Students' Online Activity on a Fully Online Introductory Physics Mechanics Course

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INTRODUCTION

The pressure to produce high quality university-level online education has increased over the years. The pilot implementation of a fully online introductory mechanics course in engineering education was carried out in Tampere University of Applied Sciences in autumn 2014 in the time period of 8 weeks. Course outlines and study methods were presented in SEFI2014 conference by the authors [1] and they are only briefly reviewed in this article.

In an online implementation, instructor does not meet the students face-to-face. Therefore, the studying and learning activities has to be investigated using the event log files of the online learning management system (LMS), Moodle. There were approximately 13 000 log events which were analysed in order to find out students' learning habits and possible correlations between different activities and learning outcomes. The most important aspect was to try to find those methods that serve students' learning in the best possible way. The interesting aspects are:

1. How does students' overall activity change during the course?
2. How does students' activity vary among weekdays and time of day?
3. How does the amount of active students change during the course and why?

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1 THE ONLINE PHYSICS COURSE

1.1 General

At Tampere UAS, academic year is divided to four periods with the duration of 8 weeks each. Most of the courses are required to last only one period. In this way, students have less ongoing simultaneous courses and more contact time per week in a certain course. The same schedule was chosen for the online course, even though there weren't any inherent need to follow same schedules as in face-to-face learning. The piloted online course started 27th of October and the students were able to log in to course's e-learning platform, Moodle, a few days earlier. The course ended and the credits were given 19th of December.

The general course structure and schedule are shown in *Fig. 1.* The implementation was asynchronous but rather strictly scheduled at weekly level. Each week students had either an assessed week exam or measurement assignment which both had deadlines. Within a week students were free to spread out their workload and proceed at their own pace. Earlier feedback and experience about measurement assignments [2] have been rather positive and therefore this activity was included even in online implementation. Most of the measurement assignments were offered as recorded video clips. Alternatively, in a few cases, students would have been able to carry out the measurements themselves using cell phone's video analysis or suitable apps, but this was very uncommon among students.

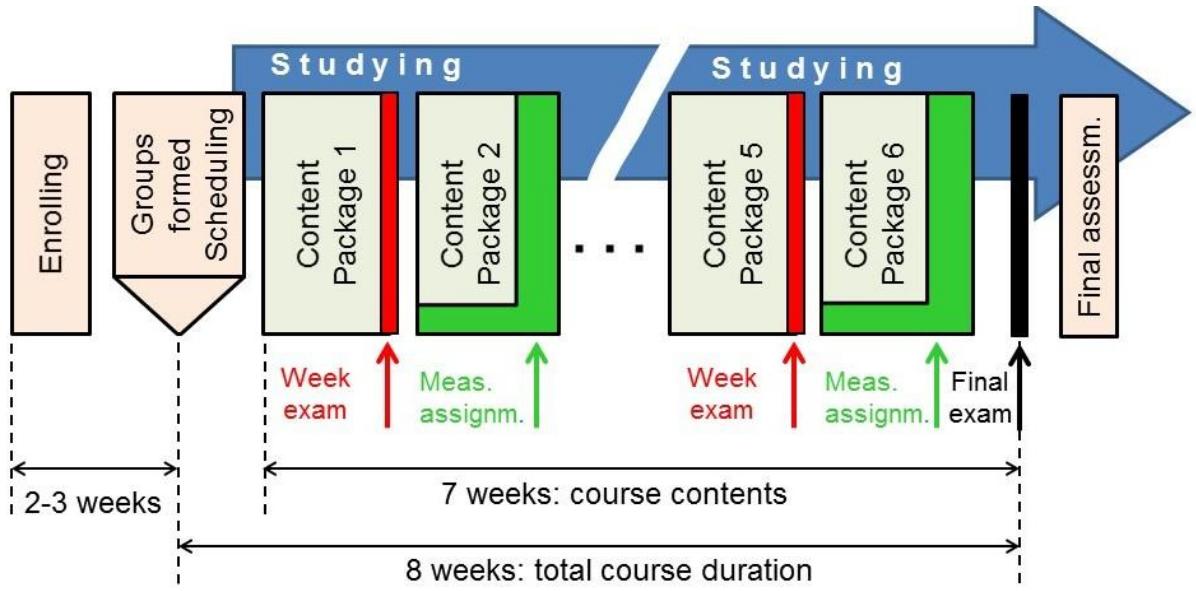

Fig. 1. Schedule for course entities and the course structure.

A study by Doggett [3] shows that students strongly prefer individual assignments in online course, rather than group assessments. However, due to the unquestionable benefits of peer work [4], students were encouraged (but not required) to work in groups throughout the course. In principle, the measurement assignments were assessed by groups, even though the group size was in many cases one person. Week exams were assessed individually.

One major challenge in online courses is to keep students engaged and committed with rather limited social interaction. Staring only at a screen makes some students feel isolated and disengaged, which can lead to poor performance and dropping out. In MOOCs the drop-out rate is often more than 90 % [5]. In this piloted

implementation, the methods to try to improve students' retention were: weekly news video produced by the instructor, call-times at evening hours, discussion forums and threads opened by the instructor, not forgetting personal, written feedback to students.

1.2 Students in this study

The amount of students included in this study is shown in *Table 1* together with their achievements. In Finland, university level grades have scale from 0 (fail) to 5 (highest). The lowest passing grade is 1. The amount of students who had enrolled for the course, but never even logged in to Moodle, was 10. This, together with those students who logged in but didn't hand out any assignments (11 students), forms 40 % of the total number of students. From online course planner's point of view, the initial number of students have to be high enough to tolerate this loss. In the beginning of an online course, there should be something so addictive that at least the loss of the logged-in's could be avoided. Unfortunately, diminishing of the group to some extend may be inevitable.

Table 1. Student's achievements

Course Achievement	Number of Students
Enrolled, but not even logged in to Moodle	10
Enrolled but no assignments accoplished	12
A few activities taken but failed to pass	4
Passed, final grade 1 (lowest)	3
Passed, final grade 2	5
Passed, final grade 3	9
Passed, final grade 4	4
Passed, final grade 5 (highest)	5
Total Number of Students:	52

1.3 Learning analytics

Learning analytics mean the measurement, collection, analysis and reporting of data about learners [6]. Many learning managements systems offer built-in tools to record, view and analyse student's online activity. Learning analytics has been used for example to evaluate the effectiveness of flipped classroom methodology [7].

In Tampere UAS, the online course platform is Moodle. In this study, Moodle's log files were transferred to Excel, with which all classification and analysis tasks were carried out. Altogether, there were approximately 13 000 log events. It should be noted, that just because a student happens to be logged in and has opened an activity, does not necessarily mean that he or she is engaged in meaningful learning activity. On the other hand, LMS cannot record such activities as reading the course book, or carrying out calculations on paper. Therefore, learning analytics offer a view to studying and learning activities, but it is not the whole truth.

1.4 Activity categories in Moodle

In this study, only the online activity is analysed and other aspects of learning are omitted, like textbook reading, for example. In Moodle, students were offered five different types of activities as shown in *Table 2*. When an activity was clicked open in course's Moodle platform, a time stamp with corresponding label was made to event log. In the "Results" chapter, the student activity is analysed based both on the total numbers (regardless the category) and also categorized.

Table 2. Activity categories used in his study.

Activity category:	Explanation:
Resource	All PowerPoint presentations, pdf-files, Word documents and other types of written material shared to students are called "resources" in Moodle. If a student opens a resource file, it is recorded in the event log accordingly.
Course	The viewing of general structure of a Moodle course, opening different pages in Moodle etc. are categorized as "course" in the event log.
Forum	Opening a discussion forum or a message thread in relation to a given topic or assignment is labelled as "forum". This category includes also the course news feed and instructor's online call time.
YouTube	Course's video material was distributed using YouTube and no links to other external web pages were offered. This category is named accordingly.
Assignment	This category includes all assessed assignments given to students, like week exams and measurement assignments.

2 RESULTS

2.1 Students' activity and learning outcomes

Earlier studies [8, 9] have shown that watching educational video clips has a positive effect on student's final grade and student consider it a good way to study. At least the amount of watched video clips can be seen as a measure of studying activity and studying in turn, improves learning outcomes in general. That data was compiled of approximately 200 students' learning outcomes and online activity. It showed that the variation between individuals and groups was rather large and only looking at sufficient large collection of data the trends became visible. This current study consists of 42 students and therefore any trends may not be so evident.

In *Fig. 2* final grades are presented as a function of total number of student's log events and in *Fig. 3* activity is shown in categories listed in chapter 1.4. Clearly, most of the failed ones haven't put much effort in studying, but rather had a look at the course contents, opened a few activities (if any) and then gave up. Only four students who actually continued to study finally failed to pass.

Among the successfully passed ones, there are no major differences in the way they have used course contents. The sum of log events per student varies between 360 and 500 showing activity in all categories. It is noteworthy, that the "forum" category

shows tens of log events, even though students posted only few questions or comments to the discussion forum. There weren't many teacher posts, either.

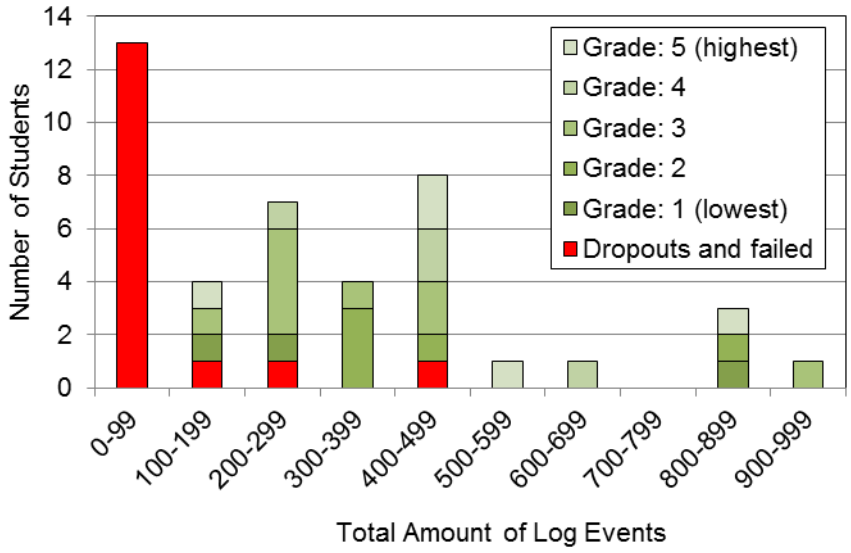

Fig. 2. Students' activity and final grade distribution.

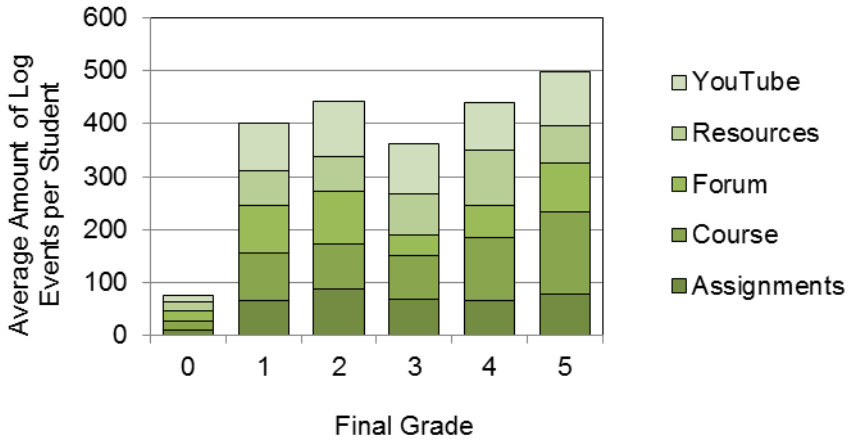

Fig. 3. Students' activity and final grade distribution

2.2 Variation of activity among weekdays and time

As shown in *Fig. 4* students study otherwise rather evenly throughout the weekdays, but Sundays seem to have roughly double the activity compared to other days. Deadlines were generally scheduled for Sundays, which might explain the higher activity. The data is based on all 8 weeks of the course duration. This implies that if an instructor would like to be available online when students are actually studying, this should happen also during weekends, especially on Sundays. Naturally, this is a bit inconvenient for many instructors.

In *Fig. 5* the total online activity is presented as a function of time of day. The blue bars show results of the online implementation presented in this study and the green ones are from a normal classroom (face-to-face) implementation of the same course. Since even the classroom implementation had a blended approach, it offered data of student's online activity for comparison. Naturally, the online activity within the

classroom implementation is far lower than that of a fully online implementation. However, both data groups show almost similar pattern: the activity is at its highest in the evening. Luckily, this is somewhat earlier than on MOOC's [5], where students tend to study at rather late hours, even after midnight. Again, the conclusion is that if a teacher wants to reach students when they are studying, it should happen after normal working hours. The instructor of the online course was, in fact, online at around seven o'clock in the evening several times throughout the course.

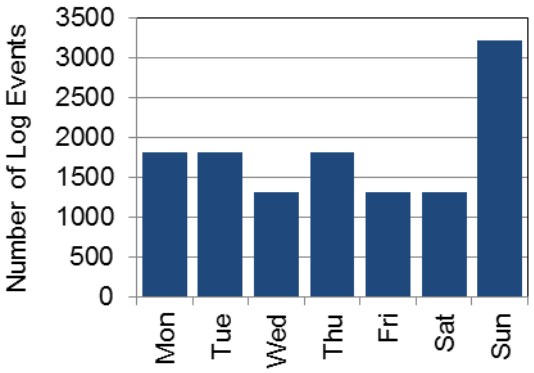

Fig. 4. The total amount of log events on different weekdays.

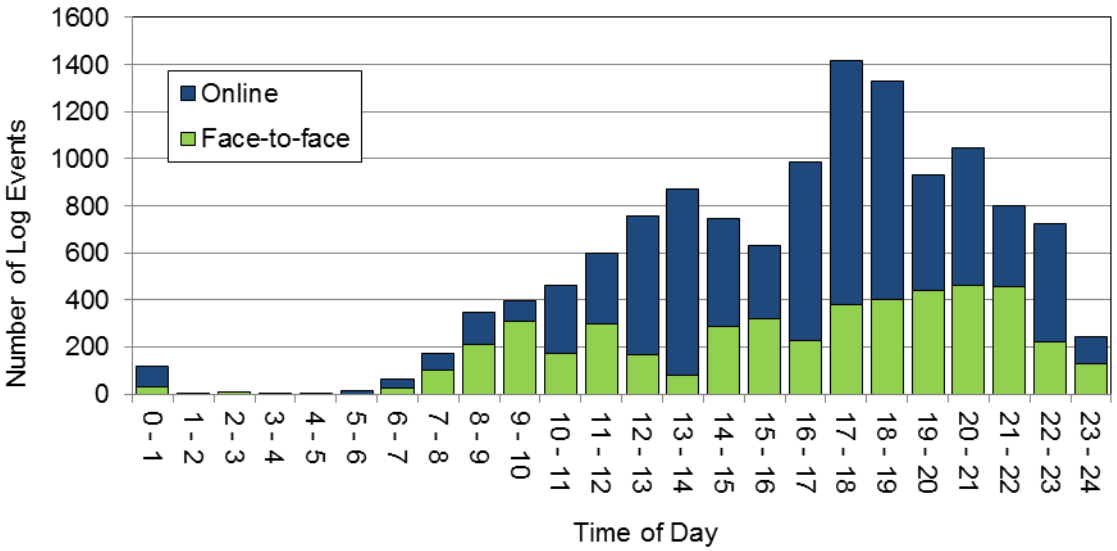

Fig. 5. The activity distribution according to time.

2.3 Overall activity during the course

In *Fig. 6* the total amount of daily log events is plotted as a function of date. The blue line presents those students who have passed the course successfully and red line the failed ones, respectively.

The graph has clear, rather regular structure with definite spikes. Despite the asynchronous nature of the course implementation, it had strict deadlines for different assessed activities on a weekly level. The spikes emerge one or two days before these deadlines showing that students mostly study when they have an utmost need to accomplish something. Since the students most likely had other courses going on simultaneously, it is impossible to say, whether this is a result of prioritizing or would they have the same postponing habit if they had only one ongoing course. Anyhow, because assessment strongly guides students' studying behaviour, a course should have not only a final examination, but rather a continuous assessment method.

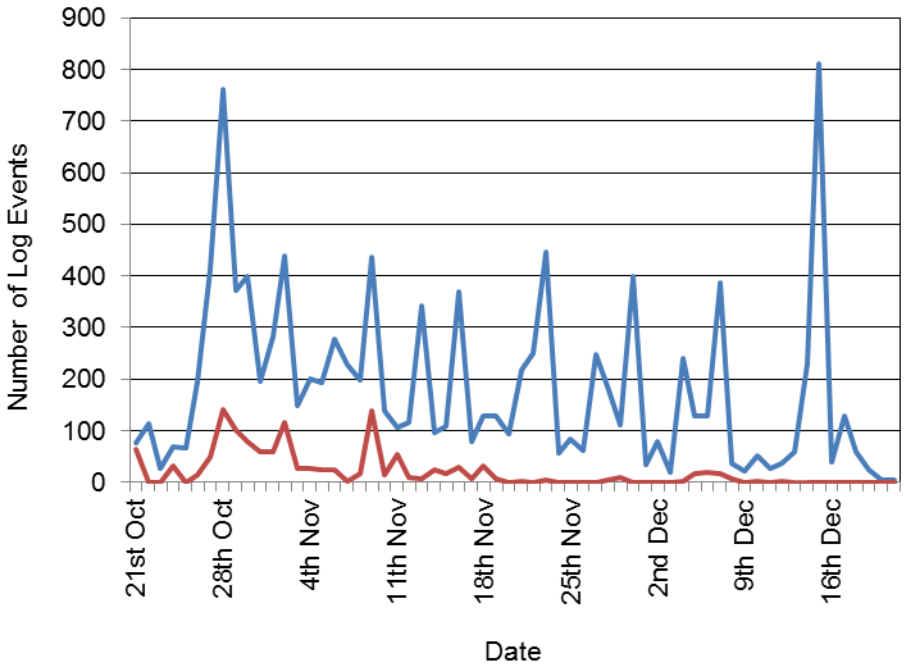

Fig. 6. The total amount of daily log events as a function of date.

3 SUMMARY AND ACKNOWLEDGMENTS

The overall activity in terms of opened study activities was observed to decrease during the course and it heavily concentrated just before the deadlines of assessed assignments. The student seemed to study in the evening hours and on the weekends, especially Sundays. If an instructor wants to reach students when they are studying, it should happen after normal working hours, evenings and weekends. Furthermore, the authors suggest that even in asynchronous studying the course contents should be strictly scheduled, it seems to be the deadlines that make students to take actions.

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