How PBL and FC Gave Remarkable Results in a Military Leadership Course at Norwegian Defense University College.

Commander Geir Isaksen, Commander (SG) Rino B. Johansen,
Staff officer digitalization and pedagogy, Associate professor,
Norwegian Defense University College, Oslo, Norway
gisaksen@fhs.mil.no, rbjohansen@fhs.mil.no,

ABSTRACT

Following the new Defense educational strategy at the Norwegian Defense University College (NDUC), one of the measures has been to implement Problem Based Learning (PBL), lay the grounds for more student activity and Flipped Classroom (FC). Not many papers over the years have looked at the introduction of PBL in higher military education in general or more specifically in the subject of military leadership. By rebuilding the pedagogical strategies and introduce PBL in the Military leadership (ML) course, the results have been remarkable.

This follows last year's paper about the plans to implement FC and PBL across NDUC programs and courses. It gives an overview of how a FC concept combined with PBL has transformed the military leadership course and discusses the differences between the course conducted in December last year and courses conducted before 2019. The shift from a conservative lecture-based course to a more student active and problem-solving approach is highlighted and discussed. Based on pre- and post-surveys, grade results and student feedback, both pros and cons are discussed and compared with previous results from ML courses. The remarkable good results in student performance and other findings are analysed and compared with exciting research and knowledge within the field of PBL and FC.

In conclusion, a summary of all findings and how these will influence the transformation of the educational programs at NDUC is highlighted.

ABOUT THE AUTHORS

Commander Geir Isaksen has more than 17 years in the field of Advanced Distributed Learning (ADL) and is responsible for more than 30 Defense projects in the field of digital learning methods and learning technology. He has published more than 20 papers covering different aspects of digital learning methods like mobile learning, student motivation, cognitive overload in e-learning, and the use of video lectures. He has a master's degree in Information Computer Technology (ICT) & Learning from the University of Aalborg (2014) and a bachelor's degree in Electrical Engineering from Vestfold University College (1998). CDR Isaksen holds the position as a Staff Officer for digitalization and pedagogy at the NDUC/Faculty administration, where he is responsible for leading and coordinating procurement, development, and implementation of digital learning projects and pedagogical support in the use of the Defense Learning Management System (LMS). His military background is from the Navy, serving on submarines for six years as an electro officer and he is also responsible for international ADL cooperation at the NDUC and MoD funded international ADL capacity-building projects.

Commander (SG) Rino Bandlitz Johansen has more than 15 years in the field of education at different levels in the Armed forces. He has published more than 15 papers covering different aspects of leadership and the military professional identity. He is also one of the authors of the recently published book “Military Leadership”. He has a master’s degree in military science and leadership and holds a Ph.D. in operational psychology. Bandlitz Johansen currently holds the position as principal teacher at the NDUC in military leadership. He is responsible for the development and conduct of leadership education and chairs the research group “Military leadership development – in theory, and practice”. His military background is from the Navy, serving at fast patrol boats for eight years, the last three as commanding officer. He also has experience from NATO article V operations in the Mediterranean. In the last 15 years, he has been occupied with different positions related to leadership and leadership development.

How PBL and FC Gave Remarkable Results in a Military Leadership Course at Norwegian Defense University College.

Commander Geir Isaksen, Commander (SG) Rino B. Johansen,
Staff officer digitalization and pedagogy, Associate professor,
Norwegian Defense University College, Oslo, Norway
gisaksen@fhs.mil.no, rbjohansen@fhs.mil.no,

BACKGROUND

As outlined in last year's IITSEC paper (Isaksen, 2019), a huge educational reform in 2018 paved the way for rethinking how we conduct training and education at the Norwegian Defense University College (NDUC). It pointed at digital tools and digital methods as one of the key pillars of a modern university (Norwegian Ministry of Defense, 2016, p.22). Also, a new NDUC strategy (2019-2022) published in 2019, outline a new learning vision, that initiated a new approach in how to teach military leadership at the NDUC Command and Staff College (CSC). The vision emphasizes that all teaching must facilitate student activity, student interaction, and strengthen the student's analytic and problem-solving skills (NDUC, 2019, p.15). At present, there are not many published studies on using Problem-Based Learning (PBL) and FC in higher military education. Based on that fact it was (in September 2019) decided to conduct a trial in the Military Leadership (ML) course, to investigate if implementing PBL and FC would have a positive impact on student performance and strengthen their analytic and problem-solving skills. During the last months of 2019, the responsible course director and the NDUC faculty worked together in planning and executing a pilot, implementing a new online and pedagogical teaching methodology in the (ML) course, incorporating FC and PBL strategies. FC and PBL were derived in last year's paper (Isaksen, 2019, p3-4.) and therefore this paper will focus more on analyzing the results from the pilot, rather than discuss the two concepts in general.

RESEARCH QUESTIONS

As shown by Isaksen (2019, p.9) four research questions were identified to help assess and evaluate the pilot. These questions will create the basis for the discussion and conclusion, at the end of this paper. The questions were:

1. Did PBL secure deeper learning compared to previous years?
2. Did the FC approach release more time for face to face learning activities?
3. Did the implementation of FC and PBL make it more time consuming for teachers and students?
4. Did the use of requirements, assessment, and tracking help to ensure better-prepared students?

PILOT DESCRIPTION

Traditionally the six weeks ML course has mainly used classroom lectures and self-study with the available syllabus as the dominating learning activities (Isaksen, 2019, p.2). The Learning Outcome Descriptions (LOD) for the ML course is developed according to the European Qualification Framework (EQF) and the National Qualification Framework for lifelong learning (NKR) (Ministry of Education, 2011). The LOD contains both practical and theoretical learning goals, aiming at giving the students' knowledge about military leadership and management and abilities to critically analyse issues related to effective leadership and management. Overall LOD`s on Master of Military Studies (MoMS) level also include goals that focus on strengthening the student's analytic and problem-solving skills in general (NDUC, 2019).

The students

52 students took part in the ML course (in 2019) as a part of the 2-year long MoMS program. These students are selected and regarded as future potential senior leaders in the Norwegian Armed Forces (NAF), and they come from different units across the Norwegian Defense. The class also included foreign students from Finland, The Netherlands, and the USA. The average age was 39 and consisted of mainly male students (85%) (NDUC, 2020b, p.2). From the beginning of the MoMS program, the students were divided into small groups of 8-9 students, and these groups was

retained for the first 3 courses in the MoMS program, where they were to solve tasks and assignments collectively. Before the course, the students were informed about PBL and FC as concepts and how it would affect the course. Based on this information they were asked some questions to measure their attitudes towards the new teaching method. Overall, most of the students had no prior knowledge of PBL (63%) or FC (82%) as concepts and most of the students had no experience of using PBL (80%). Even so almost 45% of the students believed that PBL would have a positive impact on the learning outcome or was neutral (42%) (NDUC, 2019a, p.3). The small percentage being sceptical to PBL all came from the group of students without previous PBL experience (figure 1).

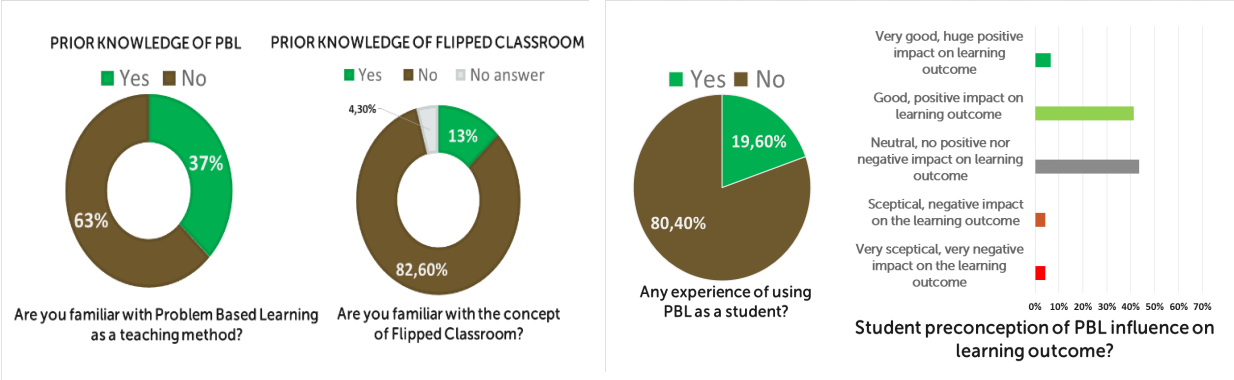

Figure 1: Student demographics for the ML course

The learning method

Traditionally MoMS courses have relied on classrooms lectures and analyzing syllabus as the dominating learning activities (figure 3, p.4). For this pilot, a new learning model was developed to implement the concept of a FC and to add problem-solving opportunities in the learning activities. For the ML course, it meant giving the students access to course material like digital syllabus and video lectures before face to face learning activities. This was done through the Defense Learning Management System (LMS) Itslearning. This was a key factor to free more time for the students to work together in groups, solving problems related to the ML subject. It was required that the students used the online material to properly prepare for the practical learning activities.

Figure 2: Comparing learning activities in the ML course

As shown in figure 2, time earlier used for classroom lectures and individual study time was reduced to increase time for group work, guidance, and feedback. The new pedagogical model was built around the principle of giving the students enough information in advance and thus enabling them to answer a weekly problem in groups under guidance from Subject Matter Experts (SME). Online material was available early on, but in addition, every Monday was used for key lectures (not available in digital format) and deriving the problem of the week (figure 4, p.4). On Tuesday and Wednesdays, the students worked together in groups with the assigned problem, without any teacher present (figure 4, p.4). Every Thursday teachers were available for questions and guidance and the groups had to submit their answers to the weekly problem trough the LMS. However, SME`s were available on request on short notice. The end of the week and part on the following Monday was used to give final feedback, discuss, and elaborate on the main take away from the previous week, and focus on the next problem. The course ended with an individual oral exam as the final summative assessment (figure 4, p.4), unlike the previous year who had both a written and oral exam. All six written papers from each group were used as formative assessments and mandatory work assignments.

The feedback along the way focused both on the progress of the subject matter through the mandatory written assignments and how they responded to the problem using proper analytical and scientific methods.

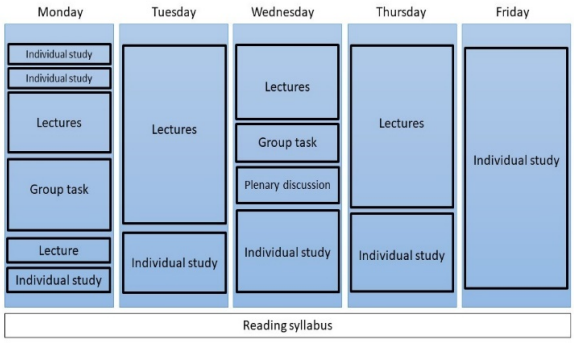

Figure 4: Traditional MoMS pedagogical model

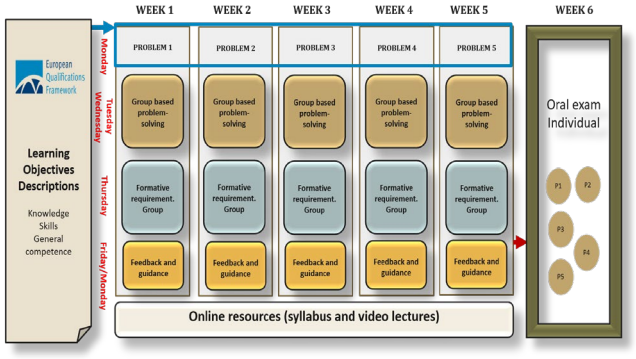

Figure 3: New pedagogical model for the ML course.

Creating useful problems

As part of the PBL concept, five problem statements were derived from the LOD, one for each week. These problem statements were meant to cover all the LOD, both the course specific LOD and the overall LOD developed for the MoMS program. It was made clear for the students that the oral examination would be based on one of the problem statements previously used in the course (figure 4). The mandatory syllabus was considerably reduced (to about 500 pages) giving the students the freedom to identify and add about 300 pages of relevant syllabus, based on their judgment.

Assessment method

It was important to choose both formative and summative assessment methods that measure not only LODs related to the subject matter but also MoMS program level LODs related to analytical skills and correct use of scientific methods. The formative assessment was the weekly problem submitted by each group, where they got feedback on both the subject matter (answer the problem) and how they applied and used appropriate scientific methods for the written assignment. The final oral exam served as the summative assessment and measured mainly the knowledge about the subject matter, but also their ability to apply critical thinking and analytical skills in their arguments and choice of literature.

RESULTS

This section will submit the results retrieved from a pre- and post-survey targeted towards the ML students (NDUC, 2020a), data from the Learning Management System (LMS) (NDUC, 2020c), an obligatory post-course survey (NDUC, 2020b), grade results from the summative assessment and observations made by faculty members, teachers, and examination sensors. The pre and post-course surveys were used to measure attitudes directly by using a Likert scale type of questions, which allow the individual student to express how much they agree or disagree with a particular statement from five different options (McLeod, 2019, p.1).

Grade results

Historically, students attending the MoMS performs well academically. For the 2019 course, the exam was conducted as an individual oral exam, where each student drew one of the problem-statements the students worked with during the course. Four 2-man commissions were mixed with sensors from NDUC and civilian universities like Oslo Metropolitan University, University of South-Eastern Norway (USN) School of Business, and The Norwegian Police University College. As shown in figure 5 (page 5), the results from 2019 are remarkably better compared with earlier courses, with over 50% of the students achieving an A and 30% achieving a B. It shows a large shift from B and C grades towards the 20% increase in A. Figure 6 (page 5), shows that 5 of the student groups had an average above B and 1 group stood out with average almost a grade lower than the other groups. Looking at this group it was not a single student performing much lower than the other, but the largest occurrence of grades C & D. (NDUC, 2020c)

Interestingly the same student's group were among the 2 groups with the lowest grades from the previous course in Politics, Society and Military force (PSM).

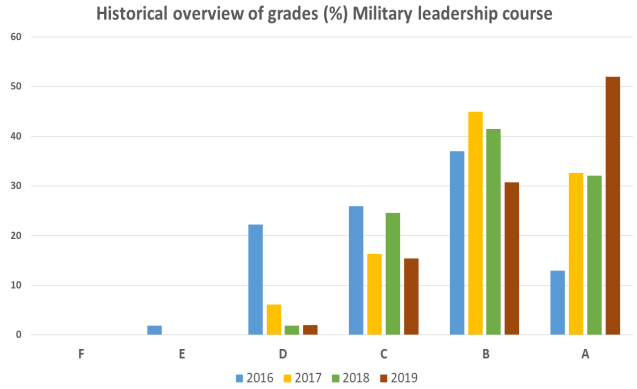

Figure 5: Grades in the ML Course 2016-2019.

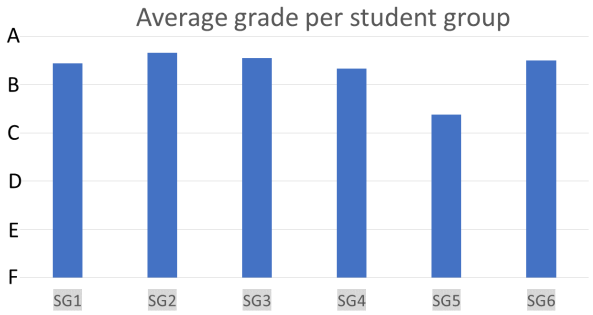

Figure 6: Average grade, student groups (SG).

PBL influence on learning outcome

As shown earlier, the majority of the students believed that implementing a PBL method in the ML course would have a positive effect on their ability to reach the LOD`s (figure 1, p.3). This although the majority had no prior experience with PBL (80%) (figure 1, p.3). The question of PBL influence was revisited after the course and gave the change shown in figure 7 (NDUC, 2020a). The number of students that believed PBL had a huge positive impact on the LOD increased with 20% and the number of students that believed PBL had a positive impact dropped to 32%. But overall, it shows an increase in the number of students that meant PBL had either a positive or very positive impact on LOD from 48% to 63%.

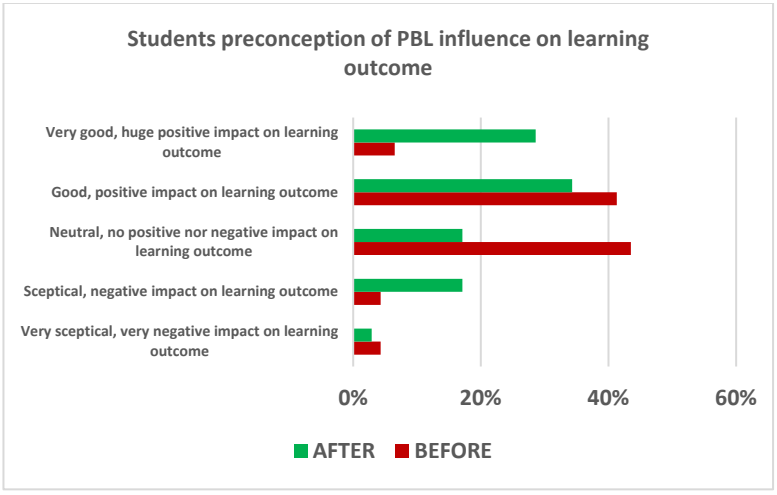

Figure 7: PBL influence on LOD, before and after.

It also was a 13% increase in the number of students that believed PBL had a negative impact on reaching the LOD and a small reduction (1,3%) of students believing PBL would have a huge negative impact. Overall, it shows an 11% increase in students believing PBL had a negative or very negative impact on LOD. The overall number of students being neutral dropped from 43% to 17%.

Students perception of PBL as a learning method

A big part of the PBL method introduced in this course was based on the students collaborating on solving the weekly problem and that the students actively engaged in discussions and the assigned tasks. Group discussions and group work were highlighted by 63% of the students, as the learning activity that motivated them the most to actively participate in the learning situation (NDUC 2020b, p.9). On the question of which learning activity they felt helped them the most in reaching the learning goals, 87% singled out group collaboration as the most important activity. In addition to group collaboration, the student pointed at key lectures (42%) and individual study time (33%) as other activities that helped them reach the LOD (figure 8) (NUDC, 2020b, p.15).

One other factor for PBL working well in this course, according to the students, was the fact that the subject of leadership is a field most of them know well and have vast experiences from. This was pointed out by several students in the course evaluation survey. Though PBL were used throughout the course, several students commented that this method worked well in the part of the course covering military leadership but was less useful in the part covering

management. The reason being that most of the students have less experience in the field of management, compared to leadership (NDUC, 2020b, p.18).

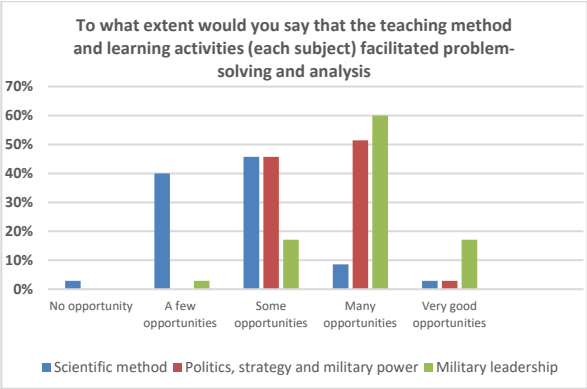

Figure 8: PBL in MoMS subjects 2019

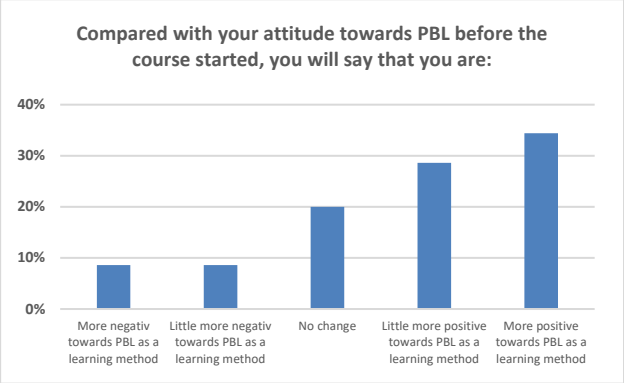

Figure 9: Students attitude towards PBL

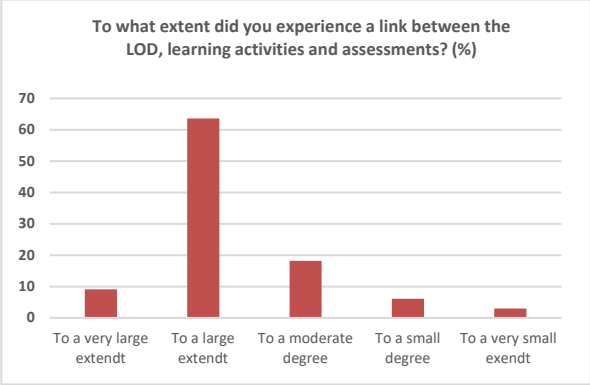

Figure 10: LOD, learning activities and assessment

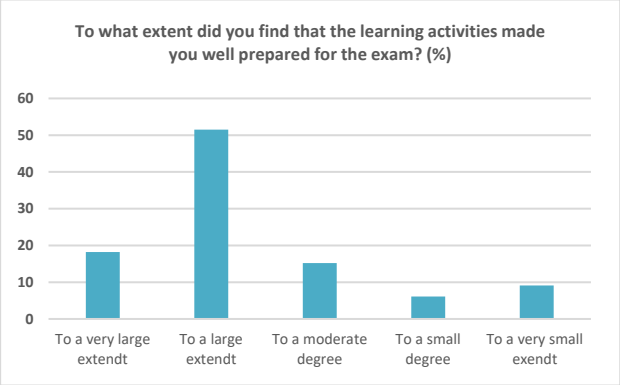

Figure 11: Learning activities and the exam.

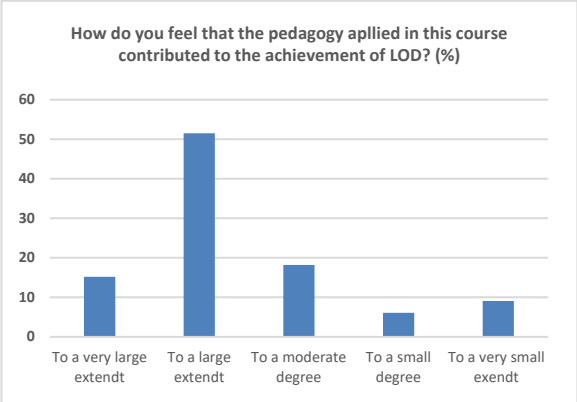

Figure 12: Pedagogical method and learning outcome

Figure 13: Student activity.

Two factors were most frequently mentioned in the course evaluation, regarding the challenges of using PBL. The first factor is student fatigue and the fact the PBL is experienced as hard work. Several students reported that their motivation and enthusiasm about using PBL dropped towards the end, largely because they got tired. Secondly, many students reported that the feedback from the SME increasingly focused more om methodology and analyzing skills in the written assignment, rather than on the subject matter of leadership and management (NDUC, 2020a, p.2). Several students also called for more lectures and thought that the few key lectures given every Monday were not enough. In the FC approach, 8 video lectures (of 30-40 min.) and 125 digital documents were made available through the LMS

and a total of 23 lectures (of 45 min.) and 5 feedback sessions were conducted in plenary (Mondays) (NDUC, 2020c). These lectures were meant to enable the students to prepare for the discussions and answering the assigned problem.

As shown in figure 9 (page 6), a total of over 62% of the students were a little more or more positive towards PBL as a learning method after completing the course. 20% had no change towards PBL, wilts 18% were a little more or more negative towards PBL (NDUC 2020a, p.3). A vast majority of the students reported to see a clear connection between the LOD, learning activities and assessment methods (72,4%) and that the pedagogical method applied, contributed to the achievement of the learning outcomes (66%) (figure 10-12). 69% found that the learning activities made them well prepared for the exam (figure 11) and 69% of the students' assets that they actively participated in the learning activities to a large of very large extent (figure 13).

The students were asked to compare the teaching methods and learning methods with the two previous MoMS courses. Results show that 77% felt that the ML course provided many or very good opportunities to practice problem solving skills. Its shows that the ML courses gave more problem solving opportunities compared with the course in Politics, Strategy & Military power (54%) and Scientific Method (12%), that had followed the traditional teaching methodology, mainly using classroom lectures and reading syllabus (figure 8, p.6).

DISCUSSION

This section will, based on the research questions identified on page 2, discuss the findings and results from the pilot and compare them with existing research, case studies, and other lesson learned.

Did the implementation of PBL methods secure deeper learning compared to previous years?

Other studies point at PBL and FCs in general as a method that could result in improved learner performance (Souza & Bittencourt, 2019, p.1 & Kłeczek, et.al, 2020, p.2). The main indicator of student performance in this course was the results from the exam, where each student was challenged to demonstrate in-depth knowledge about the subject by applying this knowledge to their field of practice, and at the same time demonstrating critical thinking and analytic skills.

An individual oral examination was chosen as the summative assessment method for this pilot. Each student drew one of the five "problems" they previously worked with during the course. The student answered the problem and the sensors probed the student's level of understanding, critical thinking, and analyzing skills with additional questions. This contrasted with earlier courses, which used both a written and oral exam. Because the grades from the pilot improved significantly, compared to the earlier courses, it raises the question if it is easier to get better grades in an oral exam compared to a written exam.

Huxam, et.al (2010) found that students answering a question in an oral exam performed better compared with students answering the same question in a written exam. However, research investigating such differences is scarce. In fact, studies have found that students experience a higher level of anxiety during an oral exam compared with the written one (Huxam, et.al, 2010, p.8 & Sayin, 2015, p.6). For some students, such anxiety could improve their performance, but for others, it may have a negative effect on the performance and thus resulting in lower grades.

Some research indicates that the oral exam combined with other assessment methods is ideal to measure higher levels of understanding a subject that may be hard to reach using only written exams and multiple-choice questions (Fitzgerald, 2016, p.1 & p.5). Compared with a written exam Gharibyan claims that *"An oral exam is more accurate and fair, and they give students a better chance to demonstrate their knowledge"* (Gharibyan, 2005, p.1). Madeleine Johansson claims that oral exams can be described as more authentic, than written ones, in the sense that it also measures other skills. When teachers are allowed to ask follow-up questions, it can also measure students' critical thinking abilities (Johansson, 2014, p.26). This aligns with the overall goals of the MoMS program. The external sensors used in last year's course reported that this class had shown a noticeable higher degree of knowledge, critical thinking skills, and ability to connect the subject to their field of practice, than the previous classes and thus scoring better grades (NDUC, 2020b). This is supported by Souza & Bittencourt (2019) that claim PBL "benefits students by developing skills like problem-solving and critical thinking" (Souza & Bittencourt, 2019, p.1).

Even though the overall performance was impressive, one group scored almost one grade lower than the rest of the class. There can be several reasons that may explain this. Justo, et.al. (2016) found in their study on applying PBL in an engineering course, that unequal involvement by group members was regarded as the most negative aspect during group work. In their opinion, this resulted in some members adding little value, whilst others found themselves overloaded (Justo, et.al, 2016, p.8). Oakley, et.al (2004) use the terms "Hitchhikers" and "Couch Potatoes" to describe disruptive elements in student groups. According to their study, the most common problems are having students reluctant to do their part and participate, dominating students forcing the group to do it their way, and students with divergent goals. Some want A`s, others are just happy to tag along (Oakley, et.al, 2004, p.7). For the ML course, signs of a so-called dysfunctional student group in the group with lower grades were observed by teachers and faculty. Several teachers observed lack of engagement, that they struggled to facilitate effective academic discussions, that members from the group where the one most frequently asked for SME help, and that they more often expressed frustration about the weekly problem.

Did the FC approach release more time for face to face learning activities?

For 2019 ML course classroom lectures were reduced by over 65 %, individual study time specified in the weekly schedule reduced by 33%, and the time set aside for the exam reduced by 50%. This extra time was used to add more time for the students to analyse, discuss, and answer the problem of the week in groups and to increase time for guidance from the SME (figure 2, p.3). Online resources like digital syllabus and some video lectures were made available through the LMS and the students were meant to prepare for the start of the week (every Monday) and the key lectures. This approach fits the definition of a FC, were traditional teaching concept is switched by letting the students prepare themselves before practical face to face learning activities (Tucker, 2012, p.1., Hauger, 2020, p.13., Larsen, et.al, 2019, p.3., Guo, et.al, 2019, p.3 & Wang, 2014, p.1).

Data from the LMS shows that the students had access to 133 online resources during the course. As an average, the online resources were visited by 44% of the students (figure 8, p.6). Mandatory syllabus and syllabus covering rules & regulations had the highest visitor rate, while video lectures and additional syllabus had the lowest visitor rate (NDUC, 2020c). This behaviour fits well with the findings from Winter et al (2019) study among medical students. They found that between 15-25% of the students utilized the online resources in general and with wide variations in how often they were visited (Winter, et.al, 2019, p.2-3). On the other hand, some studies found that more than 80% of the students have visited recorded classroom lectures in a blended course (Karnad, 2013, p.6).

A total of 21 classroom lectures of 40 minutes were conducted during the ML course (on Mondays) in addition to the "Monday Huddle", time used to elaborate on the problem of the week. Many of the lecturers came from institutions outside the armed forces and even though the students could ask questions during and after the lectures, all of them can be converted into video lectures in the future. In that sense, the FC principle could be extended in the coming years, with even more online resources and more time released for group activity and SME guidance. Some students expressed that they would prefer more classroom lectures to prepare them for working with the upcoming problem (NDUC, 2020b, p.18). This contrasts with the fact that a little under half of the students did not visit the video lectures available in the LMS (figure 8, p.6).

Did the implementation of FC and PBL make it more time consuming for teachers and students?

By planning to implement PBL and FCs in this pilot, the teacher (s) had to invest more time in the planning phase to restructure the learning strategies and learning methods to fit PBL and FCs. But by applying FC and PBL, more time was freed up during the implementation phase. Every Tuesday and Wednesday the student worked alone in groups and the teachers were only available through e-mail and the LMS. Every Friday was reserved for the students to prepare online for the upcoming week from home. This freed a significant amount of time for the teachers they could use to observe and guide the student groups.

Several students reported that despite being motivated and somewhat enthusiastic about PBL, they felt tired after 3-4 weeks (NDUC, 2020b, p.19). Preparing in advance, analyzing, and discussing in groups and working with the mandatory weekly requirements, felt rewarding but more and more exhausting towards the end of the course. A so-called PBL fatigue among students has been addressed in several other studies, finding that students report PBL to be demanding and that they after a while experience a "PBL fatigue" (Czabanowska, et.al, 2012, p3., Pyle, 2019 & Sayin,

2015). Looking at the students in an *Introduction to Programming course*, Souza & Bittencourt (2019) found that "vitality decreases throughout the problems, pointing to the increase of tiredness for each problem solved". This coincides with what some of the students in the ML course reported in course evaluation. One student said that: *"Problem-based learning made a positive impression, but it takes a lot of the group to keep the "steam" up for 5 weeks"* (NDUC, 2020b, p.18).

Czabanowska, et.al (2012) introduced the implementation of more active and self-directed learning methods in combination with PBL, as means to reduce student fatigue. Applying an Active and Self-Directed Learning (ASDL) model to a bachelor of European Public Health program at the Maastricht University for 3 years, lead to improved student satisfaction with PBL and reduced PBL fatigue (Czabanowska, et.al, 2012, p.12). According to Fucuzawa, et.al (2017) students from the University of Toronto using PBL felt that they did not have enough instructor guidance to properly "solve" the problem, but they did recognize that PBL groups forced them to collaborate with peers and take more responsibility for their learning (Fucuzawa, et.al, 2017, p.5). This somewhat aligns with the ML course, where some students called for more time for SME guidance, but at the same time recognized the positive impact PBL and group collaboration had on reaching the LOD (figure 12, p.6) and their performance (NDUC, 2020b, p.18).

Did the use of requirements, assessment, and tracking help to ensure better-prepared students?

The grade results from this pilot alone indicate that students were well prepared for the exam and that they reach a level of deeper learning of the subject and reached the learning outcomes to a great extent. Although PBL in its form focuses on solving relevant problems, other benefits like gaining experience, social interaction, communication, and group collaboration are often highlighted (Nurtanto, et.al, 2019, p.3), and as pointed out earlier the group collaboration on solving the weekly problem in this course is highlighted by the students as the most valued learning activity. This falls in line with findings from other studies like Lestari, et.al`s (2019, p2.) study on interprofessional tutorial groups, that found that students are satisfied with collaboration in groups because *"it provides opportunities to discuss, argue, present and hear one another's viewpoints, thus contributing to the intellectual growth".*

In that sense, you can argue that using mandatory requirements, where each group collaborated in solving problems in itself helped to get better results. In the course evaluation, students were asked about which learning activities motivated them most to participate actively in the learning process. Several students pointed at solving problems in groups as most rewarding (NDUC, 2020b, p.19). This aligns with previous studies finding group work itself to increase the student's intrinsic motivation (Fucuzawa, et.al, 2017, p.2 & Souza & Bittencourt, 2019, p.7). Quotes from the ML course evaluation underline this. One student wrote, *"Group discussions are very useful and motivating",* another pointed at problem-solving by saying: *"I found the problem to be solved in groups to be motivating"* and a third student stated that: *"It was the discussion around the week's problem in the group context I found to be most interesting and what motivated me the most for active participation"* (NDUC, 2020b, p.9).

The course was divided into two main parts, military leadership, and management. Many of the students reported an increased motivation based on the fact that the subject of leadership fit well to PBL because they had a lot of personnel experience in the field. A quotation from the course evaluation underlines this: *"The fact that I have considerable knowledge of leadership in advance of the education makes it a lot more motivating to participate, and I have now learned a lot more about the connection between theory and practice...."* (NDUC, 2020b, p.19). Opposite more students felt that PBL was less suited to the management part of the course, due to lack of personal experience working with military management. One student concluded that: *"Group work works well where students have experience and knowledge enough to know where the discussion should go and where to start looking in and / or outside the curriculum"* (NDUC, 2020b, p19.). In contradiction, one student wrote: *"Classroom instruction motivates me more than group work, especially when group dynamics are not good".* This particular student likely came from the somewhat dysfunctional group that collectively scored lower grades on the exam (as discussed on page 8).

All the weekly written assignments got assessed by an SME through guidance and feedback both in plenary and in the groups. In the end, all the submitted assignments were shared with all the student's trough the LMS. Access to all the written papers was pointed out by several students as a key element in preparing for the summative assessment. Reading 6 different perspectives on each weekly problem helped them secure a deeper understanding of the subject in general. This underlines the relevance and importance of sharing material at this level of education, also stimulating a "learning environment" rather than a "performing or competition environment".

In a FC concept, an important keystone is that students use available resources (in this case digital syllabus and video lectures) to prepare for the practical learning activities (group discussions and formative conversations with SME). Even though the students were made aware that teachers and the course director could track their use of the online learning material in the LMS, results show that the resources were visited by under half of the students. On average the students visited 44% of the online resources made available to them (figure 14), to prepare for the group discussion, answering the weekly problem and the oral exam (NDUC 2020c). This indicates that tracking student's utilization of online learning material not necessarily influences how much they use them to prepare for the upcoming learning activities.

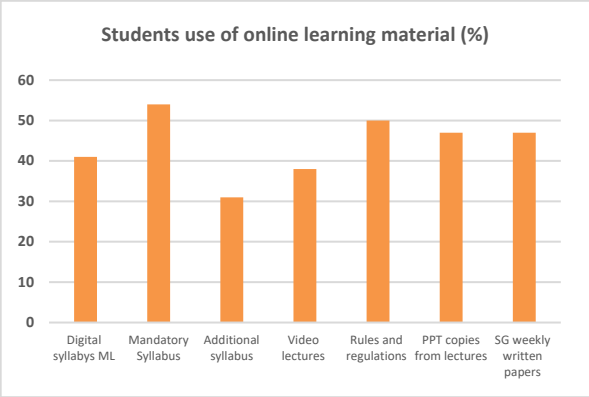

Figure 14: Use of LMS resources in the ML course

But it can also mean that the student groups found other ways of acquiring and sharing the learning material Through conversations with students, we found that some groups had divided the syllabus among them with the notions of presenting it for each other along the way.

SUMMARY

The new NDUC strategy and learning vision initiated the restructuring of the ML course during the fall of 2019. The decision was made to conduct a pilot in which PBL and FC strategies were tested out in the 6 weeks long course. To adapt to the concept of FC the number of classroom lectures normally used in this course was reduced by over 65%, and time for individual study time reduced by 33% to pave way for more time for practical learning activities (figure 2, p.3). Five problem statements were composed, based on the determined LOD, and assigned to each week (week 6 was used for the exam). The course was structured so that every Monday was used to elaborate on the upcoming problem and conduct key lectures. Every Tuesday and Wednesday the small student groups work collectively to answer the weekly problem, trough discussions, and utilizing assigned online learning material. The groups had the opportunity to get feedback and guidance in person by an SME on Thursdays before they had to submit the mandatory written assignment. Friday was set aside for the students to prepare for the upcoming week and a new problem (figure 4, p.4).

Results from the individual oral exam showed a remarkable increase in the number of A and B`s earned compared with previous years (figure 5, p5.). This suggests that using a student active method like PBL had improved the learning outcome and resulted in deeper learning for the students. Although improved grades in its self are not solid evidence of deeper learning, it is supported by the fact that external sensors found these students to be increasingly more able to elaborate about the subject and connecting this knowledge to their field of practice, whilst demonstrating very good analytic and critical thinking skills, compared with previous years (NDUC, 2020b). There are no studies found that determine that oral exams make it easier to get good grades, on the contrary, the setting of an oral exam is found to be more frightening for many students ((Huxam et al, 2010, p8 & Sayin, 2015, p6.).

Several studies have addressed how an oral exam gives students a better opportunity not only to convey their knowledge about the subject, but also to demonstrate a more in-depth knowledge by also applying critical thinking and analyzing skills (Fitzgerald, 2016, p.1& p.5., Gharibyan, 2005, p.1., and Johansson, 2014, p.26). Oral exams also allow teachers to drill deeper into student knowledge by asking follow-up questions. All these elements suggest that the remarkable good grades from the ML course give a correct measurement of the students learning outcome. One of the student groups scored almost a whole grade lower than the rest of the groups. Findings from the surveys and conversations with the teachers indicate that this group showed signs of being somewhat dysfunctional and that can be a part of the reason why they overall performed slightly worse during the exam.

Overall, the evaluation shows an increased number of students believing that PBL had a positive impact on the LOD (69%), compared with the result collected before the course (figure 2, p.3), although some students still felt PBL had a negative impact (19%). In general, 63% (figure 9, p.6) had a little more or more positive attitude towards PBL after the course. Many students (72%), saw a clear link between the LOD, learning activities, and assessment method pointing at the weekly problems derived from the LOD as the main factor (figure 10, p.6). Furthermore, 69% of the

students reported that they to some extent or a very large extent experienced more student activity (figure 13, p.6) and 66% felt that the pedagogy applied in this course contributed to them reaching the LOD, to a large or very large extent (figure 12, p.6). Finally, 69% of the students reported that the learning activities helped them prepare for the exam, to a large or very large extent (figure 11, p.6).

That the students who worked with job-related problems in an area they had a lot of experience, were highlighted by many as one of the reasons PBL worked well in the ML course. It is an important element to note, that several students pointed out that PBL was less effective when they worked with the subject of management, an area the majority of the students had no or very little prior experience. The other element students claimed worked very well was the group discussions and sharing of experiences (NDUC, 2020b, p.19).

One finding from this pilot is that many students reported that they found PBL to be rewarding but more and more tiring towards the end of the course. This is supported by findings from several other studies that have found students experience PBL fatigue towards the end of a course using PBL (Czabanowska, et.al, 2012, p.3., Pyle, 2019 & Sayin, 2015). More variation in applied learning methods, especially in course of longer duration is highlighted as one of the measures that can give some "breeding space" for the students and prevent PBL fatigue.

As FC was applied on this course, 133 digital learning resources were available through the LMS. It was somewhat surprising that overall little under half of the students visited them (NDUC, 2020c). Other studies show both similar experiences and the opposite result, where the majority of the students make use of the online material. Even though specific resources like the written assignments were highly used, it raises the questions if the students find other means of using and sharing the resources and how important these resources really are for the learning outcome? By applying FC and PBL, the course director and the teachers experienced that they had to invest more time in the planning phase, but more time was released during the course and made available for guidance and observation of the learning prosses (NDUC, 2020b).

CONCLUSION

PBL is meant to pave the way for more student activity and enable deeper learning in the process. The results found in this pilot indicate that applying FC and PBL on the 6 weeks long course in Military leadership did just that. The remarkable better results on the exam compared with previous years was more than anticipated, but the notion of students getting deeper learning was supported by reports from the external sensors from universities outside the NDUC. They reported increased in-depth knowledge and better critical thinking and problem-solving skills.

The most rewarding learning activity, according to the students, was the group collaboration and discussions. This was an essential part of the learning process. One of the groups scored almost one grade lower than the rest of the class and showed signs of having a somewhat dysfunctional learning environment.

Other indications from this pilot are that PBL should be applied with caution, especially in longer courses. Although most of the students find PBL motivating and rewarding, this method is demanding and can result in PBL fatigue, and cause a decline in performance. It also indicates that PBL works best in subjects where the students have prior experiences. Such experiences enable them to take a more active part in the problem-solving process. These findings are largely supported by other PBL studies.

WAY AHEAD

Several of the findings from this pilot is both relevant and important to further explore in higher military education. Following questions are of interest and examples of subjects well fitted for further studies at NDUC:

- What is the best way of using PBL methods in a blended learning course?
- How to prevent dysfunctional online student groups?
- How important is online learning resources for the learning outcome?

REFERENCES

Czabanowska, K., Moust, J. H., Meijer, A. W., Schröder-Bäck, P., & Roebertsen, H. (2012). *Problem-based learning revisited, introduction of active and self-directed learning to reduce fatigue among students*. Journal of University Teaching & Learning Practice, 9(1), 6.

Tucker, B. (2012). *The Flipped Classroom. Education next,* 12(1), 82-83.

Fitzgerald, C. W. (2016). *The Pros and Cons of Oral examinations in Undergraduate Education.* Master Thesis, Center for Faculty excellence, US military Academy, West Point, NY, 2016

Fukuzawa, S., Boyd, C. L., Cahn, J. (2017). *Student Motivation in Response to Problem-based Learning*. Collected Essays on learning and Teaching, 175-187. DOI: 10.22329/celt.v10i0.4748.

Guo, J., Santiago, J., Phillips, P., & Kasley, K. (2019). *Combining FC and Integrating Entrepreneurial Minded Learning in DC Circuit Analysis and Design Course.* In Annual ASEE Conference and Exposition.

Gharibyan, H. (2005). *Assessing students' knowledge: oral exams vs. written tests.* ACM SIGCSE Bulletin, 37(3), 143-147.

Hauger, J. P. (2020). DNP final report: *The FC: An evidence-based, course redesign to increase retention rates in a vocational nursing program.*

Huxham, M., Campbell, F., & Westwood, J. (2012). *Oral versus written assessments: a test of student performance and attitudes.* Assessment & Evaluation in Higher Education*, 37*, 125 - 136.

Isaksen, G. (2019a). *Implementation of a "true" Flipped Classroom concept at the Norwegian Defense University College.* Published by NTSA in the IITSEC proceeding 2019.

Isaksen, G. (2019b). *Presentation: Implementation of a "true" Flipped Classroom concept at the Norwegian Defense University College.* Presented at IITSEC 2019, Wednesday, December 4th, 2019, Orange County Convention Centre.

Johansson, M. (2014). *Högskolepedagogik och examination-universitetsläraruppdragets Janusansikte?*

Karnad, A. (2013). *Student use of recorded lectures: a report reviewing recent research into the use of lecture capture technology in higher education, and its impact on teaching methods and attendance.*

Kłeczek, R., Hajdas, M., & Wrona, S. (2020). *Wicked problems and project-based learning: Value-in-use approach.* The International Journal of Management Education, 18(1), 100324.

Kristensen, F., Troeng, O., Safavi, M., & Narayanan, P. (2015). *Competition in higher education – good or bad?*

Larsson, A. K., Gullberg, S., & Lundevall, J. (2019). *Blended learning, Active Learning Classroom, and information literacy in higher military education.* Læring om læring, 3(1).

Lestari, E., Stalmeijer, R. E., Widyandana, D., & Scherpbier, A. (2019). *Does PBL deliver constructive collaboration for students in interprofessional tutorial groups?* BMC medical education, 19(1), 360.

McLeod, S. (2019). *Likert Scale Definition, Examples and Analysis.* Retrieved from www.simplypsychology.org, June 1st, 2020.

NDUC. (2019a). *Education at Norwegian Defense University College, curricula, and course descriptions*. Retrieved from https://utdanning.forsvaret.no/nb/studieplaner/2018/Master%20i%20milit%C3%A6re%20studier in February 2019.

NDUC. (2019b). *NDUC educational strategy 2019-2022*. Approved April 27th, 2019.

Norwegian Department of Education (2011). *Nasjonalt kvalifikasjonsrammeverk for livslang læring* (NKR). Published by the Department of Education on December 15th, 2011.

Norwegian Ministry of Defense. (2016). *Military Combat and sustainability*. *IVB 2017-2018.* Retrieved February 28th, 2017, from https://www.regjeringen.no/globalassets/departementene/fd/dokumenter.

NDUC. (2020a). *Military Leadership course, Learning methodology survey*, 2019.

NDUC. (2020b). *ML course evaluation survey*.

NDUC. (2020c). *ML course LMS report*. Retrieved from the LMS Itslearning in January 2020.

Nurtanto, M., Sofyan, H., Fawaid, M., & Rabiman, R. (2019). *Problem-Based Learning (PBL) in Industry 4.0: Improving learning quality through character-based literacy learning and life career skill* (LL-LCS). Universal Journal of Educational Research, 7(11), 2487-2494.

Oakely, B., Felder, R. M., Brent, R., Eljajj, I. (2004). *Turning Student Groups into Effective Teams*. Published by New Forums Press, Inc, 2004.

Pyle, E., & Hung, W. (2019). *The role of subject presence type on student motivation in a PBL learning environment.* Advances in Health Sciences Education, 24(4), 643-663.

Sayin, B. A. (2015). *Exploring anxiety in speaking exams and how it affects students' performance.* International Journal of Education and Social Science, 2(12), 112-118.

Souza, S. M., & Bittencourt, R. A. (2019, October). *Motivation and Engagement with PBL in an Introductory Programming Course.* In 2019 IEEE Frontiers in Education Conference (FIE) (pp. 1-9). IEEE.

Wang, Z. (2014, August). *Research on teaching design and application of Flipped Classroom model.* In 2014 2nd International Conference on Education Technology and Information System (ICETIS 2014). Atlantis Press.

Wynter, L., Burgess, A., Kalman, E., Heron, J. E., & Bleasel, J. (2019). *Medical students: what educational resources are they using?* BMC medical education, 19(1), 36.