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Editor's Introduction

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While there is still a great deal of uncertainty surrounding the COVID-19 pandemic at the end of 2021, PBL researchers continued their effort in studying various pedagogical frameworks and techniques in PBL. Through their findings, further insights and guidelines for implementing PBL/PjBL will be shared with the PBL community to help improve student learning. In this issue, we have collected six research articles that investigated research areas in PBL ranging from social knowledge co-construction to techniques and technology for providing effective and individualized scaffolding and facilitation in large PBL classrooms, tutor training, as well as one article for the section "Voice from the Field."

The research on collaborative learning in the context of PBL has focused on group processing and dynamics, rather than knowledge co-construction. Since PBL is a group learning pedagogy, knowledge co-construction is a critical component of the student learning process. Tan & Tee (2021) analyzed how students' interactional interplays led to their social construction of knowledge. Based on their analysis, the authors provide a modified nIAM conceptual framework to represent the six phases of social knowledge co-construction during the PBL process and in turn, guide educators to effectively facilitate students' collaborative interactions to fruitful knowledge co-construction.

Implementing PBL in big classroom groups on a large scale has always been a challenge since the original PBL was designed to be implemented in a small group setting. Bae et al. (2021) described a set of synergistic scaffoldings used to structure the PBL process as well as the supporting activities in a large classroom of 96 students and support their learning of historical thinking skills using hard technology, such as whiteboards and large computer monitors, and more importantly, process technology, which is a PBL-LHC (Large History Classrooms) instructional framework. Further utilizing hard technology to assist facilitators in simultaneously facilitating multiple groups of students' collaborative activities during the PBL process, Chen et al. (2021) implemented orchestration technology to enable facilitators to effectively perform such tasks. They studied how the visualization of the data from the students' discussions and interactions on the teacher dashboard (part of the HOWARD asynchronous PBL learning environment) helped 10 facilitators gain a better understanding of the group dynamics and apply appropriate facilitation techniques to provide effective facilitation.

Successful facilitation of the student PBL process is a function of many variables. The provision of hard technology, such as orchestration technology studied by Chen et al. (2021) and process technology used by Bae et al. (2021) are enhancement tools that assist the facilitator to make better decisions during the facilitation process. However, all of these technologies would not be of use if the facilitators were not properly trained. Facilitator training or tutor training in itself is a complex topic. As Nicolaou et al. (2021) uncovered, many variables, such as tutor motivation, support program, and the responses from the students, intertangle and could produce very different results. The provision of an effective conceptual framework to design a tutor support system could help the tutor to tailor their own facilitation plan to fit their unique individual needs.

From slightly different perspectives, Ramlo (2021) studied students' perceptions of using PBL in a general chemistry lab. The author used a somewhat uncommon research method (Q) to conduct the study. Using this quantitative and qualitative research methodology, the study once again confirmed the importance of positive group dynamics to successful student learning and experience. Navalta et al. (2021) reported two courses (undergraduate-level Applied Exercise Physiology, and graduate-level Evaluation of Physical Work Capacity) using PjBL to structure its lab to help undergraduate and graduate kinesiology students develop deeper understanding of the domain knowledge. By requiring the students to design experiments as projects using a prototype device to measure energy expenditure utilizing a PjBL course, the undergraduate and graduate students perceived greater benefits of PjBL in promoting their motivation to learn and creativity.

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Lastly, an article is included in the section "Voice from the Field" in this issue. One of the signature features of PBL is to provide a real-life problem in as authentic as possible an environment to not only learn the domain knowledge through solving the problem, but also gain the context-specific nuances that are difficult to simulate in a formal educational setting. Nicholas et al.'s (2021) PBL project attempted to create an authentic learning environment for the students by utilizing STEM professional volunteers as the facilitators. Through analyzing the results, the authors provided lessons learned from the implementation of the project, which included benefits as well as challenges of utilizing professional volunteers as facilitators, not only from the school's perspective, but also the industry partners' as well.