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Problem-based Learning during the COVID-19 Pandemic: Can Project Groups Save the Day?

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Abstract:

In this paper, we describe how a Danish problem-based learning university adapted to the circumstances surrounding the coronavirus disease of 2019 (COVID-19) pandemic. Our findings reveal that digital problem-based learning mitigated some negative consequences that appeared with the lockdown and resulting shift to 100 percent online teaching. While students prefer the traditional face-to-face teaching mode due to the energy, variation, and socialization associated with on-campus learning, we observed that students who have worked in project groups had a more positive experience with online learning, which indicates belonging to a project group can increase students' motivation to participate in online teaching activities. Our findings challenge the idea that problem-based learning revolves around face-to-face interaction on campus. We highlight lessons that we learned when we rapidly shifted to online distance teaching.

Keywords: COVID-19, Problem-based Learning, Higher Education, Online Distance Teaching, Project Group.

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1 Introduction

The coronavirus disease of 2019 (COVID-19) pandemic has had major negative consequences for our health and the economy, but it has also paved the way for innovation and creativity. Among other things, it has caused higher education institutions around the world to rethink how they deliver their teaching activities. In Denmark, the COVID-19 pandemic led the government to enforce a national lockdown on 13 March, 2020. As a result, all university employees and students had to stay home to self-isolate for a then-unspecified period (Madsen, Haslam, & Nielsen, 2020, Haslam, Madsen, & Nielsen, 2020).

In this paper, we examine and offer lessons learned from a case study of how a Danish university, centered on problem-based learning (PBL), adapted to this challenge by deciding that the semester would continue in a digital format, which effectively made the university fully digital with little warning or preparation. We specifically address how digital PBL in project groups turned out to have positive impact on student motivation during the lockdown.

2 Case Study Context

Aalborg University in Denmark has a long tradition around using PBL as the central educational principle behind all its student learning activities (Kolmos, Fink, & Krogh, 2007). PBL rests on the idea that students learn better while engaged in solving authentic and often ill-structured problems (Marra, Jonassen, Palmer, & Luft, 2014). PBL has many variations (Savin-Baden, 2014). In this paper, we focus on "small group problem-based learning" (Mennin, 2007). Researchers also refer to such learning as project-oriented and/or collaborative PBL in which students work in project groups to define, analyze, and solve a professional workplace problem with a high emphasis on group members' reflexivity and shared accountability for group dynamics, learning process, and project result (Savin-Baden, 2014).

The university's study programs have focused on the group project in each semester since Aalborg University was founded in the early seventies. Thus, for most such programs, the semester starts with establishing the project groups (of two to six students), and students collaborate for the entire semester to complete them. The semester project typically comprises a longer written report that students hand in at the end of the semester. The group project accounts for 50 percent of students' grade for the semester and, thus, consumes approximately 50 percent of the students' time as well. The group project focuses on providing a social structure that gives students the opportunity to 1) work closely with their peers in the project group, 2) apply knowledge gained from lectures to practical problems, and 3) collaborate with private or public organizations to understand the problem's complexity and potential solution in a real-world setting (Dolmans & Schmidt, 2010; Thomassen & Stentoft, 2020).

Traditionally, as an important part of the PBL teaching method, project group members gather in their designated room on campus to collaborate and discuss their project and have meetings with their supervisor. The substantial body of empirical research that suggests that people derive health and motivational benefits from being in the same physical room due to nonverbal communication, active listening, reciprocal conversation, and relationship building informs this approach to PBL (Reamer, 2013). However, the advent of COVID-19 and the need for social distancing made this face-to-face approach to learning impossible, which forced PBL groups to become fully digital and distributed for the semester.

3 Empirical Data

In this paper, we concentrate on how the social science faculty at Aalborg University handled the transition to fully online teaching amid the exogenous shock that the COVID-19 pandemic caused. We collected multiple sources of both qualitative and quantitative data as Yin (2014) recommends. First, we conducted 60 semi-structured interviews (Kvale, 2008) with key stakeholder groups: students (20), teachers (20), managers (14), and digitalization staff (6). A first interview round took place during the first weeks of the COVID-19 lockdown in March/April, 2020 (30 interviews), and follow-up interviews took place at the end of the semester in June/July, 2020 (30 interviews). We held all interviews online (Lo Iacono, Symonds, & Brown, 2016) using Microsoft (MS) Teams or Skype for Business. Through these interviews we, among other things, inquired into how students and teachers experienced the lockdown and online distance teaching: its suddenness, benefits, disadvantages, and unintended consequences. We had our research assistants transcribe all interviews verbatim. Second, we obtained access to student survey data. In total, 632 students at the social science faculty (e.g., from sociology, political science, and history) responded to a survey (May, 2020) that covered questions about their experiences with online teaching

during the COVID-19 lockdown. Third, we gained access to statistics about how staff and students used software (e.g., MS Teams) from the university's IT department.

We analyzed the empirical data through several steps (Creswell & Clark, 2017). First, we focused on understanding how teachers and students had experienced the shift to online teaching and digital PBL overall. At this stage, we looked at the full data set (i.e., usage statistics, survey data, and the transcribed interviews), noted down ideas, and discussed insights. It became clear that online teaching posed some challenges, while the qualitative interview data revealed that the students had positive experiences with digital PBL. We decided to zoom in on this aspect. Thus, in the second step, we conducted open qualitative coding of the 20 student interviews (Braun & Clarke, 2006) during which we identified initial codes, such as isolation, lack of variation, missing campus, group collaboration in MS Teams, finding a new "everyday online", productive online meetings, and "what about small talk". Next, we grouped the interview data together under similar codes and then sorted them into two overall themes: 1) belonging to a digital PBL group and 2) structuring the PBL group's digital workday. The two themes capture how the students' anchoring in a PBL project group helped counteract some challenges that fully online teaching presents.

4 Shifting to Online Teaching

The COVID-19 pandemic triggered an unexpected experiment in online teaching and digital PBL at Aalborg University. The social science faculty cancelled or postponed as almost all teachers and students began using available digital solutions immediately. MS Teams turned out to be the most used platform. Usage statistics show a sharp increase in MS Teams users from February (3,000 users at entire university) to March (12,000 users) and an upward curve for the rest of the semester (17,000 users by May, 2020). A professor reflected on the development as follows: "Many of the digital tools, such as MS Teams, have been available for quite a while, but you only really notice them when you are forced to seek them out".

Students provided mixed feedback about online teaching activities. On the one hand, students reported some positive learning experiences from online teaching (see Table 1). That is, 60 percent of the students rated online supervision positively (i.e., they found it "very positive" or "positive"), 54 percent rated the live stream lectures positively, and 48 percent rated the recorded lectures positively. On the other hand, most students (60-62%) still reported that they preferred the traditional face-to-face lectures and supervision when compared to online teaching.

Table 1. Students' Learning Experiences during the COVID-19 Pandemic (N = 632)

Type of teaching	Participated in this type of teaching	Positive learning experience*	Negative learning experience*	Preference: online	Preference: traditional
Live stream lectures	74%	54%	20%	23%	62%
Recorded lectures	73%	48%	23%	26%	60%
Online supervision	72%	60%	15%	16%	60%

* The category "positive learning experience" contains the response categories "very positive" and "positive" from the survey. The same applies to "negative learning experience". We omit the answer category "neutral" from the survey to obtain a simple presentation.

5 The Challenges of Online Teaching

After further examining our empirical data, we found that both students and teachers found online teaching's technical aspects easy and, from a learning perspective, that it worked better than they had expected. However, students also noted that online teaching also had several challenges related to limited social interaction. Specifically, they noted that:

1) They found it difficult to concentrate when alone at home in front of a small screen all day and

2) They missed the variation and interaction of on-campus learning activities.

Most students preferred a traditional setting when it comes to lectures, seminars, group work, exercises, and so on. Yet, from our in-depth qualitative interviews, we also found that belonging to a PBL project group and collaborating digitally on the semester project helped counteract students' isolation feelings,

concentration problems, and lack of motivating social interaction during the COVID-19 lockdown. In Sections 6 to 8, we explore how group PBL projects helped mitigate the negative social consequences of the shift to online teaching at Aalborg University.

6 Belonging to a Digital PBL Group

The students noted that they found it difficult to concentrate and maintain motivation for longer periods of time when learning via online instruction. They cited the fact that they stayed home alone all day rather than with others in a dedicated, physical learning space for specific periods as the main reason why. For example, two students said:

> *The hardest thing for most students was sitting at home, alone, in front of your screen all day. Not socializing becomes a big problem. It is hard to stay motivated.* (Undergraduate student)

> *It is like doing home workouts. When I work out at home, on my own, I put in maybe 10 minutes. Whereas if I go to the gym, I will usually do 1-1.5 hour[s] because I am in a place which is designed for that purpose, keeping me focused.* (Graduate student)

However, we also found that online collaboration in the PBL project groups worked well as a counterbalance to these effects and helped reduce their motivation problems and feeling of isolation. By using digital platforms such as MS Teams, the PBL project groups could continue to collaborate as they did before the COVID-19 lockdown. As an undergraduate student noted: “Project group work saved my day”.

Thus, for our student interviewees, their digital connection to their PBL group saved them each day during the COVID-19 pandemic lockdown since it meant they were not alone with their tasks or their social and emotional needs. A graduate student explained:

> *We use MS Teams a lot. We hold frequent meeting with the case company we are collaborating with, our supervisor, and our lecturers. Our group meets and collaborates through MS Teams, so we simply invite them to join our session when we need to discuss or share something with them.*

Because the students’ learning activities centered on their PBL project, they met frequently online to engage with each other, their project supervisor, and their case company. Moreover, the PBL group members were always (regardless of format) accountable to each other on an ongoing basis to produce results (i.e., the practical solution to the case company, the academic report, and the grade). This accountability meant that that, during the lockdown, the students committed to keep up with online lectures and exercises—despite screen fatigue—as they needed the knowledge for their shared PBL project (Jaggers & Xu, 2016). A graduate student explained:

> *The exercises with the group were more important because you met over Teams just to solve them and you expected everyone to have read the course material. This is not the case with the traditional way of teaching.*

Conceptually, we can understand this accountability as “belongingness motivation”; that is, the need to form and maintain positive interpersonal relationships that provide fundamental psychic energy and responsibility to engage, collaborate, and contribute (Leary & Cox, 2008).

7 Structuring the PBL Group’s Digital Workday

The students described that, in online instruction, they missed the variation and energy of having to get up in the morning to go to campus and partake in different types of learning activities. For example, an undergraduate student said:

> *When you have physical teaching, well then you have to get up, put on clothes, and show up…. It takes the everyday element out of it when you just have to get up in your nightwear, sit in front of your computer, listen for an hour to an online lecture, and go to bed again.*

To compensate for the lacking variation in everyday activities during the lockdown, many PBL project groups started to use their MS Teams room much like they would normally use their physical group room on campus. In doing so, they could emulate familiar learning and social practices in a digital space. As one graduate student stated: “My workday has more or less standardized on MS Teams”.

To overcome the challenges of online learning, such as its more fluid nature, the students had to become much better at structuring how they would spend their days individually and as a project group. Thus, they had to assign responsibilities and decide at what times during the day they would follow-up with each other on the progress of the day's work. One undergraduate student said:

> *We used the Planner feature in MS Teams to manage our work schedule. Normally we would use the whiteboard in our physical group room but since that was not possible, we used Planner instead. It worked well and allowed us to assign responsibility and lots of other useful stuff. Much better than our old whiteboard solution.*

The students also reported that their online PBL group meetings were shorter, more effective, and more goal oriented, which helped them experience "productivity energy". For example, a graduate student said:

> *We were generally much better at staying on topic. We did not get sidetracked and start talking about what we did during the weekend or stuff like that. Small talk is important once in a while but as a rule our online meetings were short and to the point.*

Even though the students experienced their online group meetings as positive and productive, some project groups realized that they needed to schedule informal online meetings for small talk (e.g., on Monday mornings and Friday afternoons) to ensure that they felt connected to each other. To their surprise, these meetings worked well as social occasions in themselves and as a way to ensure the quality of their project-related interactions (Cramton & Hinds, 2004; Elsbach, Cable, & Sherman, 2010).

8 Lessons Learned

In this study, we describe how students at a Danish problem-based learning university experienced the unexpected, rapid shift to a fully online university during the COVID-19 lockdown. We summarize the lessons learnt and suggestions for future application in Table 2. We propose that our results might also be useful for non-PBL universities that expect more online teaching in the future.

Table 2. Lessons Learnt and Practical Applications

Lessons learned	Suggested practical application
Students described digital project group work as the most positive aspect of the fully online learning experience. Although the students did not prefer the online format to completely replace the traditional face-to-face approach, they reported that MS Teams supported their collaboration well and, in some instances, better.	Universities should inspire students to use social collaboration tools, such as MS Teams and Zoom, because they work represent good platforms for small groups to work effectively together.
The PBL model, with institutionalized project group work, seems to mitigate some negative consequences of fully online teaching, such as feeling isolated and difficulty concentrating. Belonging to a project group can literally "save the day" by enabling frequent, meaningful, and motivating interaction towards shared results in a virtual space.	Introduce group-based activities where the same small student groups work together (both online and physically) throughout the semester. These activities can help counter isolation and increase motivation to engage with online material due to peer-to-peer accountability.
Even for students with extensive PBL experience, online project group work also seems to require a "work hard" dynamic to, among other things, avoid screen fatigue. Thus, groups gather online and are productive in shorter, more intense, bursts followed by periods in which they rest offline and do work individually.	Working effectively online in project groups is a skill that one must practice. In particular, undergraduate students will need help with both adopting the software tools and structuring their project group work to cope with the challenges of online teaching and to develop digital collaboration practices.
Students report mixed experiences with online teaching during the COVID-19 lockdown.	We do not recommend educators conduct fully online teaching for an entire semester.

Our results challenge the established idea that PBL necessitates face-to-face interaction between students in designated group rooms on campus, and we expect that digital PBL will play a more prominent role from now on. More research, both during and after the COVID-19 pandemic, needs to look at the long-term impact that this rare event has had on PBL practices, including how to balance face-to-face and digital instruction.

Extreme situations, such as the COVID-19 pandemic's impact on university teaching in general and on PBL practices more specifically, can help researchers develop new insights because the dynamics studied become more visible than they would be in other situations or contexts (Flyvbjerg, 2006). However, extreme cases also call for caution as, for example, some challenges that we mention above (e.g., being alone all day and feeling isolated) are specific to the lockdown. Under more normal circumstances, online teaching and digital PBL will coexist with many other social life practices.

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