PBL and IT - Improving Moodle for flipped classrooms to decrease drop-outs

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Introduction

The bachelor in Medialogy at AAU currently has a comparatively high drop-out rate. Many Medialogy students find acquiring programming and supporting mathematical skills difficult and can lack motivation despite the high correlation of programming skills with post-graduation employment. A recent internal cross campus (AAL/CPH) study from the UNESCO PBL chairs found that Medialogy students seek more face-to-face time interacting with and being coached by teachers and teaching assistants on concrete problem-solving in informal settings in programming and math courses [1]. This request from the students is in line with a previous educational approach at Harvard University. Students in science, technology, engineering, and mathematics (STEM) disciplines in flipped classrooms perform better and are only half as likely to change to non-STEM disciplines than traditionally taught students [2]. In flipped classrooms, students do not listen to a lecturer in an auditorium but prepare e.g. at home at their own pace for more hands-on interactive teaching sessions. Preparation often consists of watching video tutorials and checking knowledge using related online quizzes or through peer discussions. In-class time with the teacher focuses on hands-on activities e.g. posing concrete problems and having student pairs discuss possible answers. Data on learning from online content (videos, quizzes) allows for analytics to identify struggling students.

While PBL is well aligned with flipped classrooms, how Moodle is currently used and configured at AAU is not. We see great potential in developing PBL by better integrating the digital tools, in this case, Moodle into concrete PBL activities. We arrive at this through a user-centred development approach that includes hands-on class experimentation. To this end, this project extends Moodle to help teachers better support their flipped classrooms and providing them with student learning data.

Methods

We applied flipped teachings at different semesters and courses of the Medialogy education. To find best practices of concrete PBL activities, we did the following:

A. Recorded and uploaded lectures to Moodle before class to showcase examples/theories and/or integrating interactive quizzes in the videos.
B. Evaluated tools for interactive lecture creation and existing Moodle modules currently not used at AAU.
C. Collected information about best practices for flipped classroom within AAU (including experience with the area from our own department [3]). The results are communicated on a course page at AAU Moodle and a PBL expert evaluated it to improving the Moodle course before launching it for teachers at AAU.

Video material on Moodle

The advantages of videos are that the students can rewind the content after class, before exams, and even next year for new students. Therefore, the videos usually present the basic information of the lecture, so it is reusable next year. Research and our own experimentations have pointed out that the video lectures to be watched offline at the students' convenience have to be engaging as the students find lengthy and static videos with no accompanying activities boring. Videos should, therefore, be no longer than 10–15 minutes after editing. Video production workflows differ in cost (i.e. production difficulty) and gain (i.e. student engagement and reusability). Find time estimates of three different production workflows in Table 1. A teacher produces a recorded lecture by simply starting the recording device at lecture start and edit the video after class. A class preparation video presents the learning material in a concise way, while an interactive video presents additional content by engaging student interactions, e.g. by using quizzes.

Table 1: A comparison between different video workflows with colour-coding of cost/gain, from most desirable (green) through desirable (yellow) to undesirable (red).

Workflow	Recorded lecture	Class preparation video	Interactive video
Production difficulty	Easy	Medium	Hard
Student engagement	Low	Medium	High
Reuse next year	No	Yes	Yes
Video duration example	3 hours w. breaks	2 x 15 minutes	2 x 15 minutes
Planning	1-2 hours	1-2 hours	1-2 hours
Recording	3 hours	1-2 hours	1-2 hours
Editing	1 hour	1 hour	1 hour
Interactive items (20)	None	None	1 hour
Export/upload to Moodle	1 hour	1 hour	1 hour
Estimated production time	6-7 hours	4-6 hours	5-7 hours

The video production process involves planning, recording, editing, and exporting/uploading to Moodle. For creating a pre-recorded 15 minutes long video, it takes approximately 90 minutes and longer if adding interactive content in videos, e.g. quiz questions for self-assessment. However, the recording and editing time might take longer due to re-takes and editing. When producing videos, we experienced that one teacher used twice the time of the video material to create it (30 minutes to create 15 minutes video material), whereas another teacher spent three times the video material for video recording only (60 minutes to create 15 minutes of video material). Updating and maintaining the videos is also a concern, as it is much easier to change slides compared to changing, rendering, exporting and uploading a video. For faster workflow, we recommend using student helpers to edit and upload videos (e.g. Medialogy students due to their interest in video production).

Evaluation of Moodle tools

In this project, we used Moodle plug-ins that improved the flipped courses and provided data about student learning progress. We recommend using Moodle Gradebook for collecting student data and activating Activity Completion for each Moodle activity. All scores in a Moodle activity are collected in Moodle Gradebook for the teacher to overview the student performance in the entire course or parts of it (see Figure 1). Currently, the students cannot view their own Gradebook on AAU Moodle, but they can follow their own progress in the Completion progress (see Figure 2).

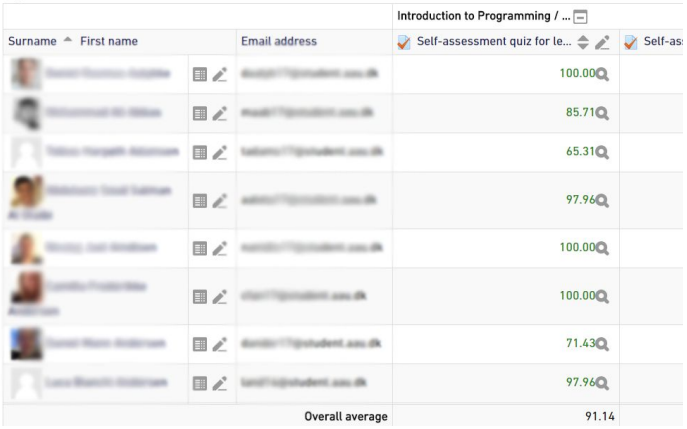

Figure 1: Overview of student scores in Moodle Gradebook for each student (rows) and each activity (columns).

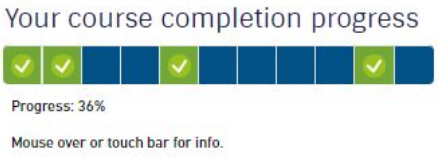

Figure 2: Completion progress illustrates complete and incomplete course activities.

We used the following Moodle activities a flipped lesson/course:

- Interactive content (H5P): The plug-in allows a series of interactivity, e.g. quiz questions in videos or memory games. Another option is to create interactive content in video editing software, such as Camtasia or OfficeMix in Microsoft Powerpoint.
- Lessons: Use at the end of the semester and preparing for an exam, the teacher can set up a lesson for students to assess their learning and then direct them to specific resources/ activities using links. The teacher can extend their slides in this activity, however, it is time-consuming to design and implement.
- Quizzes: Use after completing the other class preparation activities/resources to find weak points in class preparations. Quiz scores can reveal if students should study the topic more.
- Active quiz (game show): The teacher can use at the beginning of a lecture correct misunderstandings from self-assessment quizzes. Supporting a faster workflow for creating moderated interactive quizzes with different levels of understanding. The teacher can in the beginning of a lecture correct misunderstandings from self-assessment quizzes.
- StudentQuiz (student-generated questions): The students create questions relevant to one/more topics and peer review questions. The students can do this in-class e.g. in pairs or out-of-class. This activity promotes critical thinking and works for exam preparation.
- Workshop (peer assessment): Use for mandatory hand-ins. For faster workflow when checking for pass/fail students, the teacher only checks the hand-ins with lowest grades.

Best practises for flipped classrooms within AAU

When flipping a lesson/course, the teacher should start by reflecting upon how realistic flipped classroom is to manage (incl. time, resources, which parts of the course can benefit from being flipped, how to start small, the logic behind organizing the flipped learning, and how it can support PBL). Most teachers have little time for improving their course and flipping it 100%. Instead, the teacher can benefit from starting small in creating reusable flipped learning content, e.g. the teacher can start by creating a few videos for a course the first year and then improve these videos by adding interactive content the next year. Here is our guideline to start flipping a lesson with Moodle:

1. Find out what your students struggle with and plan how to flip that.
2. Plan study activities before, in-class and after class.
3. Use one Moodle activity to aid your flipped learning plan and test run it.
4. Collect student learning data (e.g. in Moodle Gradebook) and modify the activity content accordingly.

We would like to stress that the flipped preparations (i.e. videos and exercises) should be reusable for the course next year, as it otherwise is too time-consuming. Additionally, the teacher should consider using all possible resources, including borrowing learning content from similar courses and asking for help from others (e.g. ITS support for technical issues and teaching assistants/student helpers for creating flipped learning content on Moodle).

Example of how the study activities before, in-class and after class are connected in a course:

- Before class: The students prepare for class by watching videos and taking quizzes for self-assessment. The pre-training principle [4] suggests that cognitive overload can be reduced by providing students with basic information ahead of time. This approach leaves class time to scaffold more complex concepts and skills through interaction, group work, peer feedback and instructor support [5]. However, the approach depends on the students' self-discipline of doing the class preparations, and therefore, the teacher can do a quick recap in the form of a class quiz, but otherwise, the teacher should expect that the students have done their homework.
- In-class: The teacher monitors student progress to adjust instructions and start early interventions [6], e.g. the teacher facilitates class discussions about misunderstandings from the self-assessment quizzes. The class time focuses on applying and analysing activities, as the teacher helps with hands-on exercises or mini-projects.
- After class: The students submit their mini-project and assess assignments with peers. The teacher uses student scores on Moodle to identify struggling students [7].

Examples of flipped courses at AAU:

- Using interactive videos in combination with reading material and the class forum on Moodle worked well for class preparation and understanding the material in the Real-time Interfaces and Interactions course (Spring 2017). The class preparations created a foundation for facilitating class discussions about the learning material, using the active quiz activity. Consequently, the prior activities gave the students a good head start to the hands-on workshop, in which they worked with their mini-projects.
- Using full-day workshops for peer reviewing scientific papers worked well in the Foundation course (Fall 2017). The workshop activity on Moodle gave the teacher a great insight of the student activities, allowing him to help the students on an individual level.

- Using a bank of self-study activities in an introductory to programming course (Fall 2017) had a positive impact on the students and teaching assistants, e.g. videos, lecture exercises, and Khan Academy. It allowed the teacher to spend less time on giving lectures and more time on helping students in the exercise session. The only drawback of the activities is that it requires self-discipline of the students to continue using them, and the self-reports reveal that some students never use a self-study activity offered to them. Thus, the course is missing some follow-up on the self-study activities in the lecture time, e.g. by grouping the students based on their performance in the self-study activities and offer them tutoring fitting their learning level.

AAU course - Flipping courses with Moodle

Based on previous studies on flipped classrooms and our teaching experiences, we designed and implemented a course for teachers seeking ideas and hands-on examples of how to flip a classroom in AAU Moodle (named Flipping courses with Moodle)[1]. This page provides a background on flipped classroom and suggestions for individual and group-based activities on Moodle (see an overview of course topics and content in Figure 3). It includes a series of how-to videos on the preparation of such activities and the videos used in flipped classrooms. The course is available online, and we are planning to run a few workshops for providing more support in the flipped methods.

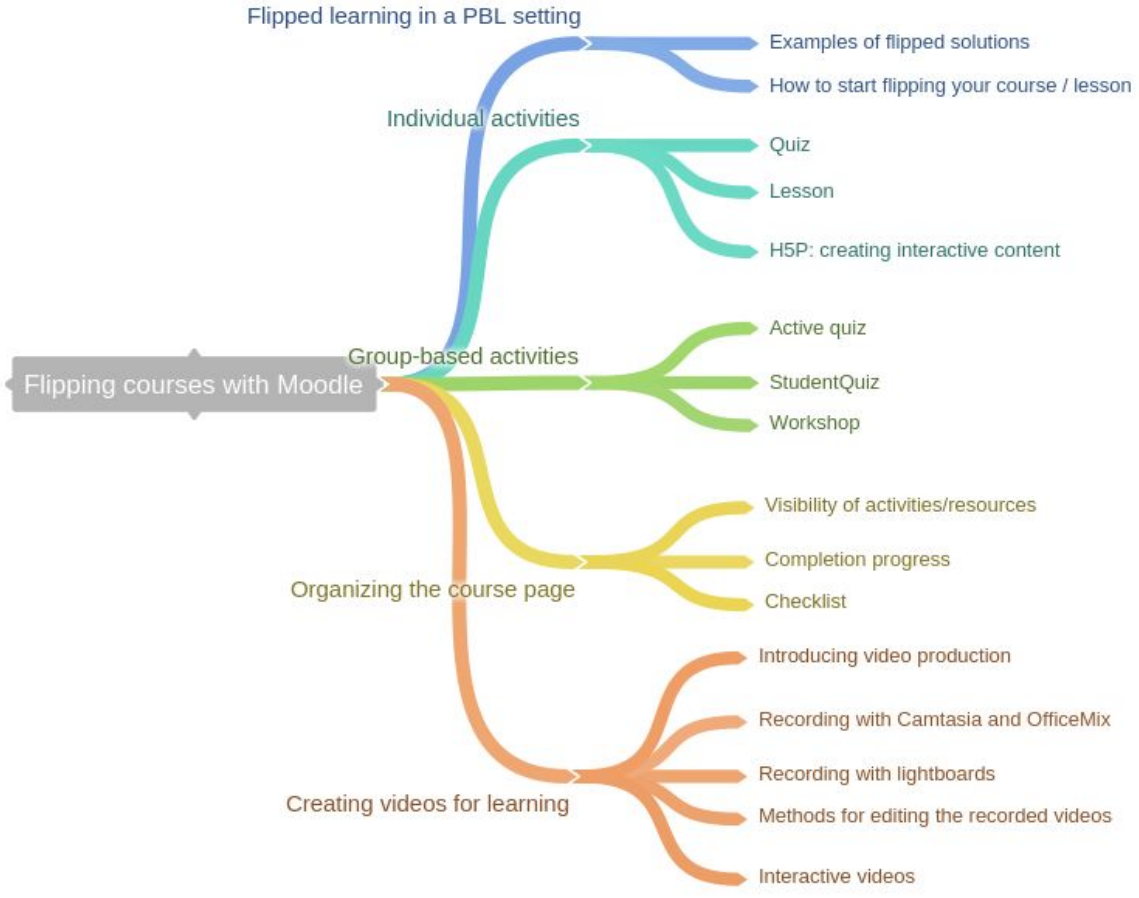

Figure 3: Overview of topics and content in the course Flipping course with Moodle.

[1] https://www.moodle.aau.dk/course/view.php?id=25351

Conclusion

This project work is considered as a starting point of the flipped learning at AAU and inspiration for teachers to start exploring Moodle features best fitting for the particular education. We recommend that the teacher choose and chunk the material provided on our course page on Moodle. More support will be available in the following year in a related project about predicting dropouts, e.g. by analysing Moodle data via the Inspire plug-in to Moodle. With the increasing focus/interest in flipped learning at AAU, we hope that the taskforce will grow, so teachers have more support for flipped methods and receive tools/aid for faster workflows. This can include technical support to access video recording equipment, create Moodle activities/resources, and pedagogical support to teach/evaluate flipped methods/practises in a course. Mastering how to flip classrooms on Moodle is gained through time and experience which we can extend in the coming years when teaching in flipped courses. Sharing and reflecting among teachers and students upon those experiences is important in this process, as some of the methods are new at AAU and require maintenance, improvements, and additions.

The next steps

- Facilitate workshops for teachers to learn about flipped teachings and share knowledge about flipped practices.
- Integrate a taskforce at AAU supporting different aspects of flipping a classroom, including:
    - ITS support for borrowing recording equipment and support help/implementation of Moodle plugins.
    - Flipped learning experts in PBL settings supporting the pedagogical approaches.
    - Tools for sharing knowledge and experiences, e.g. in online Moodle forum or facilitating annually workshops for teaching interested in flipped teachings.
    - Inform students about flipped learning in PBL courses at first semester, as we need to teach them how such courses are facilitated and how to get most out of flipped learning as a student.

References

[1] Bøgelund, P., Justesen, K., Kolmos, A., & Bylov, S. M. (2016). *Undersøgelse af frafald og fastholdelse ved medialogi og andre uddannelser ved det Teknisk-Naturvidenskabelige Fakultet 2015-2016: Arbejdsrapport Nr. 1*. Aalborg Universitet.

[2] Dekker, G. W., Pechenizkiy, M., & Vleeshouwers, J. M. (2009). Predicting Students Drop Out: A Case Study. *International Working Group on Educational Data Mining.*

[3] Triantafyllou, E., Timcenko, O., & Kofoed, L. B. (2016). Teachers' development in a flipped classroom for applied mathematics: a use case in a transdisciplinary engineering study. In *44th SEFI annual conference European Society for Engineering Education. Annual Conference proceedings.*

[4] Mayer, R. E. (2005). Principles for managing essential processing in multimedia learning: Segmenting, pretraining, and modality principles. *The Cambridge handbook of multimedia learning*, 169-182.

[5] Green, L. S., Banas, J. R., & Perkins, R. A. (Eds.). (2016). *The Flipped College Classroom: Conceptualized and Re-Conceptualized*. Springer.

[6] Bergmann, J., & Sams, A. (2014). Flipping for mastery. *Educational Leadership*, 71(4), 24-29.

[7] Christensen, B. C., Bemman, B., Knoche, H., & Gade, R. (2018). Identifying Students Struggling in Courses by Analyzing Exam Grades, Self-reported Measures and Study Activities. In *Proceedings of SLERD'18* Springer Verlag.