This presentation assesses the impact of PAL methods applied in teaching Mathematics and Physics in Sweden and Russia.

It evaluates and compares the quality of students' experience of PAL in traditional classroom and university settings;

It analyses the challenges teachers face in implementing innovative approaches to teaching and learning in two different settings.
Background

- This study is part of an on-going collaboration between Lancaster University UK, University West and Gothenburg University, Sweden on using non-traditional teaching methods such as Problem-based, Project-based and Peer-assisted learning in HE in maths-based disciplines.

PAL

- PAL can be incorporated into the learning process in a variety of ways:
  - An alternative teaching method
  - A strategy to rectify specific problems
  - Part of planning a new curriculum etc.

- A range of PAL strategies (e.g.):
  - To achieve particular learning outcomes;
  - To enhance students’ experience through group work and collaboration with peers.
PAL

- Group formation:
  - Randomly selected groups;
  - Purposely selected groups;
  - Self-selected groups.

- Peer tutors
  - Academic performance, BUT
  - With “enthusiasm and reliability”;
  - Avoid self-absorbed individuals.

Objectives of the study

- The introduction of PAL methods was focused on developing problem-solving, analytical skills and developing the ability to formulate a problem mathematically;
  - To evaluate the quality of students' experience;
  - To analyse the challenges teachers face in implementing innovative approaches to teaching and learning.
Methodology: Sweden

- University West – pilot project
  Land Surveying Programme, 9 weeks;
  2008 – 42 1st year students;
  2009 – 48 1st year students.

  Lectures – 4 h/week – traditional format;
  PAL – 4 h/week – 3 sessions.

- Random group allocation
  A peer tutor from each student cohort was assigned to each group and trained. Tutors had studied Mathematics at a higher level in High School. We have A, B, C and D-levels; tutors have studied at D-level. Entry requirement – C-level.

Methodology: Russia

- Russia: School #99, Moscow; (specialises in mathematics and physics education, in association with the Moscow State Institute of Radio-Engineering, Electronics and Automation)

  - 2008 – 31 A-level students; 8 weeks, 2 h/week
  - 2009 - 2 groups:
    AS-level – 24 students
    A-level – 30 students.
  
  PAL sessions took place throughout the year.
  Lectures were delivered in a traditional way.

  A physics lecturer with over 30 years of teaching experience, used to traditional methods of teaching.
### Methodology: Russia

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<th>AS Level</th>
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| - Students’ decision how to form groups  
- Tutor thought it would be more motivating and would account for their social needs. | - The students were divided into groups according to their level of knowledge by the teacher.  
- However, their social needs were taken into account. |

A peer tutor from each student cohort was assigned to each group and trained. Peer tutors were selected from the more advanced students.

### Methodology

- The group leaders in both Sweden and Russia decided themselves which teaching method they were going to use.

- They were encouraged to try different ideas and try to draw on their teaching experience by analysing and evaluating the outcome.
To evaluate students’ experience we used a questionnaire.

For example, we asked the students:

- **Has the PAL method:**
  - met your learning needs?
  - motivated deeper learning?
  - made you feel more engaged in the learning process than traditional teaching methods?
  - made you feel more confident about the subject?
  - created a more relaxed and friendly learning environment?

- **Was your group leader**
  - Well prepared?
  - Competent?
  - Enthusiastic?
  - Able of giving clear instructions?
  - Able of explaining well?
  - Confident as a leader?
Results

- The PAL sessions provided an open and positive atmosphere. The students felt that they were more relaxed during the PAL sessions compared to ordinary sessions.
- Both Swedish and Russian students highly rated collaboration with peers.
- Both groups felt that PAL encouraged team work and developed their team working skills. (Russian students appreciated this experience higher).
- Both groups felt that they raised their confidence in the subject.

PAL implementation

- The Swedish group pointed out that the use of PAL in revision sessions before exams was stressful as they wanted to ask the lecturer the question rather than their peer tutor. However, the Russian group appreciated PAL as a method for their final exam preparation and thought it was one of the most efficient methods.
- In group discussions - the Swedish students pointed out that the assistance from the second or third year students would be more appropriate as they regarded the Maths subject as rather difficult.
**PAL implementation: Russia**

For the Russian students it was easier to ask questions, get support and explanation from a peer tutor.

The Russian students stopped feeling uneasy and scared → **motivation → interest → deep conceptual understanding.**

Comparing the two groups:

- **AS-Level students**
  - were less relaxed,
  - were used to the leading role of a teacher and
  - at the beginning were not in favour of this activity.
  - the change of a leader in 2 groups changed the outcome.

- **A-Level students**
  - highly evaluated the methodology;
  - recommended the same activity to the other two subjects teachers;
  - → deep conceptual understanding.

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**Results: Lecturers and student group leaders**

- Both lecturers positively evaluated the PAL experience. They felt that the method resulted in students' active involvement in the educational process.

- Some of the Swedish PAL group leaders realised the limitations to their own knowledge, which motivated them to get a better understanding of the subject.

- PAL group leaders felt that they raised their confidence when they were explaining to peers → enhance conceptual understanding.
Conclusions

- The use of PAL was rewarding for, and well received by both student groups;
- PAL provides an opportunity to accommodate a diverse range of learning styles for students;
- There is no need to focus on the stereotypical ‘average’ learner, which can be an obstacle in teaching mathematics;
- Both course leaders had rearranged their time and used it to prepare supplementary course material;

Our study gives indications were some difficulties in implementing PAL can be anticipated and it gives some ideas how to avoid them.

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.

- We recommend using of PAL in higher education when a lecturer has a large number of students with different ability levels, oversized groups and/or courses which include a collaborative element in programme delivery.
  - PAL – larger groups (>30 students)
Conclusions

- Maths – PAL works more efficiently if 2nd or 3rd year students can be involved

- Group allocation and group leaders
  - Our studies also showed that the choice of a group leader can influence the students’ engagement with the learning process.

  - We suggest choosing leaders who are willing and prepared to share their knowledge and engage with their peers in the learning process.