Sense and sensibility in workload calculation

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ABSTRACT: The time students need to efficiently learn a curriculum and complete course activities constitutes the *workload* of a course. The workload, as perceived by students, depends on a multitude of parameters. Not allowing students time to complete all the course activities – including time for learning outside the classroom, reduces the likelihood of a *deep* approach to learning, thus leading to a *surface* approach.
We examined workload in 7 biology courses using a calculation model described in Karjalainen et al. (2006a). This model, with preset factors for preparation adapted to the specific activity, is meant to determine the time required by students to achieve *high quality learning*. The case study also included interviews with the course leaders (teachers) to investigate how time is allocated to teaching activities. The results reveal that the assigned ECTS credits for a given course do not necessarily reflect the workload. Course leader interviews suggest that calculation models are not systematically employed to determine workload, which may contribute to increased perceived workload by students.
The main conclusion is that student workload calculation models should, to a larger extent, be used as a tool when planning a course. Allocating time and deciding workload of different activities must be regarded as a central part of good course design and is crucial for the learning outcome.

1 INTRODUCTION

The time a student needs to efficiently learn a curriculum and complete course activities constitutes the *workload* of a course (Karjalainen et al., 2006a). Workload is measured in ECTS credits and the European countries (EHEA) have defined 60 ECTS as a fulltime year of studies ("Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG), 2015). The full time student in Norway is expected to complete 60 ECTS credits in an academic year of app. 1600 h, which gives *40h per week* (1 studiepoeng = 26-27 h).

Higher education institutions follow local, national and international guidelines to design and support high-quality courses and degrees. Course leaders at universities must comply with a series of recommendations in order to design courses where intended learning outcomes, learning activities and assessment are aligned. However, very little help is available to course leaders when it comes to judiciously allocating time for the different activities.

Deep learning is dependent on students having enough time, and time is therefore a basic precondition for learning (Karjalainen et al., 2006a). A deep approach to learning includes time to understand the underlying principles, to integrate the learning with previously acquired knowledge and to get a holistic view on the subject. Insufficient time, however, may lead to *surface* learning (Biggs & Tang, 2011; Karjalainen et al., 2006a) where students only have time to memorize facts and data, and do not have time to understand and develop their conceptual approach (Case & Gunstone, 2003).

If a course does not allow the student time to complete all the course activities – including time for learning outside the classroom, a *deep* approach to learning is unlikely, and students may turn to a *surface* approach to learning where they work below the required level to reach the course learning outcomes (Biggs & Tang, 2011; Light et al., 2001). Careful evaluation of workload must be performed to give students enough time to learn, and estimating course workload by merely summing the number of contact hours would be a critical mistake. Learning does not primarily occur only during contact hours, and time spent on reading course material, self-study and preparation for exam should not be omitted (Raaheim, 2013). Fair workload estimation relies on a system calculating all necessary study hours, where all hours are clearly accounted for and quantified.

Even though the effects of workload on student performance and motivation have been studied; advice on, and models for, workload *calculation* are sparse. To our knowledge, there is no universal agreement on a system for fair calculation of course workload.

The main purpose of this micro-study was to examine the student workload in a selection of biology courses given at the University of Bergen (UiB) and the University Centre in Svalbard (UNIS), to see how student workload corresponds to the given course credits. We have investigated 7 biology courses and applied the workload calculation model described in Karjalainen et al. (2006a). Additionally, course leaders were interviewed to gather information on how they were planning their courses with regard to student workload.

2 METHODOLOGY

2.1 Workload mapping

Seven biology courses (referred to as course A, B, C, D, E, F and G, see table 1) at UiB and UNIS were included in this study. All course levels (BSc, MSc, PhD) were represented. Data were collected during spring 2016 from course descriptions and schedules, as well as interviews with course leaders. To quantify student workload, a workload schedule was created based on a model described in Karjalainen et al. (2006a), where the different teaching methods are classified and described in relation to a calculated workload. Interviews with course leaders were carried out for all seven courses. Course leaders were asked how they plan, calculate and adjust workload in their courses.

Table 1. Breakdown of the time schedule of the seven biology courses included in the study.

Course	Level	ECTS	Schedule (hours)	Assessment	Required reading (pages)
A	BSc	10	lecture: 37, seminar: 10, lab: 2, field: 4, div.: 17	1 lab report, 1 oral exam, 2 written exams	English (book): 205 English (pop. Sci.): 385
B	BSc	10	lecture: 58, seminar: 4, lab: 68, field: 4	4 lab reports 1 written exam	English (book): 242 Norwegian: 250 Lab notebook: 177
C	BSc MSc	10	contact hour: 16, seminar: 8	portfolio	English (book): 440
D	BSc MSc	10	lecture: 30, seminar: 39, lab: 6, field: 6	2 assignments, 2 presentations, 1 lab report, 2 written exams	English (book): 428 slides: 221
E	MSc PhD	10	contact hour: 14, seminar: 6	portfolio	English (book): 150
F	MSc PhD	10	lecture: 22, seminar: 15, lab: 20, field: 35, div: 15	2 written reports, pre-sentation of scientific papers, 1 oral exam	English (papers): 350
G	BSc	15	lecture: 40, seminar: 20, lab: 40, field: 83, div.: 6	2 written reports, 1 oral exam	English (papers): 80 English (book): 372

2.2 Workload calculation methods

The workload of each of the selected courses was estimated using factors and parameters of the model described in Karjalainen et al. (2006a). In brief, each contact hour is multiplied by a factor to determine the total time to be considered to prepare for, attend the course, and complete the assignments and exams. The factors are: lecture x4, seminar x3, lab work x2, and field work x2. Time needed for reading course material (syllabus/required reading) was calculated as follow: English text (textbook) 3.3 pages/hour, English text (popular science) 5 pages per hour, Norwegian text (text book, slides, lab book) 5 pages per hour, preparation for exam 20% of total study time.

3 RESULTS

3.1 Study time analysis in biology courses

The results of our study are summarized in *Fig 1*.

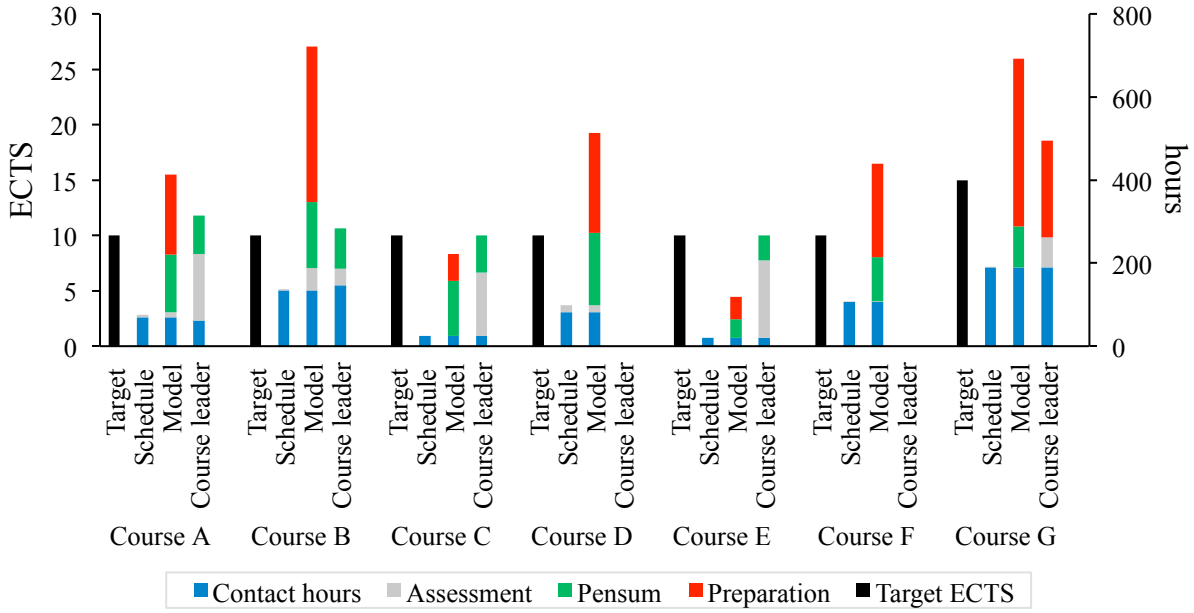

Fig 1. Student workload calculation across seven biology courses. Course workload expressed both in ECTS (left Y-axis) and hours (right Y-axis) for course A-G based on the model described in Karjalainen et al. (2006a) (Model), course leader estimation (Teacher) and scheduled activities in course description (Schedule). Target indicates the number of ECTS credited upon completion. Note that course leader estimation was not available for course D and F.

The analysis of the student workload of seven biology courses revealed:

1. Moderate to large divergences between the set number of ECTS and the workload estimation based on the model (course A, B, D, E, F and G),
2. Moderate to large divergences between the workload estimation given by the calculation model and the estimation provided by the course leaders (course B, E, G).

Discrepancies between the set number of ECTS for a course and the model of Karjalainen et al. (2006a) are clearly illustrated by the case of course B. The workload of this course was estimated to 27.1 ECTS by the model, i.e. nearly 3 times the set number of ECTS credited (*Fig. 1*). Similar discrepancies were also observed in course A, D, F and G, where the workload was estimated to 1.55, 1.92, 1.65 and 1.73 times the number of set ECTS by the same model, respectively. In contrast, the calculated workload was approximately half of the given ECTS in course E.

Course leader workload estimations (when available) were close to target ECTS in most cases (*Fig. 1,* course A, B, C and E). However, the course leader estimations were moderately to largely different from the calculated number of ECTS credits according to the model of Karjalainen et al. (2006a). This was observed for course B and G, where the workload as calculated by the model was 2.55 and 1.4 times greater than the course leader estimation. In the case of course E, however, the model indicated a workload corresponding to 0.45 times the course leader estimation.

3.2 Summary of course leader interviews

Several of the interviewed course leaders report that they did not plan and design their courses from the beginning. Those who «inherited» courses base much of their workload planning on the previous course schedules. All course leaders say they do consider student workload while planning. Some use

a calculation formula (typically from Raaheim, 2013), but they make adjustments to the factors based on their own experience and judgement, and changes in teaching methods.

When asked about preparation time the answers differed both between course leaders and the different activities. Some preparation time for teaching activities was taken into account when estimating workload, but weighting of preparation time differed, and also how systematic this calculating was. Several course leaders feel that they might be underestimating preparation time for teaching activities. All course leaders report that time for reading course material was part of the workload calculation. Time was also allowed for assignments, but again course leaders report that they feel they underestimate the time students need to complete assignments.

General impressions from the interviews are that course leaders expect students to prepare, but they do not believe that they actually do. Most course leaders say they have adjusted workload in different ways, both based on feedback from students and their own experience of teaching.

Some course leaders give students very detailed information about the expected workload/preparation time for different activities, while others just expect that students do the necessary preparations without specific instruction.

4 DISCUSSION

According to the workload calculation model of Karjalainen et al. (2006a), most courses examined in this case study have a workload over the set number of ECTS credits. Course leader estimations tend to be lower, and this is mainly because they allow for less independent study time, preparation for contact hours, reading the curriculum and preparing for the exam. Course leaders may reduce time allocated for self-study after adjusting for what they consider to be overlap between the study time needed for some activities (for example reading textbook and preparing for a lecture). The model assigns preparation time independently to each category of learning activities.

Karjalainen et al. (2006a) uses factors for different learning and assessment activities that should give students enough time for deep and effective learning. When applying Karjalainens factors, which aim for sufficient time to learn in every activity, the amount of workload increases heavily for most courses. In the examined courses, it is shown that when activities overlap, cumulative time for certain activities become very high in relation to actual contact hours scheduled. Reducing factors for preparation time, as done to a large extent by the course leaders, could compensate for overlap between activities. However, the need for independent study time might be underestimated when adjusting factors like this, and the actual time needed to *learn* insufficient. Karjalainen et al. (2006a) emphasize that the workload calculation model is hypothetical and must be verified by experience. Accordingly, some course leaders use factors as guidelines, but adapt them to the activities of the course. This adaption is based more on their experience or "gut feeling", than an actual analysis of the needed preparation time for specific activities. Still, according to the course leader interviews, course leaders have a feeling that they underestimate preparation time in general.

An interesting finding is that the two courses that use a Team-Based learning approach and portfolio assessment (Course C and E) are the only two where the course leader estimations of workload was higher than the models. In fact, they are the only two courses that stay within the given ECTS limit. In a Team-based learning approach there is less need for allocating separate time for preparation since the independent study time is included in the Team-based learning sessions (Raaheim, 2013). In the model of Karjalainen et al. (2006a) the different teaching and assessment activities are counted separately. In Team-based learning these activities are closely integrated with each other and this makes the model difficult to apply - especially when comparing results with courses using more traditional teaching and assessment methods.

Allowing students to engage in deep learning by carefully balancing course workload thus appears to be an arithmetical challenge, where various activities and how they interact must be considered. Another challenge for workload models is the variation and complexity of students experienced workload, and the difficulty of collecting reliable data from the students (Bowyer, 2012; Chambers, 1992).

Actual workload (intended workload for the course activities) and students' perceived workload could be very different (Chambers, 1992; Karjalainen et al., 2006a; Kember*, 2004), and getting an

objective measure of workload for the individual student is virtually impossible. Factors that have been shown to affect the perceived workload are course design, learning environment and learning approaches, but also students' characteristics, motivation and general life situation. These factors have a complex relationship and are often co-dependent (Bowyer, 2012; Karjalainen et al., 2006a; Kember*, 2004). A situation of too high workload can cause students to adopt a surface approach to learning (Biggs & Tang, 2011). However, a high workload could also have a positive influence on student effort. Low workload may cause students to not putting in the necessary effort to effectively learn the content (Marsh, 2001). Balancing workload is therefore crucial for student learning and motivation.

Chambers (1992) introduces the concept of *responsible course design*, where workload is an important factor to consider while planning a course or degree. Student workload must be regulated by making predictions on how much time the average student would need to complete activities and achieve effective learning. By adopting the idea of constructive alignment (Biggs & Tang, 2011) we believe that the improved coherence of teaching activities, learning outcomes and assessment also will have to affect the way course leaders (teachers) plan their courses in relation to workload.

A model for calculating workload can be a tool for course leaders to evaluate and aim for an appropriate workload, but must be used in the context of the specific course. Adjusting factors and workload calculation to a course must be done in the perspective of effective deep learning, and not to "fit the form". Coordination within and between courses to distribute workload appropriately is also important, and should be part of the quality assurance work of the institution.

An alternative to a complex model is the simple calculation form presented in Raaheim's book *Råd og tips til deg som underviser* (Raaheim, 2013), which builds on the work of Karjalainen et al. (2006a,b). This calculation form is simple and pragmatic, and allows for adjustment to specific courses, but still fills the purpose of making the course leader think through the workload of the course within the hours available by the set number of ECTS.

In addition to giving students the time to think (which again means *learn*), we as educators should also help students use this time right. Clearly communicating to students the expectations and learning goals, how they should prepare and how much effort should be put into different activities, will help students control and balance their available time and avoid unnecessary stress (Karjalainen et al., 2006b; Raaheim, 2013).

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