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Introduction course considerations for supporting graduate students in PBL practices

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INTRODUCTION

Universities working with problem-based and project organized learning (PBL) are likely to face a challenge when introducing students to its methods, practices and potentials, not least for graduate students coming from non-PBL undergraduate education programs. Each summer, 83% of the graduate student intake at Aalborg University Copenhagen (AAU) stem from undergraduate diplomas from other universities. Most new graduate students therefore lack experience with the PBL-based, project-organized 'AAU model'. To prepare these students, since 2014, AAU study regulations dictate an introductory PBL course for all non-AAU-bred graduate students, running 3 lectures over 2 months, as mandatory across all graduate programs. Despite huge differences in educational direction between programs, as well as previous experience with PBL practices between students, the study regulations have locked the course on a standardized model across all programs, from a one-size-fits-all perspective. The goal of the course is mainly to prepare new students for their practical application of the AAU Model, e.g. in collaborative project work in groups, but struggle with a handful of issues. For example, the course has favored an abstract and theory-driven approach, rather than skills and understanding which would allow students to apply the AAU Model principles in practice, and work with other students who are already familiar with the model. Another issue is a general disregard for the possibility that new students have previous PBL experience, even if not with the AAU model. These issues have formed a disconnect between the course and students, and resulted in low student engagement and interest in the course, as well as a lack of trust in the AAU PBL approach with many new students. Meanwhile, in the latest iteration of the course development, PBL Intro teachers across 9 different study programs, have worked to revise the course ideology and content. This saw its pilot application implemented with 4 study programs, with the aim to make the course practically useful, establish a connection between students with and without previous PBL experience, bring an understanding of the advantages of the AAU model of PBL, and to introduce the necessary skills and considerations for practical application in students' project-based group work. In this paper, we describe the transition to new PBL introduction course approaches, and discuss the effects, based on teacher and student evaluations.

1 BACKGROUND

AAU has developed principles and models for Problem Based Learning and project work (PBL) since 1974. Graduates have been educated to solve problems, engage in cooperative relationships and communicate with different actors in a globalized labor market [1]. The commitment to PBL is highlighted in Aalborg University's strategy [2] as a fundamental

principle for all study programmes. On a practical level, this entails that PBL is embedded in the organization through (among other things) a systematic introduction to PBL at undergraduate - and now also on graduate programmes - to ensure that the AAU PBL model is an explicit learning outcome with all study programmes.

1.1 AAU Model for PBL competences

Many AAU students (especially graduate students) come from an international background, which supports AAU students experience not only nationally-based, but also internationally oriented problem-solving, collaboration and communication, which has been highlighted as competences for a future workforce. Holgaard, et al. [1] also distinguish between two sets of competences; *profession-specific competences* related to the theoretical and methodological mastery of a profession, and *PBL-related competencies*, such as the ability to analyze a problem, the acquisition of flexible knowledge, effective problem-solving skills, self-directed learning skills, and effective collaboration skills, which all are aligned with 21st century skills [3] [4] [5]. The AAU model reflects this in how students have a) courses specifically aimed for field-specific competences, and (b) a semester project where students are required to practice the aforementioned PBL-related competences such as include abilities to identify problems, work interdisciplinary and apply project management skills [2]. The focus on group-based project work in the AAU model is based on constructivist and social learning theories, and rely on scholars who have variations between the understandings of learning, but where all emphasize that learning is based on real life problems. [6]. These considerations are at the core of the group-based, project-oriented focus in the AAU model. While used in course teaching, the semester projects are where they get students develop their primary PBL competences, with years of applied experience with PBL praxis.

1.2 PBL skill development for AAU undergraduate students

One of the challenges for the PBL intro course, has been to align new graduate students with graduate students already having an undergraduate background with AAU. Undergraduate AAU students start their PBL journey on the 1st semester. A 5 ECTS introduction course spans the 1st semester, with lectures on PBL theory and practice, project planning and management, groupwork-oriented communication methods, conflict management methods, academic project dissemination, reflection paper dissemination, etc. In addition, each student receives 6+ hours of consultation work from a select group of teachers, to further improve their understanding of- and relationship to PBL practices and project work, over the 1st year of studying. Undergraduate student practice these skills, primarily through project work throughout the bachelor program, but new graduate students need to acquire and represent similar skills very quickly, to work with previously embedded AAU students. The project work which is the central hub for PBL practice, are set to a 15 ECTS workload each semester, per student. The problem- and project processes (-focus, analysis, -definition, -solution design and development, and -evaluation) are key to working with the curriculum under the AAU Model, as the semester courses' curricula are expected to be included in the project's academic focus and practice. While project groups have an academic supervisor, the success of the project depends on the choices students make (self-directed learning skills, and responsibility which students take for that learning process). It is on this foundation, that student improve their ability, and acquire their educational background; being able to put course curricula into practice, by using knowledge, competences and skills to define and solve a problem. At the same time, students will need to understand the relationship between performing study activities as a group, while being evaluated individually at exams. Compromises between personal preferences and interests are inevitable, and students need to weigh the pros and cons, as well as take personal aim at which parts of a collective work-effort, they will want (or need) to represent at individual exams. Through their undergraduate program, AAU students experience at least two things a) that the PBL-approach to studying becomes completely integrated with the experience of being a university student, and b) the level of their PBL skills become instrumental to develop the level of their academic skills.

1.3 History of the AAU PBL graduate student introduction course

For graduate students coming from outside AAU, the just described PBL study environment of AAU has been complicated to fully utilize, unless they a) have prior experience with similar working conditions, or b) are able to adapt very quickly. Prior to 2014, there was no help for new students, other than what they might get from fellow group members or (in some cases) the supervisor. The 'PBL introduction course' was launched in 2014 to bridge the PBL gap. From 2015 onwards, the course was gradually formalized, standardized and implemented within all master programmes under the Faculty of Technology and Science. In 2016, a 3-lecture (1 ECTS) course was fully established in its formalization and standardisation, with centrally specified content sequencing for each individual lecture, and including pre-produced slides offered across all programs. Meanwhile, for some teachers, the course format left a lot to be desired, as explained in the Introduction to this paper, and which led to the current revision, from 2016 to 2017.

Learning outcomes intro-day:

- To be able to describe what PBL is as a learning approach at AAU
- To be able to describe collaborative and planning perspectives of PBL
- To be able to describe and understand plagiarism
- To be able to declare and justify an initial individual challenge when using a PBL approach

Learning outcomes challenge-day:

- To practice PBL in a reflective team
- To declare and justify an individual challenge and work out a plan how to deal with it
- To develop and practice peer feedback skills

Learning outcomes evaluation-day:

- To reflect on PBL practice
- To practice presentation skills
- To practice critical skills when giving feedback to peers

Figure 1 Overall themes for the course

2 CASES

In this part of the paper, we will look at the PBL Introduction course as it was structured and run in respectively 2016 and 2017, specifically focusing on the course run for graduate students from the four programs. Initially, each case will be addressed on a descriptive level, from both a topic-quantity and a content perspective. From there, a summary of the course evaluation of the 2016 course will be presented, to roughly inform the changes made for the course in 2017. This will feed into an analysis on the changes between the cases, explaining the reasoning for the transition between 2016 to 2017. Following the analysis, the paper will continue by addressing and discussing the results of the 2017 course.

2.1 PBL Introduction course 2016

The pre-designed slides of the 2016 *lecture 1* had students go through an extensive collection on everything in the AAU PBL model (content themes can be seen in Figure 1). Examples include bullets, terms, models, theories, frameworks, figures, images, approaches, exercises, examples, assignments, discussion topics, practical information, etc. Main topics included 'what is PBL', the AAU Model, AAU PBL principles, unique AAU features, group-based project exams, former student experiences, current graduate student experiences, problem orientation, project planning, project management, scientific writing, referencing, plagiarism, cooperation in groups, thinking models, personality types, learning styles, learning test, team roles, supervision, facilitator (supervision) styles, group work, and PBL challenges. In-class exercises were one 2-minute pair-discussion (on individual group roles), a 3-minute active listening trial, and quiz on plagiarism. For homework, students were asked to prepare a 1st draft of a '*personal PBL challenge*' written reflection assignment, based on their individual thoughts on the lecture content, and send it to the course teacher for comments. As a response to this 1st lecture format, a body of students in 2016 filed an official complaint, asking to be removed from the course. It was described it as a waste of time, based partly on the fashion of marathon format, and what was perceived as simply a repetition of PBL content, which many students claimed to already know from previous education. In this case, course merit was not an option. In response, teachers sent out a survey to map students' needs, so the last two lectures might also address or focus more on those.

Lecture 2 only 2 new topics were (briefly) introduced; reflective peer-feedback, active listening. Continuing the format of the standard slideshow, the dominant part of the lecture was a single, in-class exercise, focusing on 'peer-discussion' (conversation between students),

meant to be a reflection space for the development of their individual 'personal PBL challenge' from lecture 1. For homework, students were asked to simply correct their 'personal PBL challenge', based on the peer-discussions, and send the new version to the course teacher.

Lecture 3 had no new theoretical content (all repetition from lecture 1 and 2). Most of the lecture was once more based on group peer discussions on the 'personal PBL challenge', though it addressed the points from the survey which were not addressed in the 2nd lecture.

An extra addition to the two last lectures, was a list of a topics based from the survey related to their official complaint. The topics were split in two, and addressed in the end of the two last lectures, focusing on what students found to be relevant to develop their AAU Model skills.

2.2 2016 PBL Introduction course evaluation

Students were very negative about 1st lecture, the written homework assignment and stale nature of the much too lengthy 'peer-discussion' process. However, most students had positive comments to the list of topics made from post-complaint survey. Especially an approach to handling conflicts, was deemed interesting and useful, as many students reported to have issues with other group members (ironically, often students with AAU-based undergraduate PBL backgrounds). In this relation, students reported enjoyment with the discussions orchestrated the teacher a lot more, than discussing their 'personal PBL challenge' with each other. For exactly the reasons that students liked the list-based discussion, students disliked the course on an overall level. The rest of the course had a contrasting poor connection (if at all) between the course contents and what students felt they could utilize in practise. The 1st lecture had too many topics, which were either abstract/philosophical or shallow, and never touching on practical issues or application methods for life as a student, and 2nd + 3rd lecture were simply students talking to each other, instead of learning from the teacher. Due to how students' expectations to the course were not met, students felt that it even increased the sensation of disconnect between AAU and non-AAU bachelor students. Many students considered it a waste of time and only attended because they had to pass to graduate.

2.3 PBL Introduction course 2017

Based on the experiences with the 2016 course, and similar complaints from evaluations across similar course runs, teachers across 9 programs redesigned the approach, eventually becoming a pilot-study on the four programs that had previously received the official complaint. The redesign included all themes from 2016 but had them spread out on all 3 lectures. The course also focused on less breadth, more time for depth and placed heavy focus on the topics requested by the 2016 student survey.

The 1st lecture, besides a small introduction to the course, only had 4 main agenda parts. Main topics included a) results and analysis of a PBL-based survey given to the students prior to the lecture on their previous PBL experience, b) the AAU model, c) PBL in projects, and d) a few project planning/management tools. Moreover, study groups were formed for in-class (between students across programs, not familiar with each other) and homework exercises on the PBL course. For homework, students were assigned to an individual Myers Briggs personality test and asked to write a 1-page reflection on how their results could potentially influence their project work at AAU .

The 2nd lecture had 8 agenda points where 3 were larger exercises in the study groups (not a repetition from previous lectures). Main topics included an in-depth look at the Myers Briggs test purpose and value, group-oriented communication, and group-oriented conflict management (each a theoretical and an applied part). The three in-class exercises included: to map the study group's strengths and weaknesses based on Myers Briggs results and Belbin team roles, to practice active listening in 3x10-minute sessions + 10 minutes reflection, and to write a 'code of conduct' collaboration document.

The 3rd lecture had 8 agenda points (where 3 were in-class group exercises), of which some were repetition for reflection on gained experiences over the past 2 months. Main topics included a revisit to the PBL statements included in their 1st lecture survey for new reflections, the AAU model revisited, project examination at AAU, and a course discussion/reflection. For exercises, groups were given 2 preparation sessions to perform a 3-minute presentation on their

opinion on a list of topics, already introduced once in the course (prep session 1: group profile for Myers Briggs/Belbin, collaboration agreements, central PBL experiences from their individual program/project until now; prep-session 2: central PBL experiences from the course, central topics they would have wished more focus on from the course). For a final homework, students were asked to make a 10-point list of a collaboration agreement for group work, a 500-word reflection on its usefulness, and another 500-word reflection on communication and conflict management challenges found interesting or personally constructive, from the lecture discussions.

3 COURSE REDESIGN - MAIN CONTRIBUTING POINTS

In the following, we will list and discuss the main considerations on the revised 2017 course, and elaborate on their effects.

Sending out an initiating survey about students' experiences with PBL and project work and using survey results to introduce the 1st lecture.

In the 2016 course, students reacted to content related to feedback on their own experiences and needs. A survey, sent out prior to the 1st lecture contained items related to their previous experience with PBL, including (but not limited to) past projects' lengths and group sizes, examples of group work experiences, their opinions on the most important, valuable, most challenging, and most overlooked aspects to project and group work. The survey results showed that many students in fact had experience with PBL, project- and group work, but qualitative responses showed that many lacked experience with the scope of AAU semester projects. Qualitative responses also showed that many students had frustration on how past projects or PBL-work had been managed, and that students lacked depth in their understanding of communication and conflict management. The discussions afforded by the survey results, gave the lecture a lot of focus on the task at hand (for the course lectures), and had students talk a lot about risks, dangers, positives, advices, central considerations, etc. It constructively set the stage to introduce how AAU worked in regards to the survey responses, what they would most likely experience as AAU students and what the course would address. Another thing which the survey afforded, was to stimulate students to discuss openly, by bringing themselves and their own experiences into play. From the discussions on pros and cons to various situations, students also appeared to become fairly comfortable acknowledging experience lacks in certain areas. It created an open attitude for both students with- and without PBL experience to share thoughts and ask questions, as neither found themselves having perfect knowledge. The initiating survey was a huge success. It turned the differences in students' PBL experience into an asset for discussion, instead of an issue of being different.

Delimiting the course content based on what is applicable for students in their program practices, and with a synergetic, shared focus between topics.

Due to the quantity and spread of topics addressed in 2016's 1st lecture, the quality (depth) of topics was not possible to realize. No time was available to properly address and explore e.g. the typical contexts or applicability of central aspects to the AAU Model, and students rarely showed understanding or acknowledgement of these aspects if asked. Based on the 2017 lectures, it was apparent that including fewer topics, with more time to explore them, allowed the necessary exploration and in-depth discussions, for students to realize the importance. It enabled more time for examples on situations and application areas for e.g. a conflict management method, gave time for more in-class exercises, and time for sharing of experiences from both teachers and students. All aspects which appeared to evolve students' understanding.

Project writing and report structure

To give an example of a central topic to introducing the AAU Model, the 2016 lectures lacked any focus on how to understand and undertake an AAU PBL project, despite being a quintessential part of AAU education. No attention was placed on how to practically approach the structure of it, and how to understand the use of the PBL principles, to form and guide the underlying logic of the project. For that reason, with the desire to focus on practical application of all course content, the 1st 2017 lecture used the project report structure as practical base, to explain the fundamental principles of AAU PBL.

Frequent, including 'long', in-class exercises

To strengthen the practical application potential, any central themes should receive practical, in-class exercise time. In 2017, students were often asked to talk for 2 minutes on certain topics or smaller questions (to induce curiosity). Spending more time with certain themes, however, was deemed necessary to understand their nature. One example is the 'active listening' exercise, where students spent 40 minutes practicing how to communicate constructively with each other. The point of the exercise was to illustrate the difficulties of performing active listening without deviation, but also how far into conversation topic it is possible to explore, if performed without interruption or premature presumptions from the receiver. This exercise received a lot of attention and reflection from students afterwards. Most students had never been allowed to talk about own opinions (or vice versa withhold opinions) for this length of time, which was an eye-opener for many. The challenge, and the necessary time available, seemed to make many appreciate the complexity behind the exercise.

Homework based on the progression of course content, and have it form a development for students' understanding, to also support the importance of the upcoming course content.

One of the issues related to the 2016 model, was how the written homework assignment 'personal PBL challenge' only changed minimally between lectures, and never evolved. No new perspectives were given between the 1st and 3rd lecture from the course itself. However, students were still asked to improve the document as homework between lectures. Student engagement went stale as a result. As a response, homework assignments in 2017 followed a progression, starting with students building a profile for themselves (Myers Briggs), from which they should work to understand both their own and profiles of other students. This progressed into applied practice, making e.g. collaboration rules and agreements, as well as analyzing potential strengths and weaknesses of different project group constellations.

For PBL-based, project-oriented homework and exercises, base students' time working on understanding tools which can be used by students individually and be aimed to improve their collaboration with others.

As an example of this, it became apparent to the *students* (which is an extremely important realization) during the 2017 course, that they lacked a fundamental understanding and tools to approach aspects of project work, such as communication and conflict management, through use of personality profiles and team roles. Group-based communication and group-based conflict management skills are essential for AAU students, and topics the 2016 course only briefly addressed. From working with the personality profiles and exercising the active listener, students seemed to be well inclined to acknowledge why certain situations could reach a high complexity level, from the appreciation of the complexity of a group's collective profile. And why methods used to address e.g. conflicts, needed to be simple in their approach to be useful for unfolding the complexity of e.g. a consensus-making conversation. (e.g. on how to approach a part of the project) between several (individual) profiles. Or even more complex, the handling of a conflict-oriented situation between contextually opposing personalities.

Spend time making good, simple and interesting slides.

A thing not addressed by any evaluation, but something that became very apparent to teachers, was the effect of slide design. The 2016 slides were approaching what Garr Reynolds would classify as "death by PowerPoint" [7]. Too much text and no visual/auditory dynamics, were likely contributors to the disconnect from students in 2016. Slides for 2017 were redesigned from a 'less (per slide) is more' priority, along with a "high-quality, image-based" visual slide design approach. Small thing, but useful.

4 2017 COURSE EVALUATION

To finally evaluate the 2017 course, a course evaluation was made for each individual student to respond, focusing on the three basic measures on the course experience; most important experiences, impact from the course, and possible improvements. This evaluation method was open-ended and explorative, to avoid leading onto any specific topics or perspectives.

The most important experiences from the PBL course this semester:

The most frequently mentioned topics addressed group dynamics related issues. Especially highlighted was the identification of skills and abilities, using the insights from personality traits and identification of team role profiles to inform group forming. For adjusting expectations, the collaboration agreement was mentioned as useful. The communication approach of active listening was mentioned several times as a tool which was found impactful on discussions. The necessity for compromise in group work was also acknowledged as valuable, also in relation to the having to work with people from many different backgrounds, and having a grounded approach to debating group work was highlighted as useful. In relation to practicing a PBL approach, students had found using PBL methods to solve a real-world problem very interesting. Also mentioned was the realization of how to actually implementing the PBL principles in the semester project and work with problem-based questions. On a note, structuring time was mentioned as important.

Experiences where the PBL course had an impact for you and your group members:

Group dynamics was quite in focus here, e.g. in relation of developing group rules, group contracts and bringing structure to the group. Also mentioned several times was the reflection on group members' strengths and weaknesses, and analyzing skills 'professionally' (as it was discussed how industry uses profiling to set project teams). Communication methods such as expectations management and tools for group discussions made an impact with several students. Also making an impression was using the course methods to observe other graduate students (not course participants), and how they were having noticeable problems with miscommunication and conflict-inducing misunderstandings during group work. Allegedly, this had led to critical situations and highlighted the necessity (for these PBL course attending students) of conflict management skills. Some students mentioned how they had felt a larger sense of responsibility for their project and group work. Project management was mentioned in terms of how to formalize group meetings, and use what they called 'retrospective meetings'. These were explained as 'going back' and reflecting on the what had been happening since last meeting, and why. Task management was also mentioned briefly. The PBL project structure and structure the report was noted as useful, and made an impact for some students. One group noted, a bit surprised, that they had witnessed 'none!' of the course teachings in their fellow 'AAU-native' group members. The presentation of this experience was clearly accompanied by a certain disbelief.

Experiences that you would have liked the PBL course to give you more info

Most responses related to more real-world cases and examples of the topics addressed during the course, such as more anecdotes to explain and unfold group dynamics, case studies from literature and more real-world examples of problems, which would allow some more concrete discussions and analyses of real project problems of the past. Similarly, students mentioned that they had enjoyed the explanation of the project report writing and would like a workshop on writing reports. In addition, they requested more possibility to use their semester project report, as base practice material for the content of the course. More tools for group work was mentioned, without real specification. Others mentioned more specifically, a need for more time with conflict management, with one example being how to manage so-called 'free-riding' group members. More discussion management tools were also requested. For the PBL Introduction course specifically, students would like even more time for exercises, and many mentioned that that lectures should come earlier, so the content would be useful earlier - especially before their semester project group forming, in order to use the tools, they had received.

As for miscellaneous remarks, feedback pointed towards the course having been interesting and useful in many ways, and indeed relevant as a preparational class towards project and group work. Some even thought it was too bad the course was not graded.

5 CONCLUSIONS AND PERSPECTIVES

Comparing the changes described to the 2017 course, to the student evaluations, it seems that many of the topics prioritized in 2017 made positive impressions among the course attendees. This is a big difference from the problems faced in 2016, and the 2017 course has seemed to solve some of the issues that was dominating the previous year. A focal point of the change, was to see if student engagement, could be obtained within a model that needed to be useful across several and very different programs. The method for ensuring this was to redesign the course, to focus on fewer things, with a more in-depth treatment of them, and with everything angled for practical understanding and application, as well as time for reflection with both teachers and fellow students. These aspects seemed to strengthen the teaching, and take to course impact in a positive direction. Some structural changes were made as well, which streamlined the content division between lectures, and provided a more progression-based logic to lecture and homework sequencing. In relation to students learning outcome and rating of the course, the learning outcome seemed to reflect the course content, show curiosity to many different parts of the course content, and generally suggest improvements to students' interest and engagement in the course. It also seems that the course was considered quite useful with many of the participating students. Some even wanted the course graded.

While challenging, it seems that it is indeed possible to design a PBL introductory course for graduate students, which is able to catch their interest and reflect their experiences of studying at a PBL based program. We believe the structure successfully remains a “one size fits all”, but also one that allows for individuality, meanwhile based on the students themselves, more than the field-specific program which they study. During student activities (discussions, exercises, homework, etc.) they become co-designers of the details of the course, while remaining within the learning goals of the course. The fact that some students became able to observe and surpass 'AAU native' graduate students, in their ability to observe and analyze behavior during group work shows promise for future iterations of the course.

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