspekter som kommunikation under læringsprocessen og en søgen efter anerkendelse af korrektheden af sin konstruktion igennem kommunikationen. Begge aspekter tilfører konstruktivismen en social indgangsvinkel, og konstruktivismen kan så karakteriseres som socialkonstruktivisme. Transponeringen fra konstruktivisme til socialkonstruktivisme opnås altså, hvis paradigmet om konstrukti-

vistisk læring flyttes fra at viden konstrueres personligt og accepteres som universelt korrekt, til at viden konstrueres gennem kommunikation og accepteres som korrekt, hvis den er socialt accepteret som korrekt (Illeris 1999). Det synes modsatrettet at benytte et sådan læringssyn inden for (eksakte) naturvidenskabelige uddannelser, men social accept kan for eksempel være accept fra en underviser eller fra en gruppe af medstuderende, der har været vejledt af en underviser.

Cooperative learning

Cooperative learning er undervisning, hvor studerende i grupper af varierende størrelse arbejder efter bestemte principper og strukturer. Disse strukturer fyldes så ud med relevant fagligt indhold af underviseren. Cooperative learning bygger på fire grundprincipper, der skal øge læringsudbyttet for alle studerende uanset fagligt niveau (Kagan & Stenlev 2006).

1. Samtidig interaktion, mange interagerer og kommunikerer samtidig. Der brydes med lærerstyret dialog, hvor enkelt studerende kommunikerer med underviser.
2. Positiv indbyrdes afhængighed, der er brug for at alle deltager og bidrager for at for at opgaven løses. Ikke så stærke studerende kan ikke gemme sig i grupper med stærke medstuderende.
3. De studerende skal have lige meget taletid i cooperative learning strukturen, hvis denne forudsætning opstilles, tvinges alle til at deltage aktivt også svagere studerende.
4. Alle studerende skal være "på" mindst en gang i cooperative learning-strukturen, derved opnås, at de studerende formulerer sig fagligt omkring emnet.

Cooperative learning med dets fokus på kommunikation og peer-evaluering af opnåede resultater er altså dybt forankret i socialkonstruktivismen.

Cooperative learning stiller udfordringer til underviseren (Kagan & Stenlev 2006). Underviserens rolle bliver observerende og vejledende, mens de studerende formulerer, videregiver og reflekterer over det faglige indhold. Da de studerende skal formulere deres viden, kan vejledning foregå tæt på de studerendes udgangspunkt. Der vil være flere, der taler samtidig i de enkelte grupper, men samtidig er tilhørerne nødt til at være

observerende, da de skal benytte sig af den viden som deres medstuderende giver dem.

Klare læringsmål er vigtigt, når cooperative learning skal inkorporeres i undervisningen. Er læringsmål klare, kan der lettere vælges de korrekte cooperative learning-strukturer. Vælges der forkerte strukturer som ikke optimerer læringen, vil cooperative learning-strukturerne kunne komme til at fremstå meningsløse for de studerende, og seriøsiteten og motivationen mindskes i cooperative learning-strukturen.

Cooperative learning til universitetsbrug

Fokus for universitetsbrug af cooperative learning bør være på videns- og tænkefærdigheder. Der er en del færdigheds- og videnslæring, som ikke foregår i en skemalagt undervisningssituation og påtænkes som selvstudie. Her kan cooperative learning selvfølgelig ikke bruges af underviseren, men cooperative learning kan bruges i for eksempel studiegrupper.

Ud over disse færdigheder opbygges der også sproglige, skriftlige (i strukturer ikke beskrevet i denne opgave) og sociale færdigheder. Især sproglige færdigheder er væsentlige at fokusere på som "sidegevinst". Gennem studiet stifter den studerende bekendtskab med en række nye faglige begreber. Hvis disse begreber benyttes i korrekt sammenhæng og inkluderes i den studerendes aktive ordforråd, kan den faglige kommunikation styrkes kraftigt. Sociale færdigheder inkluderer tilvænning til at kommunikere sin faglige viden videre, en ikke uvæsentlig færdighed at besidde.

Nedenfor er en række cooperative learning-strukturer beskrevet (Kagan & Stenlev 2006). Disse strukturer er udvalgt med henblik på brug i universitetsundervisning.

Ordet rundt
Underviser stiller et spørgsmål, som svares af alle i gruppen på tur.
Tænk-par-del
Trinene i tænk-par-del er simple. Underviseren stiller et spørgsmål, hver elev tænker over svaret, diskuterer med sin skuldermakker, og svaret deles med klassen.
En for alle
Gruppemedlemmerne giver sig selv numre og underviser stiller et spørgsmål. Gruppen diskuterer svar og ideer og underviser siger derefter et nummer, denne person skal præsentere gruppens svar.

Par-sammenligning

Par-sammenligning er en videreudvikling af tænk-par-del. Opgaven/spørgs-målet stilles, svar og ideer diskuteres med skuldermakker. Sammen med et andet par sammenlignes og diskuteres svar og ideer.

Par-tjek

Den studerende løser en opgave, mens skuldermakker følger med og hjæl-per. Hvis de ikke er enige om løsningen, spørger de sideparret. Kan opgaven stadig ikke løses søges hjælp fra underviser. Der byttes roller og næste op-gave løses efter samme struktur. Når alle har løst en opgave sammenlignes resultat med sidepar.

Team-par-solo

Gruppen arbejder sammen om at løse en opgave. Underviser giver løsningen i plenum. Er opgaven løst korrekt, arbejdes der med næste opgave, men nu i par. Løsningen gives igen af underviser i plenum. Er opgaven korrekt, ar-bejdes der med næste opgave solo. Kan opgaven ikke løses, arbejder man sammen med sin skuldermakker om at løse opgaven. Kan opgaven stadig ikke løses samles gruppen, og opgaven løses i fællesskab. Man arbejder sig op og ned mellem gruppe-, par- og sololøsning af opgaver over tid.

Ekspertpuslespil

Forskellige opgaver deles ud til hvert medlem af en gruppe, en til hver. Gruppemedlemmet mødes med andre medlemmer fra andre grupper, som har samme opgave. Ekspertteamet arbejder sammen om at løse opgaven. Der forberedes en gennemgang af svaret. Alle vender tilbage til deres op-rindelige gruppe og præsenterer deres opnåede svar.

Beskrivelserne ovenfor er fokuseret på et eksperimentelt undervisnings-forløb, men i andre former for undervisning vil cooperative learning-strukturer også kunne benyttes. Ved for eksempel forelæsninger vil struktu-rerne kunne blive brugt som stop-strukturer, altså konstruktive afbrydelser af forelæsning for at bryde undervisningen op i mindre dele og foretage løbende evaluering af opnået læring. Det er oplagt at benytte "tænk-par-del" og "par-sammenligning" som afbrydelser.

Didaktiske overvejelser

Nogle strukturer er mere tidskrævende end andre, nogle er egnet til under-visning i mindre hold (op til 30), mens andre kan implementeres i undervis-ning uanset størrelse på holdet. Underviseren bør tænke didaktisk og vælge

hvilke strukturer, der passer til den givne undervisningssituation, faglige stof og læringsrummet.

I et undervisningsforløb hvor der indgår eksperimentelt arbejde, kan cooperative learning-strukturer for eksempel indarbejdes på følgende måde: Teoretisk introduktion til undervisningsforløb

- "Tænk-par-del" og "par-tjek" benyttes under indledende teoretisk gennemgang af stoffet, denne undervisningssituation vil oftest være sammenlignelig med en forelæsningssituation.

Brainstorming af forsøgsplanlægning

- Her kan der benyttes "ordet rundt" eller "en for alle strukturer".

Typeopgaver eller andre teoretiske færdighedsopgaver

- "Par-tjek" og "team-par-solo" strukturer er velegnede til at sikre, at alle har løst typeopgaver og haft mulighed for at verificere deres resultater.

Resultatanalyse, konklusion og refleksion

- Her kan "ekspert-puslespil" benyttes. Afhængig af undervisningsforløbet kan strukturen modificeres.

Denne gennemgang af et eksperimentelt undervisningsforløb viser, at cooperative learning-strukturerne kan benyttes i forskellige undervisningssituationer og passer udmærket ind et eksperimentelt undervisningsforløb, som indgår i en række kurser eksempelvis på KU-LIFE.

Cooperative learning i eget undervisningsforløb.

Mit undervisningsforløb "Biosyntesen af klorofyl" med en tidsramme på syv timer er en del af kurset "Biokemi 2".

Dele af læringsmål for hele kurset "Biokemi 2":

- Reflektere over eksperimentelle data i forhold til cases, tekstbogsstof og original litteratur
- Udføre en række centrale biokemiske analysemetoder
- Samarbejde med andre om gennemførsel og rapportering af laboratorieforsøg

I overensstemmelse med de overordnede læringsmål for kurset "Biokemi 2", som omhandlede laboratorieundervisning, blev mine læringsmål opsat. Mine opstillede læringsmål for undervisningsforløbet "Biosyntesen af klorofyl", var hovedsageligt fokuseret på det eksperimentelle arbejde, og der var stor fokus på at opnå kompetencer inden for specifikke teknikker, fortolke opnåede resultater og opnå højere taxonomisk forståelsesniveauer (Biggs & Tang 2007).

Læringsmål for undervisningsforløb i klorofyl biosyntese:

* Få kendskab til og prøve solvent ekstraktion, her bruges det til ekstraktion af fotosyntesepigmenter
* Introduktion og afprøvning af absorption- og fluorescence emissionmåling
* Introduktion til HPLC og kørsel af egne prøver
* Analysere HPLC-kromatogrammer opnået ved brug af photodiode array og fluorescence emissionsdetektorer
* Sammenholde og fortolke biokemiske og genetiske data for at opnå viden om biosyntesen af fotosyntesepigmenter

Rammen for undervisningen:
Ugen inden kursets start fik alle studerende udleveret øvelsesvejledning med undervisningsforløbets indhold.

* Mandag, 1 times introduktion.
* Tirsdag, 4 timers eksperimentelt arbejde.
* Fredag, 2 timers gennemgang og analyse af resultater.
* Efterfølgende aflevering af skriftlig rapport, der vurderes ud fra bestået eller ikke bestået og med skriftlig kommentar. I den udleverede øvelsesvejledning var kravene til rapporten beskrevet.

På baggrund af rammerne for undervisningen havde jeg fokus på to specifikke didaktiske udfordringer. Det var først og fremmest at få skabt en dialog mellem alle studerende, så alle fik mulighed for at involvere og engagere sig på trods af den sparsomme tidsramme. For det andet at sikre en tilstrækkelig grundig analyse af de opnåede eksperimentelle resultater, inden de studerende skulle skrive deres rapport. Sidst nævnte anså jeg som vigtig, idet rapporten skulle afleveres efter kursets afslutning, og dermed var hjælp og yderligere vejledning ikke let tilgængelig.

Ud fra de givne rammer valgte jeg at gøre brug af følgende strukturer fra cooperative learning i mit undervisningsforløbet:

- *Mandag* blev brugt til kort introduktion med en gennemgang af lærings-målene. De studerende blev konfronteret med en cooperative learning tænk-par-del struktur, hvor projektforslag, til hvordan man kan eluci-dere biosynteseveje af komplekse stoffer, blev diskuteret, og en kort gennemgang af nogle af de teknikker, som de studerende ville benytte i laboratoriearbejdet.
- *Tirsdag* foregik i laboratoriet med det eksperimentelle arbejde.
- *Fredag* lå de færdige resultater fra laboratoriearbejdet klar til de stude-rende. Der blev lavet en kort opsummering af læringsmålene, samt en introduktion til hvordan de studerende skulle analysere deres resultater.

Derefter blev der sat et modificeret ekspert-puslespil i gang. Min mo-dificering bestod af hver gruppe, som arbejdede sammen i laboratoriet var eksperter på deres resultater. Efter ekspertgruppen havde gennemgået svar, samledes der grupper med et medlem fra hver af ekspertgrupperne, hvor de enkelte ekspertgruppers arbejde blev præsenteret. Dette ekspert-puslespil blev sat til at vare en time, altså en længerevarende øvelse. Under denne øvelse var vi to undervisere tilstede, som sikrede at de ekspertgrupper, der ønskede hjælp, kunne få grundig hjælp, så korrektheden af analysen var højst mulig. Derefter var der en opsummering, igen med præsentation af læringsmål for at synliggøre at alle læringsmål var blevet behandlet. Halv-delen af de tre konfrontationstimer som undervisningsforløbet indeholdte tidsmæssigt blev altså benyttet til cooperative learning-strukturer.

Evaluering under og efter undervisningsforløbet

I det meget kompakte undervisningsforløb var det vigtigt for mig at sørge for, at de studerende fik mulighed for en løbende formativ evaluering af den forventede læring. Dette tilgodeså jeg ved hjælp af, at de studerende arbejdede med strukturerne fra cooperative learning, hvor alle de studeren-de skulle deltage i faglige dialoger. Hermed gav det mig som underviser den mulighed, at jeg på skift kunne lytte med i gruppernes faglige samtaler og bidrage med for eksempel forklaringer på undrende spørgsmål og stille de studerende udfordrende spørgsmål. Dette gav mig selv som underviser et godt overblik over de studerendes læring, udbytte af undervisningen og opfyldelse af læringsmålene.

De studerendes aflevering af en rapport lagde meget ensidigt op til at evalueringen af de studerendes udbytte af undervisningen udelukkende blev

en summativ form for evaluering. Dette forstærkedes af det praktiske forhold at jeg kun kunne give de studerende en skriftlig tilbagemelding.

De studerendes rapporter vurderede jeg summativt med "bestået" eller "ikke bestået". Hertil ønskede jeg at give de studerende bedst mulig feedback på deres arbejde og den læring de havde tilegnet ved hjælp af en mere formativ evaluering. Derfor lavede jeg et retteark, hvor jeg skrev korte kommentarer til hver enkelt rapport omkring rapportens styrker, mangler og konkrete ideer til, hvordan den faglige, skriftlige dokumentation kunne forbedres.

Jeg ville have fortrukket at kunne have lavet en dialogisk mundligt formativ evaluering af de studerendes læring. Dette kunne have været gjort, hvis de studerende havde arbejdet med peer-review af hinandens rapporter. Under dette arbejde ville jeg kunne nå ud til hver af de arbejdende gruppepar og give min feedback på rapporten og opnåede læring. Forløbet kunne så samles med en kort generel fælles opsamling.

Egne refleksioner over cooperative learning i laboratorieundervisning

I min undervisning oplevede jeg tre generelle udfordringer som underviser ved at benytte cooperative learning-strukturerne:

- Introduktion af strukturen
- Tidsrammen for strukturen
- Læringsrummet

Gennemførelsen af cooperative learning-strukturerne krævede mere introduktion, end den jeg faktisk leverede. Cooperative learning-strukturerne var nye for de studerende, og de var derfor ikke på forhånd bekendte med betingelserne for at deltage i strukturerne. Dette problem afhjælpes selvfølgelig, når cooperative learning-strukturer bruges oftere og mere generelt.

Det er vigtigt som underviser at fastsætte tidsrammer for cooperative learning-strukturerne. Det kan være fristende at lade en konstruktiv og givende dialog forsætte, men for at sikre at man gennemgår og når den planlagte undervisning, skal der være en tidsstyring. Dette kommer også til at gælde som styring for de studerende, så de kan strukturere arbejdet i gruppen. Denne tidsstyring blev ikke korrekt implementeret af mig. Jeg kom under tidspres, fordi kommunikationen var konstruktiv. Dette gjorde, at jeg

ikke nåede at gennemføre hele den planlagte undervisning. Dette skal for-
bedres i min kommende undervisning.

Under gennemførelsen af strukturerne var der flere samtaler i gang sam-
tidig, og der var studerende som byttede plads undervejs. Læringsrummet
kunne forstås som uroligt og ukonstruktivt, en situation som undervisere
normalt vil undgå. Det kan derfor kræve en tilvænning til en anden under-
viserrolle, der er radikal anderledes end en traditionel forelæsende under-
viser på universitetsniveau. Denne omstilling var ikke vanskelig for mig.
At "give slip" på læringsrummet kræver troen på, at der foregår læring i
kommunikationen mellem de studerende.

De to strukturer, jeg arbejdede med i mit undervisningsforløb udviklede
sig positivt, og eleverne fik hurtigt en kommunikation i gang. Dog er der
nogle ting, jeg efterfølgende synes kunne ændres således at de ønskede mål
for undervisningen blev tilgodeset på en bedre måde. "Tænk-par-del" var
nem at sætte i gang, da de studerende kendte denne struktur fra mange
forskellige undervisningssammenhænge. "Tænk-par-del" strukturen vil jeg
nok ændre til en "par-sammenligning", da jeg tror, at denne struktur vil
inkludere flere studerende i dialogen. Ved brug af "par-sammenligningen"
vil den afsluttende samtale på klassen tidsmæssigt kunne begrænses, da
alle de studerende har været igennem to samtaler under gennemførelse af
cooperative learning-strukturen.

"Ekspert-puslespillet" fungerede rigtig godt. Ude i ekspertgrupperne
var det tydeligt for mig, at alle gjorde deres bedste for at forstå teorien bag
det eksperimentelle forsøg og lave en holdbar analyse af forsøgsresultater
og på den måde være i stand til at kunne kommunikere deres opnåede
forsøgsresultater videre til deres medstuderende. Det høje engagement
smittede af på de studerende, når de skulle være lyttende til en gennem-
gang fra en anden studerende fra gruppen. Dynamikken i læringsrummet
var rigtig god. De studerende var støttende over for hinanden og fik svar
på mange undrende spørgsmål. Den dialog, der blev ført i alle grupperne,
nåede et højt fagligt niveau.

Afsluttende evaluering

I min undervisning opnåede jeg en aktiv deltagelse fra alle de studerende,
engagementet var højt, og alle ville gerne bidrage. I arbejdet med de to
strukturer fra cooperative learning var der en god, konstruktiv og faglig
dialog mellem de studerende. De udfordrede hinanden med spørgsmål, fik

svar på det, de undrede sig over og hertil fik alle sat ord på undervisningens faglige indhold.

Ved på skift at observere de studerendes dialoger havde jeg mulighed for at have fokus på enkelte elever, grupper eller på hele holdet. Jeg følte, jeg havde et frirum, hvor jeg kunne deltage i dialogen, vejlede, lytte, stille spørgsmål med videre alt efter det behov, der var. Ud fra dialogernes faglige indhold og niveau kunne jeg evaluere min egen undervisning og dermed justere undervisningens indhold således at læringsmålene blev indfriet.

Tilbagemeldingen fra de studerende var meget positiv omkring cooperative learning-strukturerne. De synes godt om udfordringen omkring den faglige dialog og om at være mere deltagende i undervisningen. Den øgede deltagelse og dialogen blev af de studerende set som et højere læringsudbytte. De studerende fandt det lettere at stille undrende og opklarende spørgsmål i de mindre grupper, og hertil synes de, at de i højere grad fik hjælp og vejledning til lige netop det, som de havde behov for.

Evalueringen af de studerendes afsluttende skriftlige rapport var også positiv. Niveauet for de afleverede rapporter var generelt meget højt, og det var tydeligt at alle grupper havde opnået indsigt i fremgangsmåden til at analysere deres forsøgsresultater.

Afsluttende kommentarer

Min undervisning i "Biokemi 2" var en del af den superviserede undervisning, der foregår igennem KNUD-kurset. Mit overordnede mål for den superviserede undervisning var at afprøve dialogbaseret undervisning.

Jeg ønskede at bringe mig selv som underviser væk fra en forelæsende lukket rolle og ind i en mere åben kommunikativ undervisningsrolle. Udover dette vil jeg gerne ændre min forberedelse væk fra at producere præsentationsmateriale til at arbejde didaktisk hen mod øget kommunikation med og mellem de studerende. Øget kommunikation i undervisningen vil flytte fokus fra for eksempel slides til dialogen.

Jeg vil komme til at bruge cooperative learning-strukturer i min kommende undervisning. Eksperimentelle undervisningsforløb er oplagte til at inkludere cooperative learning-strukturer i.

Jeg vil derudover introducere cooperative learning-strukturer som læringsform til andre undervisere, jeg samarbejder med. Jeg er overbevist om, at undervisning kan løftes ved at inkludere cooperative learning-strukturer.

Indføring af peer-assessment og øget studenteraktivering i et kortvarigt øvelsesforløb

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Indledning

Peer-assessment er en meget virksom aktivitet, som kan indgå i den formative feedback, de studerende får i løbet af et kursus. Ved denne type formativ evaluering kan de studerende få klarlagt hvor de står i deres indlæring og dermed få hjælp til at bevæge sig i den rigtige retning i læringsprocessen (Biggs & Tang 2007, kap. 9). På den norske højskole i Østfold blev der indført forskellige aktiviteter med gensidig studentervurdering – peer-assessment – i matematikundervisningen og det resulterede i et markant fald i dumpe-procenten fra 54% til 15% (Muugesten & Lauvås 2004). Aktiv deltagelse og det at forklare teorien for ens medstuderende er altså vigtige elementer for indlæringen, og det er disse elementer, jeg vil indføre i et kortvarigt øvelsesforløb, der strækker sig over kun to uger.

Baggrund

"Enzymology and Experimental Biochemistry" er et kandidatkursus (7.5 ECTS) der udbydes til 30 kursister i blok 2 på KU-LIFE. Kurset består af forelæsninger samt teoretiske og eksperimentelle øvelser. Labøvelserne vægtes højt med 9 ud af 12 timer per uge og kurset afsluttes med en mundtlig eksamen. Mere information findes på kursets hjemmeside: http://www.kursusinfo.life.ku.dk/Kurser/230006.aspx (25. juli 2011).

Immunokemiske teknikker er et nyligt indført delelement i kurset. Undervisningsdelen har hidtil forløbet sig over 20 timer fordelt på tre dage, to

hele og én halv dag, og det består af en enkelt indledende forelæsning, én teoretisk øvelsestime og labøvelser. Labøvelser afsluttes med en teoretisk opsamling ved klasseundervisning, hvor holdene efterfølgende arbejder på en rapport, som skal afleveres den efterfølgende dag. Der har hidtil været maks. antal deltagere i kurset, og øvelsesforløbet har været meget presset, da det er nogle lange laboratorieøvelser, som skal indpasses på kort tid og faciliteterne er ikke optimale til det store antal deltagere. Immunokemiske teknikker er placeret sidst i undervisningsblokken, og der er minimal inddragelse af Immunokemiske teknikker i den mundtlige eksamen. Derfor evalueres de studerende ved denne del kun ved godkendelse af den afsluttende rapport med underviserens kommentarer som feedback.

Sidste år startede jeg med at være laboratorieøvelseslærer i Immunokemiske teknikker og jeg skal have samme øvelsesforløb igen i år. Min opfattelse af forløbet fra sidste år var, at de studerende arbejdede koncentreret i laboratoriet med fokus på korrekt håndtering af reagenser, protokoller og udstyr, samt fokuserede på at producere resultater. Efter min opfattelse var der dog for meget ventetid i laboratoriet, som ikke blev optimalt udnyttet.

Overraskende viste det sig, tydeliggjort i den afsluttende rapport, at mange af de studerende havde svært ved at analysere deres data, såsom at lave en standardkurve og beregne detektionsgrænse. Noget som burde være relativt simpelt på dette uddannelsestrin, men alligevel noget der skabte problemer. Endelig tydede de endelige rapporter også på, at flere ikke havde opnået forståelse for formålet med øvelserne og havde svært ved at sammenholde de analyserede data med teorien.

Det overordnede formål med det eksperimentelle arbejde i Immunokemiske teknikker er, at de studerende skal opnå forståelse for antistofbaserede teknikker og forstå fordele og ulemper ved de forskellige teknikker. Læringsmålet for denne del er i overensstemmelse med nogle af de Intended Learnings Outcome's (ILO'er), som er opstillet i kursets læringsmål og som omfatter flere niveauer i SOLO taxonomiem (Biggs & Tang 2007, kap. 5). Men de Teaching and Learning Activities (TLA'er), som har været anvendt i forbindelse med øvelsen, har umiddelbart ikke været konstruktivt aligned, da målbeskrivelsen og undervisnings- og læringsaktiviteterne ikke har været på linje med hinanden.

Af praktiske grunde er problemet og metoderne i det eksperimentelle arbejde lukket forud for øvelserne, mens svaret er åbent (Tamir 1989). Men eftersom kurset er et kandidatkursus, er det forventeligt at de studerende allerede har opnået en vis teknisk kompetence i laboratoriet. Ved at lade problem og metode være lukket kan de studerende få ro til at opbygge ru-

tine i deres praktiske laboratoriumkompetencer og i stedet fokusere på det åbne svar. At have et øvelsesforløb med ingen rigtige svar er udfordrende for de fleste studerende, da de skal til at udvikle og benytte nogle af de såkaldte 'High level'-kompetencer. Disse indeholder elementer såsom validering af assays, være kritisk overfor opnåede data, samt resonere logisk over opnåede data og teori (Wood 1996).

Ud fra besvarelserne i den afsluttende rapport tyder det dog på, at udførelsen af øvelserne ikke har styrket de studerendes kompetencer i at kunne ræsonnere over de opnåede resultater og den forelæste teori, og ej heller i at kunne udføre relative simple dataanalyser. I dette projekt vil jeg derfor give et teoretisk oplæg til, hvordan man kan indlægge formativ feedback primært ved peer-assessment i Immunokemiske teknikker, da formativ feedback undervejs i læringsprocessen er en vigtig TLA, specielt når studerende skal opnå både praktiske og High Level-kompetencer i et laboratorium (Wood 1996). Samtidig vil jeg revidere øvelsesvejledningen for at forøge studenteraktiviteterne i laboratoriet. Alle nyindførte TLA'er har til formål at øge indlæringen, og som bonus vil tiltagene afhjælpe på ressourcekrævende forberedelsestid for underviserne.

Problemformulering

Vil indførelse af peer-assessment og øget studenteraktivering i et kortvarigt øvelsesforløb forbedre de studerendes indlæring?

Planlægning af Immunokemiske teknikker

I modsætning til de forrige år vil Immunokemiske teknikker strække sig over to fulde uger, det vil sige to hele samt to halve dage, og vi vil dermed få en ekstra halv dag til rådighed. Dette har afhjulpet lidt på planlægningen af kurset og med de planlagte ændringer kommer øvelsesforløbet til at se ud med følgende TLA'er (se appendiks A for en detaljeret undervisningsplan, hvor der er kalkuleret med et maksimum antal kursusdeltagere, som samlet udgør ti hold med tre studerende per hold).

TLA'er i det reviderede øvelsesforløb

1. Teoretisk gennemgang
2. Teoretiske øvelser med peer-assessment

3. Prælab spørgsmål
4. Laboratoriearbejde med indlagte spørgsmål til det praktiske arbejde
5. Resultatanalyse og udarbejdelse af rapport
6. Evaluering ved peer-assessment af rapport

Ad 1) Forud for Immunokemiske teknikker udleveres et kompendium som der forelæses i den første øvelsesdag. Hidtil har der været afsat $2\frac{1}{2}$ time til denne forelæsning, efterfulgt af en times teoretiske øvelser. I den reviderede planlægning vil jeg afsætte tre timer til forelæsningen for at få ekstra tid til at indføre studenteraktiverende elementer. Dette gøres med henblik på at træne og tvinge de studerende til at diskutere med hinanden, og også for at få en mere interaktiv kommunikation med underviseren. Endelig vil sådanne aktiviteter opretholde de studerendes opmærksomhed, som generelt falder drastisk allerede efter ca. 15 minutters forelæsning (Biggs & Tang 2007, kap. 7).

Helt konkret vil jeg indlægge to større pauser samt mindre aktiviteter hvert 20. minut. Aktiviteten kan være at de studerende får til opgave at sidde i et par minutter og tænke over, hvilke ting de ikke forstår og derefter tale med sin sidemand om det uklare i forståelsen. En anden aktivitet kan være at man fortæller sin sidemand i store træk, hvad der netop er blevet forelæst om, gerne to gange, hvor den sidste aktivitet er placeret umiddelbart sidst i forelæsningen for at øge dybdelæringen. Endelig skal underviseren fortsætte med løbende at stille spørgsmål ud til de studerende og gerne med dialogisk karakter, hvor der stilles åbne spørgsmål til de studerende og derigennem lede de studerende frem til det, der skal læres.

Ad 2) De teoretiske øvelser var før fastlagt til én time hvor de studerende sad i grupper og løste opgaverne, mens underviseren løbende og efter behov gennemgik opgaverne på tavlen. Denne gang vil de studerende få ca. 45 minutter til løsning af opgaverne individuelt. Her vil jeg pointere vigtigheden af, at man har arbejdet på opgaven og nedskriver kommentarer om, hvilke problemer der er opstået, hvis opgaven ikke kan løses. Efterfølgende har de 45 minutter til holdvis at rette et andet holds opgaver. Afslutningsvis vil underviseren følge op på opgaverne i plenum (Appendiks B). Svarene skal efterfølgende uploades til Absalon.

Ved denne øvelse får de studerende tid til først selvstændigt at tænke opgaverne igennem, og ved den efterfølgende peer-assessment af opgaverne vil de blive yderlige aktiveret til at diskutere opgaverne. Alt sammen noget som vil bidrage positivt til læringsudbyttet.

Ad 3) I laboratorieøvelsesvejledningen vil der blive indført en række prælab-spørgsmål, som skal besvares skriftligt, mens den studerende forbereder sig på øvelsen og altså inden start i laboratoriet (Appendiks C). Spørgsmål 1-7 behandler den indledende teoridel i øvelsesvejledningen, og jeg har fokuseret på de områder, som tidligere har vist sig at skabe problemer under rapportskrivningen. I spørgsmål otte skal de studerende lave et flowdiagram over hver af de tre eksperimentelle øvelser, og gennemgang af dette spørgsmål skal foregå i plenum inden start i laboratoriet. Jeg mener, det er vigtigt at netop dette spørgsmål skal gennemgås inden start i laboratoriet, da det vil være med til at give de studerende et overblik over, hvad de skal igennem. Spørgsmål 1-7 skal diskuteres i grupper af to hold i laboratoriet, når der er ventetid. Jeg har planlagt at de hold, der skal evaluere hinanden, udfører de samme øvelser i laboratoriet og har derfor ventetider på samme tidspunkter. Endelig skal diskussionen af prælab-spørgsmålene foregå i uge et, dag to, hvor der vil være en del uudnyttet ventetid, eftersom holdene endnu ikke har resultater, de kan analysere på.

På grund af tidspres og apparaturbegrænsning sidste år måtte enkelte hold få delvist bearbejdet materiale til at arbejde videre på. Disse hold nåede derfor ikke at arbejde alle tre deløvelser igennem. Det mener jeg ikke er hensigtsmæssigt, da forståelsen for øvelsen er bedst, hvis man selv har været aktiv fra start til slut. Hvis alle ti hold skal nå alle tre deløvelser igennem, er det nødvendigt at laboratoriearbejdet strækker sig over alle fire dage. Jeg har derfor måtte indføre en kort labøvelse på dag et efter forelæsningen. Mit ønske om at gennemgå prælab-spørgsmål otte som det første inden start i laboratoriet, har jeg derfor måtte vente med at indføre på dag to for at få tiden til at passe.

Ad 4) I den reviderede øvelsesvejledning har jeg indført opklarende spørgsmål undervejs i protokollerne (Appendiks D, kun spørgsmål er opgivet, men de er normalt indsat lige under de relevante trin i protokollen). Formålet er at tvinge de studerende til at tænke over, og diskutere undervejs, hvad det rent praktisk er, de står og laver og hvorfor. Det er relative simple spørgsmål, da det ikke skal volde de studerende for meget besvær eller forårsage at der laves fejl i det eksperimentelle arbejde. Evalueringen vil foregå ved at underviseren går rundt og giver feedback til de enkelte hold, da det ikke skal påvirke flowet i øvelserne.

Endelig har jeg gjort hele øvelsesvejledningen mindre "kogebogs-agtige" ved at de studerende selv skal lave de fleste reagenser og udregne fortyndingerne dertil. På den måde bliver de studerende i højere grad aktiveret

ved hvert enkelt step og de opnår forhåbentlig større ejerskab i øvelserne og dermed øget motivering.

Ad 5) På grund af den sene placering af Immunokemiske teknikker, er de studerende meget stressede over at de snart skal til eksamen. Derfor er der mindre fokus på denne sidste øvelse, hvilket er noget, der gør rapportskrivning til en stor stressfaktor. Jeg vil derfor have fokus på at få de studerende til at indse, at det er vigtigt at resultatanalyser og rapportskrivningen skal udarbejdes løbende, når der er tid i laboratoriet. På den måde kan det forhåbentligt undgås at de studerende sidder og knokler med at færdiggøre en hel rapport i sidste øjeblik. Jeg har planlagt at der kun er én øvelse ud af tre, som skal færdiggøres i laboratoriet den sidste dag. Derfor burde det give de studerende tid nok til at færdiggøre deres rapport til den sidste dag om eftermiddagen, hvor den så skal afleveres til peer-assessment. De studerende får fra start en skabelon til rapporten, som de løbende kan udfylde med data. Kun forsiden af rapporten er medtaget (Appendiks E).

Ad 6) Den endelige rapport skal rettes ved peer-assessment således at de studerendes arbejde evalueres samme dag som aflevering. Jeg mener, det er vigtig at den bliver afleveret og evalueret den samme dag, da eksamen som før nævnt er tæt på og de studerende skal føle sig frigjorte til eksamensforberedelse, når sidste dag i denne øvelse er afsluttet. Peer-assessment vil foregå ved at man holdvis sidder og retter et andet holds rapport. Der afleveres kun én rapport per hold. Ud over at rette rapporten skal de studerende skrive en evaluering og i den forbindelse give en karakter for det samlede arbejde. Ved at rette andres opgaver eller projekter og sammenligne dem med deres egen besvarelse, vil det få de studerende til bedre at reflektere over deres eget arbejde og hvor godt de selv har opfyldt de givne kriterier. Endelig vil de studerende lære at rate andres arbejde, samt give konstruktiv kritik. Karaktergivning er ment som en øvelse, da den ikke vil have indflydelse på kursusbeståelse. Men det er en rigtig god træning og endelig kan det også virke meget motiverende på udarbejdelsen af rapporten, hvis de studerende fra start ved at det er medstuderende, som skal evaluere og give karakter på arbejdet.

Udførelse og evaluering af det reviderede øvelsesforløb

Det er ikke muligt at afprøve de planlagte ændringer og tiltag i praksis, da kurset først afholdes i blok 2, 2011-12. Men for at evaluere ændringerne er to tidligere kursister blevet interviewet med fokus på erfaring med peer-

assessment og studenteraktivering, samt for at belyse tilfredshedsgraden af ændringerne af øvelsesforløbet. Spørgsmål anvendt ved fokusgruppeinterview ses i appendiks F, hvor også besvarelserne er indsat. De to tidligere kursister kaldes for A og B.

I første del af interviewet bliver de generelt spurgt om, hvilke aktiviteter der giver dem en god læring i en laboratorieøvelse og om de har erfaring med prælab-spørgsmål og peer-assessment. Efterfølgende kommer fokus på Immunokemiske teknikker og hvordan de forskellige undervisningsformer virkede på deres indlæring og om tiden var tilpas disponeret i forløbet. Endelig bliver de præsenteret for appendiks B, C, D (Peer-assessment af teoretiske øvelser, Prælab-spørgsmål og Opklarende praktiske spørgsmål til det eksperimentelle arbejde), og deres holdning til de forskellige tiltag og ændringer øvelsesforløbet belyses.

Resultater og diskussion

I den generelle del af fokusgruppeinterviewet var det mest påfaldende at begge deltagere får mest ud af en laboratorieøvelse, når de skal til at skrive den efterfølgende rapport. De føler ikke at prælab-spørgsmål bidrager til deres læring og specielt ikke, hvis underviseren ikke følger op på spørgsmålene. Endelig havde kun kursist B prøvet at lave peer-assessment og hun var meget positiv over for det. Kursist A havde ikke prøvet det og mente at man som studerende virkelig skulle se ideen i det, og at det skulle være godt planlagt, før man ville bruge energi på det.

Begge kursister havde svært ved at genkalde det præcise forløb i Immunologiske teknikker. Men den generelle opfattelse var at der var meget ventetid i laboratoriet og at det var kaotisk i laboratoriet, da reagenserne ofte ikke var til at finde. Ingen havde overblik over øvelsen inden start, men det frustrerede dem ikke, da det er noget, de er vant til. Endelig gav de udtryk for, at det var et meget uheldigt tidspunkt øvelsesforløbet lå på, da den kommende eksamen tog meget fokus fra øvelsen og rapporten. Dette var uheldigt, da både A og B opfattede øvelsen som rigtig god og spændende.

Med hensyn til de tiltag jeg har planlagt i øvelsesforløbet, var de generelt positive stemt over for de forskellige aktiviteter. Dog var de meget bevidste om, at det ikke måtte være for indviklet at udføre peer-assessment til de teoretiske øvelser, at man skal vide på forhånd præcist, hvor meget de enkelte besvarelse skal fylde og endelig at man skal have de rigtige svar til opgaven udleveret, men først efter aktiviteten er gennemført.

De praktiske laboratoriumspørgsmål samt spørgsmål otte i prælab-spørgsmålene, var begge kursister meget begejstrede for. De mente at det var noget, som virkelig kan hjælpe på forståelsen af øvelsen, og de ved at det lige præcist er sådanne ting, man ikke tænker over, når en protokol følges. Prælab-spørgsmål 1-7 blev også positivt modtaget. Dog var de skeptiske over, om man som studerende ville være disciplineret nok til at gå sammen holdvis og diskutere spørgsmål. De mente at det måtte være underviserens opgave at sætte holdene sammen og også at tjekke om spørgsmålene besvares. Men ellers mente de at det ville være godt at diskutere teorien med medstuderende.

Begge kursister mente at peer-assessment af rapporterne var en rigtig god ide og de mente også at det kunne lade sige gøre rent tidsmæssigt. De fandt det også vigtigt at holdene skulle skrive en fyldig evaluering til rapporten og ikke bare en linie med god eller dårlig. Endelig foreslog de at besvarelserne til prælab-spørgsmål samt de praktiske lab spørgsmål skulle vedlægges rapporten og derved også bedømmes. De begrundede det med at de studerende vil nedprioritere den type spørgsmål, hvis de ikke skal afleveres og rettes. Endelig er det vigtigt at alle skal have de rigtige svar udleveret til både prælab, praktiske spørgsmål og til rapporten. Men først efter peer-assessment af rapporten er overstået og evaluering samt karakteren er afgivet. Underviseren kan derefter få en kopi af alle rapporter og evalueringer, og efterfølgende sende kommentarer over mail, hvis der er noget helt galt eller rigtig godt.

Fokusgruppeinterviewet viser, at det er meget vigtig for de studerende at der bliver fuldt op på deres arbejde, uanset hvilke type det er. De føler ikke det er nok "bare" at diskutere teori med medstuderende og derved opnår en bedre læring. De skal se en mening med det og meningen er i dette tilfælde at det skal afleveres og de skal have et svar fra underviseren, om det er rigtigt eller forkert. Jeg ved fra sidste år at nogle af de svar, de studerende får i laboratoriet er meget åbne. Men hvis man træner de studerende til at diskutere på spørgsmål i de teoretiske øvelser, Prælab og praktiske spørgsmål inden, kan det måske hjælpe dem til at diskutere på de opnåede "åbne" svar fra labøvelserne og derved bedre kunne resonere logisk over deres data og teori.

Det er yderst vigtig at man gør det klart og tydeligt for de studerende hvilke opgaver og spørgsmål, der skal besvares, hvornår det skal laves, hvor meget det skal fylde og hvordan det skal evalueres. Så selvom de studerende er på kandidatniveau, skal de stadig have klar besked om, hvad der forventes af dem. Jeg har imødekommet disse behov ved at give klare instrukser i

starten af hver aktivitet, der er indsat i den reviderede udgave. Ved planlæg-
ning og udførelse af en aktivitet, for eksempel ved holdsammensætning til
peer-assessment, er det også underviseren, der er ansvarlig for at organisere
og iværksætte aktiviteten, da det ikke er noget, de studerende gør frivilligt
eller selv kan tænke/læse sig til. I den forbindelse mener jeg også at det er
vigtigt at sætte forskellige hold sammen ved hver ny session, da de stude-
rende på den måde får flere synsvinkler på teorien i stedet for kun at se det
fra de samme tre holdmedlemmer igennem hele forløbet.

Konklusion og perspektivering

I min problemformulering ønskede jeg at undersøge om indførelse af peer-
assessment og øget studenteraktivering i et kortvarigt øvelsesforløb vil for-
bedre de studerendes indlæring. Jeg har nu revideret at kortvarigt øvelses-
forløb og fået indført flere formative feedback elementer blandt andet ved
peer-assessment, så teoretisk kan det godt lade sig gøre. Samtidig mener jeg
at de indførte TLA'er nu er bedre på linje med nogle af målbeskrivelserne i
kurset. Om det reelt vil forbedre indlæringen må afprøves næste gang kur-
set forløber. Men umiddelbart blev tiltagene meget positivt modtaget af to
tidligere kursister. Disse gav udtryk for at det var en hel klar forbedring at
indføre de forskellige studenteraktiverende elementer og at det gerne måtte
indføres i hele kurset.

Hvis tiltagene viser sig at styrke de studerendes læring, må det næste
skridt være at indføre flere af de samme aktiviteter i resten af kurset. Peer-
assessment af alle rapporter i dette kursus ville eventuelt være en god akti-
vitet at indføre. De studerende kunne give karakter til hinanden og lade gen-
nemsnittet af disse vægte en mindre procentdel i den samlede bedømmelse
efter den individuelle summative evaluering. På den måde ville kurset bliver
mere konstruktivt aligned, da målbeskrivelsen, undervisnings- og lærings-
aktiviteterne samt eksamen er bedre på linje med hinanden.

A Undervisningsplan

<u>Uge 1</u>
Dag 1. Tirsdag kl. 8-12:
- Forelæsning, 3 timer med indlagte pauser og studenteraktiverende elementer
- Kort lab intro (kun til coating) + coating til Sandwich og Competetive ELISA

Dag 2. Torsdag kl. 8-10.30:
- Besvarelse af Teoretiske øvelser (45 minutter)
- Holdvis retning af hinandens opgaver (45 minutter)
  Byt og evaluering: Hold 1+10, Hold 2+9, Hold 3+7, Hold 4+6 og Hold 5+8
- Afsluttes med opfølgning i plenum

Dag 2. Torsdag kl. 11-16:
- Gennemgang af Flowchart, pkt 8 i prælab spørgsmål i plenum
- Hold 1-4: SDS PAGE og Immunoblot
- Hold 5-8: Competetive
- Hold 9-10: Competetive
  I ventetiden går Hold 1+2, Hold 3+4, Hold 5+6, Hold 7+8 og Hold 9+10 sammen og diskuterer prælab spørgsmålene. Underviseren går rundt og giver feddback til diskussionen

<u>Uge 2</u>
Dag 3. Tirsdag kl. 8-12:
- Hold 1-4: Inkubering + Sandwich
- Hold 5-8: SDS PAGE og Immunoblot + Sandwich
- Hold 9-10: Sandwich + SDS PAGE (afslutning af immunoblot udføres af underviseren)

Dag 4. Torsdag kl. 8-14:
- Hold 1-4: Competetive + Rapport
- Hold 5-8: Inkubering + Rapport
- Hold 9-10: Inkubering + Rapport

Dag 4. Torsdag kl. 15-17:
- Aflevering af Rapport
- Byt og evaluering, samt karaktergivning:
  Hold 1+5, Hold 2+7, Hold 3+8, Hold 4+9 og Hold 10+6

B Theoretical exercises

Answer individually in written form the following 8 questions. Two or three sentences per sub question are to be expected.

NOTE: If you don't know the answer for some of the questions, write down your thoughts on the difficulties in answering the question. You have 45 min.

After 45 min, hand in your answer to team X (se blackboard) and discuss and correct in your respectively teams the answers from team X. You have 45 min.

The teacher will clarify uncertainties in plenum at the end of the lesson and the answers will be uploaded on Absalon afterwards.

1. State major differences in polyclonal and monoclonal antibodies, as regards:
   a. Production
   b. Specificity
   c. use in precipitation assays.
   d. interference of contaminants.
2. Discuss disadvantages and advantages of using polyclonal and monoclonal antibodies, respectively, in
   a) immunoblotting.
   b) rocket immunoelectrophoresis.
   c) competitive ELISA.
3. A monoclonal antibody towards a low molecular compound (Mw~300 Da) is available and an immunochemical assay has to be established. Suggest an assay and make a draft of how to perform it.
4. An antibody binds to the N-terminal of a small peptide. Discuss the antibody binding if the pH is
   a) changed from neutral pH to pH 10.
   b) changed from neutral pH to pH 4
5. An assay for a specific plant enzyme present in very low amounts is to be established in the lab. Discuss the advantage/disadvantage of using an immunochemical method as opposed to measure the enzyme activity.
   Advantage:
   Disadvantage:
6. An enzyme is heat-treated and it has lost its activity when measured by an enzymatic assay. When measured by an immunochemical method, however, there is no difference in the measured amount of enzyme. What does this tell about the antibody/the epitope?
7. A monoclonal antibody has an affinity for a protein of Kd ~ 10^{-8} M. Two other cross-reacting protein binds to the antibody with a Kd ~10^{-7} and 10^{-9}M, respectively. How much of either of the cross-reacting protein should be added to reduce the antibody's binding to the original protein?
8. A protein with a pI = 6 is to be purified by immunoaffinity chromatography. The protein binds to the column at neutral pH. Suggest appropriate elution conditions.

C Immunochemical techniques for quantification and characterization

Prelab questions

Answer in written form the following eight questions during preparation of the lab exercises. Two or three sentences per question are to be expected.

The answers must be <u>completed prior to the exercises</u> and they will be evaluated by fellow students in spar-time during the lab exercises.

NOTE: Answers must also be included in the final report.

1. What do KSTI and BBI have in common and what are the differences between the two proteins?

2. Is it a good approach to use antibodies for quantifications of the two inhibitors in the same sample? Why?

3. List a number of advantages that ELISA have over immunoblotting

4. How many antibodies are needed for respectively Sandwich and Competitive LISA? Why?

5. Define *detection limit* in regards to quantitative ELISA

6. Explain in your own words what *the analytic sensitivity* means

7. Explain in your own words what is meant by *Matrix effects*.

8. Draw a simple flow chart of the experimental work of the three analysis you are going to perform:

    1. Sandwich ELISA to measure the content of KSTI in extracts of soy and chick pea.
    2. Competitive ELISA to measure the content of KSTI and BBI in extracts of soy and chick pea.
    3. Immunoblotting to determine the antibody specificities of the antibodies used in ELISA.

D Experimental

Questions in the experimental procedures must be answered in teams <u>during</u> the exercises. Two or three sentences per question are to be expected and the teacher will give feedback on your answers during exercises.
NOTE: Answers must also be included in the final report.

- *Why is it important to use carbonate buffer when diluting the antibody used for coating, when the remaining reagents must be diluted with PBS-Tween?*

- *Why do we dilute the samples?*

- *Explain the purpose of adding TMB substrate prior to visualization*

- *Why is it important to use new tips and trays for each antibody?*

- *Explain why antibody and sample are pre-incubated in an uncoated plate*

- *Define 'reduced' and clarify why we are analyzing both reduced and non-reduced samples*

- *Ad 19) What will your observations tell you?*

- *Why is skimmed milk added to the TBS-T buffer when incubating for 60 min?*

E Immunochemical techniques

Final Report

<u>Deadline for Final Report: 2 pm on the last day of exercises (date)</u>

Note: Answers from 'Prelab questions' and 'Questions in the experimental procedures' must be handed in together with the Final Report.

The Report, including 'Prelab questions' and 'Questions in the experimental procedures', will be evaluated by teams of fellow-students from 3 to 4 pm on the last day of exercises (date) Room X. See blackboard for which teams are evaluated each other.

Each team must write down an evaluation (½ to 1 page) of the report and grade the work. The grading <u>will not</u> be used in the final exam. It is only meant for practice.

After evaluation, the reports and evaluations will be returned to the owner teams.
A copy must be handed over to the teacher, who will comment it further.

Answers to 'Prelab questions' and 'Questions in the experimental procedures' and also the comments to the final report will be uploaded to Absalon afterward.

The teachers will assist with printing and copying of the reports and evaluations.

Team no.: _____ .

Experiments carried out by (student numbers and names): _____

_____

_____

Report written by: _____

_____

Report accepted on ___20___ By _____

Teacher's comments:

Data processing

F Fokusgruppeinterview, interviewguide

Beskriv hvad det er der gør at I får en god læring ved en labøvelse

Forberedelsen
Intro af underviseren
Det eksperimentielle arbejde
Udarbejdelse af efterfølgende rapport

- A: *Det er en blanding af det hele, vejledningen er ikke nok, og en opsamling er meget vigtig: Hvilke resultater er der kommet og hvorfor, gerne i hele klassen. Spørgsmål kan hurtigt bare blive besværet, men hvis der er mange små øvelser og der mangler opsamlingen til sidst kan det blive et problem til sidst.*

- B: *det er det eksperimentielle og rapporten, hvis jeg skal vælge noget. Jeg tænker mest over tingene når jeg skal skrive rapporten.*

Har du erfaring med Prælab spørgsmål

Hvis ja, hvordan blev der fulgt op på dem
Følte I at det hjalp på forståelsen af øvelsen
Hvis nej, ville du få en bedre indlæring ved indføring af prælab spg

-A; *ja, det har jeg prøvet. Der mangler opfølgning på spørgsmålene. Det kommer an på hvad det er for nogle spørgsmål, f.eks. hvis man allerede har udregnet koncentrationer, men om spørgsmålene bliver besvaret først eller til sidst er det ligegyldigt. Samlet introduktion er bedre.*

-B; *ja, men jeg kan ikke bruge dem for der bliver ikke fulgt op på dem. Men jeg bruger mest resultaterne. Udregninger kan være godt, men spørgsmål til teori kan man lige så godt svare på i rapporten.*

Har du erfaring med at rette og evaluere med-studerendes opgaver

Hvis ja, Kan I lide denne form for evaluering, er den god for indlæringen
Hvis nej, tror du at denne form for evaluering ville forøge læringen

A; *Det har jeg ikke prøvet, men der skal noget til før man gider ligge energi i det.*

B; *Ja, det har jeg lige prøvet. Det er super godt, men man skal give en skriftlig evaluerering. Det er ikke nok bare at skrive det er godt eller dårlig, men man skal svare udfra teorien. Det er guld at få andres synsvinkler. Det var ikke indenfor samme emne, og det var godt. Måske ikke hvis det er samme emne, så har man kun sine egne svar.*

Følgende spørgsmål har fokus på Immunokemiske teknikker i kurset 'Enzymology and Experimental Biochemistry'

Hvordan virkede følgende undervisningsformer for jeres indlæring

Forelæsningen
Teoretiske øvelser
Forløbet i laboratoriet

A; *i forhold til de andres undervisning i kurset, var gennemgang i denne del mere uddybende og grundig. Det var godt hos os, det var meget grundigt. Underviseren spurgte meget ud i klassen, men ikke alle svarede.*
TØ: *En side med spørgsmål lige efter undervisningen, det kan være meget rart at man lige får gennemgået hvad man lige har hørt, underviseren gennemgik svarene bagefter.*
Lab: *Jeg kan ikke huske det så godt, men et problem var at ingenting var sat frem og gjort klar, derfor var alt kaos, man gjorde nok tingene halv hjertet pga man var presset fordi det var sidst i kurset og man havde den anden store rapport at tænke på.*

B; *jeg kan godt huske undervisningen. Vi manglede mere immunologi, og underviseren gik udfra at vi vidste mere end vi gjorde.*
TØ: *Vi havde ikke spørgsmål men øvelser. Vi skulle aflevere spørgsmålene og fik dem ikke gennemgået i klassen bagefter*
Lab: *jeg synes øvelserne gik godt, men jeg kunne selv hente de ting jeg skulle bruge.*

Hvordan oplevede I følgende i forbindelse med det eksperimentielle arbejde

Ventetiden.

-A; *meget vente tid, næsten kun ventetid, ingen ting var sat frem, vejledningen var mangelfuld for hele kurset, men jeg mener at til denne del af kurset var det godt nok. Det var vist meget godt planlagt med at man kunne lave noget andet mens man ventede på f.eks. ELISA. Det var godt med stationer.*

-B; *der er altid vente tid ved maskinerne, sådan er det bare. En god gruppe betyder meget og det hjalp. Vi kunne bruge vente tiden.*

Havde I overblikket fra start, undervejs, ved rapportskrivning, slet ikke.

-A: *Jeg havde ikke overblikket fra start, men det er man vant til. Det kommer når man skriver rapporten*

-B: *jeg synes vi fik det i rapporten, vi kom ikke og havde et stort overblik, man er vant til at man aldrig helt ved hvad det er man skal når man kommer*

Følte I at der var tid nok til at udføre øvelserne og den efterfølgende rapport

-A; *Ja, men vi skulle ikke op til eksamen, så vi lagde vist ikke al vores energi i det. Det er svært at huske, det var en meget presset periode.*

-B; *Ja, vi havde afleveret alt inden, så vi havde tid.*

Blev rapporten evalueret tilfredsstillende

-A; *Vi havde en simpel øvelse med pipettering lige inden Immunokemiske teknikker som ville have været bedre at have til sidst i stedet for. Så ville vi bedre kunne koncentrere os om Immunokemiske teknikker. Man burde kunne pippetter på kandidatdelen og derfor ikke nødvendigt at bruge tid på det.*
Vi vidste godt at vi ikke kunne komme op i det til eksamen.

-B; *jeg kan ikke huske nogen tilbagemelding, vi havde andet i tankerne, det var sidst i forløbet. Vi havde vores opgave, og de kunne godt spørger ind til pensum, men det er ikke der man lægger sin energi. Nok fordi underviseren fra Immunokemiske teknikker ikke er med til den mundtlige eksamen.*

Følgende spørgsmål har fokus på forbedringerne indført i Immunokemiske teknikker (Peer-assesment af TØ, Prælap spørgsmål og opklarende praktiske spørgsmål til det eksperimentielle arbejde udleveres når interviewet er nået til dette punkt)

Interviewer forklarer hvad de enkelte tiltag går ud på.

Tror I at de præsenterede aktiviteter vil fremme indlæringen

Peer-assesment af TØ:
-A: *Det kommer an på hvor lang tid det tager. Hvis man har spørgsmålene inden, kan man google dem. Man skal ikke kende dem. Det skal stå mere klart hvad formålet er for man ved ikke om det skal være kort eller langt. Få sætninger eller mere uddybende. Vi skal vide hvad vi skal og det skal hænge sammen med tiden. Vi har brug for mere uddybning specielt hvis man diskutere det i grupper, sæt gerne tid på så vi ved om 15 min skal bruges til 3 spørgsmål.*
Jeg tror, man kan blive forvirret over at få 6 forskellige svar, det er bedre at tage det individuelt også tage det med de 3 i gruppen inden man får de andres.
Svarene kan komme på nettet. Gruppe byt i stedet for enkelt byt, og ikke tilbage for at tale om det, læren må mærke om grupperne har fået det samme, og så kan man lade det være. Det bliver for meget hvis man skal rettet en anden gruppe og så mødes med de andre grupper.
Det giver en bedre forståelse hvis TØ spørgsmålene ligger først.

-B: *Jeg tror man venter på de rette svar og så bruger man dem til sin egen opgave og sammenligner. Man skal have en karakter eller lignende for at ligge energi i det, specielt*

hvis det ligger sidst på dagen. Så har man snakket om opgaven tre gange det er for meget. Fokus kommer til at ligge på at få svaret på spørgsmålene.
Man kan ligge sine svar på nettet og så retter læren. Men det er en god øvelse at rette andres.
Det er et dårligt tidspunkt at det ligger efter labøvelserne, når man har knoklet, så vil man hjem. TØ spørgsmålene skal ligge først, det er bedst at have øvelserne til sidst. Stille teori først, øvelserne bagefter om eftermiddagen, så kan man også bruge pauserne.

Præ-lap spørgsmål til teorien:
-A: *Flow rigtig god ide, man mangler tit overblik, det er folks eget ansvar at få mere ud af det og godt at det bliver gennemgået på tavlen. Men de andre spørgsmål kan ligeså godt være i rapporten, men det kan være rart at få vendt inden man skal besvare rapporten. De skal laves inden og de skal afleveres i rapporten. Men hvis man ved at de først skal afleveres senere så laver man dem ikke inden. Det skal være en stor pause, hvis man skal have tid til at besvare spørgsmålene, f.eks. sammen med en ph.d studerende. Først får man tid til at svare dem alene og derfor sammen med underviser.*

-B: *Det er ikke sikkert at holdene har ventetid samtidigt. Flow er godt at få gennemgået, hvis man ikke vil rette spørgsmål skal man ikke stille dem, folk vil ikke svare på det hvis de ikke bliver tjekket. Der skal være opfølgning, at begge grupper sætter sig sammen og får talt om det.*
Der er forskel om man skal lave dem inden, eller om de skal besvares i rapporten.
Vi er meget mast af blokstrukturen og gør kun lige præcis hvad man skal og ikke mere.
Der skal være en underviser tilstede så man kan få det rigtige svar. Og fik jeg ret? Man har brug for at få af vide om man svarede rigtig.

Opklarende praktiske spørgsmål til det eksperimentielle:
-A: *Gode spørgsmål, for det tænker man ikke over, så får man tænkt over hvad buffer f.eks. er og hvad der kan være gået galt. Hvorfor spørgsmål er rigtig gode. For det er faktisk rigtig svært. Men de skal vedlægges rapporten, men skal besvares løbende. Og det er godt at få respons på det man har svaret hvis læren ikke har nået alle spørgsmålene i alle grupper. Skal kunne besvares direkte i rapporten. Bare læg spørgsmålene på Absalon. Husk at skriv med stort hvad der skal med i rapporten*

-B: *Så tænker man også overfor hvorfor man gør som man gør. De spørgsmål må gerne stå i rapporten, ellers bliver de ikke lavet. Bare en streg under, så man kan svare på papiret og se hvor lang besvarelsen skal være. Så går man hellere ikke død. Man får altid bare en brugsanvisning som man følger.*

Peer-assessment af med-studerendes rapport:
-A: *Det er en god ide, med mindre det ligger sammen med eksamenslæsning, det skal gøres opmærksom på fra starten af, for har man travlt så skubber man rapporten til sidst. Det kan nogle gange være svært at få kordineret i gruppen efter man har knoklet med sin egen rapport.*

-B: *man skal gøre det ved alle rapporterne og lave en skriftlig evaluering og også få karakter der gælder i den samlet karakter. Det skal være noget det andet hold får noget ud af. Det skal være en færdig skabelon hvor man bare skal sætte svar ind om den anden gruppes rapport. Det skal ikke være et pdf dokument, skriv gerne hvor mange ord man skal skrive.*

Tror I at det kan lade sig gøre at indføre peer-assessment i så kort et forløb og samtidig opnå et gavnligt udfald

-A og B: *Ja og både præ-lap og experimentiel spørgsmål og evaluering af andres grupper, må gerne blive afleveret sammen med rapporten, bare skriv at alt skal afleveres. Alt afleveres holdvis, i rapporten, undtagen TØ spørgsmål. Meget klar vejledning af hvad rapporten skal indeholde.*

-A og B: *Der var mange ny begreber, det er godt at kunne svare på spørgsmålene under øvelserne, så er der en underviser og spørger. Underviserne skal sige klart og tydeligt at rapporten skal laves undervejs i øvelserne og sige et der er kun hjælp at hente under øvelserne.*

-A og B: *Når man retter hinandes rapport skal man rette de andres først inden man får svarene.*

A: *Svarene skal komme fra læren på baggrund af rapporten, man lære mere af at få svarene på nettet, og så giver læren kommentarer på den enkle rapport nogle dage efter. Man behøver kun få kommentarer hvis man har svaret helt forkert. Så kan man selv tjekke svarende på nettet.*

Tror I at feedback ved peer-assessment vil forbedre jeres indlæring
-A og B: *Det må gerne indføres på hele kurset, så man ved hvad man skal gøre med alle rapporterne. Det vil helt klart være en forbedring at indføre disse spørgsmål og ændringer*

Peer Assessment of Oral Presentations on the History of Life

Nicolas Thibault

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I am responsible and the sole teacher of a first year bachelor compulsory course in Basics and Invertebrate Palaeontology. This course is given in Block 2 with an average of eight hours a week for the student (four hours of lecture and four hours of practicals). In average, a little bit more than 40 students participate to this course and that means that I generally teach 16 hours a week, students being divided into three groups for the practicals. The first two years were really tough to prepare and I did not reach the level of satisfaction I expected from the students. The academic "Susan-type" students (Biggs & Tang 2007) enjoyed the course but clearly, I could identify many problems with the rest of the class. One of the many reasons was the lack of active teaching and participation of the students during lectures.

The goals of the lectures can be divided into two main parts: (1) providing the very basics of Palaeontology for which I designed new class activities this year and (2) providing some knowledge on the History of Life and raising their interest in Palaeontology and Evolution. Typically, History of Life pretty much falls within story-telling meaning that it is quite difficult to design in-class activities when you basically have to tell a story. So the past years, I ended up giving long two-hours lectures in a (too) silent classroom. Moreover, the preparation of these lectures was quite time-consuming for a non-satisfactory result. The idea of this project was thus to make this teaching fully active, to make students responsible of their own learning, and to prepare them for oral examination. Therefore, students were divided in groups and had to prepare an oral presentation and an essay on a topic. Ex-

pert and multiple peer assessment was attempted by providing an oral peer assessment form to the classroom.

Material and methods

At the beginning of the course, each group of three students had to choose one subject among a list of 15 different topics which nearly covered the whole History of Life (Origin of Life, Prokaryotes to Eukaryotes, Ediacaran fauna, Cambrian explosion, and so on). The material on History of life was provided in the text-book and with the addition of relevant literature on the different subjects uploaded on Absalon. Students were also advised to crossreference multiple Wikipedia webpages and other web resources which are very informative and quite dense in the field of Palaeontology.

For peer assessment, an oral assessment form (Appendix A) was built using criteria from several web ressources[1] (Howarth n.d., Draper 2010). The assessment form was uploaded on Absalon at the beginning of the course so that each group knew the criteria of evaluation and what they should focus on for their presentations. Students were then asked to write an individual essay on their topic and were advised to use the peer-reviews on the content and structure of their oral presentation to correct and/or update their essay. Assessment was only formative. To align this teaching with the final examination of the course, every student was asked a question about their topic.

This project was tested in the course Grundlæggende og Invertebrat Palæontologi during Block 2 of 2011-2012. A survey on the appreciation of this teaching by students was made online on Absalon as well as with an interview of seven students.

Reasons for the choice of oral presentations and peer assessment

On the Oral presentation in groups

As long as I could not expect first year Bachelor students to learn the whole History of Life in eight weeks besides fundaments of Palaeontology and

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[1] Peer evaluation sheet for oral presentations with summary of pros and cons. http://isucomm.iastate.edu/oralpeereval

the main invertebrate fossil groups, it made sense to design teaching that would not be fully part of the pensum but would still be useful to train students' skills, raise their interest in Palaeontology and give them the will to go deeper into this discipline. Knowing that "most people learn 95% of what they teach someone else, as opposed to 20% of what they hear" (Biggs & Tang 2007), dividing my students in groups and asking them to prepare their own lecture on a given subject was soon imposed as the best way to teach this part of Palaeontology. The reasons for the choice of these oral presentations by the students is thus summarized below:

- Making the teaching fully active.
- Making students responsible for their own teaching.
- Students learn 95% of what they teach someone else.
- Simplifying the teacher's job. No more lectures to prepare on this subject. The teacher must only prepare relevant literature.
- Enhancing the ability of the students to research and synthesize various information sources in the literature and web resources.
- Familiarizing students with oral examination.
- Students often find group projects more interesting than traditional methods of teaching (Conway et al. 1993)

On peer assessment

Alternatives in assessment forms have been introduced and tested in higher education in the past two decades. Among them, the use of self- and peer-assessment have proved to encourage students to become more responsible and reflective (Dochy et al. 1999). In particular, peer-assessment contributes to more involvement of the students and is beneficial for their learning (Orsmond et al. 1996). The reasons for the choice and benefit of peer assessment in this project are listed below:

- Favorizing more focus and concentration: the peer review assessments forces the students to pay more attention to the presentation (Howarth n.d.).
- Enhancing students' abilities to formulate an issue and structure their presentations (Dochy et al. 1999, Biggs & Tang 2007, Cho & MacArthur 2011).
- Providing immediate feedback and enhancing critical feedback skills (Dochy et al. 1999, Draper 2010).

- Providing a good teaching atmosphere: an empathy may be created between the teacher and the student through the challenges of assessing (Dochy et al. 1999, Biggs & Tang 2007, Draper 2010).

Results of the survey

An online survey was uploaded on Absalon on motivation and teaching climate, usefulness of the oral presentation, values and usefulness of peer assessment, learning and effective feedback through a series of 18 questions, ten of which are treated below with statistics (Q1 to Q10). The survey is based on the answers of 18 students and results are shown in percentages. In addition, an interview with seven students was conducted to provide feedback, hear the opinion of students on this form of teaching and get suggestions for improvement.

Intrinsic motivation and teaching climate

Q1: Did you find the lectures on the History of Life more, less, or equally enjoyable than the rest of the lectures in Palaeontology?
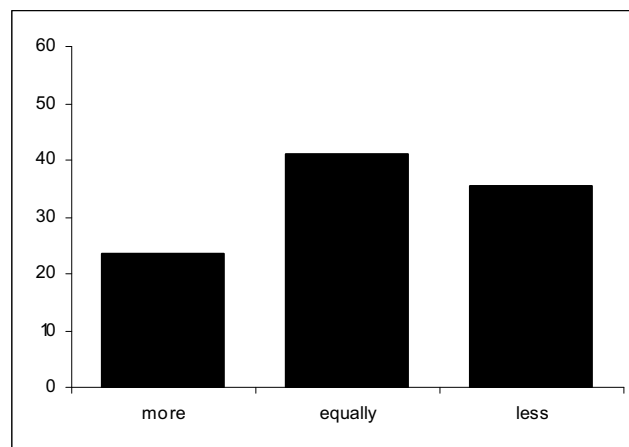
Fig. 21.1. Percentage of students in the different categories for Q1.

Students' answers to the question "Why?":

- "You have to focus on one specific area"
- "We had to go deep into our subject"

- "It was fun working and gathering information for."
- "Once you've presented something, you're definitely more keen on the subject and you know it better."
- "It was nice to see different approaches to the task and learn from fellow students."
- "It was actually more enjoyable because some of the subjects were explained in a very very simple way".

These answers delineate more involvement of the students in the learning process of their topic and creation of a good climate atmosphere. But they did not particularly prefer that exercise to the traditional lectures.

Q2: Would you rather have lectures on the History of Life given by the teacher?
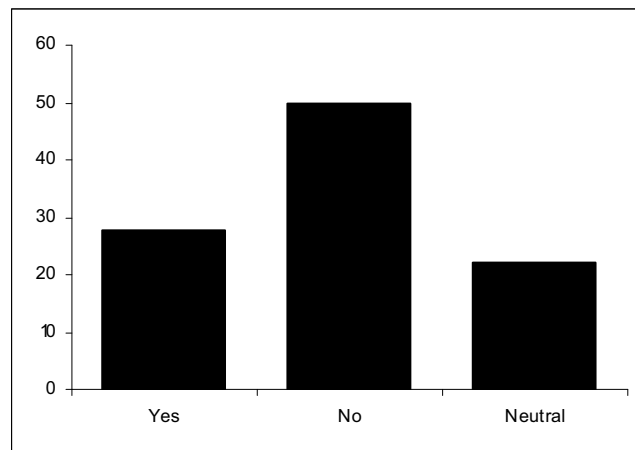
Fig. 21.2. Percentage of students in the different categories for Q2.

Specific remarks with respect to this question:
Pros:

- "There are pros and cons. It's very good idea with us presenting our topics"
- "No, I wouldn't. It is nice trying to make presentations and you have to study your topic very well, so I learned a lot, both about my topic, history of life in general and how to make presentations"
- "No, it was a chance to get deep understanding within one subject of the history of life"

Cons:

- "Not all presentations were well prepared. It was difficult to get an understanding of a lot of the different subjects."
- "The way it was done was not a home run. It would have been better if done by the teacher. Uncomfortable, unsecured and stuttering students do not work well as teachers. Me included. I'm not supposed to be the teacher. I'm here to learn."
- "I feel I would get a better overview if done by the teacher."
- "Yes, simply because the students' presentations were at such a low level from some of the groups. I had expected better presentations of university students."

Students admit a stronger involvement in the learning of their own subject but some regret a lesser understanding of other topics than if delivered by a teacher. However, probably because of the good teaching climate created by the exercise, a majority would not have preferred lectures by the teacher.

Q3: Did you find the peer assessment enjoyable or annoying?
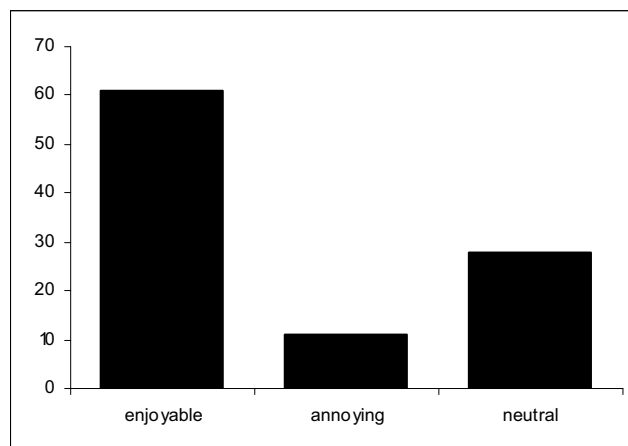
Fig. 21.3. Percentage of students in the different categories for Q3.

It seems that peer assessment participates to the construction of a good atmosphere.

Usefulness of the Oral presentations

Q4: Did you find it useful to have to prepare your own lectures?
    Specific remarks on the preparation of students' lectures:
    Pros:
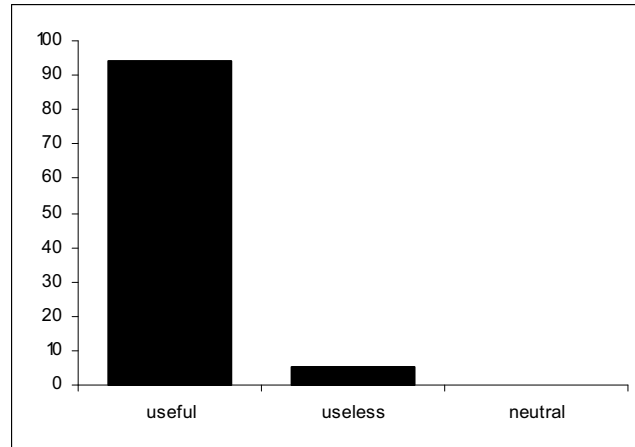
Fig. 21.4. Percentage of students in the different categories for Q4.

- "Have to go deep into the stuff"
- "you're forced to get to know your topic"
- "It was an interesting process to figure out what was the most important to say and what could be left out"
- "The exercise was useful for learning to communicate a scientific subject."
- "It also gives some preparation for the exams"
- "I learned more about my strengths and weaknesses"
- "I became interested in the subject. I was an active part of my learning. I had to prepare more"
- "The preparation stage was fun to work with the subject in my own hands"
- "It was something I was not familiar with and it was great exercise for future teaching"
- "Learned more. And group work was a good way to discuss the topic"
- "I feel like I definitely got an understanding or the different hypotheses and controversies pertaining to my subject – and I also got to gain insight into how hypotheses are formulated and tested"

Cons:

- "No, it added extra stress."

Once again, these answers mainly delineate more involvement of the students in the learning process of their topic and creation of a good climate atmosphere through the group work.

Usefulness of peer assessment

Q5: Did you feel that doing this oral peer assessment was useful?
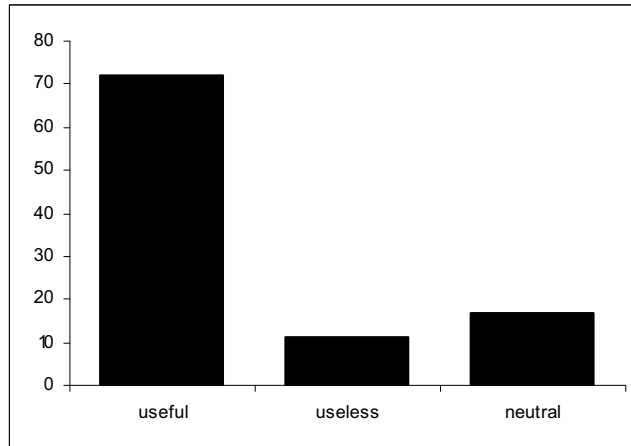
Fig. 21.5. Percentage of students in the different categories for Q5.

Students' answers to the question: "In which ways was peer assessment useful?"

Pros:

- "It was good to get some constructive criticism after."
- "It is fun to share the teacher's own conclusions on assessing"
- "I became aware of different criteria that are important when presenting."
- "The good comments and bad comments were very helpful"
- "I can make my next presentations much better"
- "Yes, but I would have liked more space to write comments."

Cons:

- "Knowing that you have to fill out the oral peer assessment kind of takes the focus a little bit away from the presenting team and the topic they are presenting because some people fill it out during the presentation."
- "It was very inconsistent between teacher and students assessments for our group."
- "It was hard sometimes since I don't like being too harsh against my fellows and yet, I don't want to be too soft…it's difficult"

- "Again, not really. We're not here to become teachers. We're not here to get comfortable in front of an audience. We're here to be taught Geology."

Most of the students found it useful but only few of them were actually able to explain why. The few answers I got fall into constructive criticism and empathy with the teacher, which again, participates in building a good teaching climate.

Q6: Did you rely on the oral peer assessment form to design your own presentation?
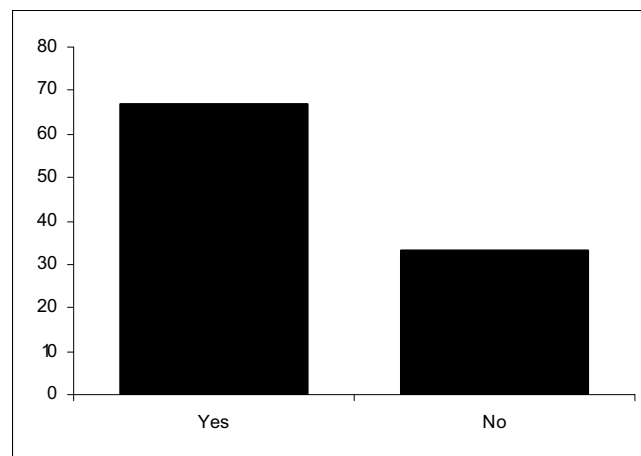
Fig. 21.6. Percentage of students in the different categories for Q6.

Students' answers to the question "In which ways?":

- "We knew how to structure the presentation with introduction, conclusions and perspectives or how to formulate an issue"
- "We could focus on the delivery, on how to present an oral in front of a crowd. I feel more prepared to do that now"

Most students instinctively identified the criteria in the oral peer assessment form as a guide to prepare their presentation, which of course, was one of the objectives.

Q7: Did the peer assessment help you focusing your attention on your fellows' presentations?

Specific remarks with respect to this question:

Pros:
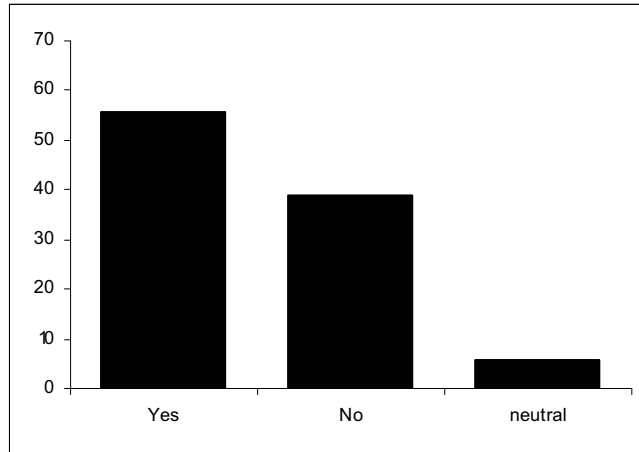
Fig. 21.7. Percentage of students in the different categories for Q7.

● "I was more actively listening to the other presentations, as I had to assess them."

Cons:

● "Knowing that you have to fill out the oral peer assessment kind of takes the focus a little bit away from the presenting team and the topic they are presenting because some people fill it out during the presentation."

Most students found it helpful to focus their attention but some actually found it distractive.

Q8: Did you find the feedback from your peers useful?
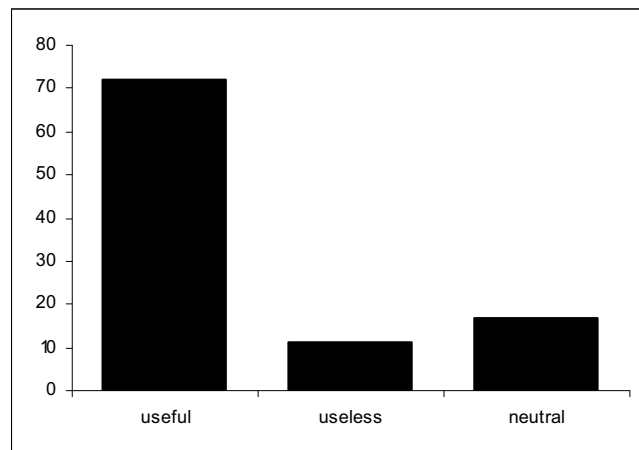
Fig. 21.8. Percentage of students in the different categories for Q8.

Specific remarks about the usefulness of their peers' feedback:
Pros:

- "It gave me confidence to see the positive remarks and feedback from the others. I can also use some of the critique they gave for later."
- "Definitely. People were really good giving constructive criticism"
- "Yes, good to hear some good and not so good things on our work"
- "Good In terms of preparing lectures and ppt"
- "Yes, for future, I know some issues and how to stand in front of a crowd."
- "It's actually the kind of exercise I will now try to use the next times I have to do a presentation"

Cons:

- "Most of the interesting feedback was from you"

Students mostly value constructive criticism here but some were doubtful about the fairness and accuracy of their peers' assessment.

Q9: Did you consider correcting your essay after getting the feedback from your peers?
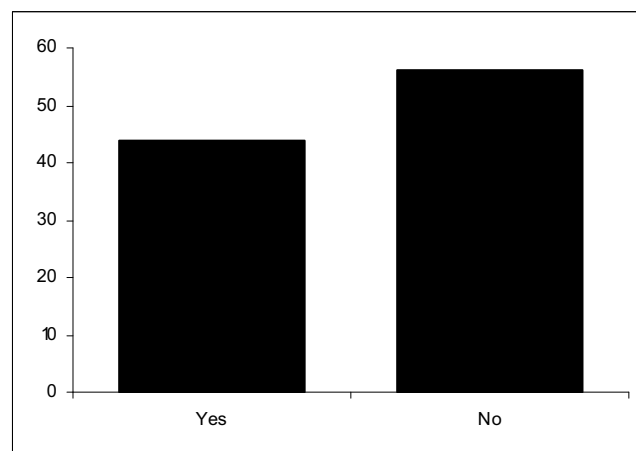
Fig. 21.9. Percentage of students in the different categories for Q9.

Specific remarks about using the feedback for correcting the essay:

- "Yes, I corrected the structure and sequencing"
- "I understood that the main purpose of the feedback was to correct the essay. Unfortunately, I got absolutely no feedback from my fellows to do so."

Less than half of the students used the feedback to correct their essay and those who did remarked that they only corrected the overall structure. Several students deplored that they did not get more feedback on the content from their fellows.

Students' learning

Q10: Do you think you learnt more, less or equally with this form of teaching than if you had lectures given by the teacher?
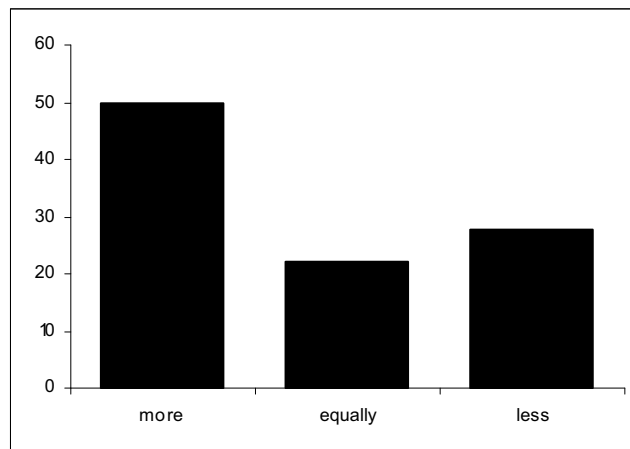
Fig. 21.10. Percentage of students in the different categories for Q10.

"What did you learn from peer assessment?"

- "It is fun to share your own conclusions on assessing"
- "I became aware of different criteria that are important when presenting."
- "That way, we wanted to make our presentation the best as possible"
- "It was good to be more than one assessing on the same sheet. We could discuss that. It helped me overcome the problem of being too soft/too harsh"

These answers delineate more involvement, better understanding of the overall oral exercise and a good teaching climate.

Suggestions of students for improvement

On the organization of Oral presentations

- "The articles given were difficult. We managed but it would have been nice with an introduction to how to read an article from Science, Nature or another scientific journal. I also don't know how to use references, it would be nice to know how to present the information in the presentation and in the essay."[2]
- "It was difficult to know whether the other groups covered well their subject or not because I don't know enough on other subjects. Every group should prepare one page of summary on their topic to be provided before their presentation."
- "Students should upload their powerpoint presentation on Absalon in advance, maybe two days before their presentation."
- "We need more guidelines to do our presentations because our topic was huge and it's difficult to synthesize."
- "Oral presentations should be longer, maybe 15 to 20 minutes instead of 10. We managed to stay in time but it was frustrating we could not go deeper in our subject. There was a lot more we had to tell."
- "It would be great to get some sort of compendia of all the work that we had done on the History of Life. Either something you made or a collection of what each group has written and presented on their topic."

On the oral peer assessment form

- "There should be more focus on personal remarks and suggestions on the assessment form. The scale 1 to 5 of the assessment form is not that useful."
- "I'm not sure the scale of 1 to 5 works well. At least not without the possibility to add extra remarks below each category. It would have been nice to know why we got that specific mark."

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[2] This 1st year bachelor student actually went so deep into his topic that he was already ready to learn how to prepare professional presentations and writing. Guidelines on essay writing and presentation of references will be furnished next year.

Discussion

Students' perceptions of the oral exercise

Overall, students were quite positive about the oral exercise. More than half of them found it more or equally enjoyable than teacher's lectures and would not have preferred having lectures given by the teacher on the History of Life. Almost all of them valued the usefulness of preparing their own lectures by digging deep into the subject and preparing them for oral examination. Many of them found this preparation stage in groups truly enjoyable. A majority of the students do not think they would have learnt more with lectures given by the teacher and many of the remarks made by students in the survey valued how much they learnt on their own topic but also on how to structure, build and deliver an oral presentation. With respect to intrinsic motivation and quality of learning, it appears clear that the exercise created a very good teaching climate and that students learned a lot. Complaints about the low level of some of the presentations and the feeling that the teacher might have given a better overview are of some concern, but since I do not expect the students to have a detailed knowledge of the whole History of Life, it seems that overall, there are more benefits than disadvantages. Also, providing a better overview to all students can be easily overcome by a reorganization of the exercise as suggested in the perspectives for improvement.

Students' perceptions of peer assessment

A vast majority of the students also found the peer assessment very useful although it does not appear clearly from their answers what exactly were the outcomes of this exercise apart from focusing their attention on their fellows on which 60% of them agreed on. One of the main advantages of peer assessment in this project appears to be that students become more involved. A few of them actually mentioned constructive criticism, extensive feedback and empathy with the teacher as already mentioned in the literature (Dochy et al. 1999, Biggs & Tang 2007, Draper 2010). Several of the students' answers about peer assessment also show that it participates actively into building a good teaching climate. Few students found the peer assessment useful to correct their essay. Some corrected the structure and sequencing only. Fellow students lacked the knowledge to provide feedback on the content of the different topics.

Fairness and accuracy of peer assessment

From the survey, it appears very clearly that this form of oral peer assessment should not be used in a summative way. Fairness and accuracy were seen by students as some of the negative aspects of this exercise. Actually, fairness and accuracy of peer assessment are well-known issues in the literature (Stefani 1992, Conway et al. 1993, Orsmond et al. 1996).

Perspectives for improvement of this exercise

There were some issues with respect to the organization of the presentations and peer assessment. Also, I deplored the lack of discussion after oral presentations. Students did not dare asking questions to their fellows and I was the only one doing so. All the suggestions for improvement I got from my supervisors were also raised by the students and many more came from the survey and the interview. This shows the importance of feedback from the students during and after a course. Students could identify very accurately what worked and what did not work and they provided a lot of good ideas for improvement.

Organization of the oral presentations

- There is a need for more specific but also more accessible literature.
- More guidelines should be provided to help students preparing.
- Powerpoint presentations must be uploaded on Absalon at least two days before the scheduled presentation to avoid stress and allow access to other students.
- A one-page summary of each group's topic must also be uploaded in advance alongside the presentation to provide an overview of the topic to everyone.
- At the end of all the presentations, the teacher should build a compendium.

Oral assessment form

- There should be more focus on personal remarks and suggestions for the different criteria. More blank space should thus be added on the assessment form.

- The ranked criteria on delivery apply to the group and not to the different members of the group. The teacher should try to find a way to re-organize the assessment form so that members get more personal feedback from their peers.

Essay writing

- The essay was considered as too long by many students. Five pages should be more suitable.
- Students should be better explained that the use of peer assessment is not only to help them correct their essay.
- This exercise could eventually be combined in the future with peer review of writing.

Promoting more discussion between students

Setting up a deadline for the uploading of powerpoint presentations and a one-page summary on the different topics long before the orals should help promoting more discussion at the end of the presentations. The students should be asked to read these summaries before coming to the lectures. Another good suggestion made by my supervisors is to appoint a student as a chairman who will be in charge of introducing the presenting group and subsequently chair the following discussion. Some students considered that the History of Life should have been in the pensum so that they could be more aware of the content of their fellow's presentations but since several students commonly complain about the amount of informations they need to know for the exam, I do not think this is a good idea. Several students said that they do not wish to ask questions because they do not want to make their fellows more nervous than they already are. More experience is needed on the overall exercise to test students' discussion.

Conclusions

From the survey and the interview with the students, it appears that the evaluation of this teaching project is quite positive. Group work and peer assessment created a good teaching climate. Active participation of the students in the preparation of the oral presentations fostered more involvement and motivation for the discipline. Students felt they learned a lot on their

topic and only a minority would rather have lectures on History of Life given by the teacher. Students appreciated to be trained for oral examinations and learned on their strengths and weaknesses from the critics of their peers. Peer assessment promoted constructive criticism but is generally not considered fair and accurate by the students. Thus, it should only be used in a formative way, at least for this exercise. Many suggestions were made by the students for the improvement in the organization of the presentations and of the assessment form that will be implemented next year. It is hoped that this reorganization will promote more discussions among students during the lectures. In addition, peer review of individual essay writing will be tested.

A Oral peer assessment form used in this project.

Assessment scores

Overall Structure

Introduction	Clear outline of topic, issue and content		Interesting introduction but purpose of the subject not clear		Unclear introduction	
	5	4	3	2	1	0
Sequencing	logical, easy to follow, with effective transitions		line of reasoning but with needless digressions		Uncertain, difficult to follow	
	5	4	3	2	1	0
Conclusion	Clear summary of key points		Uncomplete summary		Inadequate summary	
	5	4	3	2	1	0
Perspectives	ends on a high note with perspectives		few perspectives		uncertain ending, flat stop	
	5	4	3	2	1	0

Content

subject well covered with evidence throughout		subject tackles with few angles only		poorly investigated, lacks evidence and key references	
5	4	3	2	1	0

Delivery

Voice	Clear, distinct and projected toward the audience		Loud enough to attract attention		Muffled and inaudible	
	5	4	3	2	1	0
	Variations in tone and pace with accentuations on key points		Few variations in tone and pace		Monotonous	
	5	4	3	2	1	0
Body language	Maintains eye contact and interacts with audience		A few eye contacts and interaction		Avoids eye contact and interaction	
	5	4	3	2	1	0
	Appears confident in posture		Neutral posture		appears very uncomfortable	
	5	4	3	2	1	0
Visual aids (illustrations, animations)	Professionally prepared and entertaining		Appropriate		Untidy and unstructured	
	5	4	3	2	1	0
	Clear and concise		Sufficient		Difficult to interpret	
	5	4	3	2	1	0
Pace of the presentation	Suitable and effective pace, time respected		A little bit too slow or too fast		Too hurried or too slow	
	5	4	3	2	1	0

Personal remarks

Please, provide three key strengths of the presentation

1)

2)

3)

Provide three suggestions for improvement (aspects that can be improved or developed by the presenters)

1)

2)

3)

Part IV

Language and cultural diversity in university teaching

Teaching in English for the Undergraduates: A challenge for effective learning?

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During the spring term in 2010, I taught parts of the Community Dentistry for the first time (six lectures, two classes) referring to Epidemiology lectures under the undergraduate curriculum of the School of Dentistry. Each class was presented mainly in English but students were free to ask and present their assignments in Danish; each lecture was supported by a Danish colleague working as an associate professor in the department. After cessation of lectures there was criticism by the students that the content was not in line with those during the previous years. After declaring that the content was exactly the same, students criticized that the lectures were in English and they could not understand. Therefore, I decided to assess the attitudes of students to learning in English medium by self-reported questionnaires during the lectures in autumn 2011. I would concentrate on basic principles of pedagogical teaching and try to make lectures more effective and interesting by activating student participation. This project aims to assess the attitudes of dental undergraduate students towards learning dental lectures in English at the School of Dentistry, University of Copenhagen. As a sub-goal, some approaches to increase student active learning and participation are discussed.

Introduction

The General Assembly of the Association for Dental Education in Europe agreed profile for the new European Dentist as follows:
On graduation the new European dentist should:

- Have had a broad academic dental education and be able to function in all areas of clinical dentistry
- Be trained in biomedical science
- Be able to work together with other dental and health care professionals in the health care system
- Have good communication skills
- Be prepared to undertake continuing professional development supporting the concept of life-long learning
- Be able to practice evidence-based dentistry based through a problem solving approach, using basic theoretical and practical skills

Competences for a dentist at the graduation should be supported by an ethos of achieving continuing professional development and promoting life-long learning to achieve a continuum of education from undergraduate to retirement along with a desire for self-improvement. It is also worthwhile that on graduation, the dentist must be competent at demonstrating appropriate information literacy to acquire and use information from library and other databases and display the ability to use this information in a critical, scientific and effective manner. A dentist should also demonstrate an ability to maintain his/her professional knowledge and understanding throughout their professional life. Evidence-based dentistry is the major tool in successful achievement of these competencies and skills. Evidence comes from mostly the international scientific articles, books and conferences; majority of those is in English. English also performs a common worldwide platform for scientific learning, discussion, exchange, and communication in the respective field. Therefore this language may be referred as a common scientific language to learn and to continue professional development.

In addition, universities and academies are joining academic consortia, such as SOCRATES, ERASMUS and LINGUA; more and more countries are joining the Bologna agreement, which aims at creating an all-European higher education and research area. The European Credit Transfer System is being implemented to make students exchange easier. The Bologna Process aims to create a European Higher Education Area, in which students can choose from a wide and transparent range of high quality courses and benefit from smooth recognition procedures. The process has been started with Bologna Declaration in 1999. English is a common language in achievement of the respective goal. Denmark is an active member of Bologna Process. The internationalization of education and training is high on the political agenda in Denmark, and government, labor market bodies

and educational institutions are active in the field of international cooperation.

Under the light of all these issues, an undergraduate student needs to have discipline-related analytic and problem solving skills in English and as well he/she needs to assess professional knowledge in this language. However, the language skills of the dental students may be insufficient in the respective field and therefore they may have problems of speaking and/or understanding scientific language in English. On the other hand, the students may have negative attitudes towards learning in English due various reasons such as not seeing any point in learning English. Undergraduate education is mostly clinical treatment oriented that students have limited opportunities to learn the different perspectives of dentistry such as analysis of scientific publications, assessment of psycho-social dimensions of the profession. Therefore due to either on clinical treatment focused training or insufficient English proficiency skills, dental students may have negative attitudes towards English learning medium.

It is worth to notice that even today 30% of Copenhagen Business School (CBS) degree programmes are taught in English along with 188 short English-medium courses, students have expressed dissatisfaction with the English language of the teaching staff, and this poses a threat to CBS's ability to ensure high academic standards. The Danish government's strong commitment to internationalization and CBS's ambition to be an internationally recognized business university at European top level will lead a further increase in the number of English-medium degrees in the coming years. Event the School of Dentistry, University of Copenhagen as well aims to internationalize and be among the recognized international dental schools, the attitudes of students and teachers seem to be negative towards English learning medium. Therefore, I wished to examine the attitudes and perceptions of the students to my lecture which was in English. Self-assessed questionnaires will be used as measurement tool for data collection which will take place during the lecture entitled "Compliance" in late September.

Aim of the present project is to assess the attitudes of dental undergraduate students towards learning dental lectures in English at the School of Dentistry, University of Copenhagen.

Methods

The design of the lectures

Formally, the lecture "Compliance", composed of two lectures (120 minutes, 45 minutes with a two-months break between), was part of Cariology course for the fifth semester students in 2011, September and November 2011. Each lecture was designed based on the principles of pedagogical teaching principles learned during the "adjunktpædagogikum" course (2011-2012), the University of Copenhagen. The lectures were presented in the format of theory background, interactive learning and peer discussion along with scenario playing and videos. At the beginning of each lecture, intended learning outcomes (ILOs) were introduced (Fig. 22.1). Teaching theory and research has shown that deep learning largely depends on being clear and the students' motivation. Therefore, the theoretical part was introduced in concise and clear power point slides. Peer discussion groups, animations, simple questions and relevance to the use in clinics/dentistry (before and after ILOs) (Fig. 22.2) were used for increasing student motivation. Institionalization was achieved by adjusting the topic for the use of clinical practice.

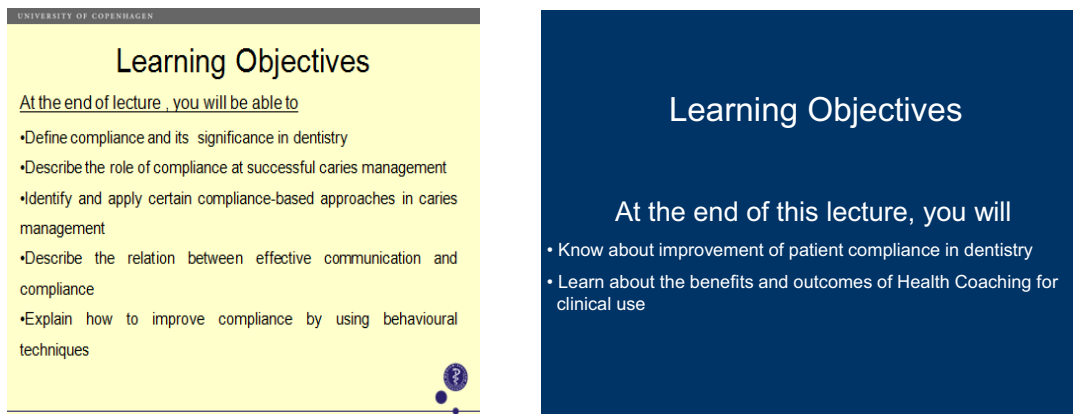**Fig. 22.1.** ILOs for Compliance I and Compliance II.

One week before both lectures, the content and the relevant literature were logged on Absalon and students were asked to read those as a task. The significant parts on literature was bolded and students were reminded to read "at least" those sections to be ready for the lectures. Students were welcomed for any comments or suggestions on the content of the lecture.

a. Compliance I: Animations and institionalization by slides to motivate student learning

b. Compliance II: Animations and Institionalization by slides to motivate student learning
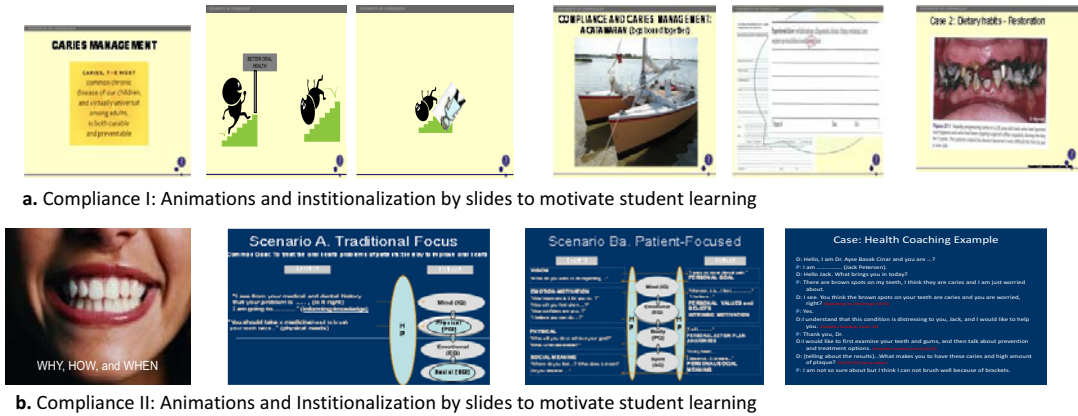
Fig. 22.2. Compliance I and Compliance II.

A guest speaker at the field of professional coaching was invited for the second lecture to have role play about coaching and as well to create dynamic platform for students, alike "business meeting days" to motivate and to enable learning. First lecture was 2 hours whereas second one was 45 minutes. Both lectures were on Friday afternoon.

Questionnaires to assess the students perceptions

Prior to initiation of the first lecture, the questionnaires were distributed in the class, and students were asked to fill in the break; most returned before. Among the participating students (n=19), 18 of them replied. Questionnaires were about socio-demographic variables (age, gender, nationality, language on primary education) and attitudes towards the respective lecture topic (Compliance-8 items) and lectures in English (11 items) on a 5-point Likert Scale (Appendix A). The answers ranged from strongly disagree(-2) to strongly agree (2) for the positive ended questions (Compliance: items 1-4, 8; Learning in English: 1-3,5,6,) and the reverse coding was applied for the negative-ended. The Cronbach alpha for reliability of scale for "Compliance" was 0.85 and it was 0.54 for the scale "Learning in English". Sum scores for both scales were taken and the means were assessed as the cut off points (Compliance:7,7; Learning in English: 4,5). Additionally, the difficulty to study in English was assessed by the question "How difficult or easy is it to study in English compared to studying in your first language?"

Descriptive statistics, Chi-square tests by cross-tabulation and Spearman correlation were used to analyse the data. Statistical significance was set at $p < 0.05$.

Results

Among the respondents, 89% were females ($n = 16$)and 84% were Danish (n=15). The mean for age was 22.1($SD = 1.6$).

Students mostly believed (61%) that In order to be a good dentist, they needed to have good dental English proficiency to follow up the current developments and innovations in dentistry (Fig. 22.3). More than half of the students reported that they disagree with the statements "it is not easy to follow the instructions in English" (66%) and "I have difficulties at analytical thinking and problem solving in English" (56%). The students who reported it was "more difficult" to study in English compared to studying in their first language was at 58% whereas for 36% of them it was "same difficult".

Among the participating students, 62% (above mean) reported positive attitudes towards learning in English and learning about Compliance. Both attitudes towards were positively correlated with each other ($r_s = 0.53$, $p < 0.05$). Those who reported learning about compliance was important were more likely to be positive towards learning in English (82%, OR = 11, 25: CI: 95% 1.19-106.1-0.95). Having positive attitudes towards learning in English was positively correlated with thinking that it was same or less difficult to study in English compared to studying in their first language.

Discussion and Conclusion

The findings revealed that the undergraduate dental students had positive attitudes to the lecture in English and they mostly believed that professional English proficiency is one of competencies to be a skilled dentist. Being able to follow the instructions easily in English and not having difficulties at analytical thinking and problem solving in this language were reported more than half of the students. These are in line by the findings of a survey by Danish Evalution Institute among Danish undergraduate students (Evalueringsinstitut 2010). The survey has also found out that regarding the lectures in English, majority of Danish students found the situations/tasks (class discussions, lectures, working in groups, etc.) "predominantly easy" or "easy". All thus may lead to the question how to improve the analytic skills and competencies of all dental students, including those who had negative attitudes towards learning in English, to enable getting out the best from lectures in English. One solution may be the arrangement

ITEM	DISAGGREE (%)	NEUTRAL (%)	AGREE (%)
1.Lectures in English improve my ability to assess the international scientific literature.	22	33	45
2.Lectures in English will facilitate my communication in international scientific media (e.g. congresses, meetings, seminars)	11	22	67
3.In order to be a good dentist, I must have good dental English proficiency to follow up the current developments and innovations in dentistry.	0	39	61
4. I can't see the point in learning lectures in English	56	33	11
5.I think it's really useful learning scientific terminology in English for the dental degree	11	17	72
6. Lectures in English will improve my professional skills; thus will help me to be respected by my national and international colleagues	22	33	44
7. It is not easy for me to follow the instructions in English	66	17	17
8.I have difficulties at analytical thinking and problem solving in English.	56	22	22
9.I don't need professional English skills to be a dentist	55	28	17
10.The use of English in learning dentistry is obvious but I can't be bothered to turn up to lectures in English	55	28	17
11.Compared to the lectures in my first language, I participate less in discussions during lectures in English.	22	17	61

	Easier %	The same as in my first language %	More difficult than in my first language %	Much more difficult than in my first language %
How difficult /easy is it to study in English compared to studying in your first language?	0	36	58	6

Fig. 22.3. Frequency distribution of items of the scale "Learning in English" and answers to the question "How difficult or easy is it to study in English compared to studying in your first language? ($n = 18$)

of undergraduate courses for professional use of English in Dentistry alike the examples for the postgraduates. That is supported by a Swedish study among the academic staff and students of Stockholm University, that both groups indicate that they would appreciate professional English support to use it as an academic language (Bolton & Kuteeva 2010).

It is noteworthy that students in the present study, to a moderate extent, were mostly aware that they needed professional English to assess the literature and to increase their dental competencies. This, to some extent, is in line with the findings of a Swedish study that more than half of the undergraduate students thought that the lectures should not be taught only in Swedish (Bolton & Kuteeva 2010). Participating dental lectures in English, where the scientific jargon and terms are presented, will facilitate reading the literature in English; thus will lead to better assessment and use of knowledge. There seems to be a need for increasing the awareness on significance and utility of English at professional life by some courses/seminars. The lack of total awareness for the need of professional English proficiency may be due to that dental students are mostly trained on clinical perspective, focusing on treatment, and therefore the broader dimension of profession are inadequately taught (psychosocial dimensions: dentist-patient communication skills, assessment of patient's health behavior; how to assess and criticize the evidence and international literature). This is a common debate that dental sciences should move forward from clinic-oriented biomedical approach. If this can be achieved then the need and significance of learning in English will be easier to assess.

More than half of the students (58%) reported that it was "more difficult" to study in English compared to studying in their first language. This was higher than the frequency found by the survey (Evalueringsinstitut 2010) among Danish undergraduate students (40%). However, in the present study, those thinking that it was same difficult as in their native tongue (36%) were less than those at the respective Danish survey (47%). One explanation might be that the undergraduate dental students in the present study are not used to take lectures in English; thus making their adaptation to learning in English harder. As concluded in the studies by Airey and Linder (2006), and Wilkinson (2005), there is a need for improving students´ coping strategies and developing new teaching approaches for the adaptation of students to lectures in English. That will require collaborative effort of teachers, and students' spending more time on for adaptation of new strategies. Students´ perceptions for the comparative easiness of studying in English were correlated with their positive attitudes towards

learning in English, which was correlated with the positive attitudes towards the lecture. Thus seems that facilitating effective learning in English may enhance positive attitudes to learning in English therefore to learning the respective lecture.

Based on the comments of the students at the questionnaires, learning the dental lectures in English does not seem to be a problem for students; thus the lectures need to be brief, concise and high quality in content. Thus may be achieved by consulting with other lectures and students about the content, focusing on the professional needs and expectations of the students and applicability of the knowledge in clinical practice. However, there seems to be another major challenge at conducting lectures in English. Based on professional experiences of the colleagues and self, the dental education board of the school seems to be not on the side of providing lectures in English. It is striking that the last experience is that the education board denies my teaching in English regarding the possibility that there may be increased drop-out in number of students participating to the lectures in case the lecture is to be in English. The reasoning is not the quality or content or teaching skills, therefore it may be a big challenge how to increase the quality of teaching if the issues not directly relevant to content and methods of teaching were taken into consideration. This may be explained by a survey in University of Copenhagen (Jensen et al. 2009) that has found the teaching staff at Health Sciences, mostly thought a) teaching through English would result in reduced learning outcome for students b) increased use of English in higher education threatened Danish as an academic language. On the contrary, same staff mostly agreed that increased amount of English-medium teaching would lead to higher academic standards and improved competitive capacities internationally.

English is the common language for professional use and improving respective competencies and skills in dentistry. There has been a global trend by international education board and authorities that there should be common guidelines and principles for teaching the profession; a tendency to create a quality based European higher education and research area in a common language (English). It is questionable to raise the quality and to keep up-date the scientific learning if the students are prohibited from learning in English.

In conclusion, the present study has shown that students mostly have positive attitudes towards learning in English and that they are aware that they need English professional skills to become competent dentists. There is a need to set up the study at a larger scale to have the general view

and perceptions of the students. It may be beneficial to assess as well the attitudes of lecturers and relevant professionals towards teaching in English, as teaching and learning is a whole. However, conducting some lectures in English for professional use is an inevitable requirement in today's world that there is a tendency to unite globally in science and education; thus may speak for a need for common language for effective communication.

In brief, based on the experiences from these two lectures, there seems to be a need for designing dental lectures in English in a specific format regarding solutions for overcoming the challenges for analytical and problem solving skills of students in English and allowing more time and space for students to think and discuss. When lecturing in the students' second language, the lectures designed based on the recommendations by (Airey & Linder 2006), as listed below, may improve learning environment in English. Some of these were experienced during my lectures and it was observed that they were positively working:

- Discuss the fact that there are differences when lectures are in a second language. Instead of discussion, students were told that the lecture would be in English alike in international congresses and asked to feel relaxed as English was nobody's native language in the class. Students were asked to ask any questions whenever they did not understand or had a question. This seemed to make students comfortable most probably due that they felt lecturer had empathy to understand them.
- Create more opportunities for students to ask and answer questions: Peer-discussion groups, simple interactive questions and "green-red" cards for "yes-no" answers were used for effective participation of students. Students seemed to like this methodology of "ask-answer". I recommend using short, small-group discussions within a lecture to come up with answers to questions and to generate new questions. These small groups allow students to check their understanding without pressure of direct interaction with the lecturer or the class. If the students are reluctant on answering, then green-red cards for yes-no answers may be a good start for active participation.
- Allow time after the lecture for students to ask questions. Being available for informal questions at the end of the lecture allows students to come forward and discuss problems more freely. Students were eager to discuss and talk more about the lecture after it was finished.
- Ask students to read material before the lecture: A good strategy is to ask students to read about a subject before lectures; the lectures can then

be used for confirmation and clarification of what students have already seen. However, the material loaded on ABSALON one week before the lectures were not read by the students even the most important points at this material were highlighted.

- Give as much multi-representational support as possible. Lecturers should support their oral descriptions with a number of other types of representation such as overhead slides, handouts, demonstrations, computer simulations, etc. Power point slides, hand-outs, case scenarios on videos were presented during the lectures. In addition, a live role-play scenario was performed with a professional from the field. This session along with videos was the most attractive part of the lectures for students. They emphasized this kind of "real-life" scenarios that could be adapted to clinics were the most useful and needed.

A Questionnaires

19/9/2011

Dear Participant,

The questionnaire aims to improve the quality of the learning by assessing your ideas and perceptions about the respective lecture. The questionnaire is part of the project for "Adjunktpædagogikum Kursus" which serves for creating better learning environment for the students at the School of Dentistry, University of Copenhagen. Please fill the questionnaire that will be treated anonymously.

---

1.   First initials of your name and surname, and birthday (e.g. AC220673):

2.   Gender: ☐ female   ☐ male

3.   Age and grade: ……………………………, …………………………………..

4.   What is your first language? ……………………………………….

5.   In which language did you primarily complete your:

   5a. primary education?   ………………………..
   5b. high school?   …………………………….

6.   **Please choose the answer that appears most appropriate.** If you are unsure about which response to give a question, the first response you think of is often the best one.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Learning about compliance is interesting					
Learning about compliance will improve my caries management skills					
In order to be a good dentist, I must know how to improve patient compliance					
Developing my communication skills is as important as developing my knowledge of dentistry to improve patient compliance					
I don't need to assess compliance to be a skilled dentist					
I can't see the point in learning compliance					
I haven't got time to learn neither communication skills nor compliance					
I think it's really useful learning "what" compliance is and "how" to improve it for the caries management					

7. **Please choose the answer that appears most appropriate.** If you are unsure about which response to give a question, the first response you think of is often the best one.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Lectures in English improve my ability to assess the international scientific literature.					
Lectures in English will facilitate my communication in international scientific media (e.g. congresses, meetings, seminars)					
In order to be a good dentist, I must have good dental English proficiency to follow up the current developments and innovations in dentistry.					
I can't see the point in learning lectures in English					
I think it's really useful learning scientific terminology in English for the dental degree					
Lectures in English will improve my professional skills; thus will help me to be respected by my national and international colleagues					
It is not easy for me to follow the instructions in English					
I have difficulties at analytical thinking and problem solving in English.					
I don't need professional English skills to be a dentist					
The use of English in learning dentistry is obvious but I can't be bothered to turn up to lectures in English					
Compared to the lectures in my first language, I participate less in discussions during lectures in English.					

8. How difficult or easy is it to study in English compared to studying in your first language?

☐ Easier
☐ The same as in my first language
☐ More difficult than in my first language
☐ Much more difficult than in my first language

I would like to hear any comments of yours.

....

....

....

....

THANK YOU FOR YOUR PARTICIPATION!

Teaching in English – how can the challenges of entering an MSc programme in nutrition taught exclusively in English be met?

Mette Kristensen

Department of Human Nutrition, University of Copenhagen

Introduction

In many European countries the courses at universities are increasingly taught in English. The reasons for the widespread use of English in universities include presence of students who do not speak the national language, availability of relevant, up-to-date course texts, use of foreign academics, competitive advantages on the job market and preparation of students for an academic world dominated by English (Airey 2010). The Faculty of Life Sciences (KU-LIFE) has had an international focus for many years, which also applies to its educational efforts. Fifteen per cent of all students come from abroad, and 75 % of the MSc courses are taught in English including a number of entire MSc programs. However, the question of language barriers in the university education is an inevitable consequence of globalisation. Surprisingly, there has been very little research into the relationship between student performance and the lecturing language at university level. However, in support of the general assumption that being taught in English may affect the academic level detrimentally, some researchers have found negative correlations between learning in a second language and undergraduate performance (Airey & Linder 2006, Klaassen 2001).

From 2009 the MSc programmes in Human Nutrition, Clinical Nutrition and Gastronomy & Health at Department of Human Nutrition has been taught primarily in English. Concurrent with this change in teaching language, we experienced a drop in Grade Point Average (GPA) on some of the courses when comparing 2008 and 2009 GPA's. However, it cannot be concluded that only language barriers resulted in this change in student

performance. Nonetheless, in 2010 we introduced a two-day English Workshop for students enrolled in our MSc programmes aimed at providing the students with strategies and tools to meet these language barriers. The students entering the MSc programmes in nutrition come with different BSc's and include both University BSc's and college professionals, the latter being taught exclusively in Danish with the use of Danish text books. Thus, the students may experience being taught in English differently depending on their educational background as well as their English proficiency.

Problem definition

This KNUD project set out to evaluate the effect of an introductory English workshop for students enrolled in MSc programmes within nutritional sciences. Specifically, the following elements were included as aids in evaluating the effect of the workshop:

- Introductory questionnaire to students taking/not taking the workshop on proficiency in English and educational background
- Evaluation of the students' learning outcome by questionnaire immediately after the workshop
- Evaluation of examination results from one written exam in the light of participation in the English Workshop
- Block 2 course evaluation and plenum discussion where comments were made specifically to the use of English

About the students' workshop

The students' workshop ran over 2 days and was organised and taught by Centre of Internationalisation and Parallel Language Use (CIP). On the first workshop day the students were given a brief introduction to reading, writing and listening strategies. Also, tests in all three areas were carried out to asses the students' weaknesses and strengths. On the second workshop day, the students were given a more thorough insight into the strategies on reading, writing and listening in English medium courses based on their own experiences and test results.

A total of 52 students participated in the workshop. In the Nutrition MSc programmes, students from both University Colleges and Universities

enter, thus they have a broad range of educational backgrounds. Most students are either Professional Bachelors in Nutrition and Health or Clinical Dietitian or hold a BSc in Food Science. The majority of the students participating in the workshop had a background from the University Colleges, as they represented 40 of the 52 students.
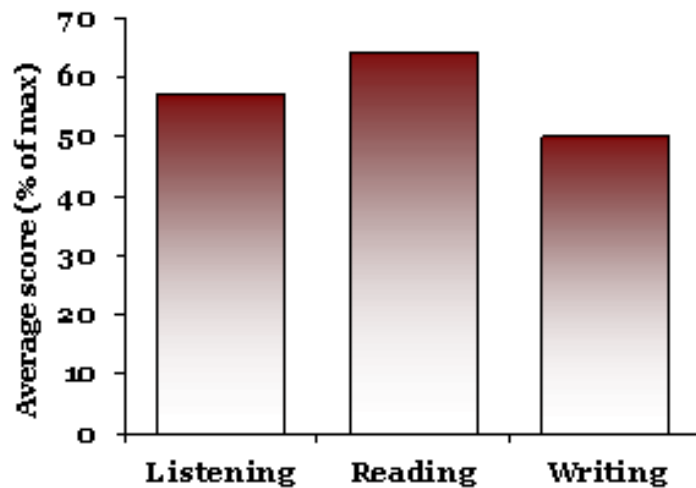

Fig. 23.1. Average score in listening, reading and writing tests during the English Workshop (n=52)

English proficiency of the students

Based on the test results, the students' weakest areas within English proficiency were writing and listening (Fig. 23.1), which was in accordance with their self-evaluation prior to the workshop (data not shown). From the writing test it was clear that academic writing (in English) was a great challenge for the far majority of students, and that this may or may not be linked to writing in English.

Students' evaluation of the workshop

On the last day of the workshop, the students were asked to evaluate the course using a questionnaire (See Appendix A for the questionnaire and

the summarised results). A total of 39 students filled in the questionnaire. Interestingly, they did not consider their English skills to a great extent before entering the MSc programme (3.5±1.1 on a 5-point scale). This is likely related to the fact that Danes generally have a high proficiency in English and they did not take into consideration that scientific language is abstract and represents special communicative traditions.

Overall, the students considered the workshop to be highly relevant. They found content of the first day of the workshop and the tools introduced useful as these were highly rated (4.6±0.7 and 4.6±0.6 out of 5, respectively). Also, the writing, reading and listening tests performed were considered by the students as useful (4.6±0.8). Not surprisingly, they did not feel that the workshop resulted in an improvement of their English skills (3.0±0.8 out of 5), but this was also not the intention with the workshop. The two main comments that were made as part of the evaluation were that the workshop and the tests in particular gave them a valuable insight into own strengths and weaknesses and that the strategies they were introduced to, particularly reading strategies and vocabulary learning strategies, were helpful; the latter also relates to getting acquainted with the academic word list.

Nutrition Physiology – a formal knowledge course

For this course in the first block on the MSc programme, the students had a regular 4h written exam. Here, a total of 85 students took the exam, of which 50 had participated in the English workshop (Fig. 23.2); two thirds of the PROF BSc students participated in the English Workshop, whereas only one third of the UNI BSc students did. Among those who participated in the English Workshop, the average grade was 5.3±3.1, where it was 5.0±3.5 among those who did not. Thus, a slightly higher grade point average was obtained among those who participated in the English Workshop. When looking at their educational backgrounds, there was no difference in average grades between PROF BSc and UNI BSc students, but in category "Others" which includes nurses, teachers and foreign students, a lower average grade was obtained (Fig. 23.3).

Based on the above, there seem to be no immediate effect on student performance of participation in the students' workshop in terms of grades for the exam. However, it is difficult to know, if they would have performed differently if they had not attended the workshop. As this is there first theoretical course taught in English, this was a first take on whether there would
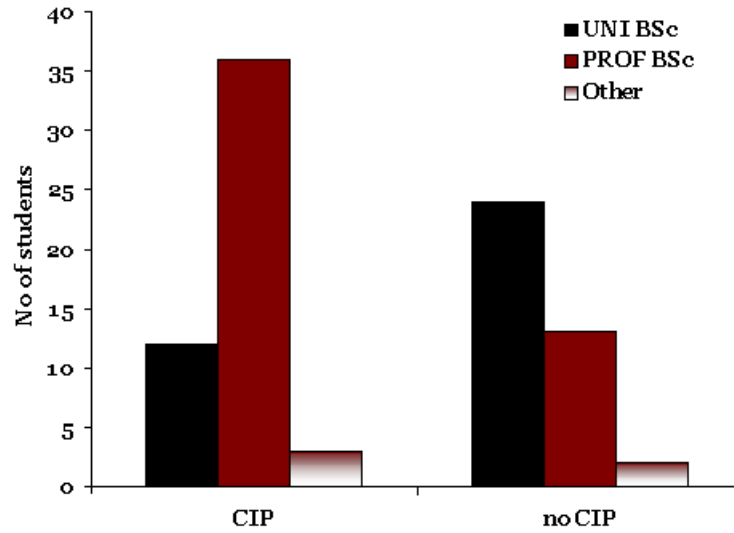
Fig. 23.2. Number students enrolled in the course Nutrition Physiology taking /not participating in the CIP Workshop from different educational background (UNI BSc: University BSc; PROF: University college professional BSc: Other: Other)
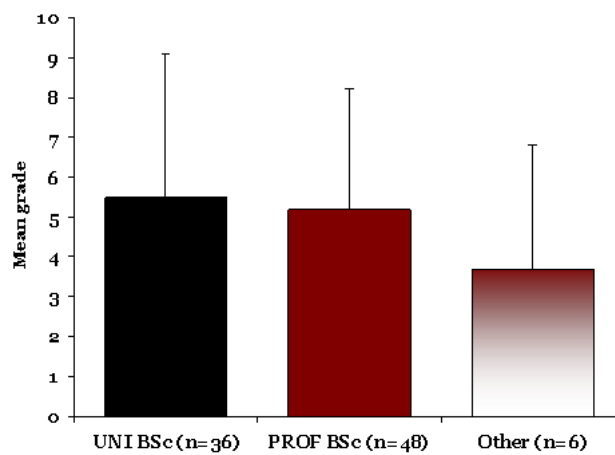

Fig. 23.3. Average grade among students enrolled in the course Nutrition Physiology according to educational background (UNI BSc: University BSc; PROF: University college professional BSc; Other: Other)

be differences early on in the MSc programme. Unfortunately, I do not have access to the course evaluation for this course.

Evidence, Diet and Health – a tacit knowledge course

In this course in the second block, the overall aim is to train the students in reading scientific literature, building an argument and evaluating the overall evidence for a nutrient-health relationship, all of which can be regarded as tacit knowledge. Tacit knowledge is not easily shared; it involves learning and skill, but not in a way that can be written down. Of the 84 students enrolled in the course, a total of 71 students took the 48h take home exam, in which they were provided with two scientific papers, for which they were asked to describe, explain and discuss specific topics.

Based on the written tests during the students' workshop, academic writing (in English) was identified as a major difficulty for the students. Therefore, we covered some of the things covered in the workshop on writing and vocabulary as part of the course introduction and encouraged them to start their own word list and become acquainted with the academic word list. We also introduced a sum-up exercise on nutrition-specific terminologies towards the end of the course. This was held as a test in number of words which they could explain the meaning of, however this was less than successful as only few students were active during this session.

One of the major problems with teaching this course in English is the lack of student participation. As part of our course, some of the lectures are given by external lecturers, which furthermore make the students hold back with discussions. This is a commonly recognized problem with second language courses. For example, in the Netherlands, Klaassen (2001) studied the shift to English-medium instruction and found that the teaching becomes relatively more monologic and less interactive when the language switches to English. Also, the Dutch students became more passive in the classroom, although this did not necessarily lead to poorer learning outcomes, at least after the first transitional year. In order to make it easier for the students to take part in discussions and better grasp the main points of the different lectures, we introduced "post-discussion", i.e. after a lecture on a specific topic, for instance health implications of alcohol consumption, me and my co-course-responsible led a discussion with the students on what to take home from the lecture. They thought it very useful in terms

of grasping the main points; however, we did not accomplish to get a more active group of students during lectures by this.

The course was evaluated both electronically and as a plenum session. On the question on whether their own English skills were adequate to benefit from the teaching, 11% answered that they were not (ratings <3, with 3 being neutral on a 5-point scale), and another 12% gave a neutral answer. Thus, it appears that 25% of the students do not positively consider their own English skills to be sufficient. Whether these participated in the workshop is not known. During the plenum course evaluation, it was mentioned that a two-day English workshop, although useful in providing tools and increasing awareness of the challenges with courses taught in English, will not improve their English proficiency considerably. However, there was a general agreement that it is important to continuously talk about the problems which English-medium teaching gives rise to, and that the workshop is an ideal starting point for this. Comments were also made on how the teachers' English skills affect the students ability to understand, for instance that wrong pronunciation of words disturbs the students' learning. This is a difficult thing to deal with, as teachers' English skills do differ and likely depend on whether they have been part of an academic environment outside Denmark. Also, it was suggested to give more attention to the tools during the course and make them part of the exercises, such as vocabulary and academic word list exercises, and discuss the purpose of reading the different texts before classes. Although not directly linked to teaching in second language, these general pedagogical focus points and tools become increasingly important when there is a language barrier as well.

A general problem with student activation, and particularly when teaching in the students second language, may be the large group of students (approximately 80), which does not facilitate taking part in a plenum discussion. Tärnvik & Stenberg (2010) studied how different group sizes of medical students discuss clinical cases, and how this affects the students' learning experience. They found that the larger the discussion group size the more students stated that they would have preferred a smaller discussion group. Comments were made that they "felt less open" and "less active since many students feel worried about their answers". This is in line with some of the comments made in the electronic evaluation, where some students suggested that we reduce the class size for some of the discussion exercises in order to activate a larger proportion of the students. This will be taken into consideration when planning the course for next year, where an equally large number of students is anticipated to enroll.

Concluding comments

Overall, the CIP English workshop should be offered to future students. Although not all students participate in the workshop, the students who do, seem to benefit from it, mainly in terms of increased awareness of strengths and weaknesses and tools to accommodate the language barriers. For the future, more emphasis should be placed on actively using the different tools as part of teaching, as the students need reminding to be able to actively use them. A two-day workshop only offers a starting point. Furthermore, the challenges should be discussed with the students continuously as this will make them more comfortable expressing their difficulties. I believe that reducing class size during some exercises will create a safer learning environment and thereby enable the students to take part in the discussions as these are very important for there academic training but also for them to become better at spoken English.

Acknowledgements

A Evaluation questionnaire for the Students' workshop

YOUR BACKGROUND

1) What is your academic background (Bachelor)? _____

2) Did you consider your English skills before applying for the MSc in Human / Clinical Nutrition or Gastronomy & Health?

   (not at all) 1 2   3   4   5 (very much)

3) Which skills did you (before taking the test) consider the most challenging with regard to English?

                 writing   listening   reading

4) Which skills did you (after taking the test) find the most challenging with regard to English?

                 writing   listening   reading

EVALUATION OF THE ENGLISH WORKSHOP (CIP)

5) How would you rate **the introductory lecture** on day 1 in terms of

   a. Relevance of content?

       (very poor) 1 2   3   4   5 (very good)

   b. Teaching pace?

       (very slow) 1 2   3   4   5 (very fast)

   c. Usefulness of the tools presented?

       (not useful) 1 2   3   4   5 (very useful)

6) Do you think it was useful to have **the English tests**?

   (not useful) 1 2   3   4   5 (very useful)

7) In which of the following areas were your English skills poorest?

                 writing   listening   reading

8) How would you rate **the second workshop day** in terms of?

a. Relevance of content?

(very poor) 1 2   3   4   5 (very good)

b. Teaching pace?

(very slow) 1 2   3   4   5 (very fast)

c. Usefulness of the tools presented?

(not useful) 1 2   3   4   5 (very useful)

9) Do you feel more prepared to start the MSc programme now with regard to your English skills?

(not at all) 1 2   3   4   5 (much more)

10) Which aspects (tools, strategies, other) from the workshop will you take with you?

_____

_____

_____

11) Has your opinion on your English skills changed during the workshop?

(not at all) 1 2   3   4   5(much improved)

12) Would you recommend this workshop to others (students, other faculties….)?

(I don't agree) 1   2   3   4   5 (I totally agree)

Why? / Why not?

_____

_____

Results of the questionnaire

Question		Mean rating ± SD (n=39) / No of students
1		10 Clinical Dietician, 15 PBCs in Nutrition & Health, 6 BSc in Food Science, 1 BSc, in Sports Sciences, 1 BCs in Biotechnology; 1 BSc in Molecular Biology, 1 nurse, 1 physiotherapist; 1 teacher, 1 BSc in Pharmacy
2		3.5±1.1
3		25 Writing 5 Listening 5 Reading
4		18 Writing 15 Listening 3 Reading
5	a	4.6±0.6
	b	3.3±0.7
	c	4.6±0.6
6		4.6±0.8
7		14 Writing 17 Listening 5 Reading
8	a	4.6±0.6
	b	3.4±0.8
	c	4.6±0.6
9		4.3±0.7
10		academic word list, glossary/word list, summary, speaking out loud
		academic word list, reading strategies
		academic word list, reading strsategies
		academic word list, word list
		glossary, reading strategies
		glosseries, academic worrd list, sttructure,
		good to be prepared
		process writing, structure, purpose to read
		purpose to read, structure
		purpose to read, structure in writing, academic word list
		reading strategies, structure
		reading strategies, structure, prupose to read, signposting
		reading with a purpose, structure
		skills on reading and writing
		structure
		structure, glossary
		structure, purpose to read
		structure, reading strategies
		structure, reading strategies
		structure, reading strategies
		structure, reading strategies
		structure, reading strategies
		structure, reading strategies, vocabulary exercises
		structure, vocabulary, reading with a purpose
		structure, word cards, academic word list
		vocabulary exercises
		vocabulary exercises, structure, reading strategies
		vocabulary, academic word list, structure, how to handle an assignment
		will use input on structure, word list, hand outs
		word cards, process writing
		word cards, writing tools
		word list, word cards, summary
11		3±0.8
12		4.7±0.6

Comments	because knowing weaknesses and strenghts are important
	because you got very good tools and strategies
	brilliant teacher
	eye opening experience
	found it very useful
	good brush up and good picture of own skills
	good motivation to want to improve
	good to get into the language again
	good to know your own skills
	good to know your own skills and good with tools
	good to test your skills and get some useful tools
	insight to own skills
	know strengths and weaknesses
	know what the challenges are
	learned a lot
	little tricks make a huge difference
	make it mandatory
	make it mandatory
	really good and useful
	Sophie was a fantastic role model
	sophie was brilliant
	sophie was excellent
	very useful tools
	yes, but only to those who do not regularly use their english

Part V

Supervision and supervision styles

Towards a better Alignment of PhD Student Development and Supervision Style

Meike Burow

Department for Plant Biology and Biotechnology, University of Copenhagen

Supervision differs from other teaching situations mostly because it aims at supporting an individual student and because it is meant to provide guidance to the student over a relatively long period in time, especially in the case of PhD students. The process as well as the outcome is shaped by both the student and the supervisor and in fact most largely by their interaction in which not only the supervisor but also the PhD student should play an active role.

In biological sciences and related disciplines which require the PhD students to perform practical work, their supervisors are expected to serve as advisor for practical/technical questions (how to perform a given experiment?, how to employ a given method in the lab?) as well as a mentor (which experiments to perform and why?, how to manage a project?, how to pursue a career in science?). PhD students and postdocs who often serve as direct supervisors are typically not only student and supervisor but also very close colleagues who work on closely related research projects. They both learn and develop within the PhD student's three years or at least the period the supervisor works in the same research group. As a consequence the student's anticipation of the supervisor and the supervisor's expectations to the students change over time.

Adjustments have to be made to the needs of individual students as well as changing circumstances of projects. Supervision of PhD students therefore requires particular "awareness of the state of the relationship and flexibility to respond to inevitable changes" (Gurr 2001). This awareness is quite often not achieved despite the close supervision characterized for example by very frequent meetings as typically seen within biological sci-

ences. Whereas a lot of time is spent on discussing details of practical methods, scientific articles and research concepts, supervision does often not include continuous evaluation of the supervisory relationship and changes are not deliberately perceived and communicated. This makes is difficult for both supervisor and PhD student to respond to any change in an active manner. A major difficulty in addressing and possibly criticizing the supervisor's current style or the student's current approach may be that mutual feedback is required while PhD project is running which means before final assessment (Gurr 2001).

The dynamic nature of the relationship between PhD student and supervisor adds to one of the largest challenges in supervision in general, namely to find the right balance between control and freedom, involvement and distance for each student at a given point in time. This balance can be considered as prerequisite for the supervisor to provide adequate, timely help without interfering with the student's development. A seemingly simple question like "How is your experiment going?" can be interpreted as an attempt to take control if the student tries to gain more independence or as a sign of interest in the student's project if the student wishes more support. Likewise, not to ask could mean that the supervisor considers the student as independent or reflect a lack of interest in the student's project. Miscommunication can occur if the student and the supervisor judge the student's independence and/or the supervisor's style very differently.

To aid conversations in the supervisory relationship, Gurr (2001) introduced a two-dimensional representation of the perception of the current relationship between student and supervisor as a tool ("supervisor/student alignment model"; Fig. 24.1). In a study with four PhD students over a period of three years, using this tool "has led students to consider and discuss their supervisory needs concurrently with the supervisor considering the appropriateness of their own approach". Placing a cross in the two-dimensional plot depicted in figure 24.1 appears to offer a fast and simple way to describe the current supervisory relationship because it requires reflecting upon both the student's status and the supervisor's supervision style. Considering that a student can be more or less independent with regard to different parts of a project or different tasks at a certain point in time, using the supervisor/student alignment model as a tool can of course only serve as entry point to an open conversation about the current supervision situation.

Apart from a brief reflection upon the student's and the supervisor's current approach, placing the cross also requires to define what makes a
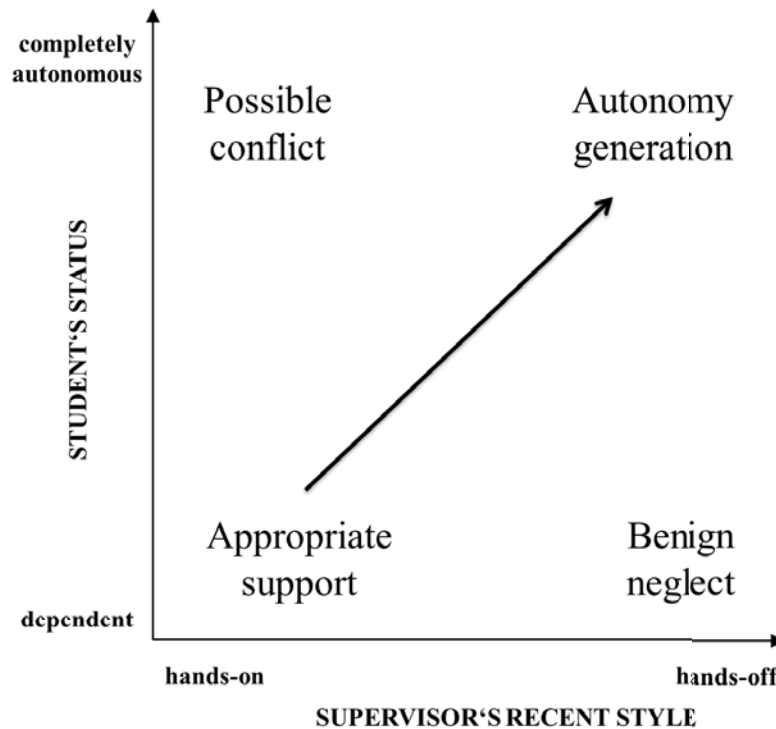
Fig. 24.1. Representation of the supervisor/student alignment model. Indicated are the outcomes of four combinations of student's state and supervisor's style and the hypothetical development. Redrawn from (Gurr 2001).

PhD student autonomous and what is considered as hands-off supervision. Different definitions on the student's and the supervisor's side could result in discrepancies in the positions of the crosses placed by the student and the supervisor even if they perceive the current relationship similarly. Assessing potential differences in how PhD students and supervisors look upon dependency and autonomy, control and freedom, could provide interesting insight to how different expectations on both sides impact the supervision process. With the aim of finding out what it is that makes a PhD student feel more or less independent and how on the other hand supervisors judge their students' independence, a survey was designed based on the supervisor/student alignment model.

Design of the questionnaires

Two separate questionnaires designed for PhD students and supervisors consisted of six questions each (Fig. 24.2) and were sent out to all PhD

students and supervisors in the Department for Plant Biology and Biotechnology at LIFE. Those PhD students who have more than one supervisor were asked to choose one and reflect upon their relationship to that supervisor when answering the questions without talking to them.

The initial questions were related to the student's stage and the supervisor's role in the supervision process, respectively. In addition, PhD students and supervisors were asked to indicate how often they have scheduled meetings and how frequently they meet and talk spontaneously because the frequency of meetings may correlate with the perception of the current supervision style. Considering that PhD student and supervisor often also interact as colleagues, spontaneous conversations may not always be classified as supervision sessions.

The main part of the questionnaire then focused on the supervisory relationship as seen from the perspective of the supervisor and the PhD student. PhD students and supervisors were asked to describe their current interaction by placing a cross in the "supervisor/student alignment" plot (Fig. 24.3). To gain some insight into how the participants decided where to make their crosses, the PhD students were finally requested to give specific examples of situations in which they feel to be controlled/left alone and the supervisors were asked to provide examples which illustrate what they expect from an autonomous PhD student and when they feel the strongest need to take control. Since it was difficult to predict what students and supervisors consider as adequate support, these final questions were left open for the participants to comment on any possible aspect of the supervisory relationship.

Results

Ten PhD students and supervisors replied to the questions listed in figure 24.2. The pairs of a PhD student and his/her supervisor are referred to as pairs # 1-10, the individual PhD students as P1-10 and supervisors as S1-10. With the exception of one PhD student (P4), all students were in the second to third year of their PhD projects. Combining the frequency of scheduled and ad-hoc meetings, most of the PhD students who participated in the survey talk to their supervisors about once a week indicating a close interaction between student and supervisor (Fig. 24.4). Although the questions about the frequency of meetings had mainly been included to get an idea of the nature of communication between student and supervisor, the

Question	PhD students	Supervisors
1.	When did you start your PhD project?	What is your role as a supervisor? primary supervisor project supervisor on-bench supervisor
2.	How often do you have scheduled meetings with your supervisor? – 1-3 times a year – 3-6 times a year – about once a month – more often than that	How often do you have scheduled meetings with your student? – 1-3 times a year – 3-6 times a year – about once a month – more often than that
3.	How often do you have ad-hoc meetings with your supervisor? – 1-6 times a year – about once a month – about once a week – more often than that	How often do you have ad-hoc meetings with your supervisor? – 1-6 times a year – about once a month – about once a week – more often than that
4.	Please describe what the interaction with your supervisor has been like in the previous three months by placing an "x" on the figure below (see Figure 2).	Please describe what the interaction with your PhD student has been like in the previous three months by placing an "x" on the figure below (see Figure 2).
5.	Give an example of a situation in which you think your supervisor takes too much control.	Give an example of a situation in which you wish your PhD student was more autonomous.
6.	Give an example of a situation in which you think your supervisor takes too little control.	Give an example of a situation in which you wish your PhD student was less autonomous.

Fig. 24.2. Questions which were sent out to PhD students and their supervisors in separate questionnaires.

answers revealed some interesting observations. Only three pairs showed full agreement (Fig. 24.4; pairs # 2, 5 and 8). Five out of ten pairs gave the same answers when asked about the frequency of scheduled meetings but not regarding unscheduled meetings. In four of these cases (pairs # 3, 6, 7 and 9), the supervisors indicated more frequent ad-hoc meetings than their students. Pair 1 shows a surprisingly pronounced disagreement which might indicate that PhD student and supervisor have different ideas about what defines a supervision session.
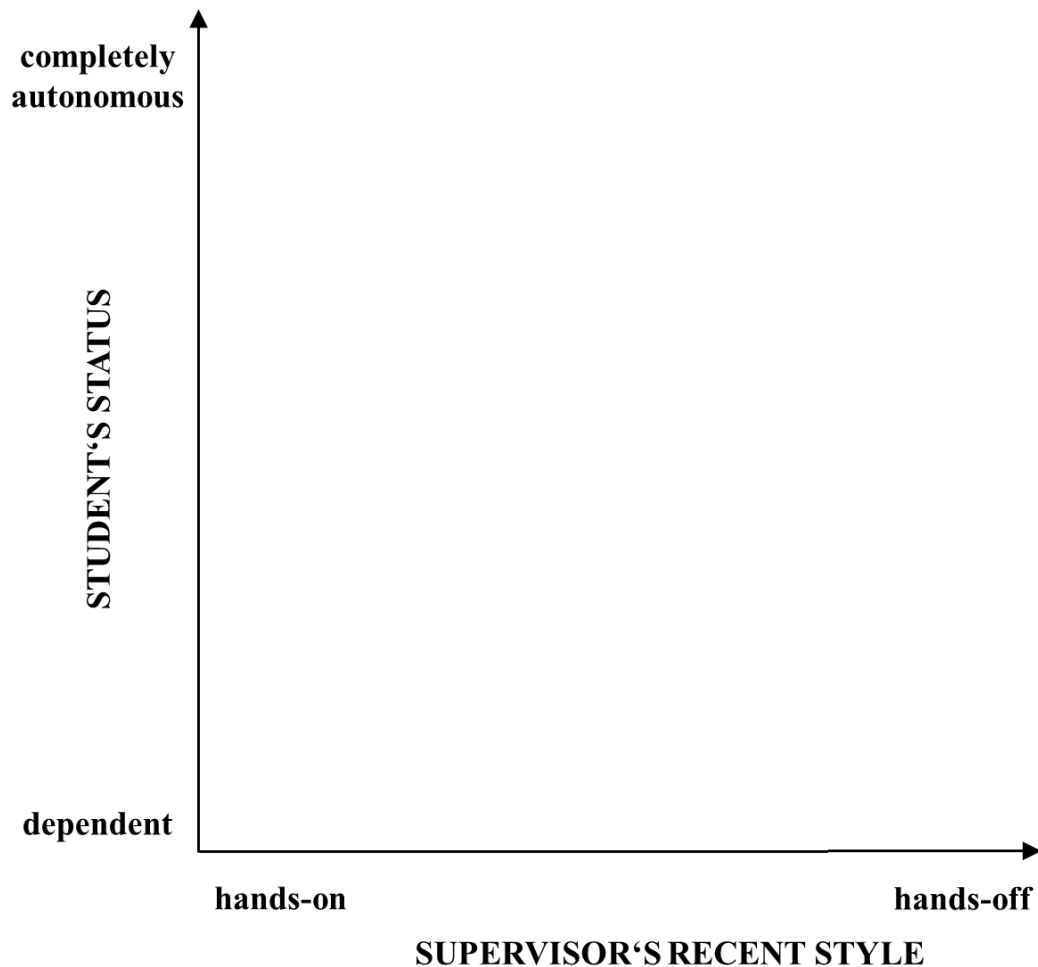
Fig. 24.3. Supervisor/student alignment plot used in the questionnaires. See also figure 24.2, question 4.

As short description of their perception of the current supervisory relationship, PhD students and supervisors were asked to place a cross in the supervisor/student alignment plot (Fig. 24.3; Fig. 24.2). Despite the option of participating anonymously, about two thirds of the participants chose to hand in their answers in person and to provide immediate feedback on this part of the questionnaire. Some described it as difficult to characterize their current supervision situation by making a single cross because in their opinion, more than one cross would be required to cover the different situations they typically experience. Other participants stated that placing the cross required more reflection than they had initially thought. They spent about ten minutes to complete the entire questionnaire.

Comparison of the positions of the crosses made by each pair of participants revealed pronounced discrepancies most cases (Fig. 24.5). Based on the relative position of the crosses, eight of the ten pairs were grouped into two categories (Fig. 24.5 A-B). In three cases (pairs # 1, 3 and 6; Fig. 24.5 A), the students considered themselves more independent than their supervisors described the students' status. Strikingly, the same three students described their supervisors' recent style as more hands-on than stated by the respective supervisors. When asked to give an example of how their supervisors take too much control, two of the three students stated that they would appreciate a higher degree of freedom to follow up on their own scientific hypotheses. Two of the respective supervisors think that their students are too autonomous when deciding which experiments should be carried out and which leads should be followed.

Five PhD students (P4, P5, P7, P9, P10; figure 24.5 B) seemed to see themselves as more dependent upon their supervisors' input than their supervisors think. Like the three students in the first group (Fig. 24.5 A), these students described the recent style of their supervisors as more hands-on than the supervisors themselves. As examples of circumstances under which their supervisors take too much control, the PhD students named rather diverse situations: interpretation of scientific results in a broader biological context, choice of the direction of scientific discussions, mail correspondence with collaboration partners, and choice of conferences. On the other hand, the same students would like to get more input with regard to specific aspects of their projects, details on practical methods and experimental design. One of the supervisors stated that his/her student should try to find answers to exactly this type of question more independently. None of the five supervisors in this group could think of a situation in which the student should be less autonomous than he/she is.

Pair # 8 (Fig. 24.5 C) differs from all others because it is the only case in which the supervisor considers his/her own style as more hands-on than described by the student, while both agreed on the student's current approach. As indicated in figure 24.4, PhD student and supervisor meet very frequently (more than one scheduled meeting per month and more than one ad-hoc meeting per week). The supervisor would like the student to plan experiments and analyze data more independently which is in line with the supervisor's perception of taking a mostly hands-on supervision approach. Finally, only one pair (pair # 2, Fig. 24.5 D) agreed upon both the student's status and the supervisor's style. In this case, the supervisor would like the student to show more autonomy upon experimental design and data analy-
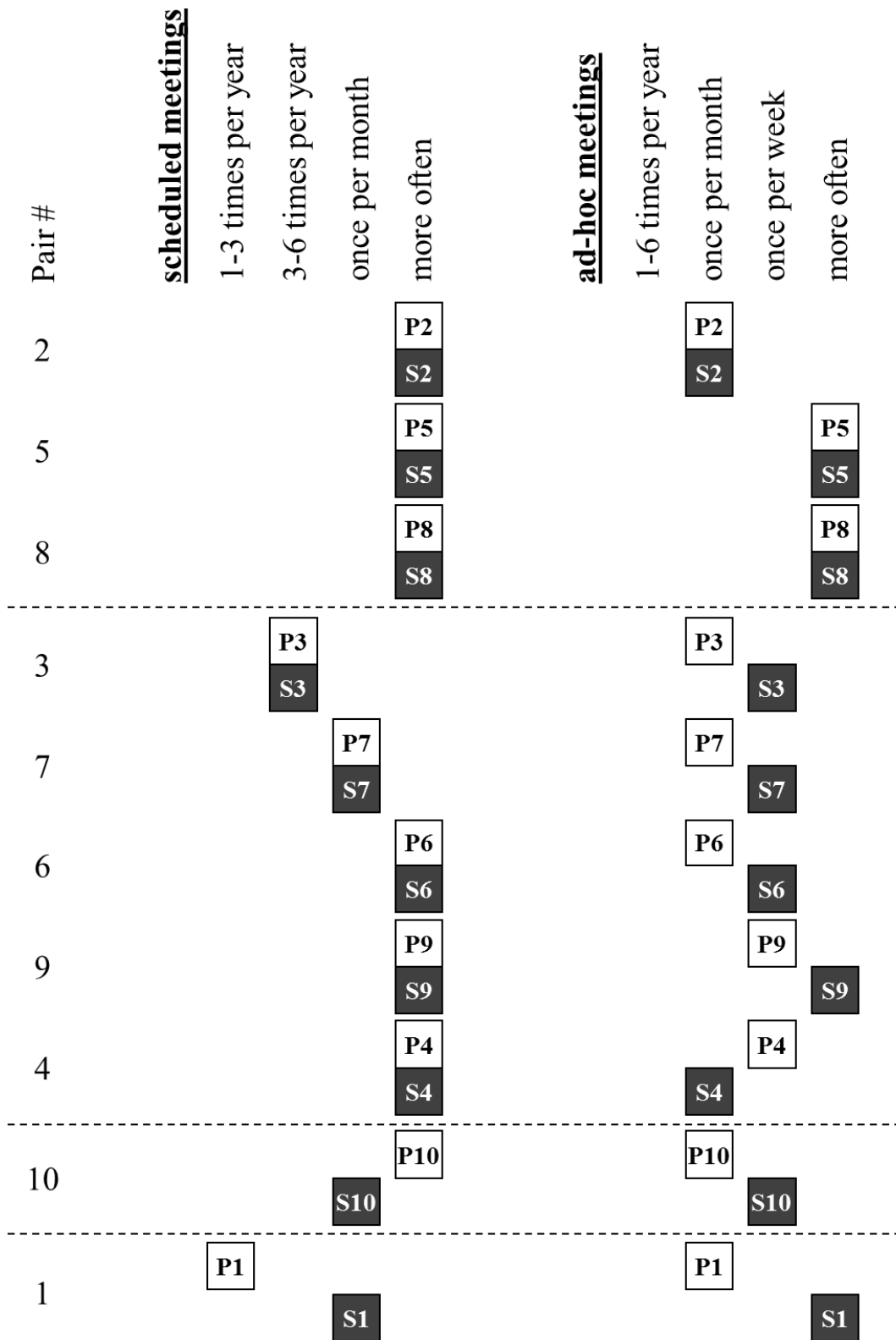
Fig. 24.4. Frequency of scheduled meetings and ad-hoc meetings. The PhD students' answers are shown as white boxes (P1-10); black boxes illustrate the supervisors' answers (S1-10).

sis and less autonomy when "jumping to the next step although the previous step is shaky" (S2). Unfortunately, both students (P8 and P2) have not given any further description of the current supervision situation.
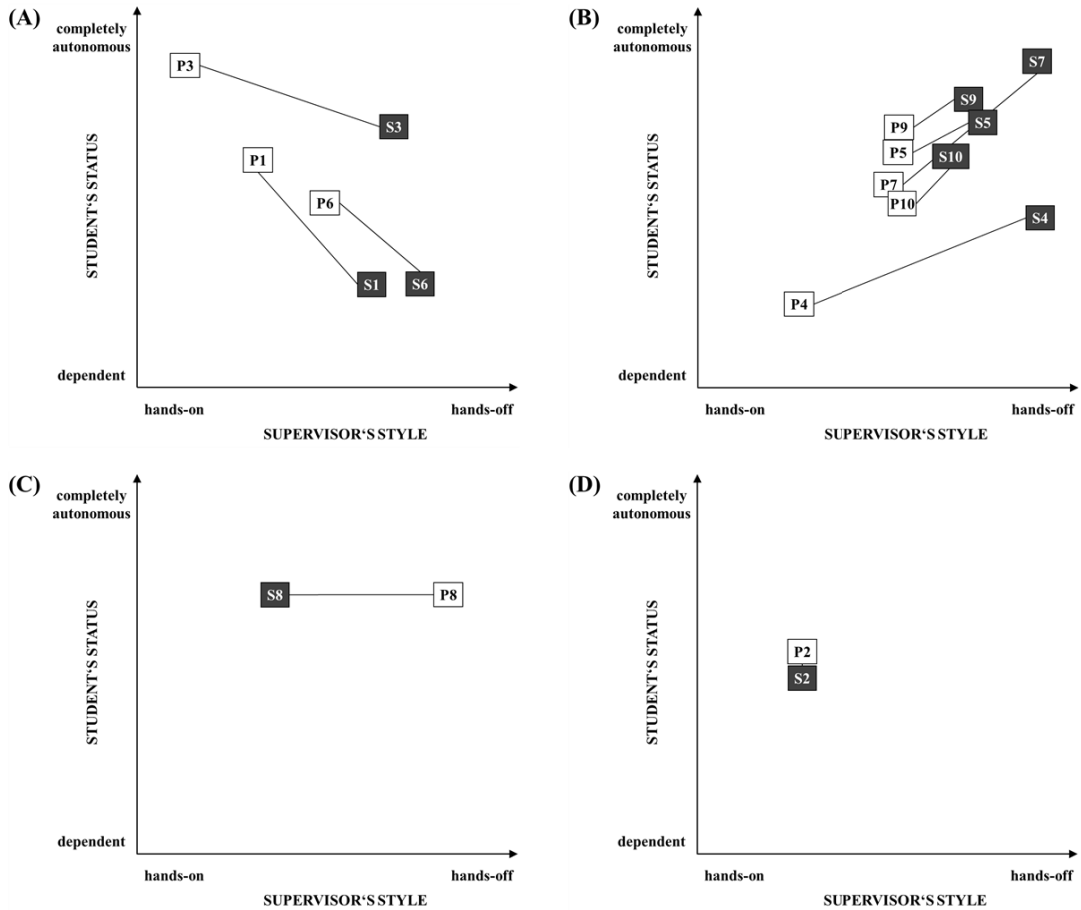

Fig. 24.5. Relative positions of the crosses placed in the supervisor/student alignment plot by the participants. Positions of the crosses are indicated by white boxes (PhD students P1-10) and black boxes (supervisors S1-10).

Taken together, nine of the ten supervisors who participated in the survey described in which way they expect their students to gain more autonomy. Five of them (S1, S2, S7, S8 and S9) expressed that the students should design and carry out experiments more independently. More specifically, the students should include all appropriate controls, find answers to small practical problems and analyze raw data without immediately consulting their supervisors. Two supervisors (S3 and S10) stated that their students should take more responsibility of their time line, i.e. the students

should realize themselves when and how much time to spend on paper and thesis writing. Two others (S5 and S6) think that their students should dedicate more time to reading of scientific articles in order to gain a more solid background knowledge required for the project (S5) or in order to get a better "strategic overview on what the project means" (S6).

The only four supervisors who also gave examples of too autonomous student behaviour (S1, S2, S6 and S8) all stated that they do not appreciate it when their students change a project's priority, drop a possibly important lead or do experiments without allowing the supervisor to suggest improvements to the experimental design.

Seven of the PhD students gave examples of situations in which they feel that their supervisors do not give them enough freedom. These examples were more diverse than the supervisors' answers summarized above. The most frequently described situations (mentioned by three students; P3, P4 and P5) were journal clubs or scientific meetings during which the students lack the opportunity to direct the discussion according to their own interest, to interpret their results in a larger context or to argue for their own hypotheses and ideas. One student expressed his/her wish to "try things out which the supervisor considers a waste of time but might improve the student's understanding of things" (P1), while another student would appreciate more freedom to develop his/her own writing style (P8). Finally, one PhD student would like to be in charge of the mail correspondence with collaboration partners (P9).

Three PhD students (P4, P5 and P7) would appreciate closer guidance from their supervisors on how to set up experiments in the most efficient way as well as on details related to practical methods. By contrast, two PhD students (P8 and P9) would like their supervisors to take more control the structure and scientific directions of the working group as a whole. Another student expects the supervisor to encourage him/her to "participate in conferences, workshops or seminars considering that the supervisor should have more information about such events" (P5). PhD student P1 stated that his/her supervisor is generally not motivating and supportive enough.

Discussion

As much as getting a PhD is about learning techniques, gaining knowledge and writing a thesis, it is also about developing towards an independent researcher. PhD students are therefore expected to gain autonomy in more

than one way over time and they can be more or less autonomous with regard to different aspects of their project. The various components of autonomy and dependency a PhD student may or may not have achieved could explain why some participants would have preferred to place more than one cross in the supervisor/student alignment plot. A PhD student's autonomy does not only vary between different aspects of the project at the same time but also changes over time. A successful student will gain an increasing level of independency during the PhD period but this development does not proceed at constant pace and will be interrupted by periods of increased dependence, e.g. in the beginning of thesis writing (Gurr 2001).

In the present survey, the PhD students used very different examples to illustrate the amount of control and the level of freedom they want which underlines their diverse needs and expectations depending on their personality as well as the circumstances of the project. Likewise, it demonstrates why it can be difficult for a supervisor to find the right level of involvement, especially if a supervisor is responsible for more than one PhD student. Within lab-based research, distinct directives sometimes have to be given to a student, e.g. when demonstrating something in practice and three PhD students would in fact appreciate closer guidance on practical aspects of their lab work. By contrast, a strikingly large number of supervisors wanted their students to gain more independence with regard to experimental design and data analysis which might simply be due to the fact that on-bench supervision takes a lot of time. However, PhD students (and maybe not even the supervisors themselves) might be aware of the fact that this part of supervision is not only time-consuming but also more and more challenging given the pace at with new techniques arise. Frequently, PhD students embark on novel practical methods their supervisors cannot provide sufficient guidance on, which means that supervisors can no longer adopt the supervisory style they experienced as a student. Besides supporting students to complete their lab work and to write their thesis, more help seems required for PhD students to develop those skills which allow them embark on new approaches such as how to choose a research project, how to choose a technique, how to prioritize experiments or how to manage a project.

To identify a student's level of autonomy and to decide how much guidance shall be provided can be quite challenging for a supervisor. Trying to find the balance, supervisors adopt hands-on and hands-off approaches at the same time (Gurr 2001) as well as at different times during the supervision period (Gatfield 2005). Moreover, they vary the kind of support they provide, i.e. intellectual, emotional or structural support (Vilkinas 2008).

Interestingly, these adjustments are made although supervisors do not seem to be capable of reflecting on their own supervisory style (Vilkinas 2008). The discrepancies between the students' and the supervisors' perception of how many ad-hoc meetings they have indicates that it is not even always easy to tell when supervision happens. These apparent difficulties in reflecting upon the supervisory relationship make it attractive to implement tools which enforce such reflection.

In the present survey, the supervisor/student alignment plot (Gurr 2001) was employed to get an impression how supervisory relationships can be perceived by the supervisors on the one hand and the PhD students on the other. A major aim was to investigate how both sides define the autonomous student as direct instructions are frequently required within lab-based research. Half of the students described themselves as less autonomous than stated by their supervisors and at the same time, they believed to get more support than the supervisors thought to have provided recently (Fig. 24.5 B). A possible interpretation is that supervisors overestimate their students' development. Alternatively, the students have already generated more autonomy then they are aware of. This latter assumption is supported by the students' examples of situations in which they would like to be more independent. Instead of mentioning too tight control with regard to practical questions, experimental design or data analysis, the students request more freedom to shape scientific discussions and to interpret their scientific results in a broader context. This indicates a certain level of student autonomy at least in those four cases where the supervisors do not state that their students need too much help with basic, practical problems.

All in all, eight out of ten supervisors believed that they provided less guidance (hands-off) than perceived by the students (Fig. 24.5 A-B). This finding seemingly disagrees with the outcome of a similar study which revealed the exact opposite trend for the majority of the students at the start of the project (Manathunga & Goozée 2007). Later in the supervision period, the supervision style changed towards a more hands-off approach based on the decreasing amount of time spent by the supervisor. The snapshot provided by the present survey may be biased because most of the PhD students were at least in the second year of their projects. Strikingly, no correlation can be observed between the frequency of meetings and the students' ratings of their supervisors' recent style (compare figures 24.4 and 24.5). Close supervision characterized by frequent meetings is thus not necessarily perceived by students as means of taking inadequate control.

Three supervisory relationships were characterized by PhD students who considered themselves as much more independent that the supervisors thought (Fig. 24.5A). At the same time, these students described the recent supervision style as hands-on, while the supervisors stated that they have recently provided rather little guidance. The pattern indicates a potential conflict if the PhD students feel that they encounter a high degree of control while seeing themselves as independent. However, as situations in which they would appreciate to have more freedom, one of the students described scientific discussion not providing enough room for his/her own hypotheses and another wanted to make more autonomous decisions about his/her experimental work. Although comprehensible, this pronounced urge for autonomy could easily interfere with the coordination of other projects in the same working group, agreements made with collaborations partners or similar considerations on the supervisor's side as indicated by several supervisors stating that their PhD students should consult them before initiating or dropping experiments. In the cases of these three pairs of participants, supervisors and PhD students appear to disagree on the PhD student's role. Whereas the students seem to strive after autonomy in a way which is not expected or recognized by their supervisors and want to make decisions beyond their own project, the supervisors define an autonomous student as a student who carries out experiments independently after aligning them with their supervisor ideas and who keeps track of a project largely defined by their supervisor.

Reflection

Both the PhD students' level of autonomy and the circumstances of PhD projects undergo frequent changes which should be tracked in order to dynamically adjust supervision style. When acting as supervisor for PhD students, I have sometimes found it challenging to be aware of my students' development, especially when I had to fine-tune my own role as PhD student/postdoc at the same time. To give an example, the less time I spend on experimental work myself, the more I depend on my students to identify bottlenecks in technical procedures which also means that it becomes more difficult to tell whether they only need time or in fact additional input to optimize a method or experimental design. The challenge increases, moreover, with an increasing number of PhD students which prompted me to test the supervisor/student alignment model as a potential communication

tool to aid supervisory relationships in the future. Based on the promising outcome of this survey and the positive feedback I received from the participants, I will employ the supervisor/student alignment plot and similar tools to better align my definition of an autonomous student and an efficient supervisor with my students' expectations.

Assessment of the BSc dissertation process from the perspective of students and supervisors

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The Bachelor degree in Biology at University of Copenhagen includes a dissertation towards the end of the obligatory study programme (Act on universities 2011). The project is weighted 15 ETCS-points out of a total of 120 ECTS-points (equal to one fourth of an annual study programme) (Studieordning 2009). Hence, for finalising their studies and achieving their scientific degree BSc students write a dissertation – a process including supervision.

Supervision is different from other teaching forms mostly because it aims at supporting and guiding individual students over a relatively long time period (e.g. Cook 1980, Handal & Lauvås 2007, Biggs & Tang 2007). Furthermore, supervision often takes place behind closed doors (e.g. Handal & Lauvås 2005) and has received relatively less attention compared to other teaching forms resulting in limited descriptions of how to perform good pedagogically supervision and how supervision should be evaluated (reviewed by Wichmann-Hansen et al. (2007), but see also (Handal & Lauvås 2005, Derounian 2011)).

For many students, the BSc project is their first encounter with such a direct interaction with a teacher where the personal connection plays a role in the successful completion of the process (e.g. Cook 1980). For most students, this project is also the first individual written larger assignment and they are expected to demonstrate the ability to formulate, analyse and process a scientific problem. This is normally carried out by conducting a research oriented project where the students additionally are required to show qualifications within e.g. data handling, analyses and formulation skills (Studieordning 2009). Thus, the BSc students are expected to apply

large parts of their obtained skills during the BSc project process. As a consequence, many students most likely view the BSc project as the most substantial and independent task they so far have undertaken during their university studies (e.g Derounian 2011). Many students also feel that this is a great chance to work within a favourite topic and make use of their achieved skills (Derounian 2011).

Most lectures and professors have supervision as one of their main teaching activities. With the increasing importance and student awareness of the BSc project as well as a growing demand by students for quality (interesting) projects, supervisors may also experience increasing competition to attract students. However, because of the different nature of this teaching form, teachers may not always be well prepared (Cook 1980) and there seem to be a need of guidelines (e.g. Rowley & Slack 2004, Handal & Lauvås 2005) or training opportunities (Handal & Lauvås 2005). Furthermore, often early career post docs and PhD students perform the day-to-day supervision of BSc student projects in which case the above would most certainly apply (Cook 1980). Hence, students and supervisors may experience that the process of the BSc project includes (a growing degree of) challenges of educational, communicational or organisational character besides the strictly scientific part of the process.

Since both students and supervisors shape the final outcome of the project process, a way to improve the process would be to introduce guidelines or tools for supervisors. Unfortunately, there is limited knowledge available in the literature, especially regarding supervision of BSc level project (Rowley & Slack 2004). A recent literature review focussing on published empirical studies were able to include 50 references on supervision. Of these, 11 were concerned with supervision of undergraduate projects (Wichmann-Hansen et al. 2007). However, much of the literature available is focussed on technical aspects such as keeping time limes, ability to write clearly and organisational skills (Rowley & Slack 2004). The importance of looking closer at supervision of undergraduate projects in particular is further underlined as very little knowledge from post-graduate level supervision is likely to apply directly to under-graduates (Rowley & Slack 2004).

One of the most efficient ways of increasing teaching skills is by evaluation (Biggs & Tang 2007). However, because of the higher degree of personal relations supervision and the difficulty of setting up an anonymous assessment evaluation of the supervision process, it is certainly very different from approaches used in other teaching form. Furthermore, tools

for conducting evaluations of supervision are not very common or broadly applied (but see Handal & Lauvås 2005, Derounian 2011).

My objective was to evaluate students and supervisors expectations to the project process and to what degree they match expectations before and during the project period as well as assessing the current extent and ways of evaluating the project process.

Methods

I prepared two separate questionnaires for students and supervisors holding 20 and 13 questions, respectively (Appendix A and B). Key questions where formulated so that the results could be directly compared. The questionnaires were handed out to 13 students and 13 supervisors from Section for Ecology and Evolution at Department of Biology and the Zoological Museum both departments at Faculty of Science. Half the supervisors were temporary employed (PhD-students and post docs) and half were holding a faculty position (associate or full professors). Only supervisors who had acted as the day-to-day supervisor of at least one BSc-student within the last two years (not necessarily the responsible supervisor as this would exclude the group of temporary employed supervisors) were included. Both current and former BSc-students were included i.e. both students in the process of conducting their BSc projects as well as students already finished. In connection to most questions, I asked for additional specific information that could increase understanding of the replies and also leave an option for additional comments. Questionnaires were filled out anonymously. Since my main objective was to assess the experience of the entire process in general, I made no attempt to couple the students with supervisors.

Expectations

For both groups, I aimed the first of the main questions at the expectations of learning outcomes and additionally for students what issues they focussed on when choosing their project and supervisor. The latter was repeated as the second last question in an attempt to force the students to re-think their choice and maybe report on what would be most important for the successful completion of the project. Furthermore, questions were included with the aim of exploring to what degree expectations were discussed prior and during the supervision process.

Starting up

The next issues focus on understanding the process of project development. Students were asked how easy they experienced the work with formulating the project and both groups were asked how this initial part of their collaboration was working. The purpose here was to obtain information on how much influence the students have on the project they are going to work on.

During the project period

I also aimed at achieving knowledge on how time allocation was experienced in the two groups. I therefore asked both groups how many supervision meetings they had and how much time the supervisor used on the project. Also part of the process is preparation for the exam so towards to end of the questionnaire, both groups were asked about degree of exam preparation in the supervision.

Evaluation of the project process

From here I moved on to questions regarding evaluation of the process. I asked both groups whether they evaluated the entire process after the exam because I was very much interested in knowing more about how common student evaluation of the supervisor performance is.

Finally, students were asked to indicate overall satisfaction after finishing their project and to list the two most important things that they learned from their project.

Results

Nine and 11 out of the 13 questionnaires handed out to students and supervisors were returned, respectively. Please note that unequal number of replies between subjects is caused by the fact that not all questions were answered by all persons in the survey.

Expectations

Ten of the 11 supervisors answered that expectations where discussed before and during the process of the project while only four out of nine stu-

dents had the same experience. Eight of the students and seven of the supervisors were not aware of the Intended Learning Objectives (ILO's) for a BSc project.

When students were asked to judge the most important issues influencing their choice of project and supervisor, future job possibilities and student environment did not apply. Instead topic and supervisor seem to be most important. When asked to rethink this question in "retro respect", having a good feeling about or recommendation of the supervisor increased in importance (figure 25.1). This result was very much in agreement with the replies from the supervisors (figure 25.2). Overall, six of nine students stated that their projects lived up to their expectations.
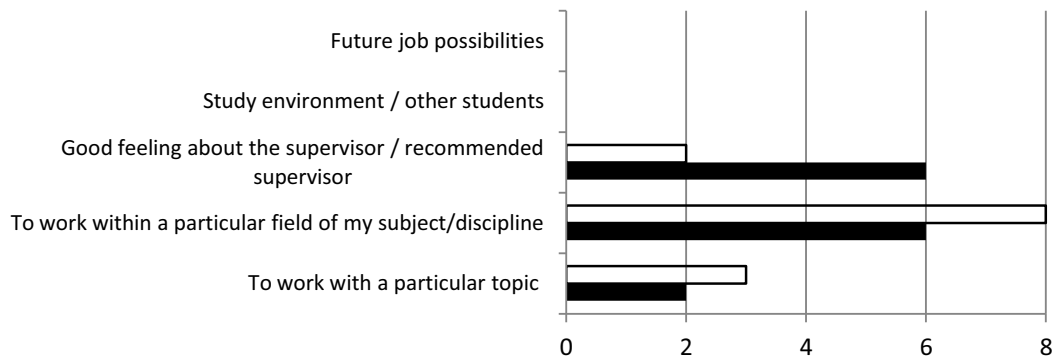

Fig. 25.1. Students were first asked: What is the most important issue when choosing project/supervisor? (closed bars) and again same question in retro respect (open bars).

Starting up

Students were asked how they experienced the initial part of the BSc-project process. Eight of the nine replied that they found it easy or very easy to get in contact with the supervisor (the last was "neutral"). From their short descriptions of how they established contact it was seen that four had a personal relation (e.g. from former teaching), three got into contact through a third person (e.g. via another student) and two reacted on a "public" project announcement (e.g. on Bioliv). Regarding the formulation of their project four of the nine found it easy while two found it difficult (3 were "neutral").
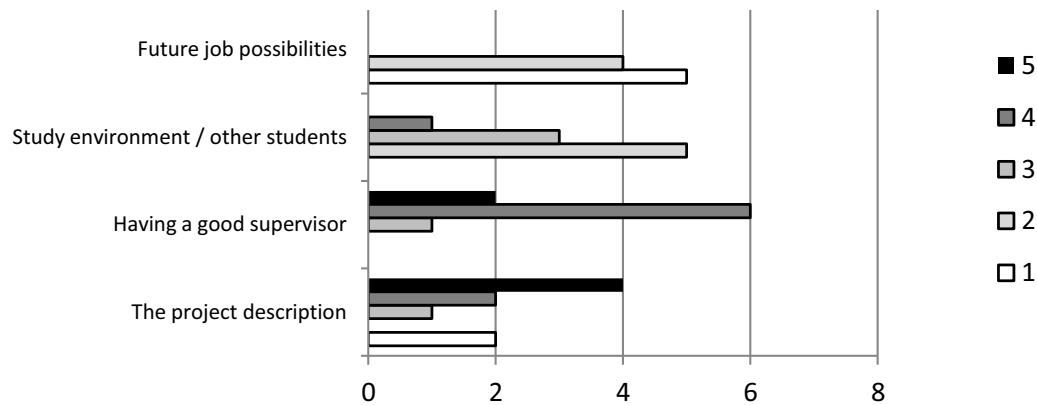
Fig. 25.2. Supervisors were asked: Based on your experience as a supervisor, please indicate the importance of the following issues for students during their BSc project? Values 1-5 were given (1 open bars to 5 filled, 5 is best).

Supervisors seem very much involved in the project formulation. Although, eight out of ten replied that they formulate the project but still develop or change the project in collaboration with the student and most (five of the eight) even offer alternative projects. Supervisors not involved in formulating the projects leave a similar impression as the projects are developed together with the students in one way or the other. As an example, one responded that he/she "*gives a topic within which the students formulated the project.*"

During the project period

In both groups they all reply that face-to-face discussions are either important or very important. As seen in figure 25.3 and 25.4, I found quite a large scatter in the number of meetings and time allocation by supervisors. Nine of 11 supervisors used more than 30 hours or replied that they used sufficient time and a very similar pattern was seen in the student replies.

Only one student (of 5 replies) stated that he/she was not prepared for the exam. All supervisors replied that they prepared students. However, seven of the 11 did only provide "some" preparation (figure 25.5).

Evaluation of the project process

Half the supervisors replied that they performed a self-evaluation after the project. This was most commonly done by reflecting on own performance
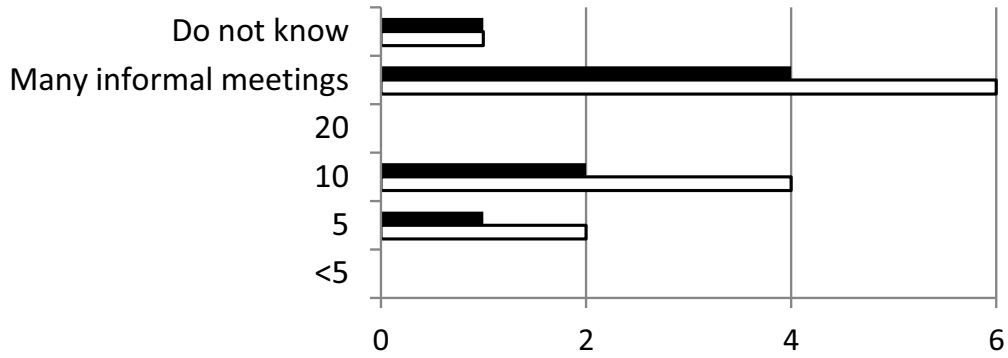
Fig. 25.3. Students (closed bars) and supervisors (open bars) were asked: How many supervision meetings do you have during the project?
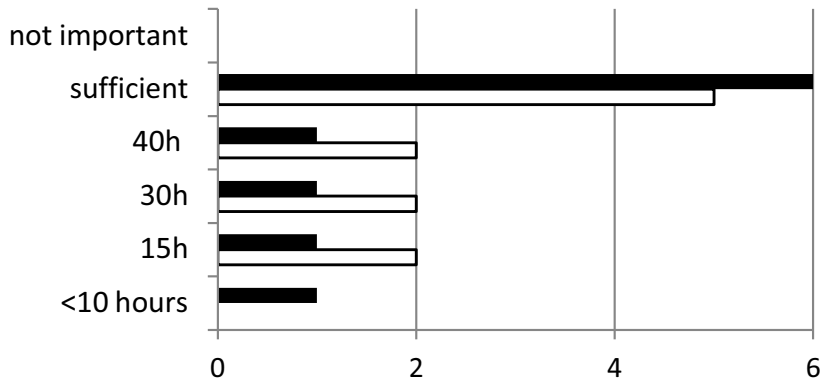

Fig. 25.4. Students (closed bars) and supervisors (open bars) were asked: How much supervisor time is allocated for each project in total?

and only two of the 11 have been in dialog with the student during or after the project process. Interestingly, half the students replied that they had been asked by their supervisor to evaluate the supervisor's performance. Only one student seemed to have evaluated own performance.

Half the supervisors replied that they used time with the students after the exam to evaluate the entire project process. As some students were in the process of conducting their projects, number of student replies is smaller in this section. However, only one out of six was of the impression that their supervisor used time to evaluate the entire process after the exam (figure 25.5).
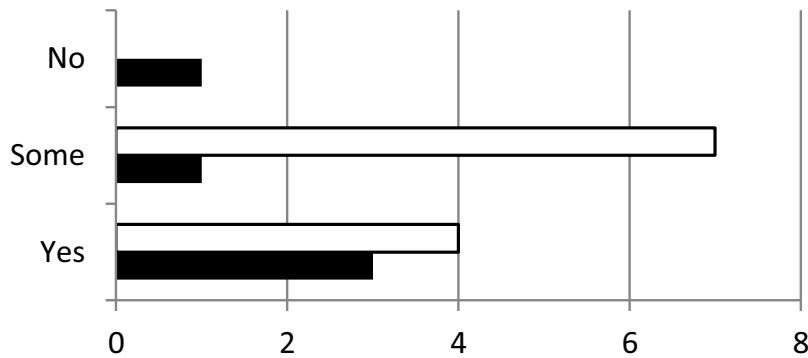
Fig. 25.5. Students (closed bars) and supervisors (open bars) were asked: How much supervisor time is allocated for each project in total?

Discussion

The general pattern found was that most students experienced a sufficient number of meeting and time allocation by their supervisors. The large scatter that was seen in the reported number of meetings being held and the time allocation by supervisors, most likely reflect the large individual variation in supervision demand by students. Most students indicated that the project lived up to their expectations which further supports that students generally found the process to be a success.

Also in the group of supervisors there were some indications that supervision is highly individual. The supervisors were generally not replying very well to questions regarding project formulation and development. Since all replies included added explanations under these questions, it seems likely that this is the results of their very individual and personal approach to supervision. This is in agreement with the conclusion made by Wichmann-Hansen et al. (2007) after their thorough literature review and the discussion by Handal & Lauvås (2007). Handal & Lauvås (2005) and Wichmann-Hansen et al. (2007) argue that the reason for the relatively little focus on improving supervision is caused by the high degree of individual variation between supervisor, subjects, disciplines, educational level and countries.

Wichmann-Hansen et al. (2007) report that one of the main conclusions from a large number of published studies is that students and supervisors should always initiate their collaboration by uncovering and match their expectations and produce a written agreement about possibilities and limitations for the project process. Furthermore, many published studies are

reporting that students have unrealistically high expectations which the supervisor cannot meet (e.g. Derounian 2011). In the present survey, half the students reported that they discussed expectations with their supervisor before and/or during the process. This number is higher than expected but still leaves room for improvement which could be approached by developing and offering tools or general guidelines for supervisors (Rowley & Slack 2004, Derounian 2011).

Both supervisors and students are of the opinion that choosing a good supervisor is important for the students. The weight of this choice actually increased when students were asked to rethink this question in retrorespect. Although, good personal relations should not be the only criteria, two studies reviewed by Wichmann-Hansen et al. (2007) support this as an important factor and one of the main conclusions was that a successful supervision process was determined by a good relationship between student and supervisor. The scientific competence of the supervisor was secondary.

It has many advantages when students take active part in developing their project and formulating the project description e.g. ensuring a general interest, commitment and valuable learning experience (Armstrong and Shanker 2006). Here, most students and supervisors reported that the supervisor did the project formulation and that a large proportion was involved in further developing the project. As students at BSc level may not have an initial knowledge of possible and realistic projects, often initial contact (also seen from these results) is based on project proposals made by supervisors. The students in this survey clearly did this and most supervisors seem to have adapted an approach with high degree of student involvement.

Evaluating teaching and own performance is broadly recognised as efficient and powerful approaches to improve teaching in general (Handal & Lauvås 2007, Biggs & Tang 2007). However, as supervision includes a personal connection over a long time period achieving an honest evaluation may constitute a difficult task. Hence, applying evaluation approaches and techniques that will work for supervision may therefore by a way forward and a key for overall improving skills of individuals as supervisors.

The issues dealt with in this study very much apply to another important part of the supervision namely good ways of giving feedback on students work during the project period. For both students and supervisors, this is a crucial part of the process and therefore it seems relevant to mention it here. Although, focussed on graduate and PhD students, Handal & Lauvås (2005) give eight very insightful and useful advises in regard to using feedback in the most efficient and motivating way for obtaining the best results.

Alongside expectations and exam preparation this is a part of the process that could be improved by post-project evaluations.

In conclusion, there seems to be basic issues within supervision of BSc students that could be improved, hereby improving the process for students and supervisors. There seems to be a clear need of tools and guidelines in how to develop your supervision skills and evaluate your own supervision. One of the most obvious challenges is finding and applying useful and effective approaches for harmonising expectations before and potentially during the project process.

A Student questionnaire

Student questionnaire handed out to 13 current or former BSc students at Department of Biology, Faculty of Science, University of Copenhagen regarding their experiences conducting their BSc dissertation.

1. **At what stage of your BSc project are you currently?** (Mark one or more options below)

Not started

Found a supervisor/subject but not started the project period

First half of the project period

Second half of the project period

Finished

2. **What learning outcomes did you expect to achieve prior to doing your BSc project?** (Mark one or more options and/or add

Learn how to work independently on a specific topic

Learn how to deal with original (biological) data

Learn how to write a scientific report/paper

Get insight of how to do research

Please add any other expectations, here:

3. **What was the most important issue when you chose project/supervisor?**

(Mark one or more options and/or add your own below)

To work with a particular topic

To work within a particular field of my subject/discipline

Good feeling about the supervisor / recommended supervisor

Study environment / other students

Future job possibilities

Please add any other expectations, here:

4. **How easy was it to get in contact with a supervisor?** (Underline one option below)

Very easy   Easy   Neutral   Difficult   Very difficult

5. **How easy was it to formulate your project?** (Underline one option below)

Very easy   Easy   Neutral   Difficult   Very difficult

How did you get in contact with your supervisor?

Please describe briefly:

6. **Project development**

Did you take a project defined by your supervisor? (yes/no)

- If yes: Did you develop or change the project in collaboration with your supervisor? (yes/no)
- If yes: Did your supervisor offer you alternative projects? (yes/no)
- If no: Describe how you got the idea for doing this particular project

7. **Did you discuss expectations to learning outcomes with your supervisor before starting your work (or during project formu**

8. **Did you discuss expectations to learning outcomes with your supervisor during your work period?** Yes/no

9. **Did you know the Intended Learning Objectives (ILO's) for a BSc project before starting?** Yes/no

10. **Do you know the ILO's for a BSc project after finishing?** Yes/no

11. **Did you evaluate your own performance during the project period?** Yes/no

If yes, how?

12. **Did your supervisor ask you to evaluate his/hers supervision after the exam?** Yes/no

If yes, how?

13. **Did you and your supervisor evaluate the entire process?** Yes/no

If yes, how?

14. **How many supervision meetings did you have during the project?** (Underline one option below)

<5   5   10   20 Many infor Do not know

15. **How much time did your supervisor allocate for your project in total?** (Underline your estimate below)

<10 hours 15h   30h   40h   sufficient   not important

16. **How important is face-to-face discussions of methods, results, etc during the project period?** (Underline one option below)

Very impor Important Neutral   not important

17. **Did the supervisor prepare you for the exam?** Yes/some/no

If yes, how?

18. **Did the project live up to your expectations?** Yes/no

If no, please state what did not work out as planned

19. **In retro respect: What is the most important issue when choosing project/supervisor?**

(Mark one or more options and/or add your own below)

To work with a particular topic

To work within a particular field of my subject/discipline

Good feeling about the supervisor / recommended supervisor

Study environment / other students

Future job possibilities

Please add any other expectations, here:

20. **Please list the two most important things you learned from doing the BSc-project:**

B Supervisor questionnaire

Supervisor questionnaire handed out to 13 supervisors at Department of Biology, Faculty of Science, University of Copenhagen regarding their experiences conducting supervision of BSc dissertations.

1. How many BSc students do you supervise per year (with you as the day-to-day supervisor)?
2. What do you expect of your BSc sudents? (Mark one or more options and/or add your own below)

Learn how to work independently on a specific topic

Learn how to deal with original (biological) data

Learn how to write a scientific report/paper

Get insight of how to do research

Please add any other expectations, here:

3. Based on your experience as a supervisor, please indicate the importance of the following issues for stude (give each issue points from 1-5)

The project description

Having a good supervisor

Study environment / other students

Future job possibilities

4. Project development

Do you normally formulate the projects for your students? (yes/no)

- If yes: Do you further develop or change the project in collaboration with your student? (yes/no)
- If yes: Do you offer alternative projects? (yes/no)
- If no: Describe shortly a typical project development

5. Do you discuss expectations with your student before starting the project? Yes/no
6. Do you discuss expectations with your students during your work period? Yes/no
7. Are you familiar with the Intended Learning Objectives (ILO's) for a BSc project? Yes/no
8. Do you evaluate your own performance as a supervisor after a project? Yes/no

If yes, how?

9. Do you evaluate the project period/process with the student after the project? Yes/no

If yes, how?

10. How many supervision meetings do you have during the project? (Underline one option below)

<5   5   10   20 Many infor Do not know

11. How much time do you allocate for each project in total? (Underline your estimate below)

<10 hours 15h   30h   40h   sufficient not important

12. How important is face-to-face discussions of methods, results, etc during the project period? (Underline on

Very impor Important Neutral   not important

13. Do you prepare the student for the exam? Yes/some/no

If yes, how?

Global bibliography

Act on universities (2011), 'Universitetsloven'.
  URL: *https://www.retsinformation.dk/Forms/R0710.aspx?id=137835*

Airey, J. (2010), 'The ability of students to explain science concepts in two languages', *Journal of Language and Communication Studies* **45**, 35 – 49.

Airey, J. & Linder, C. (2006), 'Language and the experience of learning university physics in Sweden', *European Journal of Physics* **27**, 553 – 560.

Alexander, W. & McDougall, R. (2001), 'Collaborative problem solving in student learning'.
  URL: *http://www.business.otago.ac.nz/econ/research/discussionpapers/DP0110.pdf*

Bain, K. (2004), *What the best college teachers do*, Harvard University Press.

Beissner, K., Jonassen, D. & Yacci, M. (1993), *Structural knowledge: Techniques for representing, conveying, and acquiring structural knowledge*, Lawrance Erlbaum Associates.

Bentley, A. M., Spyros, A.-T. & Stanford, J. S. (2008), 'Nanocourses: A Short Course Format as an Educational Tool in a Biological Sciences Graduate Curriculum', *CBE, Life Science Education* **7**, 175 – 183.

Biggs, J. (2003), *Aligning teaching for constructing learning*, second edition edn, Open University Press.

Biggs, J. & Tang, C. (2007), *Teaching for Quality Learning at University*, 3rd edition edn, Open University Press: Maidenhead.

Bligh, D. (1998), *What's the Use of Lectures?*, 5th revised edition edn, Intellect Books.

Bolton, K. & Kuteeva, M. (2010), 'The Survey of the Use of English at Stockholm University carried out by the Centre for Academic English in 2009'.
  URL: *http://www.english.su.se/centre-for-academic-english/survey-on-the-use-of-english-at-su*

Bonwell, C. C. & Eison, J. (1991), *Active Learning: Creating Excitement in the Classroom*, ERIC Digest.

Bowden, J. A. (2004), *Capabilities-driven curriculum design in Effective Learning and Teaching in Engineering*, Routledge.

Bowden, J. & Marton, F. (1998), *The University of Learning: Beyond Quality and Competence*, RoutledgeFalmer.

Bowden, J. & Masters, G. (1993), *Implications for Higher Education of a Competency Based Approach in Education and Training*, AGPS, Canberra.

Buzan, T. (1995), *The mind map book*, BBC Books.

Cho, K. & MacArthur, C. (2010), 'Student revision with peer and expert reviewing', *Learning and Instruction* **20**, 328 – 338.

Cho, K. & MacArthur, C. (2011), 'Learning by Reviewing', *Journal of Educational Psychology* **103**(1), 73 – 84.

Conway, R., Kember, D., Sivan, A. & Wu, M. (1993), 'Peer assessment of an individual's contribution to a group project', *Assessment and Evaluation in Higher Education* **18**, 45 – 46.

Cook, M. C. F. (1980), 'The role of the academic supervisor for undergraduate dissertations in science and science-related subjects', *Studies in Higher Ecucation* **5**, 173 – 185.

CWSEI & CU-SEI (2009), 'Clicker resource guide'.
URL: *http://www.cwsei.ubc.ca/resources/clickers.htm*

Derounian, J. (2011), 'Shall we dance? The importance of staff-student relationships to undergraduate dissertation preparation', *Active Learning in Higher Education* **12**, 91 – 100.

Dochy, F., Segers, M. & Sluijmans, D. (1999), 'The use of Self-, Peer and Co-assessment in Higher Education: A review', *Studies in Higher Education* **24**, 331 – 350.

Dolin, J. (2007), Progression, *in* E. Damberg, J. Dolin & G. H. Ingerslev, eds, 'Gymnasiepædagogik: En grundbog', Hans Reitzel, pp. 330 – 340.

Draper, S. (2010), 'Assessment and feedback: How to get more with less. Rethinking Assessment Practice Around Feedback'.
URL: *http://www.psy.gla.ac.uk/~steve/talks/rgu.ppt.pdf*

Ellström, P. E. (2001), 'Integrating Learning and Work: Problems and Prospects', *Human Resource Development Quarterly* **12**(4), 421 – 435.

Evalueringsinstitut, D. (2010), 'Undersøgelse af undervisning på engelsksprogede kandidatuddannelser', *Tabelrapport studerende* .

Foundation, N. S. (1996), 'A New Way to Learn: Students Argue About Physics', *Frontiers Newsletters* .
URL: *http://www.nsf.gov/news/frontiers_archive/11-96/11physic.jsp*

Gatfield, T. (2005), 'An Investigation into PhD Supervisory Management Styles: Development of a dynamic conceptual model and its managerial implications', *Journal of Higher Education Policy and Management* **27**(3), 311 – 325.

Gibbs, G. (1981), 'Twenty terrible reasons for lecturing'.
URL: *http://www.brookes.ac.uk/services/ocsld/resources/20reasons.html*

Gurr, G. M. (2001), 'Negotiating the "Rackety Bridge" – a Dynamic Model for Aligning Supervisory Style with Research Student Development', *Higher Education Research & Development* **20**(1), 81 – 92.

Handal, G. & Lauvås, P. (2005), 'Optimal use of feedback in research supervison with master and doctoral students', *Nordisk Pedagogik* **3**, 177 – 189.

Handal, G. & Lauvås, P. (2007), 'Veiledning i de videregående utdannelser', *Dansk Universitetspædagigisk Tidsskrift* **3**, 4 – 10.

Herskin, B. (2001), *Undervisningsteknik for universitetslærere*, Samfundslitteratur.

Herskin, B. (2004), *Undervisningsteknik for universitetslærerformidling og aktivering*, Samfundslitteratur.

Heylighen, A., Martin, M. & Cavallin, H. (2005), 'How to Teach and Archive Tacit Design Knowledge'.
URL: *http://www.di.net/articles/archive/2387/*

Higgins, E. & Tatham, L. (2003), 'Multiplechoice questions in assessment', *Learning and Teaching in Action* **2**(1).
URL: *http://www.celt.mmu.ac.uk/ltia/issue4/higginstatham.shtml*

Holland, B., Holland, L. & Davies, J. (2003-4), 'An investigation into the concept of mind mapping and the use of mind mapping software to support and improve student academic performance.'.

Horst, S., Jensen, A., Johannsen, B., Holm, C. & Troelsen, R. (2011), *Udvikling af universitetsundervisning – rammer, barrierer og muligheder.*, INDs skriftserie nr. 22, Institut for Naturfagenes Didaktik, Københavns Universitet. Hvidbog baseret på DUN-konferencen 30.-31. maj 2011.
URL: *http://www.ind.ku.dk/publikationer/inds_skriftserie/2011-22-Udvikling-af-universitetsundervisning/DUN-Hvidbog2011-Udvikling-af-universitetsundervisning.pdf/*

Howarth, T. (n.d.), Improving the Oral Presentation Assessment Process With the Use of Formative Peer Review, *in* L. Wright & A. Jones, eds, 'Good Practice and Innovation in the Assessment of Students in Built Environment Subjects in Higher Education', Liverpool John Moores University, pp. 41 – 47.
URL: *http://cebe.cf.ac.uk/learning/sig/assessment/reports.php*

IARE (2003), 'Graphic organizers: A review of scientifically based research'.
URL: *http://www.inspiration.com/vlearning/research/index.cfm*

Illeris, K. (1999), *Læring – aktuel læringsteori i spændingsfeltet mellem Piaget, Freud og Marx*, Roskilde Universitetsforlag.

Jensen, C., Stæhr, L. S. & Thøgersen, J. (2009), 'Underviseres holdninger til engelsk som undervisningssprog – en spørgeskemaundersøgelse på Københavns Universitet'.
URL: *http://cip.ku.dk/*

Jonassen, D., Carr, C. & Yueh, H. (1998), 'Computers as mind tools for engaging learners in critical thinking', *TechTrends* **43**(2), 24–32.

Kagan, S. & Stenlev, J. (2006), *Cooperative Learning, undervisning med samarbejdsstrukturer*, Alinea.

King, A. (1992), 'Comparison of self-questioning, summarizing, and notetaking-review as strategies for learning from lectures.', *American Educational Research Journal* **29**(2), 303 – 323.

King, A. (1995), 'Inquiring minds really do want to know - using questioning to teach critical thinking', *Teaching of Psychology* **22**(1), 13 – 17.

Klaassen, R. (2001), 'The International University Curriculum: Challenges in English-Medium Engineering Education'.

Kleinbaum, D. G. (1995), 'Teaching Short Courses in Biostatistics and Epidemiology', *The American Statistician* **49**(2), 200 – 203.

Kvale, S. (2005), *Interview. En introduktion til det kvalitative forskningsinterview*, Hans Reitzels Forlag.

Le, K. N. & Tam, V. W. Y. (2007), 'A survey on effective assessment methods to enhance student learning'.

Leon, P. (2002), 'Log on to student motivation'.
URL: *http://www.timeshighereducation.co.uk/story.asp?storyCode=168877&sectioncode=26*

Manathunga, C. & Goozée, J. (2007), 'Challenging the dual assumption of the 'always/already' autonomous student and effective supervisor', *Teaching in Higher Education* **12**(3), 309 – 322.

Mazur, E. (1997), Peer instruction: Getting students to think in class, *in* E. F. Redish & J. S. Rigden, eds, 'The Changing Role of Physics Departments in Modern Universities, Part Two: Sample Classes', AIP Conference Proceedings, American Institute of Physics, pp. 981–988.

Mazur, E. (2009), 'Farewell, Lecture?', *Science* **323**(5910), 50 – 51.

McGregor, D. (1960), *The Human Side of Enterprise*, McGraw-Hill.

McManus, D. A. (2001), 'The Two Paradigms of Education and the Peer Review of Teaching', *Journal of Geoscience Education* **49**(6), 423 – 434.

Ministeriet for Videnskab, T. o. U. (2006), 'Kvalitet i undervisningen'.

Moon, J. (2004), 'Using reflective learning to improve the impact of short courses and workshops', *Journal of Continuing Education in the Health Professions* **24**(1), 4 – 11.

Morrow, L. (2006), 'An application of peer feedback to undergraduates' writing of critical literature reviews', *Practice and Evidence of Scholarship of Teaching and Learning in Higher Education* **1**(2), 61 – 72.

Muugesten, M. & Lauvås, P. (2004), 'Bedre læring av matematik ved enkle midler? Høgskolen i Østfold', *Rapport* **6**.

Nielsen, T. (2008), Metodologiske indblik og udsyn, *in* A. B. Christiansen, T. Hetmar, J. Ivanouw & H. Kirkeby, eds, 'Festskrift til Benny Karpatschof', Forlag for Psykologisk Forskningsmetode.

Orsmond, P., Merry, S. & Reiling, K. (1996), 'The importance of making criteria in the use of peer assessment', *Assessment and Evaluation in Higher Education* **21**, 239 – 249.

Patterns for programming in parallel, pedagogically (2008), ACM Press.

Piaget, J. (1950), *The Psycology of Intelligence*, Routledge & Kegan Paul.

Poincaré, H. (1908), *Science et méthode*, E. Flammarion.

Resnick, M. (1997), 'Turtles, Termites, and Traffic Jams: Explorations in Massively Parallel Microworlds (Complex adaptive systems)', *MIT Press* .

Rowley, J. & Slack, F. (2004), 'What is the future for undergraduate dissertations?', *Education and Training* **46**, 176 – 181.

Rump, C. (n.d.), 'Nogle overvejelser over tavlegennemgang og alternativer'.
  URL: *https://isis.ku.dk/kurser/blob.aspx?feltid=78168*

Salmon, G. (2004), *E-moderating - the key to teaching and learning online*, 2nd edn, Routledge, London.

Sandelin, A. (2008), 'Student activation by using lecture/lab hybrid teaching'.
  URL: *http://www.ind.ku.dk/begivenheder/2008/postersession-unipaed/posterisaneimann.pdf/*

Savin-Baden, M. (2000), *Problem-based Learning in Higher Education: Untold Stories*, Open University Press.

Schneider, M. (2007), 'Student-activating lectures in almen cellebiologi: 'active thinking activities' as tool for better understanding of basic concepts'.

Sfard, A. (1991), 'On the dual nature of mathematical conceptions: Reflections on processes and objects as different sides of the same coin', *Educ. Stud. Math.* **22**, 1 – 36.

Sparke, L. & Gallagher III, J. (2007), *Galaxies in the Universe: an Introduction*, 2nd edn, Cambridge University Press.

Splittorff, K. (2006), 'Studentercentrerede klassetimer i kvantemekanik'.

Stefani, L. (1992), 'Comparison of collaborative, self, peer and tutor assessment in a biochemistry practical', *Biochemical Education* **20**, 148 – 151.

Steffe, L. & Gale, J., eds (1995), *Constructivism in Education*, Lawrence Erlbaum.

Studieordning (2009), 'BA Studieordning 2009'.
URL: *https://intranet.ku.dk/biologi_ba/uddannelsensforloeb/ studieordningerogregler/Sider/default.aspx*

Tamir, P. (1989), 'Training Teachers to Teach Effectively in the Laboratory', *Science Education* **73**(1), 59 – 60.

Tärnvik, A. & Stenberg, B. (2010), 'Suitability of the multiple case method when applied on dermatology and infectious diseases at the clinical stage of medical education', *The Internet Journal of Medical Education* **1**.

Vilkinas, K. (2008), 'An Exploratory Study of the Supervision of Ph.D./Research Students' Theses', *Innovative Higher Education* **32**, 297 – 311.

Wichmann-Hansen, G., Eika, B. & Mørcke, A. M. (2007), 'Hvad findes der af litteratur om vejledning? – Litteratur med fokus på publicerede evidensbaserede studier', *Dansk Universitetspædagigisk Tidsskrift* **3**, 11 – 19.

Wilkinson, R. (2005), 'The impact of language on teaching content: Views from the content teacher'.
URL: *http://www.palmenia.helsinki.fi/congress/bilingual2005/ presentations/wilkinson.pdf*

Willis, C. & Miertschin, S. (2006), 'Mind maps as active learning tools', *Journal of Computing Science in Colleges* **21**(4), 266–272.

Wood, E. J. (1996), 'Laboratory work in biochemical education: Purpose and practice', *Biochemical education* **24**(3), 132 – 137.

Yorke, M. (2003), 'Formative assessment in higher education: Moves towards theory and the enhancement of pedagogic practice', *Higher education* **45**, 477 – 501.