Students' Experiences on Modern Fully Online Introductory Mechanics Physics Course

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INTRODUCTION

Engineering education research and physics education research have produced a number of good practices and techniques, such as Peer Instruction, Just-in-time Teaching and Flipped Classroom to enhance learning. The good practices are mainly designed and implemented in lecture- or other face-to-face learning environment. The revolution of online learning including massive open online courses raises the question, if the good practices are implementable also in online learning environment? The aim of the study is to find out what kind of student experience concerning prior expectations, different course activities and the online learning method is achieved in such implementation using before mentioned practices. The student experience was surveyed using questionnaire at the end of the pilot course.

1 TURNING BLENDED METHOD TO ONLINE METHOD

In order to improve students' learning outcomes, a new blended, only partly online method to study physics was presented by authors in SEFI 2013 – conference [1]. The key points of the method are:

1. The continuous assessment using week exams and group measurement assignments
2. The use of the active engagement learning methods in the lectures

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3. The use of video material to push the routine tasks in the web environment

The basis of the method lies on the results of the physics education research and the engineering education research. Active engagement methods, like Peer Instruction [2], or interactive lecture demonstrations [3], are proven to produce better learning outcomes [4]. Nowadays ICT provides opportunities to implement even more activating studying strategies, like Just-in-time teaching or flipped classroom [5]. The common factor among these methods is to activate students to interact and process their knowledge during the valuable lecture time. The initial knowledge needed for peer work and discussion has to be learned beforehand using textbooks or online pre-lectures [6].

The implementation plan for fully online course applying the same method was presented in SEFI2014-Conference [7]. In online course, the continuous assessment, solution videos and small lecture video clips are easy to implement. The challenge is to activate students to process their ideas about physics concepts among themselves and to wake peer education and studying with groups. Assessed group measurement assignments present also a challenge even though nowadays a social media gives better opportunity to this than ever before. The studying in the course was asynchronous, but scheduled in week level.

2 PILOT IMPLEMENTATION

2.1 Background information

The pilot implementation of the online course was carried out in the course “Mechanics” (3 cr), in autumn 2014. The course was offered in the Open University of Tampere University of Applied Sciences, but the degree students were also able to participate. All course activity was implemented online. The course took eight weeks. The content of the course was divided in weekly parts. Every other week students carried out an assessed measurement assignment according to the topic and on the other week, the week exam was held covering the contents of two weeks. The last two weeks was left for preparation to final exam and the exam itself.

2.2 Students

There were 52 students who enrolled the course. 42 of them logged in to the course’s learning environment in the learning management system Moodle. 31 students participated in some of the assessed activities and finally 26 passed the course. Majority of the passed students were students of the Open University of the Tampere UAS. The pass rate is only 50 % if it is calculated from the original 52 enrolled students, but if it is calculated from 31 students, who really did at least some of the online activities, it is comparable to normal face-to face courses. In MOOCs the drop-out rate is often more than 90 % [8]

2.3 Course activities

To enhance self-directed learning, the course followed a textbook. It was mainly considered as supportive material. Although a majority of students’ exercises were taken from the textbook. In the learning management system, the students were offered video content, including short video clips explaining theory and clips of example calculations. The theory videos and examples were based on teacher’s own material. The solutions to homework exercises were also delivered as carefully explained video clips. To enhance the social dimension and the active engagement of the students, a weekly group assignment was offered and the students were encouraged to work in groups on the assignment. The groups were formed by the

students, not by the teacher. Submitting of the group assignment was mandatory, but submitted assignments received detailed feedback from the teacher. The feedback included teacher's comments about students' answer, how well they had succeeded, which parts are done well, which less well and where to find assistance to those parts that students had most difficulties. The possibilities to interact among students and with the teacher were available with discussion area after each activity. The weekly online discussion sessions were also available and the teacher was of course reachable by email or by phone. The students were encouraged to use any media or equipment to interact between themselves.

2.4 The role of the teacher

The role of the teacher in an online course like this is different from the traditional one. The teacher prepared the necessary video clips and delivered them to students using learning management system, but the main role still was to give detailed, individual and prompt feedback to students who had returned their assignments and exams. Each returned assignment whether it was assessed or not, got detailed feedback. The teacher had an active role in course's discussion areas. Weekly video greetings explaining the activities of the week were also available.

2.5 Assessment

Half of the points in the course were given by the weekly assessed measurement assignments and week exams. The other half were given by the final exam. The students were encouraged to perform the measurement assignments in groups. The week exams and the final exam were individual. Peer assessment and self-assessment could give interesting aspects to assessment, but they were not used in the pilot implementation.

3 DATA GATHERING AND RESULTS

The data of student experience was gathered using online questionnaire at the end of the course. The link to the questionnaire was delivered to all 42 students logged in to course's learning management system. There were 21 answers, all from students who passed the course.

The questions with particular interest were following.

- What kind of student experience is achieved in implementing good face-to-face practices in online environment?
- How does the online course meet the students' expectations about their studying?
- What is the students' opinion on course activities, which are most helpful for their learning?
- How successful was the interaction while there were no face-to-face sessions?

The survey showed that only 7 of the students had prior experience in online learning. 19 students would recommend the online course to other students, but still 11 students would take the traditional lectured face-to-face delivered course if possible.

Students were asked to evaluate on 5-point Likert scale, how the course met their expectations on the following areas: Contents of the course, online study methods, development of own expertise, interaction with the teacher and the assessment method of the course. Grade 1 meaning well below expectations, 3 meaning meet

the expectations and grade 5 meaning well over expectations. The distributions of the students' answers are presented in figures *Fig. 1.- 5.*

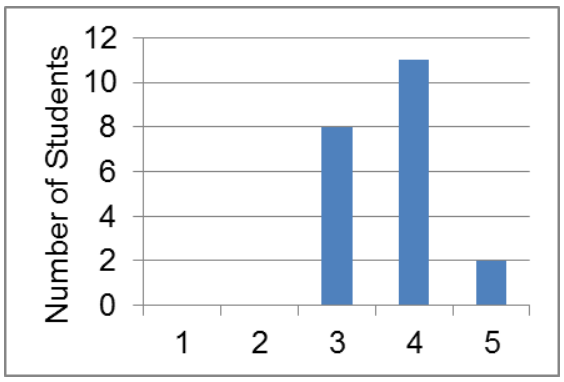

Fig. 1. Contents of the course

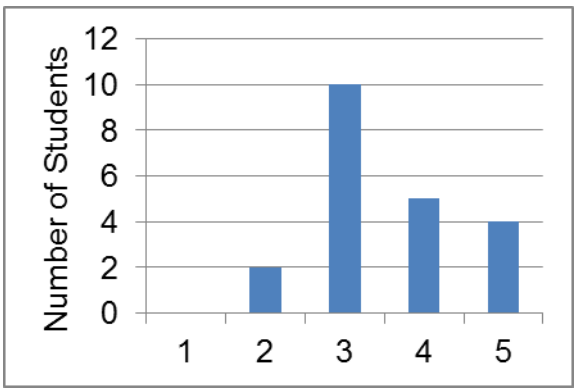

Fig. 2. Online study methods

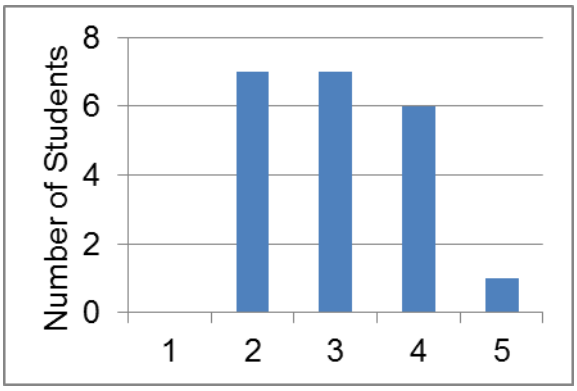

Fig. 3. Development of own expertise

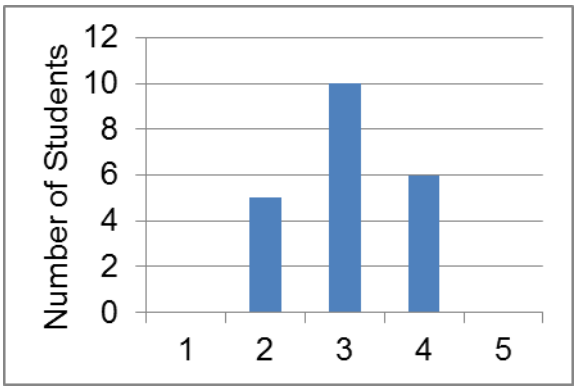

Fig. 4. Interaction with teacher

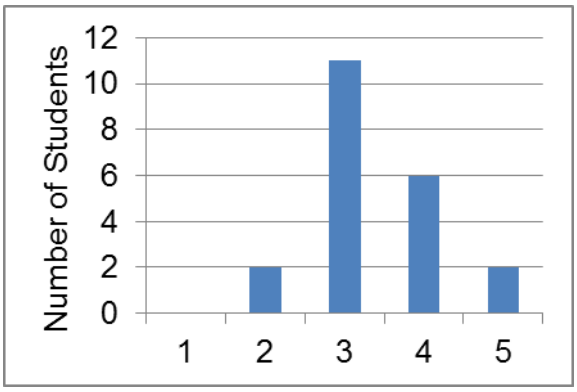

Fig. 5. Assessment method of the course

In figures *Fig. 1. - 5.* it can be seen that the course met the students' expectations quite well. The students were most satisfied with the contents of the course and the online activities offered. They were slightly less, but still somewhat satisfied with the development of their own expertise.

Students encountered several types of activities during their studying. Students' perspective about how much different online activities, like theory videos, example calculation videos, assessed measurement assignments, week exams, non-assessed group assignments, discussions, theory summaries and textbook reading, have supported their learning is presented in figures *Fig. 6 –13*.

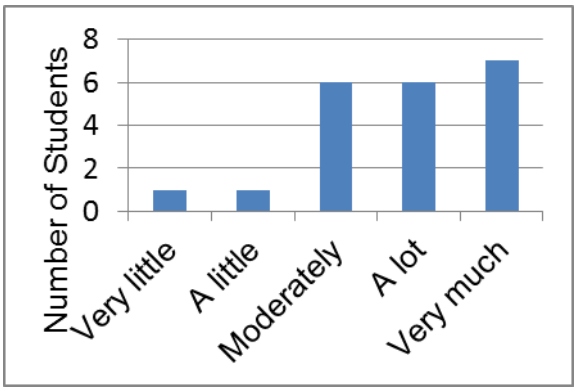

Fig. 6. Theory videos

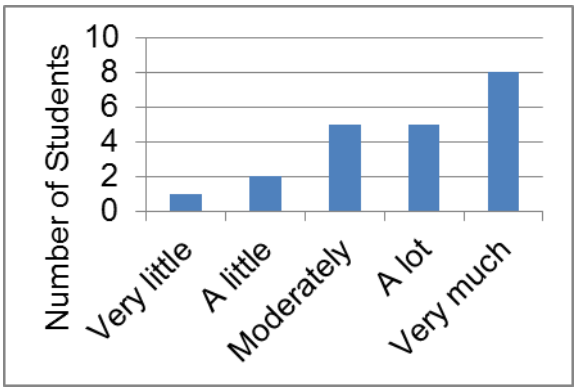

Fig. 7. Example solution videos

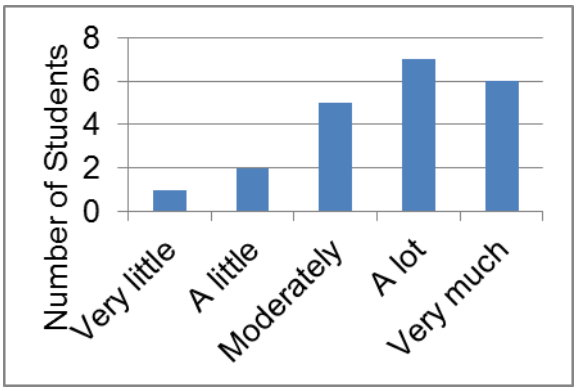

Fig. 8. Assessed measurement assignments

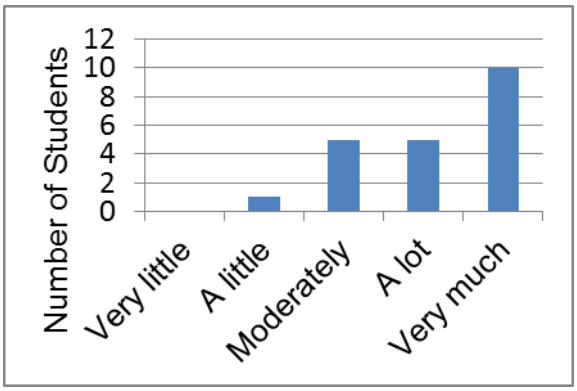

Fig. 9. Assessed week exams

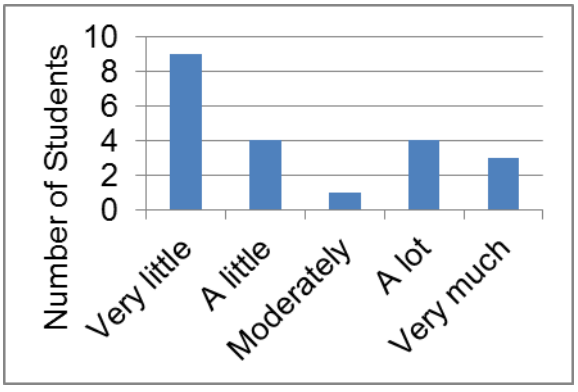

Fig. 10. Not assessed group assignments

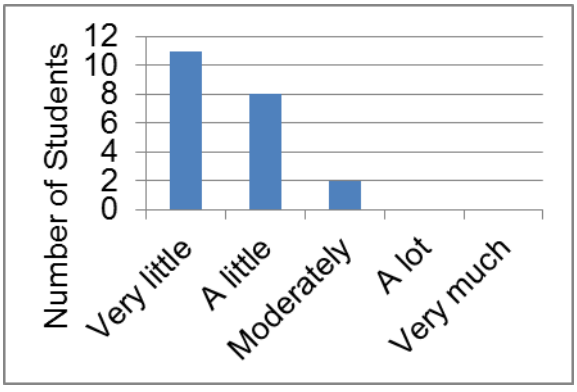

Fig. 11. Online discussions

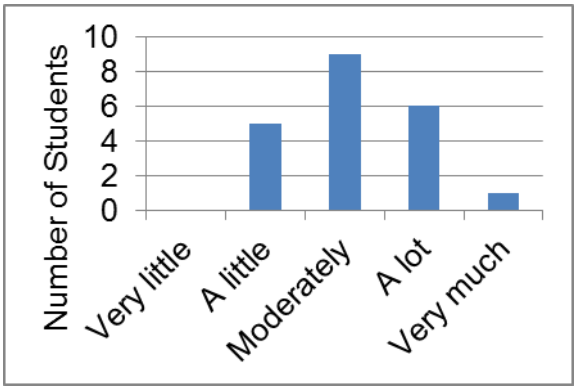

Fig. 12. Written theory summaries

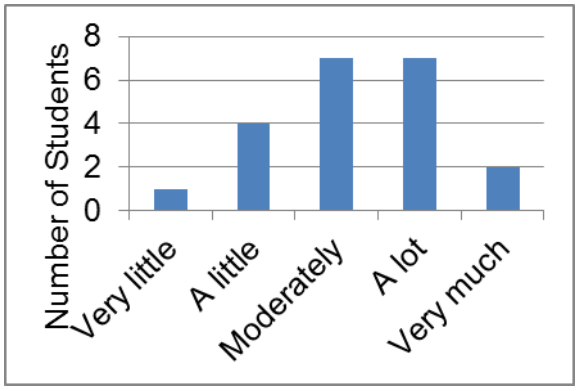

Fig. 13. Textbook reading

Figures *Fig. 6. – 13*. indicate that according to the student experience, the most helpful activities to support their learning are video-contents offered and assessed tasks. Online discussions and non-assessed tasks are experienced to be less helpful. The reason for this may be students' low activity for participating in these activities. Surprisingly textbook reading activities are also considered to be quite helpful for supporting learning. Students' written comments mainly emphasized the importance of video material as very helpful tool to self-directed learning. The weekly assessment system also collected positive comments like "It forced to study and helped to understand contents as a whole."

When using active engagement methods, students are expected to process their knowledge actively with peers. The online implementation supported this kind of activity by offering tasks meant to carry out and even assessed in groups. Group discussion areas were also supported. According to survey, only 10 of 21 students studied as a member of a group. The rest studied individually. It can be said that pilot online implementation partly failed to awake peer work in studying. Students who reported studying as a part of the group, found it very helpful for their learning. Students were also asked how the groups should be formed. 14 of the 17 answerers of this question still answered that students should form the groups by themselves, the teacher should only give some help if the groups are not formed. Minority's opinion was that the teacher's should form the groups.

The assessment was based on weekly measurement assignments and week exams (50 %) and on final exam (50 %). In the survey, 17 of the 21 students announced that the assessment system used was better than traditional final exam.

4 CONCLUSIONS AND FURTHER DEVELOPMENT

In the pilot implementation of 100 % online course, students managed to study actively in online implementation even though it was a new experience for majority of them. Almost all students who studied actively, passed the course. Quite high dropout rate gives a suggestion that some real effort should be made to activate the online students in the very beginning of the course. This could happen even before the main course contents begin. It could be worth of trying to use at least one or two weeks in the beginning of the course just for grouping the students, for example by forcing the students somehow shortly introduce themselves online and let them form the study groups in which they will study the rest of the course. The dropout rate of

the course was still well below the typical dropout rates of the MOOCs [8]. The pilot implementation also partly failed in the active engagement of the students, because only minority of them studied in a group.

According to the course feedback, the students liked the assessment system that included weekly assessed tasks and exams. The cognition of assessment helped or forced students to study more evenly throughout the course, not just a few days before final exam.

81 % of the students who dropped out, dropped practically before the real beginning of the course. For future research it could be interesting to carry out research focusing on students' targets and the stage of motivation in the beginning of the similar online implementation.

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