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Shifting Facilitator Roles: The Challenges and Experiences of Tutors within Aalborg and Maastricht PBL Settings

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Introduction

Problem-based learning (PBL) has become a widespread method of teaching and learning around the world since the early 1970s. While several varieties of PBL are in use in many educational institutions, two primary models have taken root: the Aalborg model originating in Aalborg University, Denmark and the Maastricht model, originating in Maastricht University in The Netherlands. The two models both guide self-directed student learning under PBL principles, but they also have distinct differences. As developing PBL facilitators ourselves, we were particularly interested in understanding the role of the facilitator as it differs across the two models. Our goal for this semester was to understand and apply PBL theory and best practices in our own educational institutions. One of our challenges, however, was that we each had different experiences and expectations for the facilitator role. Our goal, then (or our problem statement) became to better understand the tutors' experiences of the facilitator role in both models so we could best apply this understanding appropriately in our own institutions. Previous research in this area is limited, so this paper fills a gap in our own knowledge of PBL as well as adding to the existing literature.

This project begins to explore the different challenges and experiences of tutors within the Aalborg and Maastricht models of PBL. In this paper, we present our findings from a small pilot study of self-reported facilitator experiences in both the Aalborg and the Maastricht models of PBL. Using a qualitative research design and ethnographic interviewing strategy with a convenience sample (n=7), we interviewed selected participants, each of which has served as a PBL facilitator for a number of years. The interviews were conducted via e-mail and personal conversations using the same questions for all participants. Thematic analysis (Braun & Clarke, 2006) was used to draw out similarities and differences in the data, which was separated into responses under the two models of PBL. The authors also analyzed the interview data by framing participant's statements into one of the several approaches to PBL facilitation put forth by Johannesen, Kokkersvold and Vedeler (2001). This study was small, so results cannot be inferred to a larger population, but we feel that we have made significant

learning achievements in better understanding the facilitator role in both models of PBL. A secondary learning outcome was that we now realize that writers of PBL literature may not clearly state which model they have experienced or are using to frame and interpret their work. We have deeper insight into understanding PBL literature by recognizing that the writer's perspective may impact their conclusions and recommendations. In the remainder of this introduction, we review some of the literature on facilitation in PBL, and on the differences between the Aalborg and Maastricht models of PBL before stating our research question.

Facilitation in problem-based learning

The original PBL tutor guidelines devised by Barrows stem from a strong educational and cognitive psychology framework and describe a non-directive PBL tutor role (Barrows, 1980). As such, in PBL the tutor becomes the facilitator[1]: their role is to guide and to monitor students' behaviour and to model the questioning and reflection that is key to the learning (Barrows, 1980). As the students need to become more active both in terms of directing the content and the process of learning, so the tutor must become less directive than would be expected in a conventional classroom. The learner, rather than the tutor, thus becomes the centre of PBL.

While there has been considerable interest in the tutor role in PBL and its impact on student learning outcomes (Dolmans *et al,* 2002), research and debate into the processes of facilitation specifically has, however, received far less attention (Savin-Baden, 2003a, b). A large part of early research into facilitation focused, for example, on the relevance of tutor's content knowledge on student learning outcomes. This is the

[1] The terms "tutor" and "facilitator" appear to be synonymous in the PBL literature. While Barrows (1980) used "tutor" to describe the teacher role in PBL, he wrote that the tutor "facilitates" student learning in PBL. Carl Rogers used the word "facilitator" and "facilitation of learning" in his "Personal Thoughts on Teaching and Learning" essay (Rogers, 1957). The term "tutor" is perhaps more encompassing than "facilitator", as the tutor can also design problems and conduct assessments. The word "facilitator" appears to be used interchangeably with "tutor" elsewhere in the PBL literature as well. Kareen McCaughan, who writes that she worked closely with Howard Barrows in clinical and educational settings for over 35 years, uses the terms interchangeably (McCaughan, 2013), so it appears appropriate to continue to do so in this paper.

issue of the expert versus the non-expert tutor, and at times includes research into the effect of peer-tutors on student learning outcomes. The evidence is fairly inconclusive (Dolmans *et al*, 2002): some studies support the importance of expert tutors, noting that tutors would not be able to guide students appropriately if they did not have knowledge of the subject areas (Moust, 2010), while other studies have demonstrated that the benefits of expert tutors (and specifically, staff tutors) are only more evident later in the curriculum, in the students' later years of study (Schmidt et al, 1995; Yoshioka et al, 2005). The research that does support the benefits of an expert tutor appear to be based on tutors using the Maastricht PBL model (e.g. Schmidt, 1994; Schmidt et al, 1993), and the importance of the role of expert tutors in different models of PBL does not seem to have been explored as yet.

Research into facilitation has undergone something of a shift in the past decade. Following concerns that there was little research into PBL student group processes - what has been termed the 'black box' of PBL (Hak & Maguire, 2000) - and the lack of conclusive evidence of whether PBL 'works' or not (Svinicki, 2007), there has been much greater focus on the processes of facilitation, group work and learning in PBL. What is needed is not an answer to whether it works, but rather *how* it works, and in which circumstances (Dolmans *et al,* 2005). This newer strand of research includes investigations into 'tutor styles' or facilitator characteristics and behaviours (e.g. Wijnia et al, 2014) as well as perceptions of tutors by students (e.g. Ates & Eryilmaz, 2010) and experiences of facilitation by the tutors themselves. It is within this strand of research that our own project fits: specifically, tutors' experiences of facilitation *across different PBL models*.

Savin-Baden (2000, 2003) has argued that much more needs to be done to examine the facilitator role in PBL and the learner identities both of the tutor and student. This involves, for, example, how tutors experience the shift to a different professional identity (see also de Graaff, 2013). This has implications not only for the tutor themselves (and how they behave in the tutorial setting), but also for the students (as the tutorial interaction is a product of the interaction between students *and* the tutor). In other

words, we cannot consider facilitation processes in isolation: they need to be understood in relation to student behaviours as well as broader PBL contextual features. This relates to Moust's (2010) argument that tutors must also have knowledge of group dynamics: knowing how to initiate group work, handle conflict and give feedback on group behaviour. These are skills which are not necessarily taught, particularly if tutors have previously taught in conventional curriculums. The onus on the tutor to have content, pedagogical and group dynamics skills is thus substantial.

The issue of facilitation and its impact on PBL settings is therefore incredibly complex, and one that cannot be separated from issues of student behaviour and the broader PBL curriculum. One area that does not yet seem to have been considered is how tutors might experience the facilitator role differently across different PBL models (Aalborg, Maastricht) and settings (for example, multiple groups or a single group). Each of these models highlights different frameworks for learning, and thus subtle differences for both tutor and student. We now briefly review these two PBL models before outlining our research question for this project.

Overview of the Aalborg model of PBL

The Aalborg PBL model was developed at Aalborg University, Denmark, in 1974, and it involves self-directed student learning via a project, such as a real problem solicited from either industry or an entrepreneurial client (de Graaff & Kolmos, 2006), that can last many weeks or months. In the Aalborg model, the "P" for PBL could be called "Project Based Learning" because the groups work together during the semester in a "big problem", or project like: "How to create a new item for safety in riding bikes?" The problem is often ill-structured and complex, in which the student team must first define the problem and identifying gaps in their current knowledge. The students then read and research the literature independently before meeting again to discuss their new knowledge, formulate possible solutions, and decide what additional knowledge is needed to select and refine their solution. These steps are repeated until a final appropriate solution is achieved, evidence of which is documented in both a major written project report as well as in an oral presentations made to the faculty members

and to the client (Litzinger et al, 2011). As such, the Aalborg PBL model provides a very practical, project-focused way of working that can be adapted to the specific educational and professional needs of the course.

Other important elements of the Aalborg model is the expectation that students will reflect on their learning and team skills and how these improve during the course of a project. This also enables students to learn the process of collaboration: learning how to work together as much as what content knowledge they have learnt (Litzinger et al, 2011). Since students in the Aalborg model are also simultaneously taking other classes - sometimes referred to as competencies - they must also learn the skills of time management and the integration of learning across different classes. These other courses may or may not relate to the project work, but ideally they would provide at least a portion of the knowledge required for the project solution, thus contributing to the integration and application aims of PBL in the Aalborg model.

Overview of the Maastricht model of PBL

In the Maastricht model of PBL, the learning also begins by presenting a real world problem - e.g. a patient case or research paper - to the students, without previous reading or specific knowledge to solve them, though problems are usually much smaller-scale and a number of problems may be tackled within a single semester. The students are divided into small groups of 5 to 12 people, and begin by analyzing the questions (and concepts) they have to answer, called learning goals. The facilitator then guides them during this period of brainstorming, often using questions to encourage the students to discuss what they know and what they do not know. When they reach the learning goals, a student acts as a recorder or reporter, and provides a summing up of concepts and questions that they have to answer to solve the problem during their independent study period. After a couple of days and depending of the complexity of the problem, the students return to the group and the tutorial begins by presenting students' answers to the questions and learning goals so far. The tutor may need to stimulate student participation, pose questions, cases or even some storytelling during the phases of PBL. In PBL every student has the chance to talk and discuss his or her

weakness and expertise, improving the ability to talk in from of an audience, to explain to others, to collaborate in a project, and to deal with responsibilities of his/her learning process. For instance, students take turns being the Chair (the time-keeper and organiser of the meeting) and the Scribe (the note-taker and person to circulate notes and minutes of the meeting), which provides opportunities for developing skills in communication, organisation and autonomy. The participation during tutorials can sometimes be graded, so students have to be prepared to engage in the discussion and to give a real contribution.

Problem statement

One of the advantages of PBL - within both models discussed here - is that it enables students to develop the ability to identify relevant information, to find new sources of information, to organize in a conceptual framework, and to communicate the results to their peers (Duch et al, 2001). The evidence shows that students in PBL programs improve communication skills, ability to work in groups, gain autonomy, and became life long learners (Duch et al, 2001; Johnson et al., 1991; Kerr, 2006; Klegeris and Hurren, 2011; Woods, 1996).

In both models of PBL (Aalborg and Maastricht), and specifically for those moving from a conventional curriculum, tutors must not only learn new skills of facilitation, but are also likely to re-define their professional identity (de Graaff, 2013; Savin-Baden, 2003a). Different models of PBL also involve different pedagogical stances of the facilitators and a subtle change in how they guide or facilitate student teams. Our problem statement (or research question) was thus: “How do the challenges and experiences of the facilitator role differ between the Aalborg versus Maastricht model of PBL?”

Methods

Design

This study uses a qualitative design, adding to calls for more research on PBL which use qualitative investigations (Hak & Maguire, 2000; Leary et al, 2013). A convenience sample of seven PBL facilitators from two universities was used (one in Brazil, one in

USA). In the USA, the interviews were performed in person, and in Brazil, were performed by email, but with no anonymity (Kuada, 2012). The respondents were selected as being experienced representatives in using PBL in their respective organizations, but they do not speak for their organizations.

Data collection procedure

The data collection process for this paper was conducted via individual interviews (either face-to-face or via email) with current PBL facilitators to learn about their experiences in PBL education. One set of data (three participants) was obtained in a Mastricht-model institution at Sao Paulo School of Economics (FGV/EESP) in Brazil that has been implementing the method since 2013 and another set (four participants) was from an Aalborg-model program, namely Iron Range Engineering (IRE) in Minnesota, USA. All participants were asked the same questions to ensure consistency across the dataset (see Appendix A).

Description of the Aalborg model and study participants

Data from Aalborg model facilitators was collected at IRE, a PBL engineering program located in northern Minnesota, USA. IRE opened in January 2010 and educates upper-division engineering students who are enrolled at Minnesota State University-Mankato, a public state university. The goal of the program is to produce graduates with significant integrated technical and professional knowledge and competencies in engineering. Upon graduation, students receive a Bachelor of Science in Engineering degree with particular emphases in a specific engineering focus area. Students at IRE work closely with industry clients on design projects throughout their 3rd and 4th years of university study. The program currently has 50 full-time students and five full-time faculty members. Students work approximately 40 hours per week in an office or lab setting where they learn engineering design through actual practice in managing engineering projects for industry clients. Approximately 20 hours per week are dedicated to design solution activities with a small team of peers, and about 20 hours per week are spent on technical learning in active learning conversations with faculty members.

For this paper, four team facilitators at IRE were interviewed in person. Three of the participants are faculty members at IRE, and one is the lab and technology director of the program. Each facilitator has from one to three years' of experience with PBL teams at IRE. Prepared questions, which can be found in Appendix A, were provided on paper to the participants. Three days later, each was interviewed by Elizabeth Pluskwik, co-author, in informal one-on-one conversations.

Description of the Maastricht model and study participants

The data from the Maastricht model facilitators was collected from FGV/EESP, a school from Getulio Vargas Foundation in Brazil. The Foundation is a private but non-profit institution, so it does not receive transfers from government (state or federal). FGV was responsible for the major innovations in education in Brazil, such as being the first institution to offer business undergraduate courses and training for public servants, responsible for the first national account system, consumer price index and gross domestic product measure. The institution creates an environment for innovation in education and research, so the implementation of PBL at Sao Paulo School of Economics had the support from the President of FGV. The School of Economics was created in 2003, and its main purpose is to change the way economics is taught in Brazil. Previously, the courses used theoretical frameworks which paid no attention to the country's particularities: the learning was based on passive lectures, so there was a huge separation between practice and theories, and the professionals went unprepared to deal with real world problems. So, with this idea in mind, the group responsible for the "creation of the school"[2] decided to build a culture to change the way classes are taught, using problems, examples, group work and demanding assignments. The institution became the top ranking in National Exams[3] by using the traditional way to teach (lecture), but the Dean was convinced that neuroscience is discovering new ways

[2] Lilian Furquim and the actual Dean, Yoshiaki Nakano, participated in the conception of Sao Paulo School of Economics and the challenge was the creation of a course in Economics in a non-friendly market situation, i.e. the demand for economic professionals were dropping in 2003. Banks, firms, equity managers, preferred to contract engineers rather than economists, because they can solve problems.
[3] Ministry of Education annual evaluation test call "ENADE". The institution is the first one since 2013 among more than 2000 universities. www.educacao.gov.br

to clarify how people learn. In 2011, the Dean discovered the Maastricht PBL Model and decided to implement in a top-down decision, but in an institution that already praised the innovation. The institution provides an annual training for facilitators and is implementing a complete evaluation program (facilitators and workbooks) with the participation of all actors. A PBL workshop was provided by Prof Hommes from Maastricht University[4], to help train tutors at FGV. All interviewed faculty attended, at least once, the PBL Workshop performed by Prof. Hommes. The most popular questions were: "How can we teach if we can not say anything to students?", "How can we be sure that they learned the subject?", "How can we measure the results of PBL?". The answers were satisfactory but some professors refused to use PBL and were not allowed to teach in the course. Three faculty members from the School of Economics with more than 5 years of teaching lectures and now facilitating were interviewed by email.

Data Analysis

The interviews were recorded in note format by the interviewer (from the IRE participants) or in written email format (from the FGV participants) and thus the data was mostly textual data. This data was then shared in its raw form to all three team members (Study Group A) via a shared Google doc file. This raw data can be found in Appendices B and C. Each of the team members read the participant responses, and noted similarities, differences, and themes that emerged across the data set. We drew broadly on thematic analysis as noted by Braun and Clarke (2006). We knew which responses came from Aalborg model participants and which came from Maastricht model participants. We also tried to frame each respondent into the Guidance grid, which shows approaches to facilitation via relations between facilitator practice and the underlying assumptions, values, knowledge, and frames put forth in Johannesen, Kokkersvold and Vedeler (2001). While this is not a formal or rigorous qualitative analysis of the data, it provides a critical reflection on the pilot data and offers an insight into possibilities for future research into facilitation in PBL.

[4] Professor Jeanette Hommes, profile at: http://www.maastrichtuniversity.nl/web/Main/Sitewide/Content/HommesJeannette.htm

Results

Findings in Aalborg model data

In reviewing the experiences of the four PBL facilitators in the Aalborg tradition (IRE participants) several common themes emerged. From conversations with these respondents, all of whom have from one to three years of experience with the program, it appeared that they enjoy facilitating student learning. The facilitator is not expected to be an expert in all content matters associated with the project, and the respondents expressed challenges in not being able to control the information flow and not always being aware of the team's questions and needs.

Several of the facilitators mentioned that they particularly enjoy being able to talk with the students in small groups and being close enough to the students' learning process to clearly observe the incremental growth in critical thinking and problem-solving skills. This gives the facilitator information on how they are learning and makes it easier for them to approach the facilitator with questions or problems. They also noted that the facilitator learns alongside the students in working with open-ended problems: "let's figure it out together". The re-positioning of the facilitator as being part of this learning process (rather than as the dispenser of knowledge), and having a different identity because of this, was seen as a challenging but positive process (Savin-Baden, 2003a).

When asked how facilitating a PBL team differed from traditional university teaching in their experience, the participants again noted the close and detailed interactions with students and opportunity to provide individual feedback that is possible and more likely in PBL environments. The roles of the learner and the facilitator also differ. One participant wrote, "I give big pictures and fill the gaps in their learning now."

Another stated:

> "In PBL, it is important for the facilitator to move away from the group so the team has to make its own decisions, take its own actions, then learn from the results, because it's not about the teacher. It's about the students learning."

The facilitator must therefore be prepared to allow the group to take control of their learning, and to resist the urge to micro-manage the group in its decision-making. In doing so, the students can explore the literature and content knowledge in their own way. This can mean that the students are more likely to retain this knowledge, but they will also gain a clearer sense of what knowledge is available, and which they need to use:

> "By contrast, in traditional formats, the teacher dispenses little bits of knowledge, and the student doesn't know what bits will be important, so its harder to know what to hold on to. In traditional lecturing, the teacher is the only one in the room to know the full use of the knowledge – no one else has that experience yet. "

The students are also expected to take control not only of their learning content but also their learning process (so how, as well as what, they are learning). This requires a shift in facilitators' (tutors') perceptions of *how much* knowledge the students should be learning:

> "When students are not used to PBL, it goes at a slower pace. Students work at a slower pace but use more information to develop a solution before it is presented to them."

> "In PBL, the facilitator's role is to manage time and the team's process. The facilitator is not the one with all the answers. Rather, the facilitator finds good ways to manage the team's efforts."

We were also interested in how facilitator's role changes when they are working with multiple teams or groups simultaneously in PBL. The participants noted that the facilitator's "illusion of control goes away." This creates some challenges for the facilitators, who reflected that, "the more people, the lower quality interaction with them. I find that I can't evaluate individual performance. The learning might be as effective but

the facilitator doesn't know it." It can be difficult, therefore, for facilitators to manage more than one group in the Maastricht model; a decision must be made as to when to move between groups (if all groups are in the same room at the same time), and how to manage this without disrupting the discussion in the groups. This can also mean that the facilitator can't hear all of the discussions across all of the groups; they miss out on how the groups are developing, and it can become harder to contribute to the group's discussion when the facilitator joins the groups. One of the participants thus noted that they must then trust that the students will ask for help when they need it: that the group must become self-sufficient and to decide for themselves when intervention or support is required.

Discussion of the Aalborg model findings

The role of the facilitator in reflecting back to the students what he/she is observing during the learning process was found to be a positive element in this sample. In a PBL team, the students own and take responsibility for their knowledge and this should be the centre of the students' learning (not the tutor's knowledge). So this means that the tutor needs to guide and encourage, not take control of the situation. In our data, two main strategies were used to tutor PBL: (1) ask questions (e.g. using facilitating questions such as, what do you know? how should you go about…? where can you…?) and problematizing questions (how can we understand? why did you…? How can that kind of knowledge be…?); and (2) reflection: give feedback to the students by telling them what the tutor observed; this allows the students a chance to reflect themselves, to see how they worked, and to perceive this from a different perspective. The facilitator's role in PBL provides an opportunity for this type of valuable feedback on real work performance.

Some of the challenges noted by the IRE facilitators rang true with the authors' own experiences. One of these is the difficulty stemming from trying to guide more than one team or group simultaneously. While not all the participants had experience in this situation, the participants who did have experience working with multiple teams stated that it is hard to keep track of each group, and there is a risk that the facilitator may miss

issues that may arise within the student groups. There is also a risk of the facilitator not being able to develop a supportive relationship with each one; there can be disjuncture and fragmentation of support. In PBL, much of the learning comes from the struggle of the team, from learning to recognize issues and to solve them. This leads onto other issues that might be explored in future research: is it the facilitator's role to even try to notice all of the issues that a team experiences? Student-directed learning in PBL should lead to less reliance on the facilitator and more reliance on the team's active engagement with self-directed and social learning, including problem-solving team issues. The proper balance of facilitator engagement versus self-regulation and team monitoring is difficult to manage, however, and PBL facilitators can improve their own knowledge of this balance through personal reflection of their own facilitator experiences as well as feedback from colleagues and students.

Findings in the Maastricht model data

The faculty members interviewed started with PBL in 2013 (Prof. A and C) and 2014 (Prof. B). Professor A is the most experienced teacher in traditional methods, and has more than 10 years' experience of lecturing. He/she teaches Math and Econometrics for beginners and advanced levels in undergraduate course[5]. When I (LF) asked about the experience of facilitation, they reported that they really enjoy the ways that students reach the solution: it is more than just finding the right answer, it is also the process of coming to their conclusions. Only in a tutorial is it possible to analyse how they construct the solution and the process. In maths education, for example, it is very common to have different paths to the same solution, and in a lecture, most of the time, there is no time to show them. Another issue that Prof A observed is that, "in a traditional environment it is much more difficult to observe that, even if questions are posed, students prefer not to answer a question without being quite sure of the answer".

Another important aspect of being facilitator is that Prof A felt free to do more important things during the class: "the teacher finds himself finally free of having to expose every detail of the textbook in class, putting its effort to help students at crucial points, more

[5] The quantitative part of undergraduate course is very demanding, mainly to equip them to read top journals in the field (Econometrica, American Economic Review, Journal of Economic Literature, etc).

effectively." Being in their third year as a facilitator, Prof A was able to notice how and when student groups change over the course of tutorials, and how to adapt to this change. They can also begin to deal with issues such as having one 'smart' student in the group who would be expected by the other group members to provide the 'right' answer. For example, Prof. A would ask the smarter student to contribute at the end of tutorial with a different solution, or to bring interesting information about the problem, either to encourage everybody to participate and to stimulate them in finding their own knowledge for themselves.

By contrast, Prof B is the youngest and least experienced teacher in the study. They teach Econometrics and Microeconomics and noted that they are really enjoying PBL tutoring, although it can be difficult with particular subjects that are theoretically demanding or which can require extensive explanations. When asked about their role as a facilitator, they immediately pointed out that the distance between practice and theory can be narrowed: "it is almost always possible to adopt a concrete problem as the object of study, which means that students seize the theoretical content more naturally." So, the theory can be applied much more easily when students use a real-world problem.

Another aspect mentioned was how the role of tutor changes from traditional to PBL tutoring, because the information flows in two directions (from tutor to students, and from students to tutor). It can be a challenge for tutors who are used to traditional teaching, however, because they have " to control the urge to intervene too much". When we let the students work through the problem themselves, they can develop innovative and divergent ways of solving the problem. In the transition from a traditional teaching method to PBL, then, the tutor might need to be able to anticipate all of the possible situations in a tutorial. Tutors might want to be in control of the teaching process, but in a *learning* process, they have to realise that is precisely the point that the students have to be in charge of their learning, not the tutor. The "good surprising factor"[6] can be used as an indicator that the student is changing their behavior too.

[6] We refer to a "good surprising factor" when students find different forms to solve a problem.

The changes to tutor behavior as they move from a traditional to a PBL curriculum can be observed in the way in which the facilitators reflect on their own practice when asked a direct question by students:

> "In the tutorials, it is very common for students informally to ask for confirmation of the answers or information they bring to the discussion. I disincentive this practice in two ways: I never signal if the answer is correct or not and sometimes I purposely provide misleading information trying to get the correct answer as a strong reaction."

And the advice for new tutors goes in the same direction:

> "I would say first of all to try to curb his impulse to provide answers quickly and try not to interfere too much. It really helps when you have the patience to wait for them to reach the correct answers. "

The same issue emerges in the responses from Prof. C:

> "For me, the biggest challenge is to know when to intervene. Let them be responsible for their own learning, discussion and tutorial organization, but also not to allow wrong conclusions or to motivate them to other similar situations to the problems. Considering all this, the difference and the challenge is to ask questions at the right time and at the right level of challenge, not to intervene too much and keep them on track."

The key point for tutors in PBL is the degree of intervention, because the temptation to give a lecture is very strong and dangerous in this phase of implementation. As Prof. C said: "The first thing is to put myself in a chair as every student in the tutorial: if I get up, I will start a lecture, i.e. do not go to the board under any circumstances!". The advice for new tutors was echoed by Prof. B:

> "Not get up, do not go to the blackboard, do not turn the tutorial into a lecture. Listen to students and have patience to see them get to the learning goals. Give feedback all the time, not just at the end to justify the participation grade, but over tutorial to highlight good placements, discussions, and also to prevent a student to transform tutorial into a lecture."

Discussion of the Maastricht model findings

What appears to be emerging from the Maastricht model data is that the new tutors understand the non-directive role of the tutor even though they noted how difficult it can be to resist providing information at times or intervening in the group processes. During the training phase at FGV/EESP, it is noted that the ideal tutor should not intervene, though there may be variation depending on the students' year of study and the complexity of the problem. It also depends on what counts as 'intervention'; asking questions is fine, but they should not ask so many questions as to become the leader of the tutorial. The tutor can, however, act as a role model for the leader, demonstrating the processes through which students might question their own and other's knowledge of the content (De Grave *et al.*, 2003). One possible solution to this internal conflict of the tutor (to intervene or not) is to clarify the different types of intervention and their purposes, and their role as tutors. To become a tutor is not to become a passive observer, but to scaffold student learning (De Grave *et al*, 1999). Analysing the material from Maastricht, it is possible to say that the main concern is with the quality of intervention, and related with the learning goals. So, the tutor has to develop some skills to perform well related to content and knowledge of the learning processes and educational principles involved (De Grave et al., 2003, p. 13).

All three professors interviewed were subject specialists, so the school could improve the tutors' abilities in the learning process. Yet even then, there are different roles for the tutors to perform even if they are not aware of these: the diagnostician, the challenger, the role model, the activator, the monitor and the evaluator. Adapting one's facilitation role to the situation depends not only on the situation (and which questions

to ask), but also needs to be adapted to the right moment in the interaction. As Prof. C noted, “the main challenge is (knowing) when to intervene”.

Applying the data to the guidance grid

In addition to the thematic analysis of the data, a second process was undertaken by the researchers to explore how the Aalborg and Maastricht facilitation experiences might relate to different facilitation approaches as defined by Johannesen, Kokkersvold and Vedeler (2010; see Appendix D). We categorised each of the participant responses (to each of the questions) into one or more facilitator types, based on the focus, goals, methods and relations of the facilitator. The findings of each grid are provided in tables 1 and 2 below. See Appendix A for descriptions of the questions (Q1 to Q5) and Appendix B and C for the responses of the facilitators to these questions.

Aalborg Model responses from US

Approach	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**
Positivist Communication			A	A	
Behaviorist/ Behavioral Therapy					A
Psycho-analytical/ Dynamic					
Humanist/ Person Centered	A		A	A A	A A
Eclectic/Cogniti ve	A A				A
Marxist/Critical		A		A	A
Constructive/ Relational	A A		A		A

Table 1: This table categorizes the Aalborg Model participant responses by facilitation approach for each of the five questions in the survey. The number of “A”s in each cell indicate the number of responses that the researchers felt best matched that facilitation type. The Aalborg Model participant responses were primarily Humanist with a Person Centered Approach and Constructive with a Relational approach in this sample (n=4). The outlined boxes highlight the finding that Q5, which asked for advice for new PBL facilitators, spanned

nearly all facilitation types. Positivistic Communication was not recommended for new facilitators in either model of PBL in this study (total n = 7).

Maastricht Model responses from Brazil

Approach	Q1	Q2	Q3	Q4	Q5
Positivist Communication					
Behaviorist/ Behavioral Therapy			M	M	M
Psycho-analytical/ Dynamic		M			
Humanist/ Person Centered	M M	M	M	M M	M
Eclectic/Cognitive		M M	M		M
Marxist/Critical	M			M	M
Constructive/ Relational		M	M		

Table 2: This table categorizes the Maastricht Model participant responses by facilitation approach for each of the five questions in the survey. The number of "M"s in each cell indicate the number of responses that the researchers felt best matched that facilitation type. The Maastricht Model participant responses were primarily Humanist with a Person Centered Approach and EClectic with a Cognitive approach in this sample (n=3). The boxes outlined highlight the finding that Q5, which asked for advice for new PBL facilitators, spanned nearly all facilitation types. Positivistic Communication was not recommended for new facilitators in either model of PBL in this study (total n = 7).

As with the thematic analysis, the analysis noted here is intended as a preliminary investigation into pilot data, to shed some light on the issue of tutor experiences across two PBL models and to stimulate further research in this area. We can note two trends that became apparent from the application of the facilitator approaches grid to our data.

The first is that the facilitators from the Maastricht model most frequently used the Humanistic and Electic/cognitive approaches regarding their experiences in facilitating project groups, while the facilitators in the Aalborg model mostly used the Humanistic and the Constructive Relational approaches. A second trend was noted in the responses to the question about what advice the participants would give to new PBL facilitators. The recommendations spanned nearly all the categorical approaches. In this sample, this was the only question that resulted in such a wide range of approaches in the responses. The researchers noted that Positivistic Communication, which more closely follows the traditional university teacher role was not recommended by any of the participants in the study. This may indicate that PBL facilitators recognize that Positivistic Communication is not an ideal approach for problem-based learning.

Conclusion

In conclusion, from our early investigations of the literature and of our pilot data, it appears that there may be different experiences and challenges for PBL facilitators across different PBL models that have yet to be fully explored in research. We offer this project as a stimulus for future research in this area. As suggested by Trigwell (2000), we desire to continue our scholarship of teaching and learning in PBL; while we discussed many questions in this project and over the course of this semester, we began to answer only a few of them. The rest of this conclusion will therefore point to specific questions that have arisen as a consequence of this project. This list is not comprehensive, but it offers a starting point for future research.

1) How do other differences in the facilitator role between the Maastricht and the Aalborg models affect learning outcomes? Given the close relationship of different elements within a PBL curriculum, it is likely that the subtle changes in facilitation between different PBL models will also impact on student learning, for example. For example, what effect does the supportive role of the facilitator have on student learning?

2) How does the facilitator most effectively manage multiple PBL teams simultaneously? Our team has danced around this question all semester but we have not fully answered it yet. The discussion hinges on the identified role of the facilitator and how much time and personal attention the facilitator plays in the social learning of the team members. Future research addressing this question might consider data collection involving the experiences of both tutors and students with regard to the 'floating facilitator' model and the video-recording of PBL tutorials with multiple groups to examine what actually happens as and when the tutor moves on. For instance, research being undertaken under the supervision of one of the project team (SW) examines the communication and interactional practices that take place within PBL tutorial settings, where the tutor is a floating facilitator and so is not always present with the group. There is huge variability in terms of what happens when the tutor 'enters the room'; sometimes the students ignore the tutor, sometimes they acknowledge her presence and carry on talking, and sometimes the students begin asking questions or providing an update on their progress so far. The tutor can be seen engaging in a range of strategies to manage this situation, such as avoiding direct eye-gaze with students on entering the room to avoid initiating conversations, and focusing on the problem documents and student notes as a way to keep students focused on their task rather than on the presence of the tutor. This research could therefore begin to answer questions on effective management of multiple PBL teams, such as the interactional issue of when and how to leave or join a team in the tutorial setting.
3) What do we need to understand about group interaction to help support learning in PBL? There still seems much to be understood about how learning actually happens in groups - i.e. as students discuss issues in the PBL tutorial, or in online spaces - and social psychology, along with other disciplines, has much to add here. Most social psychological research on groups doesn't consider groups in the classroom, and yet there is a prime opportunity here for us to use psychological and social interaction theories to develop our understanding of learning and of student and tutor identity development.

In summary, this paper has outlined our understanding of the background and principles of PBL teaching and learning with an emphasis on the Maastricht and Aalborg models. We researched facilitation roles and strategies, we then designed, planned, and implemented a small-scale PBL study. We interviewed PBL facilitators in both models with the aim being to understand their experiences in facilitating student learning. Seven participants from two universities were interviewed, three from a Maastricht model program and four from an Aalborg model program. We found the whole process of gathering experiential stories interesting in furthering our own understanding and application of PBL. We reflected on our own strategies and practices in facilitation and gained much understanding in being a both PBL student and facilitator through this project. We experienced uncertainty and some challenges as a team, but worked through those with patience and feel now that we have gained invaluable experience as PBL learners ourselves. We also made professional connections, gained friendships, and know the seminal researchers to follow in the literature. We have deeply learned a considerable amount of knowledge and plan to integrate this into our work with students as we continue on our paths of life-long self-directed learning.

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Appendices

Appendix A: Interview questions for PBL team facilitators

1. *Describe your experiences in being a team facilitator.*
   What do you enjoy about it?
   Are there any challenges or issues you need to manage?

2. *How is facilitating a PBL team different from teaching in a traditional classroom?*

3. *How do your strategies change?*

4. *How / Does your role change when you work with multiple teams/groups in PBL?*

5. *What advice would you give to new PBL facilitators?*

Appendix B: Data from FGV/EESP - Brazil

Data from three participants at the São Paulo School of Economics (FGV/EESP). The three professors teach at FGV/EESP, in the undergraduate course of Economics and they have experience (minimum of 5 years) in teaching lecture. PBL – Maastricht Model - was implemented in 2013 in the undergraduate course of economics. All three are women and teach quantitative disciplines and the interviews were performed by email. The original responses in Portuguese are provided, with the English translation underneath.

#1. Prof. A– Tutor of Mathematics at São Paulo School of Economics. She has been working at the School since 2003, when it was created. She teaches undergraduate and graduate courses in Economics; this is her third year as a PBL tutor, though overall she has more than 15 years' teaching experience.

1. ***What do you enjoy about being a PBL team facilitator?***

"Gosto muito da possibilidade de observar a linha de raciocínio dos alunos: como eles pensam num certo problema, quais são as dúvidas que surgem, que conhecimentos prévios eles usam e em que ordem. Numa aula tradicional é muito mais difícil conseguir observar isso, mesmo que sejam colocadas perguntas, pois os alunos evitam ao máximo responder a uma pergunta sem ter bastante certeza da resposta. A grande maioria dos alunos nunca se manifesta numa aula tradicional e o professor fica sem saber como está indo a evolução de cada um, até a hora da primeira prova. Além disso, numa aula tradicional os alunos nunca têm a função de expor a teoria, pois isso fica sempre a cargo do professor."

"I really enjoy the opportunity to observe the students' line of reasoning: how they think a certain problem, what are the questions that arise, prior knowledge that they use and in what order. In a traditional environment it is much more difficult to observe that, even if questions are posed, students prefer not to answer a question without quite sure of the answer. The vast majority of students never manifest in a traditional classroom and the teacher does not know how is the evolution of the course, until the time of the first assignment. Moreover, in a traditional classroom students never have the role to participate, it is always the teacher's role."

2. ***How is facilitating a PBL team different from teaching in a traditional university? (Challenges?)***

“Acho que a resposta à pergunta anterior responde em grande parte a essa segunda pergunta, pois uma das grandes diferenças entre ser supervisor de um grupo de PBL e dar uma aula tradicional é que no primeiro caso você tem a possibilidade de observar o raciocínio e a evolução de cada aluno em cada um dos encontros.
Outra diferença é que, usando o sistema de aprendizado por problemas, o professor se vê definitivamente livre de ter que expor cada detalhe do livro texto em sala de aula, guardando seu esforço para ajudar os alunos em pontos cruciais, de um modo mais efetivo.”

“I think the answer to the previous question responds largely to this second question because one of the big differences between being a supervisor of a group of PBL and give a lecture is that you have the possibility to observe the thinking and evolution of each student during the tutorials.
Another difference is that, using PBL, the teacher finds himself finally free of having to expose every detail of the text book in class, putting its effort to help students at crucial points, more effectively.”

3. Do your strategies change?
“Sim, as minhas estratégias mudam de acordo com o grupo de alunos. Já participei de um grupo em que dois alunos já conheciam bastante bem a matéria que estava sendo apresentada nos problemas. Nesse caso tive que pedir para esses alunos reservarem, na medida do possível, a sua participação para o final do discussão, para permitir que os demais alunos pudessem seguir a sua linha de raciocínio passo a passo, descobrindo possíveis caminhos sem ninguém indicando um caminho desde o início.”

“Yes, my strategies change according to the student group. I have participated in a group in which two students already knew quite well that the subject. In this case I had to ask for these students, as far as possible, to participate in the of the discussion, to allow other students to solve the problems by themselves.”

4. How does your role change when you work with multiple teams/groups in PBL?
“Conforme destaquei na resposta anterior, o supervisor pode ter que se adaptar a grupos com diferentes características, mudando um pouco o seu papel. Grupos cujos alunos têm maior conhecimento prévio requerem, na minha opinião, muito menos intervenção do supervisor. O supervisor precisa apenas ficar atento para evitar erros, mas a discussão flui com muita facilidade. Nesses casos, em geral acho interessante apenas colocar algumas ideias ou perguntas mais desafiadoras ao final da discussão. Quando o grupo têm um nível mais baixo de conhecimento prévio, muitas vezes acaba sendo necessário guiar mais a discussão, colocando uma ou outra pergunta extra mais

no início da discussão. De qualquer modo, acredito que as intervenções devem ser evitadas e, quando inevitáveis, devem ocorrer sempre na forma de perguntas.
O líder da discussão em geral faz bem o papel de chamar a todos para participar e ir organizando cada passo da discussão, mas, se algum dos alunos for realmente muito tímido e inseguro, acho que o supervisor também pode ajudar a incentivar esse aluno tímido a participar."

"As highlighted in the previous answer, the supervisor may have to adapt to groups with different characteristics, changing your role a little bit. Groups whose students have greater prior knowledge require, in my opinion, much less intervention by the supervisor. The supervisor needs to observe, but the discussion flows very easily. In such cases, usually I find it interesting just put some ideas or more challenging questions at the end of the discussion.
When the group have a lower level of prior knowledge, often turns out to be necessary to guide further discussion by putting either extra question earlier in the discussion.
Anyway, I believe that interventions should be avoided, and when unavoidable, should always take the form of questions.
The leader has the role of calling everyone to participate and to organize the discussion, but if some student are really very shy and insecure, I think the supervisor can also help encourage them to participate."

5. What advice would you give to new PBL facilitators?
"Sempre estudar e recordar o assunto a ser discutido no encontro, como se o supervisor estivesse se preparando para uma aula tradicional, em que terá que expor cada detalhe. Isso é importante para que o supervisor acompanhe cada passo do raciocínio dos alunos e esteja pronto para entender e avaliar os diferentes caminhos adotados pelos alunos para resolver um problema. Também é importante para que o supervisor seja capaz de perceber quando algum aluno estudou um assunto apenas superficialmente.
O supervisor tem que se esforçar para prestar atenção ao mesmo tempo no conteúdo e na participação dos alunos como um todo, evitando que alunos muito tímidos e inseguros (ou que não estudaram) deixem de participar."

"Always study and remember the subject to be discussed at the meeting, as if the supervisor was preparing for a traditional classroom, where will have to expose every detail. This is important for the supervisor to track every step of students' thinking and be ready to understand and evaluate the different strategies taken by students to solve a problem. It is also important for the supervisor to be able to evaluate when a student has studied a subject only superficially.

The supervisor has to struggle to pay attention to both the content and the participation of students as a whole, preventing too shy and insecure students (or have not studied) cease to participate."

#2: Prof. B : Teaches Statistics and Econometrics. About 5 years of teaching experience, and this is her second year of PBL tutoring.

1. What do you enjoy about being a PBL team facilitator?

"Act as tutor in PBL gives me a chance to involve all students in the learning process and require them predominantly active role in finding answers to problems or themes of discussion. Because of this, it is almost always possible to adopt a concrete problem as object of study, which means that students seize the theoretical content more naturally."

2. How is facilitating a PBL team different from teaching in a traditional university? (Challenges?)

"There are many differences. The first concerns the role of the teacher. While in the traditional system knowledge flow is unidirectional, in PBL the tutor should mainly take the role of facilitator. The greatest difficulty for teachers with lots of experience in the traditional system is to control the urge to intervene too much.

In addition, I see two other major differences. In PBL, as it is not the teacher who guides the discussion, a theme can be approached in many different ways, that even the teacher think of address. For this reason, the tutor must be fitted with a much larger framework of information, examples, references etc. This does not occur in the traditional system.

In the traditional system, the teacher has little or no idea about the degree of understanding of students, until a formal assessment is made. In PBL, the tutor is closely monitoring the development of the student, is able to provide differentiated instruction and provide feedback."

3. Do your strategies change?

"Certainly. The PBL urges us to adopt very different teaching techniques. I can cite two techniques I use a lot in almost all tutorials. The first is to promote the engagement of different ways. For example, when I realize that a more 'passive' student is not satisfied

with the response of a colleague, I encourage you to question him. When I realize that a more shy student is about to give up to participate, I make everyone pay attention to him. The second is to try to get students to take foothold. In the tutorials, it is very common for students informally ask for confirmation of the answers or information they bring to the discussion. I disincentive this practice in two ways: never I signal if the answer is correct or not and sometimes I purposely provide misleading information trying to get the correct answer as a strong reaction."

4. How does your role change when you work with multiple teams/groups in PBL?

"When working with different groups, I try to take advantage of good practices with each, as externalities for others. However, the dynamics can vary greatly between different groups, depending on their composition. For me, the most important is to ensure that the minimum contents have been met in all groups."

5. What advice would you give to new PBL facilitators?

"I would say first of all to try to curb his impulse to provide answers quickly and try not to interfere too much. It really helps when you have the patience to wait for them to reach the correct answers. The (apparently) most chaotic discussions are, for a teacher of traditional system, the most distressing. For a PBL tutor they can be the most productive ones."

#3. Prof C - Tutor of Mathematics and Course Coordinator. She has been in Aalborg and Maastricht to have the first experience with PBL. She has more than 5 year experience teaching Math and this is her third year as a PBL tutor.

1. What do you enjoy about being a PBL team facilitator?

"Para mim a melhor parte de trabalhar como professora no PBL é, além de notar como os alunos discutem assuntos em uma velocidade diferente da que eu daria em uma aula (não só mais lentamente, mas às vezes mais rapidamente também), ver como eles apresentam soluções diferentes, ou seja, como várias pessoas (ainda que estudantes) discutindo um mesmo problema podem ter linhas de raciocínio diferentes, mas que levam a possíveis soluções corretas (ainda que esta seja única, como ocorre muito em disciplinas de exatas)."

"For me the best part of working as a teacher in PBL is: to notice how students discuss issues at a different speed than I would in a lecture (not only slower, but sometimes faster too), see how they present different solutions, or as several people (even students) discussed the same issue may have different lines of reasoning, but which lead to possible correct solutions (specially in quantitative disciplines)."

2. **How is facilitating a PBL team different from teaching in a traditional university? (Challenges?)**

"Para mim o maior desafio é saber quando intervir. Deixar que eles sejam responsáveis pelo próprio aprendizado, discussão e organização do tutorial, mas também não permitir conclusões erradas ou não deixar de motivá-los com outras situações análogas aos problemas. Considerando tudo isso, a diferença e o desafio está em colocar perguntas no momento certo e no nível de desafio certo para não intervir demais e mantê-los no caminho certo."

"For me, the biggest challenge is to know when to intervene. Let them be responsible for their own learning, discussion and tutorial organization, but also not to allow wrong conclusions or to motivate them to other similar situations to the problems. Considering all this, the difference and the challenge is to ask questions at the right time and at the right level of challenge, not to intervene too much and keep them on track."

3. **Do your strategies change?**

"Com certeza. A primeira é corporalmente me manter sentada no tutorial: levantei, comecei a dar aula, ou seja, não ir para a lousa em hipótese nenhuma! Depois é notar qual o ponto em que os alunos estão e avaliar se, continuando nessa direção irão atingir os objetivos propostos para o problema (tanto na pré, quanto na pós discussão). Considerando esses dois pontos, a grande mudança é conseguir deixar totalmente de explicar, para apenas colocar perguntas."

"Absolutely. The first is to put myself in a chair as every student in the tutorial: if I get up, I will start a lecture, i.e not go to the board under any circumstances! Observe where students are in solving the problem to assess whether they will achieve the learning objectives of the problem (both pre and post discussion). Considering these two points, the big change is to leave entirely to explain, just asking questions."

4. How does your role change when you work with multiple teams/groups in PBL?

“Meu papel como tutora em qualquer grupo de tutorial sempre busca contemplar o que comentei nos itens anteriores. Por algumas vezes, em 2 disciplinas diferentes, tive a oportunidade de ser tutora de duas turmas ao mesmo tempo.O interessante de ter duas turmas é notar as diferenças entre elas (apesar de ser a mesma disciplina, no mesmo momento, e eu ter escrito os problemas): diferenças no ritmo de resolução, no aprofundamento da discussão e das dúvidas levantadas, entre outras. Essas diferenças são a causa de uma possível mudança de papel e na estratégia: algumas turmas, as intervenções ocorrem mais para corrigir algum rumo ou algum conceito; em outras, para cobrar mais profundidade em alguma solução; até em realizar intervenções para que uma turma vá além do que já estudou para resolver o problema. É realmente incrível ver como grupos diferentes reagem de maneira diferente ao mesmo problema. E isso coloca mais um novo para o professor, de adaptação a turmas diferentes praticamente "just in time", ou seja, um tutorial sair bom não é garantia para que um mesmo com uma turma diferente também o seja.”

“My role as a facilitator in any tutorial group always seeks to contemplate what I said in the previous items. A few times, in two different disciplines, I had the opportunity to be facilitator of two classes at the same time. The interesting to have two classes is to note the differences between them (despite being the same discipline at the same moment, and I have written the problems): differences in the pace of resolution, to deepen discussion and doubts raised, among others. These differences are the cause of a possible change of role and strategy: some classes, interventions occur more to fix some direction or some concept; in others, to charge more depth in any solution; even of carrying out interventions for a class beyond what already studied to solve the problem. It's really amazing to see how different groups react differently to the same problem. And that brings up a new challenge for the teacher to adapt to different classes practically "just in time", i.e a good tutorial in one class is not a guarantee to the other class.”

5. What advice would you give to new PBL facilitators?

“Antes de mais nada, ficar sentado! Não levantar, não ir a lousa, para não transformar o tutorial em uma aula. Ouvir os alunos e ter paciência para vê-los chegar ao ponto desejado. Dar feedback o tempo todo, não somente no final para justificar a nota de participação, mas ao longo do tutorial para destacar boas colocações, discussões, e também para evitar que um aluno transforme o tutorial em uma lecture dele. e por fim, transformar tudo em perguntas, sempre, não responder suas próprias perguntas, nem as dos alunos; se os alunos ficarem "empacados" em algum ponto, pedir para algum aluno retomar alguma ideia que te pareça que vai levar ao ponto desejado, e assim ir guiando-os, sem responder diretamente.”

“First of all, sit! Not get up, do not go to the blackboard, not to turn the tutorial in a lecture. Listen to students and have patience to see them get to the learning goals. Give feedback all the time, not just at the end to justify the participation grade, but over tutorial to highlight good placements, discussions, and also to prevent a student to transform tutorial in a lecture him. And finally turn everything into questions, always, do not answer their own questions, nor the students’; if students get "stuck" at some point, ask for another student to resume any idea that help to reach the learning goal, and go on, guiding them, without answering directly.”

Appendix C - Data from Iron Range Engineering, Minnesota, USA.

Elizabeth gave the prepared questions to four PBL facilitators, then three days later, asked them each question in informal one-on-one conversations. Elizabeth took notes on their responses. Each facilitator has from 1 – 3 years of experience with PBL teams made up of 3rd and 4th year university students at the Iron Range Engineering program in Minnesota. In this section, the responses from each of the four facilitators is provided under each question.

1. What do you enjoy about being a PBL team facilitator?

· Close interactions. Discussions with students. Observe students thinking. Coach student thinking. Towards the end of the semester, I can see them grow and they come up with good comments & thoughts. Increase their critical thinking.

· Getting students to teach themselves with me as their guide – the "a-ha" moment.

· It is interesting to prepare material for non-electrical students (the facilitator is an electrical engineer).

. Working with students, open-ended problems, the teacher learns also. Flexible and adaptable. Tying theory to application.

· Enjoys learning new things along with the students because the facilitator learns too. "Let's figure it out together." Rather than the teacher dispensing knowledge.

2. How is facilitating a PBL team different from teaching in a traditional university?

· *Close and detailed interactions with students. Able to give detailed feedback to individuals.*

3. Do your strategies change?

· *I start out (a PBL class) like a traditional class, I build more confidence in handling the learning students. I can focus more on details and fill in the gap in student learning. So, I give big pictures and fill the gap in their learning now.*

· *PBL students are ready for the PBL environment – they are used to it. When students are not used to PBL, it goes at a slower pace. Students work at a slower pace but use more information to develop a solution before it is presented to them.*

· *In PBL, the facilitator's role is to manage time and the team's process. The facilitator is not the one with all the answers. Rather, the facilitator finds good ways to manage the team's efforts. In PBL, its important for the facilitator to move away from the group so the team has to make its own decisions, take its own actions, then learn from the results, because it's not about the teacher. It's about the students learning. PBL starts with a problem – so it's easier for students to decide what knowledge is important to solve the problem. In PBL, all effort is towards solving a problem, towards achieving a specific goal. This is realistic problem solving. By contrast, in traditional formats, the teacher dispenses little bits of knowledge, and the student doesn't know what bits will be important, so its harder to know what to hold on to. In traditional lecturing, the teacher is the only one in the room to know the full use of the knowledge – no one else has that experience yet. It's harder for the teacher in tradition classrooms to get the knowledge across to other people who don't have the experience that the teacher does – on how to apply that knowledge.*

4. How does your role change when you work with multiple teams/groups in PBL?

· *I only manage one design team, but during a learning conversation, students are assigned to independent groups and will discuss within their group, then share to the whole class. In that case, my role is more of controlling information flow and summarizing information.*

· *The more people, the less quality interaction with them. I find that I can't evaluate individual performance. The learning might be as effective but the facilitator doesn't know it. The facilitator has to change focus more often managing each table group. Can't hear it all. Also it's harder to add to each conversation.*

· *The illusion of control goes away. The developmental level of students in PBL is such that the teacher does not have to have 100% control. Students will ask for help when they need it. The facilitator can oversee the work and point out potential problems. It's up to the students to decide what to do with that input from the teacher. It's their project. The teacher needs to step away for students to make their own decisions. It's their education, so they learn more from their own decisions/actions & results --- not just what the teacher said to do. The students have actual control of their own learning.*

5. What advice would you give to new PBL facilitators?

· *Be open to feedback.*

· *Try not to fall back into old habits of just teaching.*

· *Practice.*

· *It's hard to estimate how long teaching/learning the topic will be; so overplan so you have extra material if the planned learning goes quickly.*

· *Don't feel like it has to be the same way every time. Continuously improve. The facilitator should have flexibility to change.*

· *You get better as you go along.*

· *In Project teams, the facilitator is the very hands-off manager. The facilitator grades the work but doesn't manage the day-to-day activities of the team.*

· *If the team starts slacking off, remind them of due dates.*

· *The role of the facilitator is to help the students learn time and project management, and serves as a guide to group dynamics. Help them learn teamwork skills also.*

· *The more you act as a leader, the more the students will not make decisions. Don't be the team leader – that is the student's job. The more the facilitator does, the less the student learns.*

· *The learning curve of a new facilitator is steep – it is SO different from traditional teaching. And it's very easy to fall back into old ways.*

Appendix D: Mapping of the data onto the guidance grid

Relations between practice (tasks and roles) and the underlying assumptions (theories), values (philosophy – focus – goal), knowledge (methods) and frames (relation)

	Positivist communication	**Behaviorist Behavioral therapy**	**Psycho-analytical Psycho-dynamic**	**Humanist Person-centered**	**Eclectic Cognitiv**	**Marxist Critical**	**Constructivist Relational**
Philosophy – view of human nature	Container Adaptability	Billiard-ball Environment-ally deterministic	Iceberg Psychologically deterministic	Acorn/seed Unique and valueable	Action-oriented	Social and change-oriented	Constructor Designer
Supervisory focus	Result	Behavior	Dys-function	Potential	Now and future	Action	Life-construction Life-design
Supervisory goal	Goal achievement	Appropriate or suitable behavior	Restoration Cure	Growth Expansion	Change Modification	Change Alteration	Re-construction Re-design
Supervisory method	Transfer	Praise and punishment	Interpretation	Standpoint	Action	Discourse	De-construction Inquiry
Supervisory relation	Instruction Direction	Teaching Learning	Treatment	Development	Collaboration	Analysis	Co-construction
Supervisory role	Specialist Expert	Teacher Manipulator	Therapist	Facilitator Midwife	Coach Logician	Critic Reviewer	Sparring partner

Types of tasks for the facilitator ? **Which challenges will the facilitator face?** **What questions will the facilitator raise?**							

Summary of chapter 2 in ”Rådgivning” [Guidance] by Johannesen, Kokkersvold og Vedeler, Gyldendal Norsk Forlag AS 2001. [in Norvegian]

Appendix E: Process Analysis document: Study Group A

Aalborg University, *Masters in Problem-Based Learning in Science and Engineering*

Semester 2 Project
June 2015

Study Group A members:

Lilian Furquim, School of Economics, FGV (Getulio Vargas Foundation), Sao Paolo, Brazil.
Elizabeth Pluskwik, Iron Range Engineering program, Minnesota State University, Mankato, MN, US
Sally Wiggins, School of Psychological Sciences and Health, University of Strathclyde, Glasgow, UK.

Introduction

This document details the process of working together as a study group over the course of this semester. It captures all the 'behind-the-scenes' work, reflections on our individual experiences and challenges, and on the development of the project focus. As such, this process analysis provides concrete evidence of not only the working process behind the project, but also the learning outcomes of each of the group members. The rest of this document will detail the various steps of our project work in chronological order and concludes with a final reflection from our group on what we have learnt, and on our process as a team.

Stages of project management: reflections on the collaborative process

Stage 1: Uncertainty

The first month or so of working together can be characterised as a period of uncertainty, both in our project goals and in our work together as a group. Getting to know each other through purely online means meant that it took us some time to get to know each other as team members. After our first meeting on March 2nd as 'Group A', with Prof Erik de Graaff as our facilitator, we used either emails, Skype meetings, the Moodle boards, and then Google Docs as our means of staying in contact. While we agreed to meet approximately once a week (on Skype) and have written discussions in between times, it was still a challenge to identify suitable meeting times that fitted our three timetables and the time zones across which we worked. In those early months, we were still very unsure about our project (and coursework) deadlines, as well as the content of our outputs, and this was an underlying concern for many of our communications. Perhaps because of that concern, we were keen even in those early meetings to choose a topic fairly quickly and to start work on our project documents. As such, Google Docs became the space where we wrote, discussed and reflected on our project ideas. While not being publicly visible to our tutors, it provided us with a space where we could simultaneously work on our project ideas and our process analysis

notes, and this space has proved invaluable for our work as an international group dispersed by time zones and large distances.

Within those early weeks, we were still gaining a sense of each other's teaching areas and PBL interests; learning these developed gradually over the following months, and helped to sharpen our effectiveness as a group and begin to see our common ground. Our work in the first month of March, therefore, was mostly spent discussing possible topics, dipping into the literature individually, reflecting back to the group, and then realising that we needed to go back to the literature again to refine our reading and ideas. This first month was also characterised by extensive communications, and trying to work out *how* to work as a geographically disparate group. We all found this really challenging, and valued any chance to meet on Skype so that we could talk face-to-face. So our first real learning outcome - alongside our growing knowledge of PBL topics - was how to work as an online-only group. We learnt the importance of planning regular meetings; time became a valuable resource as our overlapping availability alongside time-zone differences drastically reduced our meeting options. Negotiating responsibilities for work within the group was achieved carefully and openly: we checked that each group member was able to contribute something and had a clear understanding of our next steps as a group.

On the 31st March we held our next meeting with our facilitator, Erik, present for the first part of it. In this meeting we discussed with Erik our interest into 'what elements make up an effective PBL team', and our two possible ways of taking this forward. Erik then gave us some critical but constructive feedback. Firstly, he noted that our topic area was incredibly broad, and far too comprehensive for a one-semester project. Second, that we needed to reflect on how we were working as a group. It is a challenge to work only in online environments, and we had perhaps not taken the time to discuss possible research areas in more detail. On reflection, we felt that our concerns to 'get the work done' may have rushed us into making decisions too quickly, or identifying possible topics without first discussing the implications of these. This feedback from our tutor was invaluable; it highlighted an issue that we might have individually considered, but not as a group had we openly discussed this. In our subsequent meetings, therefore, we spent more time on discussions *as well as* deciding on action points and making decisions. This also gave us an opportunity to talk more informally, and to begin to get to know each other as group members, and thus to work more effectively and positively together.

Stage 2: Generating ideas

Following our meeting with Erik, we spent more time discussing our own experiences with PBL, and we picked up on the issue of the tutor in multiple groups in PBL; i.e. how, as a tutor, do you manage many groups at the same time, or many groups over different settings? This was still a broad topic area, so we 'brainstormed' different topic areas within this. We felt that we needed time to explore this literature for ourselves, and to talk to colleagues, before coming to any decisions about the narrower focus that we would take. We also spent more time reflecting on our experiences of the MPBL so far, and of the challenges of distance learning, and studying alongside full-time jobs. Our collaboration as a team seemed to grow as a result of these discussions; we were able

to more freely discuss both the content and process of learning, whereas previously we may have been focused more on discussing the content of learning. Our concerns over outputs, assessments and deadlines were shared amongst the team, and these concerns may have coloured our early experiences of working on our project and coursework. Collectively, we came to realise that as our tutors did not appear - at least at that stage - to be focused on deadlines and assessment, then neither should we. While we were still keen to 'do well' in our assessment, we began to see that our learning was happening as we were going along; it was not simply the end product, it was a process in itself. These reflections marked a slight positive shift in our group work; we were able to talk more about how, as well as what, we had learnt. We had moved on from a period of uncertainty, and were starting to generate concrete ideas for our project focus.

The month of April included a break between course 1 and course 2 of the semester's work, and we became more involved as a group as we focused equally on discussing course materials alongside our project work. The coursework thus informed our project ideas, and we moved closer to a focus on facilitation across different PBL models. After several weeks of reading the literature, generating questions and purposes for our research problem through team discussion, and reflecting on what we wanted to learn from the process, our team decided to conduct a research design based on the experiences of PBL tutors across two different PBL models. The focus on this research question then became another key moment for our teamwork; it allowed us to focus on one area, having first done some exploration of the literature and refining of our focus on a few occasions. We were now in a much better position to allocate specific writing tasks to each team member, and to begin to start pulling all of our ideas and reflections together.

Stage 3: Focusing

As we moved into May, our collaborative group work was more fluid and focused. We had a clearer sense of our goals and outcomes, and this had been achieved primarily through discussions, written reflections and reading of the literature. While we had made minimal use of Erik, and had not used the Moodle space, this may have meant that our group work has been largely invisible for our tutors. This highlighted further for us the benefits of experiencing (online) PBL as a student. We now had a greater insight into not only how our students learn, but also that they will adapt ways of working together that will suit them, rather than us as tutors.

During May and June, the team experienced an opportunity to use project management skills in time and task allocation when two of our team members had outside commitments that precluded their ability to be "present" for one to two weeks at a time, due to particularly busy times at work, family vacations, and needing time to focus on individual essay work. The team was flexible, understanding, and handled the time commitments and planning of tasks well, with all three team members contributing equally and valuably as their schedules permitted. The choice of using Google Docs was invaluable since each team member could work on the project paper and process analysis documents when they could. We left comments and questions to each other in

colored text to keep track of what areas still needed work; we also continued to meet via Skype regularly to discuss progress and next steps.

Reflections on learning: products and processes

In this section we provide our individual reflections on the learning process throughout the trajectory of the project. As such, names and dates are provided in parentheses to indicate the author and date of each reflection, and these mirror to some extent the three stages noted in the previous section. We wrote our reflections in a document in google-docs, so that we could read each other's reflections, and collect them all together in one space. Being able to write down our reflections, as well as reading each others', became a crucial part of our learning throughout the semester.

Stage 1: Uncertainty

Elizabeth (15th March): *I feel we are a bit behind on our project. The team members all participate, but I feel we are not adept yet at solving the barriers of distance, written communication only, and we have not set regular meeting times. There is no emergent leader yet - and we are still unclear on the project deliverables and due dates. Sally shared with us that we have a Course 1 assignment due - thank goodness, because I didn't see that, so we now are corresponding about that assignment. I feel we need to make a list of deliverables, divide out the topics, and set dates for work to be completed, since Sally will be traveling for work in the next week, and I haven't heard much from Lilian lately. I feel the need to make a workable plan in the next day or so.*

Sally (16th March 2015): *I'm also feeling a bit behind with the project, and confused by the lack of clear deadlines for our 'deliverables'; although I know that we need to work together to figure out our project and own progress, it feels like the 'external' structure of this semester is lacking. So I'm unsure sometimes as to what is negotiable, and it feels like there is a tension between having assessed outcomes for this course (and for the other course and project) that we must meet, but no clarity over what and when these must be produced. I'm finding this challenging as I'm so used to having clear deadlines, which I can then use to structure and plan my time accordingly. Like Elizabeth, I'm also keen to make a workable plan so that we can divide up the required work and set our own deadlines. The barriers of working distance are tricky, but hopefully we can make greater use of Skype sessions to keep us on target and able to discuss things that are difficult to work out on written documents and 'asynchronous' communication channels.*

Lilian (16th March 2015): *I completely agree with Sally about unclear deadlines. I have to say, I still have doubts about our assignments too. For me we have to "discuss" some aspect of PBL. PBL is a huge subject, and I use the word "discuss" because we do not have time to do a scientific paper, or collect data. My suggestion is to send to Erik our schedule, taking the end of May as our deadline. Second, if both agree, we should focus in some part of PBL that we have some experience, working with groups, using our background to start. Can we meet on Skype this week?*

Elizabeth (Mar 17, 2015): *Thanks, Lilian for the agenda and suggested meeting times. It seems we all have similar questions about the expectations of this project. We'll get it though! It seems we have a great deal of autonomy as to the topic for the project, as*

long as it has some aspect of setting a PBL curriculum and trying it out - as a planned experiment or with actual students. Sally has a research question posted in the Moodle - Project area for Group A that we can talk about when we meet. It appears that one of our learning outcomes from this course is getting familiar with world time zones!

Lilian (March 18, 2015): Tks Elizabeth, I think that we are going well, besides the challenge to work as group in different time zones. I think we will learn a lot from it. I think that on Monday 23rd we will have more ideas and questions for our meeting with Erik, on March 25 and, we will be able to work on the project group with our goals and schedule defined.

Sally (31st March 2015): *I found our meeting with Erik today to be really productive. Over the last few weeks I have felt that we're really starting to work together as a group and have a better understanding of where each of us has interests and concerns, and how we can manage our time as a group. But talking with Erik has made me realise that in part I've been too focused on the outcomes of this semester: worrying about deadlines, concerns over when I'll fit in this work around my job and other commitments, and wondering how the three elements of this semester (course 1, course 2 and the project) fit together and how I'll work on them effectively in order to get the most out of them. But mostly I've been concerned with doing things 'correctly' and with achieving a great outcome. I'm doing exactly what I get frustrated with my students about; they want to know how to get a good grade, and I keep telling them to just focus on understanding the material! I have realised that part of my learning on this course is learning how to learn. One of the things that I wanted to get out of this course was some structure and guidance to allow me to explore the PBL literature and to learn more as I'm working.*

Elizabeth (3/31/2015): *I echo much of Sally's reflection comments from today. While the three team members are all educated, motivated, efficient women, we have not "produced" anything yet of substance, and like, Sally, I was starting to get a bit worried how we would finish this large project by the end of the semester. After the meeting today with the three of us and Erik, I realize that I have learned a great deal through this struggle. I also feel that I identify much more with the students in our PBL program in Minnesota now, which surprised me. I already did feel like I understood their experiences in PBL learning, but now that I am in a project team, immersed in PBL, in an unfamiliar environment, with a project to accomplish, I realize that it is really hard! I have a new appreciation for the frustration that students show at times. I also realize, that although the team of Sally, Lilian, and I have very little to show as output for the semester so far, and it has been challenging to even get this far, I have actually learned a great deal through this experience. Some of my learning that I have achieved so far in this work: that it is OK to not know everything about the learning that is to occur; it is difficult to work with a global team and scheduling over 7 time zones; how to use Skype; how to use the Moodle; we three ladies have a great deal in common, and that is very comforting; PBL is definitely a worldwide education model that has many forms, and the recent literature on it has skyrocketed in the last 10 - 15 years; I learn a lot through trying and struggling, even when it doesn't feel like learning; I am a good facilitator and getting better at it through these discussions; Taking the notes from a meeting and writing these reflections are excellent ways to clarify my thinking, and new*

insights/ideas/solutions often bubble up in my head as I write; sharing ideas with a group really does help my learning. Most of my learning has been independent, so this new group discussion model is new for me; It is difficult to come up with a research question. The process is circular ~ the research topic is very broad at first, and is informed through reading relevant articles and discussion. Then the question can be narrowed or altered a bit, then read more, etc. Much learning takes place through this process.

Stage 2: Generating ideas

Sally (13th April 2015): *I have really felt a break between course 1 and course 2 of the semester, in that I've missed the online sessions with the rest of the students, and having regular commitments to read, make notes, and reflect on teaching practice. Although it has only been just over 2 weeks since our last group session (as a class), it feels like a lot longer! I'm still finding it difficult to juggle various work commitments and my work on the PBL masters course, but I think the long Easter weekend, and my subsequent conference abroad, knocked me off-track a little. I'm looking forward to focusing more closely on my PBL work and my work with group A for the project over the coming weeks. [Note to Elizabeth and Lilian: I have a family holiday booked from 22nd May - 6th June in Canada, and don't think I'll be able to access the internet or engage in group sessions during that time]*

Elizabeth (Apr 14, 2015): *Thank you, Sally, for the comments and information about your upcoming trip to Canada with your family. I will plan to work with you and Lilian on the project a lot prior to May 22, so we can make significant progress before your trip. I have also missed the interaction with the other PBL Masters' students; I have made good progress on my individual essay ~ I find that the extra time to reflect and think allows deeper insight into the topic of my essay.*

Lilian (Apr 14, 2015): *Tks Sally and Elizabeth for the comments. I think that we agree in some issues, but we realize how difficult is to be a "virtual team". Maybe these is our great outcome from the course, how to be a functional team in on line PBL. It is far from trivial thing. We can use 22 May as our deadline to have some work done and decide our research question next section (on 15 Apr) and propose little tasks to the next one. It is important so feel that we are working in something.*

Sally (15th April 2015): *I am really finding the process of discussing issues with the other group members incredibly valuable and insightful, whether it be finding shared areas of interest or curiosity, or adding new ideas to things I hadn't encountered before. I am also very aware of my academic background in psychology and that this might be blinkering me to specific ways of looking at teaching and learning. I don't want to be too directive on the group and lead them into issues that they may not be interested in or which aren't relevant to them, so my challenge is then to ensure that I explore my own interests while at the same time learning different approaches and different fields. So this is another of my challenges: to read widely, gain new understandings, but stay focused on answering a specific question.*

Sally (6th May): *I am finally feeling much more relaxed about the project now. Although it has been fun from the start, and always very positive and fun to work with Elizabeth and Lilian, I have been concerned about deadlines and what I am supposed to have 'learnt' by that deadline. Now that we actually have our exam dates and submission dates, I feel so relieved. There is plenty of work to be done by then, of course, but I know what I'm aiming for now. My reading is becoming more focused, and I feel like I'm starting to get a grasp of the literature; or at least, some sections of it. I also have the motivation of a 2 week holiday before then, and would like to go on holiday feeling that I've achieved as much as I can by that date, and contributed enough to the group work so that Lilian and Elizabeth don't have too much to carry on their own. When I return, there will be a week left for me to help with the final 'push'. So, seeing the finish line in the near-distance is an excellent motivator for me. I'm looking forward to the next two weeks and to see our project taking shape. Once again, writing has been a core part of this process. Through seeing the writing develop, I also feel that I've learnt more, and have something to show for that.*

Sally (13th May): *As we delve into the facilitation literature, I am becoming more aware of our roles as students in this course, and how little we have involved our facilitator, Erik, in our discussion as a project team. The first time we included him in a meeting, it was really helpful, and I wonder whether we have missed opportunities here to include him more regularly. I am starting to recognise our group amongst examples in the literature; where, perhaps, we spend a lot of time trying to polish our work before letting the tutor see it! As a result, we don't get the immediate feedback from our tutor as we're going through the process. I see this in my students too - and know how hard it can be to create an environment where they feel secure enough to discuss pre-formed ideas - and I think that I have fallen into this trap myself now!*

Stage 3: Focusing

Sally (8th June): *It has been a few weeks since I last reflected on my learning on this course, and this is in part due to a two-week holiday where I was removed (physically and mentally) from work and study. This provided a great opportunity for me to refresh my perspective on the MPBL and to return to our work as a team with fresh eyes and renewed enthusiasm. It is easier to see now how far we have come. It is obvious, for example, that in the first few months of working together, we struggled a lot with uncertainty about the course, and how we would work in such diverse environments, and then being overwhelmed with the breadth of issues that we might consider for our project. We found, however, that our focus on facilitation across the two PBL models developed naturally from discussions with each other about our own settings. This also allowed us to make greater use of Lilian and Elizabeth's colleagues within PBL (I am somewhat isolated in my department), and to use their responses as preliminary data. It has also become clear to me that our written reflections were much more regular while we were struggling with our confusions - this links into Savin-Baden's (2000) notion of student identity and the need for disjuncture to provide change and development - once we were confident about the path we were going to take, we felt less of a need to reflect and spent more time working on our project document.*

<u>Concluding remarks</u>

As a group, we have used a PBL approach (Aalborg model) to learn more about PBL. It was at times challenging, uncertain, and required us to learn in a way that was unfamiliar to us. Even though we are all experienced university teachers, we were all challenged by being students in this PBL semester. We found ourselves wanting to know the due dates, the type of exams, and what we would be graded on. We wanted to work together, yet found challenges in working over a distance over time differences of several hours. Working together purely online, and so geographically dispersed, meant that we needed more time to develop as a team: to get to know each other through meetings and discussions, through talking about the literature and our assignments, through agreeing and sometimes disagreeing. We enjoyed hearing from each other our experiences, stories and reflections on teaching and learning, and now we could reflect not only as PBL tutors, but as students within a PBL approach. As we became more settled as a group, and clearer about our outputs, our written reflections became noticeably fewer. We spent less time concerned with 'what we were doing' and more time reading and writing on our chosen focus.

We also came to realise that the more we knew about PBL, the more there was to know. There is no 'one way' of doing PBL 'correctly', and we now feel that we have an international network of colleagues who we can collaborate with, share experiences and with whom we can continuing learning. Our teaching programmes will undoubtedly benefit from our experiences and renewed engagement with learning theories and we hope to have some influence on our colleagues at our respective institutions. So, alongside our growing understanding of PBL, our confidence has grown, both in terms of feeling better about our own teaching and also more able to tackle new challenges ahead. We have, as it were, become self-directed learners in our teaching as well as in our research.

We have all thoroughly enjoyed our time together as a group and hope to stay in touch in the years ahead. This has truly been a rewarding, challenging and engaging journey for us all, and we look forward to our next steps ahead.