OUTSTANDING TEACHING, LEARNING AND ASSESSMENT

TECHNICAL SKILLS NATIONAL PROGRAMME

Output 20: Think Piece 4 - Problem-Based Learning and Functional Skills Maths Learning
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Think Piece 4

Is problem-based learning an effective pedagogy for learning maths? The Problem with Problem-Based Learning in Functional Skills Mathematics

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Students arrive on a Functional Skills Mathematics course in Further Education have failed GCSE Maths (at least once) or having completed a Functional Skills Mathematics course at a lower level. Typically, after 11 or more years of mathematics learning, they have achieved a Grade 2 GCSE at best. Often mathematics learning has been an unpleasant experience leading to low confidence, low motivation and a disengagement with mathematics teaching. Nardi and Steward (2003) contend that students find mathematics as "tedious, isolated, rote-learning, elitist and de-personalised" and suggest that "these perceptions were attributed to the concentration on 'teaching to the test' and not enough emphasis on engaging and inspiring students" (p345). The teaching-centred diet of Mathematics has not worked for many students arriving in Colleges.

The DfE (2017) state that "a key aim for Functional Skills Mathematics specifications is that they enable the student to gain confidence, fluency in, and a positive attitude towards, mathematics" 9p30. To achieve this aim, and to change perceptions of failing mathematics students, it would be folly to continue to teaching mathematics in a similar manner to that experienced at school.

Problem-based learning provides an opportunity to engage students in tasks that are not overtly "maths related", involving them in solving real-world problems that require maths competencies to solve. Learning is an active process; a variety of activities that challenge students and give them an opportunity to grow. Problem-based learning applies the OECD's 7 principles of learning (2017). It puts *students at the centre of learning*, encouraging their active engagement and exploration. It promotes the *social nature of learning* actively encouraging well-organised co-operative learning. Developing a 'solution' to a problem can develop *positive beliefs in students*. Problem-based learning is sensitive to *individual differences*. Because students lead their learning, teachers can intervene to progress and challenge individual students; they can be flexible and adaptable to meet individual differences. Problem-based learning provides a pedagogical approach to *challenging students to reach above their existing level* and to enable high-achieving students to help lower-achieving students. As groups of students work through a problem, opportunities occur for *formative assessment* to support learning. Problem-based learning has the potential to support students to see the connections between their formal Mathematics learning and the wider environment and society. Employer engagement in the creation of tasks is a strategy for putting maths into a real-life context, such as employer written scenarios based on a specific work-based problem or employer data and information used by teachers to create tasks to use in the classroom. Such an approach encourages "*horizontal connectedness*" and fosters deeper understanding, as well as dismantling preconceptions that Mathematics isn't 'relevant'.

Problem-based learning can elicit students' discovery and construction of knowledge in mathematics and brings with it a whole host of secondary aims such as teamwork, communication and learning to be accountable for own and group's learning. These skills have been shown to be desired by employers (CBI/Pearson, 2016). Students start talking about mathematics, and become interested not only in the correct answer, but also in ways of solving the problem. They ask many more

questions. It provides an opportunity to engage students in tasks that are often seen as not being 'maths' which develops their confidence, problem-solving and critical thinking-skills which can then be transferred into their maths learning to provide greater success.

However, it is evident that in the current landscape, where students are assessed through a standardised assessment, teachers find it threatening to change their teaching methods. "The question remains whether, in the current state of affairs with the loaded curriculum and the limited number of teaching hours, it is possible to devote part of the time to experiential activities" (Davidovitch et al, 2014, p145). Teachers are at the cornerstone of enabling problem-based learning in mathematics. Some teachers find PBL a challenge as it requires a step back from didactic teaching to an intervention approach, guiding students to a goal rather than leading from the front. Problem-based learning requires teachers to engage with employers, increasing workload and pressures.

Standardised assessment by examination and the risk to teachers and organisations of poor "exam results" impacts on willingness of teachers and organisations to take risks. The nature of formative assessment in maths education means that schemes of work are often tailored to meet and fulfil the needs of an exam specification, aiming to include enough 'content teaching' to provide students with the best chance of success in their examination. Progress is measured at points during the course through replicate "exam" assessments. Problem-based learning doesn't allow for a linear approach to monitoring progress as success is often shown at the 'last-minute' when the task is completed. In the current climate, a pure PBL approach cannot work. If it doesn't work, the impact on a student is tremendous and the impact on the organisation is equally negative.

So, is problem-based learning an effective pedagogy for engaging, developing and progressing low achievers in their Functional Skills Maths course? The evidence indicates it can be, but not on its own. Problem-based learning must form part of a combined teaching strategy. The approach that we recommend at the present time of high-stakes standardised assessment is to use problem-based learning in sessions in conjunction with traditional taught lessons. The skills used in problem-based learning are the same problem-solving skills that are so vital in today's mathematical teaching and learning. The benefits to the wider skill development through problem-based learning are obvious: students with greater communication, teamwork, confidence and wider life-skills. However, in order for deep and meaningful change to occur in teachers and teaching strategies, it must be valued and reinforced by policy-makers.

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