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## Using Peer-Assisted Learning in Mathematics and Physics in Higher Education in Sweden and Russia

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### Background

This paper evaluates and compares the students' and academics' experience of peer tutoring system in mathematics and physics for engineers in higher education. The higher education sector has been experiencing a dramatic change during the past decade: it is rapidly expanding both in the number and diversity of students. Student to staff ratio has enormously increased. The students are coming from different ethnic, social, and cultural backgrounds and have different levels of knowledge. The change in higher education from an "elite" to a "mass" system creates new challenges for educators. At the same time, the main features of the modern knowledge-based society, the society we live in, are the fast pace of technological advancements, interdisciplinary work organisation and globalisation of the work market. Educators in Europe are facing new challenges in preparing young people for their social and professional integration, successful career and personal development.

The appropriate choice of teaching methods which meet the demands of the knowledge-based society, influence the learning process and accommodate the needs of young generation is crucial in achieving these tasks. Implementing student-centred approaches in the educational process creates the learning environment which stimulates students' learning and develops their ability of independent and deep learning[1].

### Research Questions

This study is an on-going collaboration between University West, Sweden, Lancaster University, UK and School No. 99, Moscow Russia [2-4]. Our study was carried out in 2008-2009 in Sweden and Russia. The Russian educational environment can be characterised as traditional classroom environment with a teacher centred educational process. In the case of Sweden, a range of student-centred teaching and learning methods has already been introduced.

The research carried out had the following objectives:

- To explore opportunities for implementing PAL in traditional classroom and in university settings to enhance students' performance.
- To evaluate and compare the quality of students' experience of using PAL in both settings and at different levels (AS, A levels) in the case of Russian students.
- To analyse the challenges teachers face in implementing innovative approaches to teaching and learning in two different settings.

### Methods

54 AS and A-level students studying Physics at the School No. 99 (which specialises in mathematics and physics education, in association with Moscow State Institute of Radio-Engineering, Electronics and Automation), Moscow, Russia took part in this research. The physics curriculum in this school corresponds to the first year curriculum in the UK and Swedish universities. 96 first year students on the 'Land Surveyors' and 'Mechanical Engineering' undergraduate programmes from the University West (Sweden) also participated in this study. PAL sessions have been incorporated into the Physics subject and 'Mathematics' module delivery. The lectures were delivered in a traditional way; several PAL sessions were introduced during tutorials. AS-level students were grouped according to their

performance. A-level students formed the groups according to their choice. The university students were randomly divided into groups. A peer tutor from the same student cohort was assigned to each group and trained. Peer tutors were selected from the more advanced students.

The questionnaire was designed to evaluate the students' learning experience. In addition, group interviews and the interviews with group leaders and both lecturers were carried out.

## **Frame**

This study is underpinned by the socio-cultural theory of the learning processes which was originally formulated by Vygotsky and is based on the idea that knowledge is socially and culturally constructed [5-7]. On the other hand, the research has also demonstrated that the teaching practices that teachers adopt affect students' learning process. Our study adopted teaching methods based on the learning-focused conception. PAL is an example of a student-to student support scheme grounded in collaborative learning. PAL is aimed to improve student performance and to develop a range of study skills through creating an informal environment for learning. This method has been applied across a range of disciplines and is becoming an important part in programmes' delivery.

## **Research findings**

Our findings showed that all AS and A-level students and the majority of the students at University Vast evaluated PAL method as useful and valuable. The students highly rated collaboration with peers and commented that it was easier to ask questions, get support and explanation although the AS students did not feel confident at the beginning. Both groups of students felt that PAL stimulated their activity, that they were more in control of their learning and found it more enjoyable. The Russian students felt more relaxed and were not afraid of getting a low mark as they normally would be in a traditional classroom. Our study showed that the number of students enrolled on the course, the choice of peer tutors and timing of the sessions are crucial for the successful implementation of PAL. During the interviews both lecturers stressed that they could use their time more efficiently. This activity gave an opportunity to a Russian tutor to prepare the additional material. The Russian students were so taken by this experience that they recommended the other tutors to introduce this method.

The paper concludes with the suggestions for further development in using PAL in a variety of settings.

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