Engaging Preservice Teachers in Project Based Learning to Improve Pedagogy

Abigail Bergen, Ed.D., Assistant Professor, Southern New Hampshire University, a.bergen@snhu.edu

Colleen Tapley, Ed.D., Program Coordinator BA.Ed. Program, University of Massachusetts Lowell,

colleen_tapley@uml.edu

Abstract

Project Based Learning actively engages students in meaningful learning that connects community and real world issues to the classroom. Project Based Learning requires students to develop and apply 21st century skills such as creativity, critical thinking, problem solving, and collaboration (inquirEd, 2023). The implementation of Project Based Learning in the classroom promotes deeper learning for all students (PBL Works, 2023). Lazonder and Harmsen (2016) examined inquiry-based learning in a meta-analysis of 72 studies and found that it was the most effective teaching practice for improving student learning outcomes. When students are authentically engaged through hands-on experiences retention improves (PBL Works, 2023). It is important for teachers to understand how to effectively utilize Project Based Learning strategies in the classroom to promote student-centered learning. Project Based Learning is a natural platform for educators to embed multiple access points for diverse learners and to engage students in the curriculum. This paper focuses on current research in the field of PBL and the implementation of strategies for modeling PBL in higher education classrooms to prepare preservice teachers to effectively apply these strategies in their future classrooms.

Keywords: preservice teacher, project-based learning, pedagogy

Project-based learning is a student-centered approach to teaching where students engage in active learning to solve authentic, open-ended problems and answer questions over an extended period of time (PBL Works, 2023). This pedagogical approach challenges students while encouraging discovery, creative problem solving, and igniting students' desire to ask questions. Project based learning allows students to develop the 21st century skills necessary for success in today's global society.

Project-based learning was first introduced as "the project method" by William Heard Kilpatrick over 100 years ago (Project Tomorrow, 2021). Project-based learning is a constructivist form of pedagogy. Specifically, PBL has its roots in inquiry- based learning, a pedagogical method that stems from constructivism. There are over 30 years of research documenting the benefits of project-based learning (Project Tomorrow, 2021). The implementation of project-based learning in the field of education continues to increase as the need for K-12 schools to ensure that students are prepared for success in a global society (Project Tomorrow, 2021).

Classroom environments that incorporate project-based learning provide students with contextualized problem solving, opportunities to make connections across content areas, and to develop reasoning skills (Wilhelm, Sherrod, and Walters, 2008). Eckardt, Craig, and Kraemer (2020) found that when they implemented project-based learning in undergraduate teacher candidate classes a supportive learning community was cultivated by productive academic struggles. It further demonstrated how students can deepen their understanding of how to connect theory and practice through the pedagogical process (2020). Pre-service teachers that experience and are mentored in project-based learning have a deeper understanding of pedagogy. This deeper understanding helps them to design instruction to engage students and encourage inquiry (Eckardt et al., 2020; Wilhelm et al., 2008).

Project-based learning demands diligent planning. When pre-service teachers participate in project-based learning they experience the benefits of this level of diligent planning and have the opportunity to observe the process modeled for them (Eckardt et al., 2020). Experiencing project-based learning as a pre-service teacher provides preservice teachers with real-life experiences that they will be able to apply when they have their own classrooms (Ayton & Capraro, 2021). Further, the collaboration, problem solving, and performance skills fostered through project-based learning build newly conceptualized 21st century skills (Hovey & Ferguson, 2014)

Project-based learning is a strategy that can be used to help pre-service teachers develop and increase their metacognition skills (Payoungkiattikun et al., 2022) University staff should provide preservice teachers with the opportunity to hone their skills to plan, self-monitor, evaluate, and reflect (Saputri et al., 2020). Fostering metacognition skills provides pre-service teachers with a strong knowledge base on how students learn. This builds their confidence in the teaching and learning process. They will continually improve their learning and quality of teaching (Payoungkiattikun et al., 2022) ultimately benefiting their future students.

The nature of project-based learning requires teachers to assess and readjust instructional methods throughout the duration of the project. This allows educators to use their knowledge of diverse learners' needs to plan for instruction and create accommodations. Having a variety of options for learners leads to increased achievement, higher levels of motivation because it is an authentic solution and allows the diverse learner to find a role that is based on their skillset so they can fully participate (Mississippi College, 2022). In addition to providing increased access points for diverse learners, project-based learning also helps to develop social skills and presentation skills (Mississippi, 2020) for all learners.

According to PBL Works (2023), there are Gold Standard Design Elements that are essential when designing high quality project-based learning experiences that are informed by research. These Gold Standard Design Elements are meant to aid educators and school leaders in the measurement, calibration, and improvement of PBL practices (PBL works, 2023). These are broken down into seven essential gold standard teaching practices and seven essential gold standard elements.

The seven essential gold standard teaching practices are: (a) design and plan; (b) align to standards; (c) building the culture; (d) managing activities; (e) scaffolding student learning; (f) assessment; and (g) engaging and coaching (PBL Works, 2023). When designing and planning it is essential for teachers to create projects that are relevant to their context and their students (PBL Works,

2023). During planning, teachers must account for a degree of student voice and choice throughout the entirety of the project while clearly aligning to curriculum standards (PBL Works, 2023). Teachers also need to create a culture around project-based learning that nurtures students' independence while setting high expectations for all students (PBL Works, 2023). They must be actively engaged, supporting students by setting timelines, scaffolding aspects of the project, and supporting areas where students may need additional skills. It is also important for teachers to build in a variety of formative assessments throughout the project to assess student progress toward the summative assessment (PBL Works, 2023).

PBL Works (2023) has identified seven essential gold standard elements that are recommended for high quality project design. The first element is providing students with a challenging and meaningful problem or question to guide their work (PBL Works, 2023). The second element requires that the problem or question be authentically connected to the real world and the students' lives (PBL Works, 2023). The third essential element is the need to allow students to have voice and choice in regard to what they create and how they work on the project (PBL Works, 2023). Students also need to have the opportunity to engage in sustained inquiry by asking questions, learning how to identify and access appropriate resources, and applying what they have learned through their research (PBL Works, 2023). The fifth gold standard element is focused on critique and revision. As part of the critique and revision process, students provide feedback for others, receive feedback from their peers and teacher, and apply that feedback in the revision of their work. Another gold standard element that is closely connected to critique and revision is reflection. This element requires students to reflect upon what they have learned, as well as the quality of their work and the successes and challenges they faced during the project (PBL Works, 2023). The final gold standard element is the creation of a public product connected to the summative assessment that is shared with an audience outside the classroom.

In addition, multimedia assisted project-based learning helps preservice teachers develop skills related to gathering information from multiple mediums. It allows them to learn how to use technology to aid communication with their students, and help their students explore ideas beyond print. This creates, "a profound ripple effect in the teaching/learning process" (Seo, Templeton, and Pellegrino, 2008, p. 264). Students with disabilities often excel in project-based learning. Having the ability to integrate technology into project-based learning creates additional access points and further removes barriers for diverse learners.

Denton, Hodara, Petrokubi, Merrill, and Velie (2021) examined project-based learning across three universities in the field of teacher preparation. Participants in the study included teaching faculty, preservice teachers, and cooperating teachers in local school districts. Their study identified five conditions that were supportive of project-based learning in teacher preparation programs in higher education. The first condition they identified was a university culture supportive of innovative practice that encouraged learning and innovation. The second condition was enthusiastic leadership support. The third condition focused on school district partnerships. Denton et al. (2021) stated that there needed to be strong leadership in partner school districts, regular communication, and support for educators. Another condition for supporting project-based learning was providing the preservice teachers and cooperating teachers with dedicated planning time so that they could collaborate effectively. The final condition was the need to provide high quality training and resources (Denton et al., 2021).

According to Ayton and Capraro (2021), project-based learning provides preservice teachers with the opportunity to develop and practice skills they will need to be successful in their future classrooms. As the demand for project-based learning in K-12 classrooms increases, it becomes increasingly important to prepare preservice teachers to enter the field of education with the background and skills they need to implement project-based learning. Participation in project-based learning also prepares preservice teachers with active learning and classroom management skills necessary for the successful implementation of project-based learning in their own classrooms (Ayton & Capraro, 2021).

Although project-based learning has become more common in K-12 classrooms, its implementation in higher education classrooms is not as widespread (Ayton & Capraro, 2021; Lee et al. 2014). Faculty in higher education face challenges in effectively implementing project-based learning (Ayton & Capraro, 2021; Lee et al. 2014). As discussed earlier, it is important that the projects are

carefully planned and that the teacher must continually assess to make sure that students are learning the key academic concepts and learning 21st century skills (Lee et al., 2014).

In a research study conducted by Lee, Blackwell, Drake, and Moran from the University of Indianapolis, three prominent themes emerged when examining faculty challenges with implementing project-based learning: community partnerships, student engagement, and assessment. Community partnerships, also referred to as an authentic audience, are one of the seven gold standards in project-based learning. In higher education, faculty experienced some challenges in recruiting and maintaining these relationships over multiple semesters and over an extended amount of time. One complication is managing the timeline of the semester, class timelines, and the ability to meet the needs of community partners (Lee et al., 2014). Despite the challenges in implementation, faculty expressed that one major benefit of community partnership was that students were provided with opportunities to meet and build relationships with professionals in the field. These partnerships could lead to internships or future employment opportunities (Lee et al., 2014).

The second prominent theme that emerged from Lee, Blackwell, Drake, and Moran's (2014) research study was student engagement. Faculty claimed that students were resistant to talk with each other and work collaboratively. Some faculty saw this as an opportunity to teach and model skills necessary for project-based learning (Lee et al., 2014). This was seen across all disciplines and academic levels. Success indicators included having the projects focus on real-world problems and in some cases, affect change in the community. One finding was that student motivation was enhanced by student agency and feelings of empowerment (Lee et al., 2014).

Challenges in assessments was the third prominent theme for challenges and successes in implementing project-based learning in higher education. The term expert has a different connotation in institutions of higher education than in other professional fields. Faculty struggled with how to evaluate deeper understanding and the 21st century skills essential to collaborative project-based activities. Faculty did find that clearly articulated rubrics were a key component to successful assessment (Lee et al., 2014).

In higher education pre-service teacher programs, every classroom has diverse learners where faculty provide accommodations and use different strategies to teach content. Research has shown that project-based learning is an effective method for these learners (Hovey & Ferguson, 2014). Project-based learning helps diverse learners with social development due to its embedded student interaction and requires students to interact with the content. This instructional method engages students at the highest and lowest levels (Hovey & Ferguson, 2014). Implementing project-based learning in higher education institutions and preservice teacher programs enables faculty to model effective techniques while reaching all learners. Through engagement in project-based learning, preservice teachers are provided with opportunities to experience this pedagogical practice as both a participant and a facilitator. This allows them to refine their skillset and master the pedagogical approaches they will use in their own classrooms.

According to Albert Bandura's (1977) social learning theory individuals learn through modeling and observing the actions of others. The act of mastering strong pedagogical practices is complex. Bandura (1977) claimed that "some complex behaviors… can be produced only through the influence of models" (p.5). It is crucial for teacher preparation programs to purposefully embed modeling throughout coursework, especially in areas where mastery of pedagogical practice is complex. The implementation of modeling in teacher preparation programs offers preservice teachers the opportunity to engage in, and experience the impact, various pedagogical approaches have on students. This experience also allows them to observe techniques for implementation that can later be implemented in their own classrooms. Modeling has also been found to improve the effectiveness of lesson planning in preservice teachers (Courey et al., 2012; Courey et al., 2013; Spooner et al., 2007).

It is crucial for educators at all levels to incorporate pedagogical practices that support the development of 21st-century skills. The use of modeling as a strategy for teaching preservice teachers pedagogical approaches to project-based learning is a powerful tool in the field of teacher preparation. A review of the literature indicates that pre-service teachers with a deep pedagogical understanding of the curriculum, and the ability to connect theory and practice, are more prepared to implement project-based learning (Eckardt, Craig & Kraemer, 2020). The use of modeling in teacher preparation programs builds

pre-service teachers' ability to effectively lesson plan to meet the needs of diverse learners through project-based learning (Courey et al., 2012; Courey et al., 2013; Spooner et al., 2007). Engagement in project-based learning during teacher training provides a vehicle for preservice teachers to hone their skills and become more effective educators.

References

Ayton, K., & Capraro, K. (2021). Students lead the charge! Using project-based learning with preservice teachers to redesign a curriculum resource center. *Education Libraries*, *44*.

Barron, B., & Darling-Hammond, L. (2008, October 8). *Powerful learning: Studies show deep understanding derives from collaborative methods*. Edutopia. *https://www.edutopia.org/inquiry-project-learning-research*

Bandura, A. (1977) *Social learning theory*. Englewood Cliffs, NJ. Prentice Hall, Inc.

Courey, P., Tappe, J., Siker, J., & LePage P. (2012/2013). Improved lesson planning with universal design for learning (UDL). *The Journal of the Teacher Education Division of the Council for Exceptional Children, 36*(1), 7-17. https://doi.org/10.1177/0888406412446178

Denton, A., Hodara, M., Petrokubi, J., Merrill, B., Velie, Z. (2021, June 30). *A case study of three universities: Preparing teachers for project-based learning.* Education Northwest. https://www.pblworks.org/sites/default/files/2021-07/OutoftheGate_Case_Study_Report_2021.pdf

Eckardt, P. N., Craig, M., & Kraemer, L. (2020). The impact of project-based learning in student content knowledge in an undergraduate, teacher preparation, foundation of education course. *Journal for Leadership and Instruction*, *19*(1), 38–42.

Erviana, V., Sintawati, M., Bhattacharyya E., Habil, H., Fatmawati, L. (2022). The effect of project-based learning on technological pedagogical content knowledge among elementary school pre-service teachers. *Pegem Journal of Education and Instruction*, 12(2) 151-156.

Freeman, S., Eddy, S., McDonough, M., Smith, M., Okoroafor, N. Jordt, H., & Wenderoth, M. (2014) Active learning increases student performance in science, engineering and mathematics. *Proceedings of the National Academy of Sciences, 111*(23), 8410-8415. https://www.pnas.org/doi/epdf/10.1073/pnas.1319030111

Gross-Loh, C. (2016). Should colleges really eliminate the college lecture? As schools incentivize innovative research, quality in-class experiences can fall by the wayside. *The Atlantic.* https://www.theatlantic.com/education/archive/2016/07/eliminating-the-lecture/491135/

Hovey, K. A., & Ferguson, S. L. (2014). Teacher perspectives and experiences: Using project-based learning with exceptional and diverse students. *Curriculum & Teaching Dialogue, 16*(1/2), 77-90.

Lambe, J. (2007). Student teachers, special educational needs and inclusion education: Reviewing the potential problem-based, e-learning pedagogy to support practice. *Journal of Education for Teaching, 33*(3), 359-377. https//doi.org/10.7771/1541-5015.1426

Lee, J. S., Blackwell, S., Drake, J., & Moran, K. A. (2014). Taking a leap of faith: Redefining teaching and learning in higher education through project-based learning. *Interdisciplinary Journal of Problem-Based Learning*, *8*(2). https://doi.org/10.7771/1541-5015.1426

Lee, J. & Galindo, E. (2021) Examining project-based learning successes and challenges of mathematics preservice teachers in a teacher residency program: Learning by doing. *The Interdisciplinary Journal of Problem-based Learning, 15*(1). https://doi.org/10.14434/ijpbl.v15i1.28786

Mississippi College. (2018, November 1). *Implementing project-based learning in special education.* https://online.mc.edu/degrees/education/med/special-ed/project-based-learning-special-education/

Ozdemir, N., Kilinc, A., Polatcan, M., Turan, S. & Bellibas, M. (2023). Exploring teachers' instructional practice profiles: Do distributed leadership and teacher collaboration make a difference? *Educational Administration Quarterly, 59*(2), p. 255-305. https://journals.sagepub.com/doi/pdf/

Payoungkiattikun, W.,Intanin, A., Thongsuk, T., & Hemtasin, C. (2022). Project-based learning model to promote preservice science teachers' metacognitive skills. *Journal of Educational Issues*, *8*(2), 576-588. https://doi.org/10.5296/jei.v8i2.20282

PBL Works (2022) *What is PBL?* https://www.pblworks.org/what-is-pbl

Saputri, W., Corebima, A. D., Susilo, H., & Suwono, H. (2020). QASEE: A potential learning model to improve the critical thinking skills of pre-service teachers with different academic abilities. *European Journal of Educational Research, 9*(2), 853- 864. https://doi.org/10.12973/eu-jer.9.2.853

Seo, K. K., Templeton, R., & Pellegrino, D. (2008). Creating a ripple effect: Incorporating multimedia-assisted project-based learning in teacher education. *Theory Into Practice*, *47*(3), 259–265. https://doi-org.ezproxy.snhu.edu/10.1080/00405840802154062

Spencer, J. (2021, April 8). *All students deserve access to project based learning.* John Spencer https://spencerauthor.com/pbl-for-all/

Spooner, F., Baker, J. N., Harris, A. A., Ahlgrim Delzell, L., & Browder, D. M. (2007). Effects of training in universal design learning on lesson plan development. *Remedial and Special Education*, *28*(2), 108-116. https://doi.org/10.1177/07419325070280020101

Toombs, J., Eck, C., Robinson, J. (2022). The impact of a project-based learning experience on the SAE self-efficacy of preservice teachers. *Journal of Agricultural Education 63*(1) 29-46

https://doi.org/10.5032/jae.2022.01029

Wilhelm, J., Sherrod, S., & Walters, K. (2008). Project-based learning environments: Challenging preservice teachers to act in the moment. *The Journal of Educational Research*, *101*(4), 220–233. https://doi.org/10.3200/joer.101.4.220-233