

Measuring the Effects of Problem-Based Learning (PBL)

Progress in the development of a scale to rate the acquisition of professional knowledge through PBL

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Outline of Presentation

The research project „PBL“ at TU Dortmund attempts to measure the efficacy of Problem-Based Learning (PBL) in Germany, Sweden and the Netherlands and is funded by the German Ministry of Education and Science (2009-2012). In order to provide recommendations for the implementation of PBL at German Universities, we are currently developing a scale to measure the effects of problem-based learning. The following presentation will lead you through the process of our conceptual work since April 1st of this year.

The research objectives of the project “PBL” are aimed at describing problem-based learning scenarios and practices across different European countries. One objective is to explore the effect of teachers’ attitudes towards teaching on the outcomes of problem based vs. ‘conventional’ teaching. We consider this attitude towards teaching as one crucial factor in the success of problem based courses. In order to measure these effects, our project focuses on the comparison of students in different problem-based vs. ‘conventional’ courses. Participants in our cross-national study will be students and teachers in Sweden, the Netherlands and in Germany. The field of research will be courses in the field of Psychology.

When dealing with what effects PBL really has – and if there is any advantage of PBL in comparison to ‘conventional’ teaching – the empirical evidences are, as mentioned before, somewhat ambiguous. On the one hand, several studies show advantages of PBL in comparison to conventional teaching, especially on soft dimensions as self-rated development of social and key competencies (Jones et al., 2002). On the other hand, there is no evidence in favor of PBL on measures of students’ knowledge and performance (see Mamede et al., 2006). Only a few studies show slight advantages on dimensions as solution of problems related to future professional fields and on prospective professional success (Colliander, 2002). This is especially the case in the field of medicine, where the major part of research on the effects of PBL was conducted since the 1980s.

One possible explanation for those divergent evidences is the inconsistency between aims and means of the teaching method and the conceptualization of measures in the following tests. In our opinion, poor alignment between teaching and testing may show results like the somewhat worse

performance of PBL-students in declarative paper-and-pencil test that only focuses on the reproduction of knowledge. In line with this argument one can easily explain why PBL-students perform better on problem-oriented and/or formative evaluation/testing formats like case-studies, portfolios and other forms of tests that are oriented toward solution of professional everyday problems.

When presenting the outline of this project on last year's ECER at Gothenburg University, the question of how to test knowledge-oriented effects of PBL was discussed controversially. Especially the issue of fairness in cross-sectional testing between problem-oriented and 'conventional' courses was a crucial point. We faced the challenge and tried to find possible instruments that take into account the special structure of knowledge acquired through PBL. Resulting questions were how this structure can be conceptualized, and how it can be measured in a way that is well aligned way to the aims and means of PBL.

If this presentation were a course that was taught in a problem-based way we would now invite you to brainstorm about this problem. Then we would send you in your study groups and let you figure out possible solutions, collect the ideas, formulate learning goals for your group, go into individual or collective study, meet again, discuss and present the solutions you found here in the plenum. Our role would be that of tutors, assisting you in finding your way through this. Since the time slot for our presentation is much too narrow for this, we decided to somewhat shorten the process by only presenting you our solutions, thus switching in the role of students going our way to further professional development.

As research hypothesis we assume, that the structure of knowledge acquired through PBL is qualitatively different to the structure of knowledge though traditional teaching. As constructivist theories of learning state, the active and situated learning situation in problem-based settings is likely to create more complex and interconnected knowledge, which is not shown in the ability to rapidly reproduce big amounts of declarative facts, but in the competence to understand fundamental principles and underlying concepts. One possibility to conceptualize this assumption is the idea of the deep vs. surface approach of learning, which, according to Marton & Säljö (1976a, 1997), leads to knowledge about how to understand and apply concepts and use declarative facts as illustrations for this. This bridges the gap to the discourse of professional knowledge acquisition, in so far as the ability to understand the conceptual background and the fundamental principles of a scientific theory is considered as professional competence of further academics (see also Laurillard, 1997).

When it comes to the question of measurement, however, research gets rather complicated. How do you operationalize holistic knowledge in a reliable way? The first possible solution that we found is to use true/false or multiple choice knowledge-items that are connected as closely as possible on professional rather than only declarative/curricular questions, as they are used in the Progress Test used at Maastricht University. These items are constructed not to test declarative/curricular aspects of knowledge acquisition but rather include a professional twist by asking: "What does a future doctor, lawyer, psychologist and so forth should know in his/her professional role?" Therefore, they are generated out of everyday and popular questions, like the statement *Women are at higher risks for depression* from clinical psychology which is to be answered by marking *true* or *false* in the test. The measures taken here are, however, quantitative in nature, so they mainly test for the amount of knowledge acquired; additionally they give the opportunity to create a profile of a single student's performance in relation to the performance of a whole cohort. Since they do, to say the least, meas-

ure rather declarative and somehow reproductive aspects of knowledge they are rather poorly aligned to the aims and means of PBL.

A second possibility, which was used by the so-called Gothenburg-Group (for example Dahlgren, 1975; Marton 1975b), seem to be text-reading experiments. In this problem-based task students are given a scientific or popular-scientific piece of text that provides declarative information as well as insights in underlying principles. By open questions such as “What do you remember from the text?” or “Please describe what was said there?” students are tested for their ability to analyze the text and understand its principles. Probably the shortest and most famous item that is in line with this method is the question that Dahlgren (1978) presented to students of economics: “Why does a bun cost one dollar?” As Dahlgren reports, there was an astonishingly poor performance event with students in senior years; most of the students gave declarative explanations relating to an equivalent between costs of producing and selling goods. For our project we tend to state that text-based experiments provide the possibility to measure qualitatively different levels of understanding. Also, it needs to be considered how well “texts as metaphors for courses” (Marton & Säljö, 1997, p. 48) reflect today’s idea of teaching and learning.

We consider both possibilities presented as valid measures for knowledge acquirement through PBL. To enhance our decision process we are looking forward to a vivid and controversial discussion on this topic. Crucial questions for the audience are focused at possible implications of our conceptualization of knowledge for the assessment and on possible combinations of the advantages of the two approaches to measure the acquisition of knowledge through PBL.

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