Blended learning in digital electronics and programming

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The presentation will show and discuss how students get more time for programming exercises in the 4 hour course as well as the tools used. An evaluation of the findings so far will be given. The digital electronics and programming course is a 5 ECTS course given on the 2nd semester of the B.Eng in Electrical Engineering degree course. A teaching experiment was performed this semester which this presentation will describe and discuss the results in relation to previous teaching methods used during the last 3 occasions the course was offered. It is concerned with moving from lectures with a lot of power points towards a video introduction of the general topics about data processing and the hardware part of the microcontroller. Together with video, some test questions are provided in a quiz or as multiple choice questions which should be taken after seeing the video. Thus the focus of learning shifts from teacher centred to active learners. Learn everywhere. Self-assessment – The active learning will also be discussed in the presentation. It is done individually as preparation and as team work with 2-3 students completing a total of 5 deliverable assignments together.

Background

The course has run for 1½ years, this semester being the fourth time. Observations from previous semesters had been that I spent 2 – 2½ hours in the lecture hall presenting material by using slide series and at the end demo programming. I used polls on CampusNet for the students to self-check and for having a short revision afterwards based on the answers. Lastly, I live coded/programmed using the Atmel Studio IDE in front of the students as Michael Caspersen et al. Lit 3 proposes. They were engaged to follow what I did. Last semester, I even recorded the screen and talk. Some students said in the evaluations that they would like more hands-on. I participated in the Learning labs course about blended learning and became inspired.

Therefore, I posed myself the question "*Is it possible to compress a 1 hour talk with slides to a 5 to 10 minute video and to let the students be more active during the programming exercises in the 4 hour lecture slot?*"

Experiences from previous semesters

The data processing part of the 5 ECTS point course is about how a microcontroller is built up and how it works in general as well as the different functionalities such as e.g. serial communication, which the students must program by using embedded c-programming. Some students find it very difficult to understand and to do the c programming. They need to read data sheets very carefully and figure out what logic level each specific bit in the register should be. Therefore, time for doing exercises is also important, while the lecturer and assistant teacher are present otherwise students get behind and don't attend the exam. As Michael Caspersen et.al. suggests in lit. 3 "live programming" is one way to teach the students how to program. My personal experience is that the students like it but it takes time from their own opportunity to practice while a supervisor is present.

At the start of each lecture there were given a code exercise using Google form – and after that the results were shown and discussed with the students. This took about 40 – 45 minutes of the lecture. New material was then presented using slides and black board. Polls on CampusNet were used for checking up on the understanding of what the lectures were about – this worked well.

Lastly, a live demo in the lecture room, showing the day's programming topics including the look up in the manual to find the information required for the programming. That took approximately 30 minutes – so after about 2.5 hours the students were well prepared for their own programming exercises.

The experiment findings

To offload and let students have an alternative way of preparing for the lecture I have, from the first lecture, produced slides where I go through: the general topics about data processing, the theoretical part, the general principles etc. I use PowerPoint slides and a screen recorder from Camtasia where it's possible to record with the camera on the lap top or an external one. Along with the slide a video of the presenter's face is shown, lit2. The duration is kept below 10 minutes – (lit. 2) recommends 6 minutes. The recoding is done in an informal setting. lit. 2 suggests: "instructors speaking fairly fast and with high enthusiasm are more engaging"(lit2).

Quizzes and polls are given during the talk as a slide "answer these questions". Both students and teacher can check that they can have learned/understood what was intended. In Lit. 1 it is stated "supporting student learning is a common recommendation that supports success and these include prompt and specific feedback clarifying and reinforcing the role of online discussion and monitoring". This is one of the challenges, how to give feedback to students who watch the videos about the learning outcome. Another challenge is how to enforce the students to watch the videos beforehand?

The live demo programming in the lecture is moved to the preparation video using the development IDE and explaining what the code does. Together with that, some videos are recorded while I talk about what happens as the simulator simultaneously runs the program.

In the presentation, I will give statistics e.g. about how many students who have actually seen the videos before or after a given lecture, students' comments to the video and comparison of previous semester's midterm multiple-choice test etc. The students get at least 1 hour more hands-on time. However, the preparation time for the lecturer has increased by 1 – 2 hours.

Tools used

Camtasia Studio ver8. – both video and screen recording video, editing facility 169 $ per license

Alternatively: the Open Broadcaster Software – open source – only recording

Google forms as multiple choice, quiz, CampusNet multiple choice and polls

References:

Lit. 1 Blended course design a synthesis of best practice by Patricia McGee, The University of Texas at San Antonio, Educational Psychology and Abby Reis The University of Texas at San Antonio, Educational Psychology. Journal of Asynchronous Learning Networks, Volume 16: Issue 4

Lit. 2 How video Production affects students engagement: an empirical study of Mooc videos by Rubin Philip J. Guo (MIT CSAIL) University of Rochester, pg@cs.rochester.edu, Juho Kim (MIT CSAIL) juhokim@mit.edu, Rob Rubin edX rrubin@edx.org. 2013

Lit. 3 Exposing the Programming Process: Jens Bennedsen and Michael E. Caspersen IT University West, Denmark jbb@it-vest.dk, Department of Computer Science, University of Aarhus, Denmark mec@daimi.au.dk. From: Reflections on the Teaching of Programming Methods and Implementations, Springer, 2005