



Problem-Based Learning: An Overview of its Process and Impact on Learning

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Abstract

In this review, we provide an overview of the process of problem-based learning (PBL) and the studies examining the effectiveness of PBL. We also discuss a number of naturalistic and empirical studies that have examined the process of PBL and how its various components impact students' learning. We conclude that the studies comparing the relative effectiveness of PBL are generally consistent in demonstrating its superior efficacy for longer-term knowledge retention and in the application of knowledge. Studies on the process of PBL, however, are still inconclusive as to which component(s) of PBL most significantly impact students' learning, although causal studies have demonstrated that all the phases of PBL are necessary in influencing students' learning outcomes.

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Keywords: Problem-based learning; Learning processes; Small-group collaboration; Self-directed study; Effectiveness of learning

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1. Introduction

Problem-based learning (PBL) has been widely adopted in diverse fields and educational contexts to promote critical thinking and problem-solving in authentic learning situations. Its close affiliation with workplace

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collaboration and interdisciplinary learning contributed to its spread beyond the traditional realm of clinical education¹ to applied disciplines such as health sciences, business studies and engineering. With this growing practice and popularity of PBL in various educational and organisational settings,²⁻⁴ there has been an increasing number of studies examining its effectiveness on the quality of student learning and the extent to which its promise of developing self-directed learning habits, problem-solving skills and deep disciplinary knowledge⁵⁻⁷ achieves its intended result. Much of the earlier studies on PBL have examined the effects of this approach within the curriculum,^{8,9} with more recent studies delving deeper to examine how the processes within PBL lead to positive learning outcomes. This paper reviews a number of studies on the effectiveness and impact of PBL and how students learn in the process.

2. Overview of PBL

In brief, PBL is a pedagogical approach that enables students to learn while engaging actively with meaningful problems. Students are given the opportunities to problem-solve in a collaborative setting, create mental models for learning, and form self-directed learning habits through practice and reflection.^{8,10,11} Hence, the underpinning philosophy of PBL is that learning can be considered a “constructive, self-directed, collaborative and contextual” activity.^{12 (p39)} The principle of constructivism positions students as active knowledge seekers and co-creators who organise new relevant experiences into personal mental representations or schemata with the help of prior knowledge.^{13,14} This is further reinforced by social theories of learning that postulate the merits of social interaction in cognitive development.¹⁵

In a typical PBL setting, learning is triggered by a problem which needs resolution. Dewey explains the cognitive element of learner engagement by describing how the origin of thinking is some “perplexity, confusion, or doubt” that is triggered by “something specific which occasions and evokes it.”^{16 (p12)} Students make connections to this “perplexity, confusion, or doubt” by activating their individual and collective prior knowledge¹⁷ and finding resources to make sense of the phenomenon; they also engage in peer learning through small-group discussions¹⁸ and consolidate their learning through reflective writing.¹⁹ Beyond enabling students to make sense of the concepts and subject matter, this learning experience is also likely to help students “develop understandings of themselves and

their contexts, and the ways and situations in which they learn effectively.”^{20 (p9)}

PBL as a pedagogical strategy appeals to many educators because it offers an instructional framework that supports active and group learning—premised on the belief that effective learning takes place when students both construct *and* co-construct ideas through social interactions and self-directed learning.^{21,22} Its implementation can vary across institutions and programmes, but in general, it can be viewed as an iterative process made up of first, a problem analysis phase, a period of self-directed learning and lastly, a reporting phase.^{8,23,24} A tutor—also known as a facilitator—acts as a guide to scaffold students’ learning, particularly in the problem analysis and reporting components of the PBL tutorial, as well as facilitate students’ inquiry paths as they make sense of their ideas through discussion and sharing.

3. Studies on the effectiveness of PBL

Proponents of PBL claim that it helps improve the quality of learning by developing students’ reflective, critical and collaborative skills. Studies on the effectiveness of PBL appear to be mixed, but have generally shown that students who have experienced PBL achieve similar or less learning gains when it comes to short-term knowledge acquisition when compared to students in a lecture-based learning environment.²⁵ However, in terms of longer-term knowledge retention, the results are significantly in PBL’s favour.^{9,26} In particular, Strobel and van Barneveld²⁷ analysed a number of meta-analyses on the effectiveness of PBL and found that PBL is more effective than traditional approaches when the measurement of learning outcomes focused on long-term knowledge retention, performance or skill-based assessment and mixed knowledge and skills. It was only when the focus was on short-term knowledge acquisition and retention that PBL appeared less effective. PBL therefore appears to be a superior and effective strategy to “train competent and skilled practitioners and to promote long-term retention of knowledge and skills acquired during the learning experience”^{27 (p55)}.

The majority of studies on the effectiveness of PBL has focused on the field of medicine. Studying the effect of PBL in applied domains and professional education also offers new perspectives on its influence on student learning outcomes. The field of nursing education, in particular, has devoted a substantial amount of research to exploring the effectiveness of PBL in healthcare training in order to prepare nursing

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