

Peer Teaching in Basic Studies of Military Technology

Lieutenant Lauri Mattila & PhD Antti Rissanen

National Defence University, Finland, Correspondence: antti.rissanen@mil.fi

Abstract: Finnish National Defence University (FNDU) offers accredited university level education for officer's profession. Introductory courses in mathematics and physics are included in cadets' curriculum. In academic disciplines student's own work is considered to be one of the key issues for sustainable learning. Guided exercises are known to help even self-aligned students to practice these disciplines. In most cases these activities are guided by senior students. As a major difference here is the fact that our exercise assistants support their mates at the same time as they themselves are active students in the very same course.

Because this type of approach is not common in peer teaching we investigate its nature. In the research participative observations and action research methodology are used as a theoretical frame. Even though the specific arrangement here has achieved much praise from the students from coffee table discussions up to the students' responses on the course enquiry, this study is the first scientific investigation on our practice. Most of the presented data and main part of the observations are from two cadet courses.

Successful peer learning needs suitable environment and attitude among peers. Officer's role as military time manager and as a troop training coach includes both pedagogical and internal team spirit appraisal skills. Another requirement for teaching is that the teacher knows the subject better than it is aimed to be taught. The mathematical knowledge level differs significantly among our students. Therefore properly selected, peers skillful for STEM subjects may have something to give for the relatively modestly set course goals. Even though the knowledge part of the peers was in order, the study showed that teaching assignments needed support and a refined orientation. Findings are compared to generic practices for STEM education in Finland.

INTRODUCTION

The Finnish National Defence University (FNDU) educates officers for the Finnish Defence Forces (FDF) and the Border Guard. The starting level is the Bachelor's degree in military science. In the basic studies of military technology students learn science and general engineering concepts and methods to become familiar with their applications in military technology. As an integral part of mathematical skills students need to internalize how to define given problem, find a method, solve, and finally evaluate the gained result. This is a universal and pragmatic skill which students need when studying new topics.

Lecturing sessions are aimed for explaining each phenomenon, methods, tools, examples, and even showing connections to applications with military meaning. Personal learning means own approach to the subject and related practices. In science and mathematics home work is the way to practice and test student's own learning. Also doing thing together may help the way to pass obstacles in learning (e.g. Falchikov, 2001). However, individual assistance is not feasible from other student groups in our campus and more over the staff of the military technology department cannot control simultaneously held small-group activities. It is obvious that some support is needed for those who have less experience or skills in these disciplines. On the other hand another group of cadets has such experience that with minor effort they may pass the course with good grades. As a solution for better learning outcome the idea of mixing and pairing these two groups sounds good.

Through out of our university's the history cadets have made unofficial and unorganized activities to support fellow cadets. Also some of the teachers has held extra evening meeting for students on their own time. When we started courses based on the Bologna process, we asked every year around 10 skillful and willing cadets to be peer teachers for their fellows. The selection is based on cadet's success in the preliminary exam. The primary job for our peer teachers is to lead active learning in small groups. In these mandatory calculation exercises cadets rehearse subjects that are taught to the

whole course in week's lectures. Moreover if and when cadets feel that they need further help, then peer teachers have organized voluntary exercises on free time. Before curriculum reform in 2015 peer teaching has been essential part of three course sets. The first course concentrates on mathematics, the second one is an introductory physics and the third one deals selected topics in physics.

In practice peer teachers are just like any undergraduate teaching assistants used in most universities. But the main difference here is that peer teachers study and teach on the same course on which the tutored cadets are merely studying. Summing: peer teachers have not participated on the courses they teach and most of them do not have any experience as STEM teacher. All of this sets certain pre-requirements.

RESEARCH METHODS

Action research links earlier observations to gathered and analyzed data. Information of the educational environment as well applied methodology plan are needed to make any changes in future courses. With continuous tracking and careful analysis we have evaluated the contribution of the peer teaching to some of the aspect how modern non major in science would learn STEM subjects. Typically action research is applied as a continuous process. Observations can often enhance analysis work, but alone without other data they tend to be personal opinions. In this study only two repetitive cycles are observed.

The exercises and personal guidance were observed in the first part of the study. Observations were analyzed with literature to form research questions. It is often very difficult to estimate how much each of the planned contributions finally affect to the gained skills and success in the final examinations. At this study this part is left out to be studied later with wider data set. Therefore this study aims to understand how our specific peer tutoring works. We shortly describe how tutors are selected with the diagnostic test. Secondly students' attitude on peer tutoring is studied. Furthermore those who worked as tutors were asked to clarify their motivation and attitudes linked to the tutoring role. The peer teacher survey studies tutors readiness and attitudes in 99th and 100th cadet courses in years 2013 and 2014. A specific professional query tool Webropool has been used for this part of study.

The data set in the diagnostic test consists of 8 cadet courses and therefore includes data from over 1500 participants. This exam, diagnostic test consists of 21 items. Answers are evaluated according to the following schema: answer is right means 1 point per statement or task set and null if not fully correct.

RESULTS

In Mattila's BA (in Military) study 77.9 % of cadets were satisfied or very satisfied to have peer teaching (*Likert scale 1-5*). Furthermore many answerers claimed that: "*it was mainly peer teacher's contribution that helped me through the course*". The generally positive feedback stems from three main entities:

- Teaching is more personal in exercise groups consisting of some 20 people vs. 160 cadets in the lecturing hall.
- Personal learning is the major activity in exercises.
- The atmosphere is open and asking is made easy.

The last mark is a result from having a peer with pedagogic skills in front of the class. Also it is straightforward to ask for guidance from a friend who lives on the same corridor. In practice peer teachers have a fairly good knowledge of their peers' skill level, so there is a chance for some adjustment in the difficulty level of the day's assignment.

Leader background, starting level and team spirit

According to cadets recruiting process profile we find our first result which further more seems to come also from open end questions in the query. A prebuild success factor for our peer teaching lies in the selection of cadets and the composition of cadet courses. Some of the requirements in the NDU's entrance examination secure that every cadet has received leadership training as a conscript. During leadership training periods pedagogical skills are furtherly improved and gained experience makes it easier to teach peers and to share them peer teacher's knowledge – which in mathematics is much better than vast majority's in the learning group has.

Also team spirit within each cadet course is a big asset in teaching peers – it gives a strong motivation for peer teachers in addition to formal monetary benefits. Knowledge and skills help tutors in teaching but without will to help classmates the results wouldn't be as high as they have been. As a summary from NDU's evaluation system data and our observations we can conclude that peer teachers have received much positive feedback from their peers.

Diagnostic test

Most of our cadets are not mathematically orientated. Results drawn from the diagnostic proves this observation. Differences between median and 1st and 9th decile are 2.1-times on average in favor of the 9th decile. A wider data set from over 1500 students is shown in figure 1. Peer teachers are selected from the 9th decile. These differences in skill levels make it possible for peer teachers to lead calculation exercises and to offer personal guidance for the weakest.

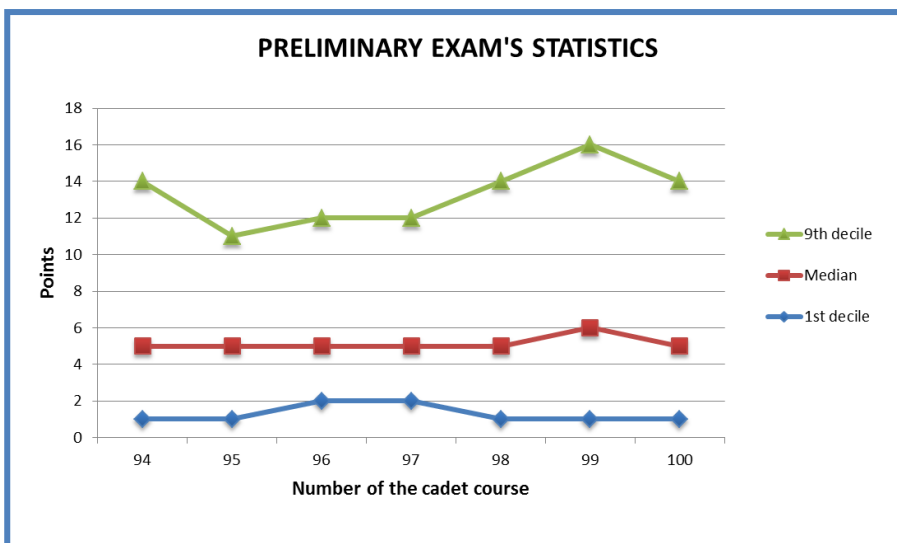


Figure 1. Summary of the diagnostic assessments in 7 courses including over 1500 participants.

DISCUSSION

Some conditions for peer teaching are unique compared to other Finnish universities:

- In NDU all cadets have a chance to live at the campus and the hall of residence is pointed for – this makes it much easier to have voluntary exercises on students' free time.
- Every cadet has some pedagogical skills and will utilize them later in his profession.
- Team spirit and will to help others is strong within the cadet course.

Mainly these elements have made peer teaching not just possible, but a system of undisputable satisfaction within all cadet courses observed in this study. But the future of peer teaching isn't certain. The main questions for the future of peer teaching are: to what extent peer teaching can be used in the studies of military technology and is too much responsibility or burden given to individual peer teachers? In other words, peer teachers might be strained too much or they might have difficulties in their own studies. These facts must have an impact in teaching. When a whisper goes around that the role of a peer teacher has too many downsides, the recruitment of future peer teachers would not work out on voluntary basis. Without true volunteers it is hard to believe that peer teaching would work as fluently as observed.

Limitation and Acknowledgement

This report focuses only on selected facts from Mattila's BA study e.g. the surveys in two cadet courses, and observations clarifying gathered data. We thank Dr. Niklas Meinander for access to the unpublished raw data describing the diagnostic test. Hence, for the future, it is recommended that future research be carried out on the alignment of learning outcome. Also the data from 101st cadet course will make more value for the presented observations concerning the peer teacher's attitudes.

REFERENCES

Falchikov, N. (2001). *Learning Together: Peer tutoring in higher education*, Routledge. London

Mattila, L. (2015). *Vertaisopetus kadettien ensimmäisen lukuvuoden matematiikan ja fysiikan opetuksen tukena*. Bachelor's thesis. Helsinki, 2015. National Defence University, Finland