Chapter 11
Enhancing Critical Thinking Through Problem–Based Learning:
A Comprehensive Approach to Modern Education

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ABSTRACT

The act of teaching is a difficult endeavor that necessitates the resolution of sophisticated challenges and issues that relate to a wide variety of aspects of learning and teaching. The problem-based learning (PBL) approach offers aspiring and certified

teachers the opportunity to work together in small collaborative groups within the setting of generative contexts. They work together to assess problems, discuss potential solutions, and make well-informed judgments in order to find solutions to problems that are based on actual teaching settings that involve real-world obstacles with several facets. This corpus of work should be expanded to include research that is directed at teacher education because there has been an increase in the number of project-based learning (PBL) studies that have been implemented in classrooms. Educational reform is being implemented and both new and veteran teachers are being required to meet the expectations of a profession that is notoriously difficult.

1. INTRODUCTION

The present trends in educational reform are pushing for training both certified and prospective teachers to handle the several and difficult issues that surface in the classroom and in pedagogy (Albanese M, 1993). Effective problem-solving calls for each of the following several key types of knowledge: Knowledge of the subject's facts, ideas, and principles is known as content knowledge; learners variations, assessment, and management of classrooms are known as pedagogical knowledge; conditional knowledge is the understanding of when to apply particular knowledge and pedagogical tools; and reflective knowledge is the ability to reflect before and after teaching actions.

Teachers deal with complex issues that sometimes call for cooperation among their colleagues. This covers framing problems, weighing several points of view, talking about fixes, assessing possible results, and thinking back on choices (Albion, 2000). While they are subject-matter specialists, both teacher candidates and professors are expected to employ solid pedagogical approaches (Chappel, 1995). They are expected to remain lifetime, self-directed learners throughout their professions and actively participate in cooperative settings with other teachers, students, and parents. Concurrent with these demands from standardized testing, which frequently runs counter to the objectives of new educational reforms, are those of These changes underline among students themselves as well as learning as a dynamic process formed by interactions between teachers and students. Experience in the real world mirrors this process (Askell-William, 2005).

Teachers have an extremely difficult job, without doubt. But problem-based learning (PBL) provides a thorough instructional framework that can enable teachers to change with the times in the terrain of education. The purpose of this study is to investigate, in the framework of teacher preparation, the use of problem-based learning (Barrows, 1996). The first part will concentrate on spotting and researching

the key features of problem-based learning (PBL) and its relevance to the present requirements in teacher preparation (Dean C, 1998).

It is also crucial to underline, though, the difficulties PBL presents for instruction. PBL is all-encompassing, hence its pedagogy needs to be flexible depending on goals, tactics, curriculum, and evaluation (Ghani, 2021). The parts following will go over these difficulties.

The last section of the conversation will look at some PBL implementation techniques that can enable teachers to fit the contemporary classroom and how these approaches might guide researchers to subjects important for both practice and academics (Dean C, 1999).

2. HISTORICAL HIGHLIGHTS OF PROBLEM-BASED LEARNING

The problem-based learning was first introduced by Barrows at McMaster University in the field of medicine. Many other disciplines, including business, law, and nursing, have adopted PBL since Barrows's success.

Most PBL implementations in teacher education since the 1980s have been carried out by individual teachers. Several studies have shown that PBL can be an effective tool for teacher education programs (Dochy, 2003). PBL improved student performance in the classroom. Additionally, PBL has been utilized in professional development for teachers.At her institution, the author has been at the forefront of smaller, more personalized PBL implementations. Memorial University of Newfoundland's and her colleagues have also used project-based learning (PBL) with a select group of in-service science educators (De Simone, 2008). Teaching and learning with PBL is studied by pre-service teachers at the University of British Columbia's integrated PBL cohort.

3. PROBLEM-BASED LEARNING

A student-centered teaching tool, problem-based learning (PBL) motivates present as well as prospective teachers to participate in goal-directed research. PBL includes students in the investigation of challenging, ill-defined problems, unlike conventional teaching approaches whereby knowledge is sometimes presented in a lecture manner. Students study these difficulties in groups throughout this process, but they also independently look at particular facets of the topic. They then return

their results to the group so that they may cooperatively work through the issue and consider their combined efforts (Edens, 2000).

PBL stands out mostly for giving students more autonomy over their educational path. From being the main knowledge source, the teacher's function changes to become one of facilitator, directing pupils in their thinking, motivating contemplation, and supporting group research. This is not at all like conventional models whereby teachers mostly "tell" or lecture and pupils passively absorb knowledge (Finkle, 1995).

PBL distinguishes itself from other active learning strategies as project-based learning or inquiry-based learning by emphasizing ill-structured, real-world problems with no obvious answers. Unlike project-based learning, in which students frequently aim toward a certain end product or outcome, PBL stresses the process of problem-solving itself. Developing critical thinking, self-directed learning, and teamwork as students negotiate the complexity of the issue is more important than simply producing a finished result (Rickinson, 2001). While PBL stresses teamwork in addressing a pre-defined, challenging problem, inquiry-based learning, while also promoting discovery, tends to concentrate more on students asking questions and doing investigations (Edwards, 2004).

PBL thus seeks to promote fundamental abilities like teamwork, self-directed learning, and the growth of both conceptual and pedagogical knowledge (Rickinson, 2003). Through active participation in problem scenarios, identification of learning difficulties, and guided group discussions, students not only gain knowledge but also learn how to apply it in relevant, practical settings. Particularly in the realm of education, this practical approach enables students to get ready for the demands of their professional life (Goodnough, 2003).

4. PBL EXPERIENCE: FEATURES & TUTORIAL PROCESS

A problem-based facilitator, learning issues, and problem-based examples make up the tutorial process of problem-based learning as shown in Figure 1.

Figure 1. Schema of the problem based learning
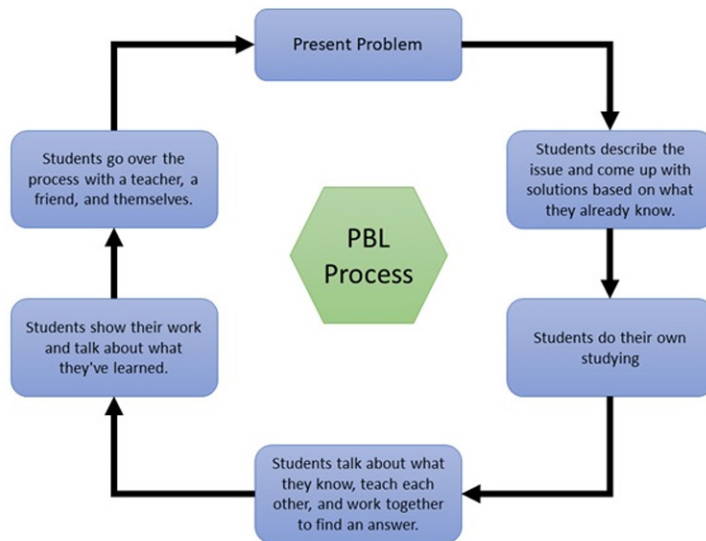
4.1 Problem-Based Cases

Using real, multifarious, and open-ended questions that provide several solution options is absolutely crucial in problem-based learning (PBL). These difficulties should be challenging enough to really captivate students since too simple problems will not inspire their critical thinking or learning (Goodnough, 2006). Though multimedia usually seems to be more interesting and participatory for students, the PBL scenarios can be taught in paper or multimedia forms. Whatever the structure, these issues should closely mirror real-life events that students could encounter, thereby encouraging them to explore several points of view, suggest fixes, weigh advantages and drawbacks, and back-off on their choices (Kwan, 2008).

PBL instances should be given in several settings so that teachers have solid, flexible knowledge (Peterson, 2001). This diversity enables instructors to apply the ideas they acquire in several contexts and see issues from several perspectives. Providing a wide spectrum of examples across the course helps teachers be more suited to apply their knowledge to fresh classroom problems. PBL thus supports one of the main goals of present educational reform in North America: fostering relationships between several disciplines.

Teachers who neglect to identify trends and create an integrated knowledge of classroom dynamics may have a limited perspective of their teaching environment, therefore missing the more general complexity (McPhee, 2002). Particularly for inexperienced teachers, this might present difficulties in areas such classroom management, student evaluation, individualized instruction, and parent relations building. PBL is a useful tool for instructors negotiating these challenges, therefore promoting a closer, more linked awareness of teaching and learning.

4.2 Learning Issues

Teacher candidates first meet to discuss the problem instances and "pull out" learning challenges; these are the ideas that candidates feel they need to study more about before they can do independent research (Levin, 2001). They break down the learning problems into smaller groups, conduct their own research on each subject, and then share what they've found while discussing and improving upon other ideas, points of view, and facts that have been presented (Major, 2001). An important part of problem-based learning is that it encourages students to think conceptually rather than procedurally while addressing a problem. This analysis then aids PBL students in doing two things: (a) defining the problem more precisely, which is a crucial part of instructional problem solving, and (b) finding reliable sources of information to add to their understanding. Because of the need for both theoretical understanding and hands-on experience in the classroom, teaching is best seen as a synthesis of the three disciplines (Merseth, 1996).

4.3 Problem-Based Learning Facilitator

In problem-based learning (PBL), the degree of learning quality mostly relies on the function of the facilitators. In the conventional PBL paradigm, teachers—who serve as facilitators—change their emphasis from only delivering materials to guiding the PBL process. Their subject-matter knowledge makes them excellent models for critical thinking and good learning. Sometimes even advanced students can help PBL go more smoothly (Murray-Harvey, 2004).

By posing provocative, open-ended questions, facilitators help students to strengthen their higher order thinking skills. They inspire pupils to have conversations, question one another's beliefs, and defend their arguments. Facilitators progressively lower their degree of support as students assume more responsibility for their group projects therefore enabling learners to grow more independent (Murray-Harvey, 2000).

Some modified PBL models advocate, in line with present educational reforms, for giving students the tools and resources they need to succeed. These tools are crucial for students in managing their anxiety, appreciating the learning process, and finally succeeding.

Should students have difficulty with a topic, facilitators can stop the PBL exercises to provide quick clarifications of any unresolved ideas. Including benchmark courses inside the PBL structure helps to review and reinforce important ideas as well. To guarantee a comprehensive knowledge of critical ideas, students in Hmelo-Silver's teacher preparation program, for instance, attended multiple lectures on subjects including cognitive transfer, instructional planning, and the constructive character of knowledge alongside their PBL tasks (Norman, 2000).

5. THE GOALS OF PBL AND THEIR REPRESENTATION IN TEACHER EDUCATION

Teachers' mastery of the material and its relevance to their field is the primary objective of project-based learning (PBL). The good educators are able to adapt their understanding of pedagogy, curriculum, and learning to the unique challenges they face in the classroom (Peterson, 1998).

Flexible knowledge is the ability to draw on relevant prior knowledge, organize one's understanding around subject area central ideas, and integrate information across many domains. Learners can effectively solve problems by retrieving, using, and expanding their knowledge. Educators who have a solid foundation of knowledge and the ability to adapt their approach to meet the needs of their students are better able to overcome pedagogical obstacles, according to studies conducted by researchers. Managing classroom practice, making instructional decisions for the entire class, and meeting the needs of individual students all necessitate problem solving on the part of teachers. Because of this, pedagogical problem solving is an especially important aim in preservice teachers' curricula. The pre-service teachers in the PBL group show a considerable improvement in their ability to address diagnosis-solution pedagogical problems compared to a control group that followed a normal curriculum. Based on these studies, pre-service teachers in the PBL group demonstrated the following skills: (a) they were able to consider the case's learners' and teachers' needs, come up with practical solutions, evaluate those solutions, (b) consider both short-term and long-term benefits and drawbacks, and (c) they were able to use educational concepts to back up their assessments of the pedagogical situation.

A crucial part of learning is the transmission of problem-solving abilities and ideas; information is useless without it. Two studies that spanned three years examined the efficacy of a hybrid online PBL course and a traditional classroom-based educational psychology course. The hybrid PBL used online whiteboards, multimedia cases, and electronic notebooks to bring attention to key points and facilitate class discussions. Both online and in-person instructions were used in the educational psychology class. Students taught using a hybrid PBL method outperformed their traditional method counterparts in multiple areas, including learning sciences concept transfer, analysis of a new video case, and the generation of recommendations for instructional method improvements.

5.1 Collaboration Goals

Group collaboration isproblem-based learning's (PBL second goal. PBL challenges students to collaborate to examine and synthesize a topic in a way that is significant to them personally as unique learners. By means of problem-solving, it also encourages active learning, enabling teachers to address both the particular needs of their pupils and more general issues including evaluation and assessment.

By contrast, cooperative learning stresses more instructor direction for spotting learning problems and creating plans of action to address them. Cooperative learning's objective is for group members to have a common knowledge of a task so guaranteeing mutual responsibility and that everyone in the group understands the contents (Yew, 2006). As seen in Figure 2, cooperative learning techniques include Student Teams Achievement Division (STAD) and Teams Game-Tourney (TGT) use rewards to inspire students to finish their assignments.

The continuous reform of education emphasizes the need of teamwork in training next teachers. The next generation of teachers will have increasingly varied classrooms and must work efficiently to handle the difficult problems of instruction and learning. Through assisting students and future teachers in entering the field, collaborative inquiry enhances teacher growth. Future teachers can learn the language, techniques, and difficulties of the job by interacting with both experienced and inexperienced instructors.

By means of this process, they acquire good communication skills and innovative application of their knowledge to address practical teaching problems. Teachers engaged in project-based learning groups enhanced their professional vocabulary, offered more careful explanations, and more precisely employed discipline-specific language as the semesters went on. They also grew more skillful in applying the tools at hand to address challenges. Group members of PBL discuss their present knowledge and pinpoint areas for additional learning, therefore enabling them to develop and use information in creative fashion. This motivates teachers to work

in communities of practice, where they could share ideas and work through issues together.

Figure 2. Flowchart of the PBL outcome process
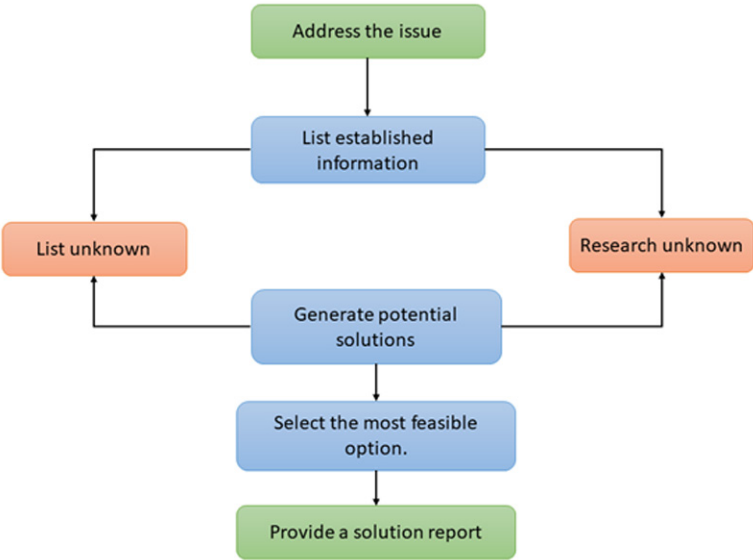
Learning to work together effectively is an important life skill. Collaboration in research does not happen by chance, Instead, PBL mentors who are also experts in the subject matter and have excellent interpersonal and communication skills are essential in this area. In order to better manage developing issues with collaborative engagement, this facilitation can involve having groups work on smaller project-based learning (PBL) activities. Asking questions also helps educators foster collaborative inquiry. The teachers' knowledge domains can be better understood through the use of questions that demand explanation, elaboration, and application. In order to promote collaborative inquiry in PBL, it is vital to be sensitive to group dynamics and assist groups in resolving interpersonal concerns. One way facilitators can help people and groups work together more effectively is by providing them with timely and relevant feedback.

5.2 Self-Regulated Learning, Self-Directed Learning, and Lifelong Learning

Cultivating abilities for continuous learning is the third objective of project-based learning (PBL). Becoming a teacher is predicated on a continuum of learning experiences throughout a teacher's career, as instructors are obliged to be lifelong learners in modern educational reform. Evidence from a variety of sources suggests that self-regulation and direction are essential components of lifelong learning. While both phrases are commonly used interchangeably, "self-directed learning" is more specific to the learning environment and has its origins in adult education. The ability to "own thoughts, feelings, strategies, and behaviors, which are oriented towards the attainment of goals" is typically characterized as a positive learner feature and is known as self-regulated learning (SRL).

This study will utilize the term "self-regulated learner" since its main focus is on how problem-based learning (PBL) can help teachers manage their own emotions, ideas, and actions while solving pedagogical difficulties. The ways in which future educators tackled educational psychology issues by utilizing available resources. Teachers were able to find material, understand it, and reflect on it with the use of these resources, which included books, computers, and maps. Teachers who are well-versed in both their subjects and pedagogy are able to make informed decisions about the best use of available resources for their students. Their resource utilization impacts their skill and motivation to self-direct, which in turn aids them in making educated decisions and guiding following actions.

The ways in which future educators utilized problem-based learning (PBL) materials varied significantly. Successful future educators were able to collaborate effectively, using a diverse range of tools and resources to analyze and resolve the problem at hand. These resources included both course-specific materials as well as more general information that, while not directly tied to course objectives, helped in defining the problem and exploring potential solutions.

However, pre-service teachers who faced academic challenges tended to approach the topics in a more superficial manner, relying on a limited set of resources. This narrow approach hindered their ability to fully understand the problem and make well-informed pedagogical decisions. Their limited engagement with the material prevented them from benefiting fully from the PBL process.

In order to address the requirements of their students quickly and successfully, teachers must work both alone and in collaboration. In order to accomplish this, students will need to solve complicated challenges through effective self-regulatory thought and behavior. In order to find a solution, they must first identify the issue, gather and assess appropriate resources, and seek input from colleagues in the field as well as parents and school administrators. While dealing with a problem, teachers

should keep an eye on the choices they make both alone and as a group. There will be serious ramifications for students if the plan fails to take responsibility, explain what's happening, or arrange the necessary components to address an issue.

5.3 Intrinsic Motivation

Motivating students to learn for its own sake is the fourth objective of project-based learning (PBL). When students are intrinsically driven, they work on tasks because they are interested in them, have agency over their own learning, and stand to gain from the experience. The amount of time and attention that students invested in a problem case was significantly affected by its quality. Most instructors join the field due to an innate commitment to pedagogy, therefore it stands to reason that issues associated to teaching would naturally serve as intrinsic motivators for teachers. Several features of problem-based learning (PBL) encourage students' intrinsic motivation, such as tackling challenging but manageable problems that are both personally and professionally pertinent. Students are more inclined to delve further into topics that interest them when they work on real-world problems related to their studies, on the use of problem-based learning in teacher education.

In the process of working together, they learn to reflect critically. Additionally, participants in PBL groups engage in conversation and compromise (components of collaboration) when faced with intrinsically engaging challenges; this is because they take on the role of problem framers, determine the primary learning difficulties, and choose, gather, and evaluate information and ideas, all found that when instructors care about a problem, they are more likely to own it and see it through to a resolution.

6. PBL CHALLENGES

Without looking at some of the difficulties in implementing PBL, any discussion of the method would be lacking in depth and accuracy. Two such aspects, the resource-intensive nature of PBL and the implementation dip, will be discussed in the next section.

6.1 Resource Intensiveness

Plan, teach, and evaluate differently with PBL. Any revisions to the curriculum must be comprehensive, not only "academic frills" or tokenistic additions made in the last minute. Cases would be built and/or chosen, then aligned with teacher education curriculum, and finally evaluated and assessed as part of this process. The

first author of this work spent three months, five days a week, with the support of a research assistant, planning and executing her first project-based learning (PBL) course. In addition, more materials are needed for PBL in big courses. Instructors should have training in both the theory and practice of project-based learning (PBL), according to the first author's initial experience.

Several recommendations for using PBL in pre-service teachers' curricula are made.Reducing the number of subjects and having students act as facilitators are two of them. The authors argue that students are unlikely to fully acquire these tactics due to the limits of their degree requirements, as they need extensive planning and a certain level of proficiency with problem -based learning (PBL).

6.2 Implementation Dip

Fullan (1992, 2001) found that when people do new things and deal with new processes, things usually go worse before they get better. Here is what Fullan refers to as the "implementation dip". When people confront an innovation that demands new knowledge and abilities, their confidence and performance take a nosedive, a phenomenon known as the implementation dip. For instance, according to Edwards and Hammer (2006), pre-service teachers' initial reactions upon being introduced to problem -based learning (PBL) in a child development course were as follows: "needing more direction about how to approach a task, difficulties in working with group members, difficulties understanding the roles of other members in the PBL team, and difficulties in understanding expectations" (p. 470). Edwards and Hammer are hardly alone in facing such difficulties. The difficulties I've encountered as a PBL implementer are similar to those that the researchers Ertmer and Simons (2006) have reported.

Fullan claims that even the most effective educational institutions go through "implementation dips" as they develop. It is commonly believed, he says, that once an educational reform is put into place, the results will match the original goals. The success of an innovation can only be determined after it has been put into practice for a while and has shown to have a positive impact. For an institution to be considered successful, it must do more than just improve the technical capacity of its employees or implement new organizational structures; it must also provide students with tangible benefits.

Additionally, in PBL, the teacher's role shifts from that of knowledge "owner" and dispenser who is accountable for evaluation to that of a learning facilitator who supports student agency. As was already mentioned, the PBL facilitator has to be able to switch gears and learn new things. Faculty professional growth and time are necessary for this process. After the first phase of a project-based learning (PBL)

has ended, it is important to resolve any issues that the instructor and students may have had with the adjustments.

7. CHOOSING APPROPRIATE PBL IMPLEMENTATIONS: IMPLICATIONS FOR RESEARCH AND PRACTICE

So far, two things have been established: (1) Project-based learning (PBL) offers numerous advantages and may help educators full-fill the requirements of new reforms in areas such as problem-solving, collaboration, and self-directed learning; (2) PBL also poses numerous disadvantages, including demands on resources and time from educators, students, and administrators. Adopting PBL is a big deal, therefore you should think about its short- and long-term effects thoroughly.

Various stakeholders, including teachers, students, and professors, have different needs, hence there are both large and minor approaches to apply PBL. In this part, I will (a) discuss various methods for implementing project-based learning (PBL); (b) explain the research problems that arise from these methods; and (c) connect them to the reform of teacher education.

7.1 Faculty-Wide Implementation

Initially, we established that the medical school model of PBL is characterized by faculty-wide implementation of PBL. Implementation happens when educators work together to test out new strategies, overcome obstacles, and hone their craft. Institutions, more than any other level, can create the kind of atmosphere that is essential for resolving the implementation challenges that are bound to arise during the early stages.One state that has started using PBL in its teacher education program is Tennessee.

Teacher candidates utilize a faculty-wide version of problem-based learning (PBL) to address pedagogical difficulties that are representative of those they may encounter in their future work as educators. Sharing resources also helps with faculty-wide initiatives. Assuming we account for teacher impacts, faculty-wide implementation allows us to test hypotheses like how well the method works across different domain sections. In addition, the faculty-wide approach can be used to ask questions regarding cognitive transfer. Does PBL, for instance, help future educators be ready for the classes? Does problem-based learning enhance their capacity to tackle problems that include many subject areas? Is it more crucial that it gets them ready for when they work as professionals? Being able to use one's information and abilities throughout one's career is a lifelong attribute that teacher candidates must

possess in order to integrate their knowledge and skills. Both students and educators will experience stress and dissatisfaction if this does not happen.

7.2 The Cohort Implementation of PBL

In teacher preparation programs, a core faculty group and a group of future educators work together as a cohort to study a specific topic (such as peace and global education, for example). As part of its cohort-based approach to elementary teacher preparation, the University of British Columbia incorporates PBL into its curriculum. Preservice teachers learn the ins and outs of project-based learning (PBL) in this approach and then incorporate that understanding into their own coursework under education and the field as a whole. Teachers are encouraged to exchange resources, expertise and discuss obstacles, and strategies of overcoming them in cohort approaches, just like in faculty-wide PBL implementations outlined above.

The PBL cohort at UBC is taught by both UBC teachers and important individuals from the Richmond School District, demonstrating the use of cohorts. In order to prepare future educators, we train them to act as facilitators, guiding other future educators as they explore questions of curriculum, learning, and pedagogy. The program's emphasis on problem identification and engagement through collaborative and networked inquiry is one of its unique aspects. As part of their 12-month teacher preparation curriculum, student teachers spend one full day each week in a practicum setting.

Researchers could examine the longer-term trajectory of project-based learning (PBL) from university classrooms to schools where teacher candidates implement PBL concepts using the cohort approach. Teacher candidates can put their knowledge of project-based learning (PBL) into practice in a real classroom setting by working with school administrators and teachers. Universities expose candidates to many modern teaching methods, but schools frequently fall behind pedagogically. Interns in public schools who are aspiring teachers tend to concentrate on "what works" without giving much thought to the reasons behind those successes. Candidates for teaching positions sometimes lose ground in critical thinking, reflection, and team problem solving as they master the application of routine methods to complex instructional contexts.

The education of teachers encompasses more than just the coursework they take in college. The connections between classroom learning and real-world application are a major focus for both educational academics and practitioners. This takes us to the next point: there needs to be integration between K-12 schools and universities so that methods like PBL can be implemented in real-world settings where they are needed.

University and school relationships have the potential to generate research questions like these: Would teachers-to-be benefit from PBL in terms of their own professional development, the quality of their classroom instruction, and the achievement of their students? What elements, both internal and external to the classroom, could impact how teachers implement project-based learning? More importantly, how can classroom instruction be better informed by students' real-world experiences? Teachers and university professors should consider how to make their courses more applicable and how to assist future teachers in developing a strategic approach to use the resources at their disposal.

7.3 Cross-Institutional Implementation

Among the many benefits of this paradigm, are the following: increased motivation, the opportunity to "de-center" from one's environment, and access to a larger pool of ideas and knowledge. As an alternative to depending solely on the intra-institutional model, this strategy allows teams of individuals to collaborate on various projects and issues while sharing resources.

Together, Hmelo-Silver and Derry (year of publication) have developed, implemented, and rethought PBL in relation to learning theories and pedagogy, forming an extended cooperation that exemplifies a cross-institutional approach. By pooling their respective areas of knowledge, the participants in this alliance can build technologies, video examples, and problem materials together. Collaborations like these play a crucial role in PBL and other significant pedagogies. The creation and refinement of PBL examples alone necessitates extensive deliberation and modification, as previously indicated. Students working on a project-based learning (PBL) case should be able to relate it to their future classroom work since each case needs to be real, hands-on, and collaborative. In order for them to believe they can make a meaningful contribution to the case, they need to have some background knowledge or expertise with the components. In order to learn and think (e.g., making plans, coming up with theories, collecting evidence, and evaluating that evidence), the case must be complicated enough. New insights can be obtained if the case calls for joint research.

When teachers share resources, they can work together, trade expertise, and help one another as a community of academics. On the other hand, non-sharing of resources could result in inefficiency and duplication of work, therefore posing difficulties for implementation and annoyance for teachers and students alike. Teachers who are frustrated sometimes return to known, conventional approaches of instruction. This begs a significant issue for theoretical as well as practical research: what drives teachers to keep implementing successful pedagogical approaches such as project-based learning (PBL).

Additionally, we can investigate any modifications it instigates using the cross-institutional model. Individually and collectively, educators have an ongoing responsibility to master the art of change management. Furthermore, this is a pre-requisite for numerous modern educational innovations. Acclimating to the rapid speed of change and mastering the technical and social-emotional components of it requires multiple iterations of trial and error and group reflection. By utilizing a cross-institutional approach to PBL, it would be possible to evaluate the differing rates of change taking place in the two or more institutions.

Encouraging students' enthusiasm and active engagement could be achieved by offering a dedicated facilitator and relevant toolsIt would be easier for both individuals and groups to get content and process direction from the facilitator.

7.4 Approach to Implementation on an Individual or Small Scale

It is not always possible or successful to have widespread involvement from the beginning of implementation, especially when it comes to PBL.When there is a need to initiate changes in education, small groups of people are more likely to do so first.The likelihood of the process gaining steam increases if they are effective.

As an example, most medical schools have relatively small classrooms (about 10 students). However, in bigger teacher preparation programs, there may be as many as fifty students in a single classroom, making it very difficult to provide individual attention to each student.Here, a wandering facilitation technique was used to adapt PBL for training big teacher education classes. Using this method, facilitators can adapt their approach based on the needs of each group. But there are limitations to relying on a single facilitator, such as a teacher or instructor. So, in order to round out the wandering facilitator method, the following criteriawere used to choose peers (potential teachers). These included the level of effort put into their work, the number of questions they raised regarding assigned readings, their involvement in class discussions, and the examples they brought in to illustrate concepts. These prospective educators may have been attentive listeners, helped distribute resources fairly, and given a platform to everyone in the group. There were a total of eight groups formed, with five or six teacher candidates assigned to each of the eight groups.

The eight classmates received an introductory lesson on the PBL goal, its processes, potential obstacles, and group problem-solving techniques. Regularly, I (the facilitator/instructor) checked in with the members and how they were doing in their groups. The APBL, content facilitators, and peer facilitators all work together to make it simpler for students and groups to become organically involved with the material and the PBL process.

8. SUMMARY

Higher education institutions are increasingly using problem-based learning (PBL) in a variety of courses and programs in an effort to bridge the gap between classroom theory and students' actual work experiences. Both realms are being brought closer together by the fundamental principles of problem-based learning (PBL), which put a premium on students actively engaging with ill-structured issues in order to build higher-order thinking skills and integrate discipline knowledge. In order to better prepare future educators for the challenges they will face in the classroom, PBL is utilized in teacher education programs. There is a pressing need to train educators who are well-versed in their subject matter and adept at implementing school-based assessment, generic skill integration into curricula, and the trend toward outcome-based education. In light of the available empirical findings, it is evident that PBL had a positive impact on the knowledge and skill acquisition of pre-service teachers. According to recent reviews, PBL is a good way to teach students valuable life skills that are essential for teachers, including how to think critically, how to learn independently, how to solve problems, and how to interact with others.

9. SURVEY FROM THE USERS

It is essential that we address some of these questions as scholars, teachers, and administrators:

- What modifications to the curriculum are required to make PBL (and other inquiry-based learning) more widely available in teacher preparation programs.
- What extra skills would educational institutions require to apply PBL.
- How can collaborations between universities and schools are formed to facilitate resource sharing and professional development across institutions.
- How technology may be applied to make the most of already-existing materials and open up fresh possibilities for PBL in teacher preparation.
- How would these modifications align with the requirements for teaching certification?
- How would the results for the students reflect these changes.

We have compiled opinions by taking surveys on problem-based learning (PBL) from teachers and students in the following images. This survey seeks to investigate how both groups may improve their knowledge and application of PBL in learning environments.

We will try to learn about teachers' present PBL practices, including the tactics they find most successful, the difficulties they experience, and the tools they think might help them in their work. Emphasizing cooperation, resource sharing, and professional development possibilities, we will also solicit their ideas on how to enhance PBL strategies in the classroom.

For students, the poll will center on their PBL experiences during their educational path. We will ask about how interacting with real-world challenges has affected their knowledge of the topic, their capacity for group collaboration, and their general learning motivation. We will also get comments on how PBL may be enhanced from their point of view on what kinds of challenges they find most interesting and what tools they need to be successful.

We hope to find important areas for development and create practical suggestions for increasing the efficacy of problem-based learning in educational environments by means of analysis of the replies from both teachers and students. This cooperative approach will enable a more vibrant and efficient learning environment, therefore benefiting teachers as well as students.

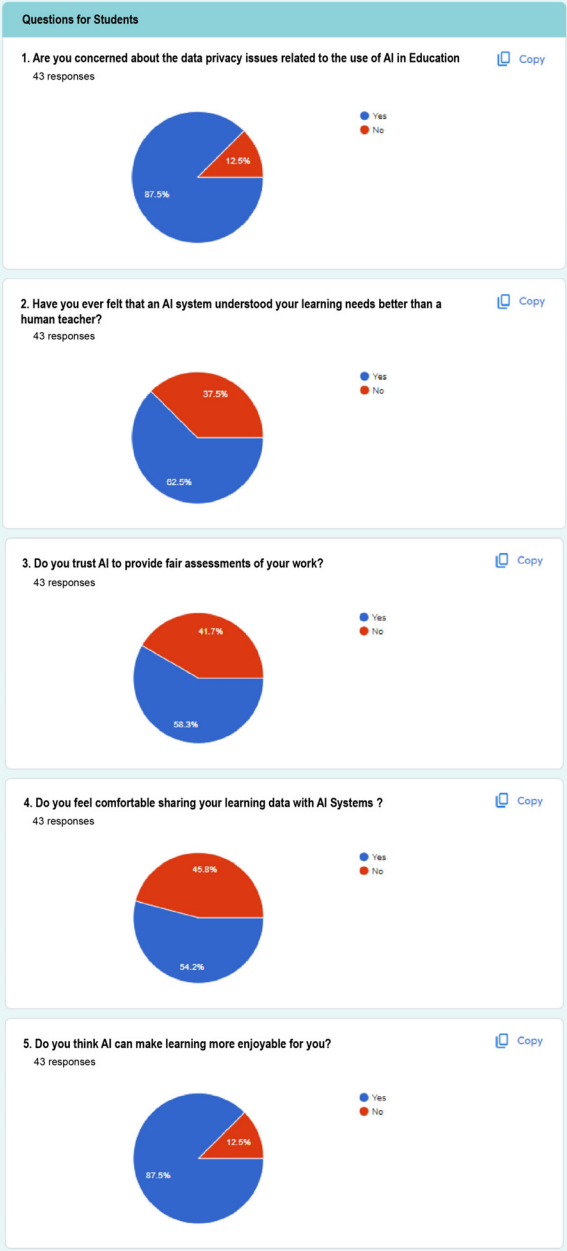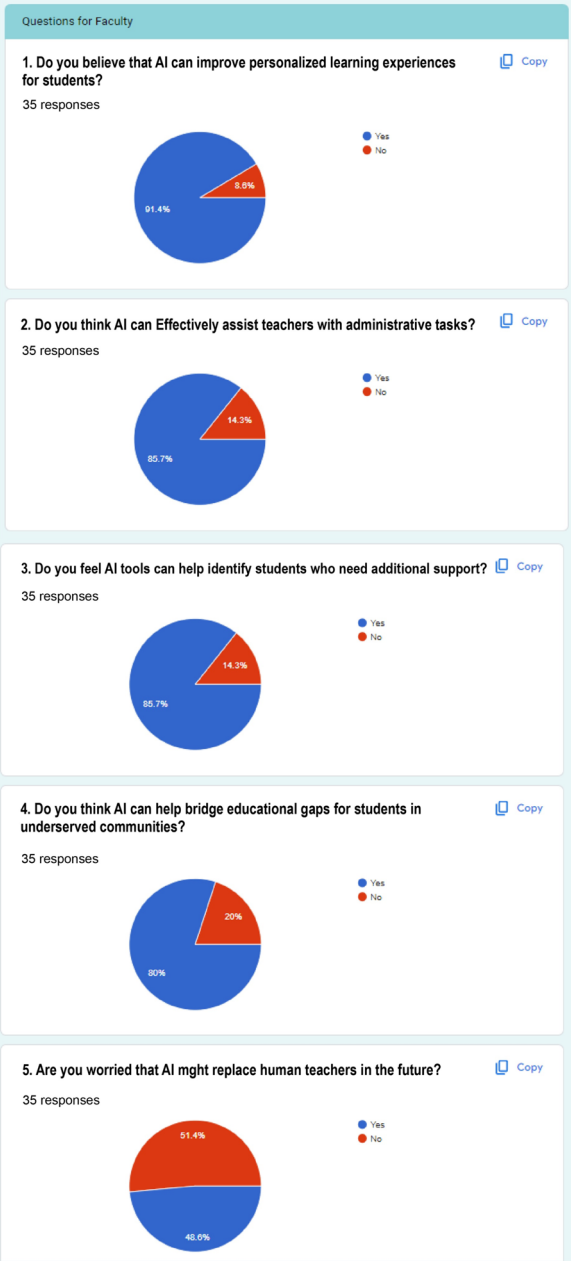*Figure 3. Problem based learning question for students*

Questions for Students

1. Are you concerned about the data privacy issues related to the use of AI in Education   Copy
43 responses

- Yes
- No

87.5%
12.5%

2. Have you ever felt that an AI system understood your learning needs better than a human teacher?   Copy
43 responses

- Yes
- No

62.5%
37.5%

3. Do you trust AI to provide fair assessments of your work?   Copy
43 responses

- Yes
- No

58.3%
41.7%

4. Do you feel comfortable sharing your learning data with AI Systems ?   Copy
43 responses

- Yes
- No

54.2%
45.8%

5. Do you think AI can make learning more enjoyable for you?   Copy
43 responses

- Yes
- No

87.5%
12.5%

277

Figure 4. Problem based learning question for faculty

10. CONCLUSION

We started out by talking about the state of problem-based learning in North American teacher preparation. The data presented here unequivocally demonstrates that PBL is an instructional strategy that gives teacher educators the chance to fulfil the requirements of 21st-century educational reform. It is required of teachers to engage in problem solving, analysis, and framing in addition to possessing strong subject matter expertise and discipline. Not less significant, they will be expected to collaborate and work as a team to address learner and pedagogical difficulties, to grow as self-reflective, self-directed, and lifelong educators, and to work with other teachers, parents, and students.

The type of PBL research and practice that follows will undoubtedly depend on how PBL is implemented, from standalone to more integrated and systematic approaches. From a research standpoint, various PBL methodologies lend themselves to various topics, ranging from questions of generalizability and theory building to action-oriented self-study questions. PBL is a broad strategy, and its application varies according to a number of institutional, social, and individual aspects.

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