



Introduction

I explored problem-based learning (PBL), and the process that teachers undergo to implement such a lesson, using the school's fabrication laboratory (FabLab) as a resource. Six teachers participated in interviews and observations, as well as two lab directors. A PBL 6-step PBL framework guided data collection and analysis: present background information, identify a problem, examine content in relation to problem, explore solutions, test and analyze solutions, and lastly, relate the outcomes of the solution and process to the original problem. The key elements of planning, facilitation, student assessment, and debriefing were discussed.

Key Findings

The Differing Emphasis on PBL Framework Components

- Steps of the process were emphasized differently by teachers, depending on the end goal of the lesson, content area, and time availability. *"When I create PBL or inquiry-based lessons, I choose one thing I want [students] to get out of it. One [cognitive] skill and one big [content] idea... I focus in terms of a teacher to assess one of those two things."*-Jennifer
- The focus redirected teacher's efforts in planning and set up: content focused more time planning background information and presentation; process focused more time on facilitation and activity.

Conflicts, Limitations and Constraints Perceived with PBL and FabLab

- PBL can be very ambiguous and present a lot of unknowns; teacher's biggest challenges were guiding students through anxiety and discomfort. *"You struggle as a teacher to say do this or do that. You kind of just have to let them figure it out."*-Jennifer
- Student experience with critical thinking or lab space impacted their reactions to the lesson; some take the idea and run, others need more guidance.
- Teacher's struggle with creating constructive conflict within the lesson. *"Do I push them into a certain way of thinking rather than saying here are the materials, you need to design a device?"*-James

Teacher's Use of PBL and FabLab for Cognitive Development

- Teachers recognized PBL for its support of interdisciplinary learning. PBL gives students the opportunity to reconnect multiple learning experiences.
- Concrete experiences in the FabLab execute PBL, problem-solving and critical-thinking. *"the learning is actually happening through the process of answering a question, or addressing a problem, or designing a thing."*-Sophia

The Role of the Environment in PBL

- Student collaboration was organic and occurred without teacher elicitation. On the other hand, teacher's strategically encouraged collaboration between students and groups.
- Teachers worked to create a comfortable environment to connect with students; a bridge between teachers and students during trials. *"building that environment is what allows students to shift from me telling them to do a think to them owning their experiential learning."* -Sophia
- Teachers valued collaboration with their colleagues during lesson development.

The Role of Reflection in PBL

- Every teacher engaged in reflection on the lesson with students in various forms including written, verbal, individual, and group-based.
- Independent teacher reflection was needed to help create the most valuable learning experiences; this strategy helped teachers adapt during a lesson or between class periods.

Recommendations for Practice

- Create time for intentional reflection. Reflect on the activity, the learning students experience, and teacher facilitation.
- Anxiety is a normal student reaction. Comfort and support students through that stage with high energy and positivity.
- Scaffold planning of the PBL lesson within a unit to help students connect their experiences.
- Focus on a big content take-away or area of skill/ cognitive development to help students recognize a purposeful learning experience.