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EFFECTIVENESS OF PROJECT-BASED LEARNING AS AN INSTRUCTIONAL METHOD
IN MIDDLE AND HIGH SCHOOL EDUCATION

A MASTER'S THESIS
SUBMITTED TO THE FACULTY
OF BETHEL UNIVERSITY

BY
CHARISE J. AEIKENS

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EFFECTIVENESS OF PROJECT-BASED LEARNING AS AN INSTRUCTIONAL METHOD
IN MIDDLE AND HIGH SCHOOL EDUCATION

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APPROVED

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Abstract

Based on the theoretical framework of experiential learning, this thesis focused on whether project-based learning (PBL) is an effective instructional method for middle and high school education. This review of the literature examined the difference between project-based learning and problem-based learning as well as the difference between project-based learning and a more traditional style of learning. It also investigated the various elements needed to have a successful PBL environment, the challenges/barriers to implement PBL, the instructional methods and support used, collaboration within PBL, and the significance of PBL. The main conclusion was that PBL is an effective instructional method that develops many skills including collaboration, creativity, and problem-solving.

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CHAPTER I: INTRODUCTION

As someone who began working in the business world after graduating from college and has since moved into the educational field, I wanted to pick a topic that I could relate to and utilize in my career. Project-based learning (PBL), which involves learning by completing a project, seemed to be an area that would have cross-over between education and real-world experience. There is a lot of research being done on the topic. Although it is a fairly new idea growing in the education field, teachers have been incorporating project-based learning methods into their classrooms for years even if they did not have the term to identify it.

I believe there is a great deal of value gained through job experience and internship programs, and see project-based learning as a smaller scale way to provide similar experiences in the classroom. My experience shows that this instructional delivery method is the best way to get students more involved in their own education and passionate about the topics they are learning about. There are always new trends popping up in education. With new trends/ideas, educators need to decide if they are simply new fads that will eventually fade or if they are a trend worth incorporating into their teaching. In my own experience, I have found value in incorporating PBL practices into my classroom. For example, in my personal finance class, I include a unit on budgeting that is entirely done using PBL. Also, in my entrepreneurship class, the students use a PBL approach to create their own businesses. The purpose of this literature review is to explore project-based learning and its use as an instructional methodology in middle and high school education.

PBL Impact

Helle, Tynjälä, & Olkinuora (2006) conducted a study to determine if PBL is a trend worth putting into practice. They had four questions: “What is project-based learning? What are

the pedagogical or psychological motives supporting it? How has it been implemented in post-secondary education? Is there any evidence in terms of its impact on learning?” (p. 287). To answer these questions, they broke their study into two parts: discovering the definition and rationale behind PBL, and a systematic review of empirical studies on PBL in post-secondary education.

For part one, they conducted a qualitative review of the literature and discovered five key aspects for their PBL definition. One, projects involve some type of problem solving which is usually determined by the student. Two, the projects also involve student initiative. Three, an end product is created whether that is a report, model, thesis or some other format. Four, the work tends to take quite a bit of time to complete. Five, teachers tend to act as an advisor rather than an authoritarian. They also found three general models of project work used in PBL and four categories of motives. The models include: project exercise, project component, and project orientation. The motives include: professional, democratic or humanitarian, critical thinking, and pedagogic.

Helle, Tynjälä, & Olkinuora also searched the existing literature surrounding project-based learning. They found many course syllabi that lacked learning outcomes and course-specific goals. The syllabi also had poorly articulated pedagogical framework, and many of them included an aspect of collaborative learning. The courses varied in size, but most of the courses required around one to three weeks of full-time work. When discussing group sizes, they typically ranged from three to five people.

Helle, Tynjälä, & Olkinuora found that they could not get enough information to claim that all parties gain through PBL. They did, however, find that student satisfaction, enjoyment, interest or motivation were more positive with a PBL approach. One problem they found was

organizing and administering the PBL classes was extremely time-consuming. Another problem was trying to match student requirements with task requirements. A third problem that was mentioned only once was the fact that the teacher was too specialized to help the students with the subject matter that they chose.

This study was limited by the amount and the quality of data that was found, and by the fact that it cannot be assumed that course descriptions are representative of the field of project studies in a statistical sense. Also, qualitative analysis requires a lot of subjective interpretation. Helle, Tynjälä, & Olkinuora believe that “students would benefit if curriculum developers and teachers were to invest more in the definition of goals and the congruence between stated goals and the activity students are engaged in” (p. 307). If these can be more congruent, and assessment of these projects can be improved upon, teachers should consider the possibility of project-based courses.

Project-based vs. Problem-Based Learning

Self-regulated learning (SRL) allows students to have more control over their learning process. Project-based learning is a method used to promote self-regulated learning, because it forces students to be active participants who can control aspects of their thinking, compare their progress with a goal, and regulate themselves as they work to achieve those goals. There has been quite a bit of research done on PBL itself, but not much comparing it with problem-based learning. The goal of the study by Stefanou, Stolk, Prince, Chen, and Lord (2013) was to discover the relationship between problem-based learning and project-based learning, as well as find the self-regulated learning outcomes of each.

A design-based research approach was used that contained five aspects: happens in a real educational setting, has an element of intervention, capable of having multiple methodologies,

capable of having multiple iterations, and contains collaboration. Students completed self-reports of SRL that were collected at two private universities. The quantitative data was collected over 2-years (2009-2011) during six courses. Two of the courses were employed using problem-based learning and four of the courses used project-based learning. There were 77 undergraduate students involved in the study along with two instructors. For the problem-based learning courses there were 10 females and 17 males. For the project-based learning courses there were 28 females and 22 males. The students who participated in the study were required to complete a questionnaire at the beginning of the course [Motivated Strategies for Learning Questionnaire – MSLQ] and another at the end of the course [Learning Climate Questionnaire – LCQ].

The MSLQ contained 81 items that measured motivational orientations and the use of learning strategies. The LCQ contained 15 items that had to do with their perception of whether they found the educational environment supportive or controlling. According to the MSLQ, the students in the project-based learning courses showed significant differences in the following areas: elaboration (increased), critical thinking (increased), metacognitive self-regulation (increased), and time and study environment (decreased). On the other hand, students in the problem-based learning courses only showed significant increases in peer learning. For the LCQ, the students who took the project-based learning courses perceived higher amounts of autonomy support than those that took the problem-based learning courses.

Neither problem-based nor project-based learning environments proved to increase the surface-level learning strategies in this study, but students who participated in the project-based learning courses had higher levels of learning in key areas from their initial start point compared with the problem-based learning students. This may suggest that project-based learning can have a more significant effect on student SRL, but both designs were successful in facilitating student

engagement of self-regulated behaviors and attitudes. There were limitations. Studying an open-ended course was not the most ideal way to collect data. Another limitation was that there are different areas of cognitive development, and it was difficult to judge whether project-based or problem-based was better when each might support the development of certain types of cognitive development more than the other. It was recommended that each instructor should choose the approach that best aligns with their desired learning outcomes.

Classroom Climate

Classrooms vary so much depending on the climate that the teacher creates with the students. There are two classroom approaches: TC (teacher-centered) and LC (learner-centered). A TC approach focuses on course content and delivery while an LC approach focuses on the students, their needs, and their process of learning. Students in an LC classroom rate themselves as having higher abilities, expectations, and pride in their accomplishments. Project-based learning is definitely more of an LC approach. Hugerat (2016) wanted to answer the following question: “How do perceptions of the classroom climate differ among students who learned science according to a project-based learning strategy in comparison with those who learned according to a non-project learning strategy?” (p. 388).

Hugerat used a questionnaire to assess a group of science students’ perceptions of their classroom climates. The group of 458 science students were around 15 years old, in 9th grade, and attended two different junior high schools. One junior high school group used a traditional non-PBL learning strategy and the other junior high school used the project-based learning strategy.

The questionnaire was designed with five factors in mind: satisfaction and enjoyment and teacher supportiveness, teacher-student relationships, gender inequality and tension, student-

student relationships, and competitiveness. The students who were in the PBL science class ranked higher in four of the five factors: satisfaction and enjoyment and teacher supportiveness, teacher-student relationships, student-student relationships, and competitiveness. The students in the traditional science class ranked higher in the gender inequality and tension factor.

Due to these results, Hugerat believes that choosing an LC approach is the way to go. Students who are involved in a PBL environment have a more positive perception of their classroom climate than students who are in a traditional TC classroom. When students have a more favorable classroom climate, they have higher interest, motivation, and achievement levels. In this study, student-teacher relationships were improved which enhanced students' enjoyment of the class as well.

Guiding Question

The intended outcome of this literature review was attained through focus on the following guiding question: Is project-based learning an effective instructional method to increase learning in middle and high school education?

Definition of Terms

The following terms are defined to help readers understand the literature review:

Employability Skills: Wickam (2015) discusses the fact that employability skills can be in one of three areas: academic, personal management, or teamwork domains. A skill can be considered an employability skill if it is transferable to any environment, can be learned in multiple ways, and there are ways to improve them over time.

Extrinsic Motivation: Lam et al. (2009) discuss that extrinsic motivation describes someone who is motivated by external factors such as physical rewards or money.

Intrinsic Motivation: Johari and Bradshaw (2006) explain intrinsic motivation as an attitude of self-determination at the core. They describe someone who has intrinsic motivation as someone who feels competent, engages in beneficial relationships with people, and has autonomy.

Problem-based learning: Rather than applying or integrating knowledge like in project-based learning, Prince and Felder (2006) believe that the emphasis for problem-based learning is on acquiring knowledge. Loyens et al. (2008) explain that problem-based learning uses simulations of problems with assistance from the teacher that the students work through to solve and meet objectives.

Project-based learning: According to Prince and Felder (2006), project-based learning puts an emphasis on applying or integrating knowledge. Barron et al. (1998) explained that project-based learning begins with a question that drives the learning with a task that is based in real-world problems.

Scaffolding: Lam et al. (2009) describe scaffolding as a way to support student learning by using methods such as modeling and coaching.

Self-efficacy: Bandura (1977) describes self-efficacy as the belief that one has in himself or herself to accomplish things.

Self-regulated learning (SRL): Stefanou et al. (2013) define self-regulated learning as student control of the learning process. They assume four things of SRL: 1. Learners are active participants, 2. Learners control their thinking, motivation, and behaviors, 3. Learners compare their progress against certain criteria to determine whether they are reaching their goal, and 4. Self-regulated mechanisms are used to mediate between the learner, the information, and the outcome.

CHAPTER II: LITERATURE REVIEW

To find relevant studies, The Bethel University Library databases were used. While conducting my online search I used phrases combining the following terms: *Project-based Learning, Problem-Based Learning, Middle School, High School, Business, Education, and Self-Regulated Learning*. Because this topic is fairly new, I included studies about both middle and high school level project-based learning as well as college level project-based learning.

The goal of this chapter is to present and critique the literature to answer the question identified in Chapter I. The Guiding Question for this literature review is: Is PBL an effective method to increase learning? This chapter is organized as follows. First, a theoretical framework for experiential learning is described. Next, there are studies that address the elements of PBL, the challenges and barriers of implementation with PBL, the instructional methods and support used in PBL, collaboration in PBL, and what skills are gained from PBL.

Theoretical Framework: Experiential Learning

A useful theoretical framework for project-based learning is Kolb's experiential learning theory. According to Kolb (1994), learning happens through the transformation of experience. He developed the experiential learning model that is made up of a four-stage cycle to describe experiential learning. The four stages are: concrete experience, reflective observation, abstract conceptualization, and active experimentation. His model was based on Dewey's (1938) push in education for students to do real-world problem-solving.

Step one of the cycle is Concrete Experience. During this step, students engage in some kind of hands-on experience. Step two of the cycle is Reflective Observation; in this step, students reflect on the experience they had in step one. Step three of the cycle is Abstract Conceptualism. After students have reflected on their experience, they draw conclusions and

learn from the experience that they have had. Step four is Active Experimentation. In this step, students try out what they have concluded or learned from their experience.

Kolb set up his model as a cycle, because he believed that learning is an ongoing process. Once students complete step four they return to step one and continue to engage in the experiential learning process. Learning involves thinking, feeling, perceiving, and behaving; both the person and the environment the person is in affect the learning that happens and the knowledge that is created through the learning process. Kolb's four-step model is applicable when using the PBL instructional method.

Elements of PBL

In order to increase student learning, many educators have sought ways to integrate different teaching styles in education. Cho and Brown (2012) conducted a case study at Columbus Signature Academy (CSA) in Columbus, Ohio. The main purpose of their investigation was to discover how PBL was being practiced at CSA and answer the following research questions: What are the essential elements of the use of PBL in this environment and what are the strengths, weaknesses, opportunities, and threats of the use of PBL at CSA?

CSA was established in 2008 as a high school that has a STEM (science, technology, engineering, and math) focus. The reason that CSA was selected for this study was because the school immerses its students in PBL. During the time of the study there were around 370 students and 21 teachers. A case study was conducted that would allow them to gather qualitative results.

The main method of data collection was done through interviews; they interviewed 11 teachers (four of which were in their first year), 12 students (3 students from each grade 9-12), two parents (of one senior and one freshman), four administrators, two community partners, the

Director for the Center for Teaching and Learning at IUPUC, and they did follow-up interviews with six facilitators, two alumni, five admins, and one community partner.

The second method of data collection was done through observation. Several classes and extra-curricular activities were observed and video-recorded. A neighboring company was visited in order to observe how students learn from corporate engineers. A Critical Friend Group (CFG) meeting of teachers who exchange feedback on projects was observed (p. 748-749). Results of the data collection were then analyzed.

Cho and Brown developed a SWOT (strengths, weaknesses, opportunities, threats) analysis to explain the results of the study. The strengths that were found in PBL education included: building on 21st century skills, student leadership opportunity, accountability, increased growth in maturity, student engagement, family culture, care from teachers, teacher satisfaction, interdisciplinary approach, trusting and respectful school culture, and supportive administration. The weaknesses included: not ideal way to learn for every student, distractions for students, less support for certain students, difficult to find students who fit into PBL, dependent upon technology, rule setting for first year teachers, and finding a solid work/life balance. The opportunities included: innovation and creativity, natural fit in a digital age, vocational training, reaching out to people, business in the community, and connecting with community partners. The threats included: pressure from standardized testing, perceptions of the school, funding, the teacher union, lack of public awareness, and differences between instructional methods used in high school and higher education.

Cho and Brown concluded that the teachers in this school chose to teach at CSA in order to be challenged in their professional careers or they wanted to be revolutionary in their teaching through PBL. "PBL was new to them but motivating enough to develop themselves through

professional development tools so they can provide detailed guidance for student group work” (p. 759). The researchers concluded that teachers were challenged to be better facilitators. As for the students, the researchers found that their roles were changed. Rather than being passive learners, students had to become actively involved in the projects to solve the problems that come up in the real world. Students were able to learn content knowledge and soft skills while working alongside community partners. Students were typically willing to share what they knew, were articulate, confident, and were more in charge of their learning.

Although they were able to discover a great deal about this particular school, limitations exist. Since the study was done in a single school in Columbus, Ohio, the results cannot be generalized to other contexts. In addition, the observations were fairly limited due to the number of times they visited the school.

With a growing interest in incorporating problem and project-based learning (PPBL) into schools, many different programs are trying to discover if this approach would be beneficial for them. At the School of Sustainability (SOS), PPBL is used and the program leaders want to be able to describe their goals and initiatives so they can offer guidance to other programs that may be interested in PPBL. At the School of Sustainability at Arizona State University, Wiek, Xiong, Brundiers, and Leeuw (2014) studied the PPBL program. The researchers used data from PPBL from 2008 to 2013. The group consisted of both graduate and undergraduate students and staff with a total of 82 courses, 46 faculty members, and 2,746 students.

The undergraduate program uses a progressive model that increases the students’ exposure to PPBL in more challenging ways the longer they are in the program. In the graduate program, SOS incorporates PPBL into its workshop courses and a few regular courses. SOS found that a major reason that PPBL has been successful for them is because the administration

has dedicated resources and set aside positions for the students and staff to coordinate opportunities. A community liaison and an advisory board have been established as well. Both are helpful in increasing the success of the program, but there are challenges. One challenge that was encountered was the increase in community fatigue and resentment. There needs to be a focus on keeping those community relationships strong and decreasing fatigue, because taking the community involvement away would be detrimental to the program. Students responded that it led to positive educational experiences, increased acquisition of sustainability competencies, valuable collaborative experience, and higher team-building skills.

The researchers concluded that there should be four actions taken to achieve their objectives for PPBL sustainability programs: development of greater program cohesion and coordination, synthesis of past products and learning, monitoring and evaluating impacts, and develop training programs for both faculty and students. With these four actions taken and a focus on both top-down commitment from administration and bottom-up drive from faculty and students, the researchers believe that a PPBL approach in a sustainability program would have better outcomes than a traditional classroom approach.

A study was done in Estonia by Täks, Tynjälä, Toding, Kukemelk, & Venesaar (2014) to examine how engineering students experience the study of entrepreneurship. To discover the views of the engineering students as it relates to entrepreneurship education, a case study was done to find qualitative results through conducting interviews. A portion of the interviews were semi-structured group interviews and the other portion was an individual in-depth interview. The study examined an entrepreneurship course that lasted four months as a part of an engineering degree. The interview participants were full-time, fourth-year engineering students. The groups

were divided based on program: automotive, resource management, and technical design/technology of apparel.

Students viewed the study of entrepreneurship in four parts or categories. The first category was a first step to self-directed learning, the second category was a preparation for work life, the third category was a path to possible self-employment, and the fourth category was a context for developing leadership and responsibility for team achievement. The integration of entrepreneurship in the students' studies can be experienced in seven dimensions. Four of the dimensions were pedagogical; these were: purpose of learning, expectations of the course, emotions involved during the course, teamwork orientation. Three of the dimensions were related to course outcomes: experienced learning outcomes, importance in the curriculum, and attitude toward entrepreneurship.

There were limitations in this study. First, since the sample was engineering students, findings may not be generable to other academic disciplines. Second, it can be difficult to get quality information from large group interviews, and the number of individual interviews was limited (Täks et al. 2014).

Barriers/Challenges for Implementation

The above section described the various elements of PBL. Challenges exist for implementing PBL; these challenges include technology training, lack of time to finish projects, increased stress and fatigue, lack of resources to carry out the project, deficiencies of skills and knowledge, identifying meaningful projects that will challenge students, and teachers relinquishing some control over class time. This section describes details of these challenges.

Studies have shown that students improve self-esteem, academic achievement, and multicultural understanding when they use online learning communities, but the use of

Information and Communication Technologies (ICT) in classrooms for PBL activities is very low. Very little research has been done to discover the barriers that exist when utilizing ICT along with PBL, and that is precisely why Kramer, Walker, and Brill (2007) conducted this study. The questions that the researchers sought to answer were: “What barriers have teachers experienced in using ICTPBL with students? Do these barriers vary substantially across the regions of North America, Eastern Europe, and Africa?”

A web-based survey was used to collect data for this study in order to allow a panel of experts to analyze the open-ended questions and reach a consensus on the results. Once the survey was created, participation selection occurred. There was a screening for educators that were part of the iEARN conference, because it would draw a diverse population of teaching professionals that use ICTPBL. The respondents that had two or more years of experience with this approach were used in order to obtain meaningful information. The population was originally made up of teachers from six different continents, but the focus was on three particular continents (Africa, Eastern Europe, and North America).

Data analysis yielded seven categories: issues with internet connectivity, technology difficulties, curriculum/program concerns, teacher training, ICT support, project-related concerns, and miscellaneous items. Not one of the 51 barriers ranked in the “very significant” to “extremely significant” range, but there were eleven that fell in the “moderately significant” to “very significant” range. The majority of the barriers (thirty-five) fell in the “somewhat significant” to “moderately significant” range, and only five barriers fell in the “not significant” to “somewhat significant” range. North America had the lowest number of barriers reported while Africa had the highest. The barrier that ranked highest for North America, technology training, was almost the lowest ranked barrier for Africa.

Researchers concluded that the situation is more complex than they originally thought. No barriers stood out for all participants, but some stood out based on the regions that were looked at. Some of the barriers that had been prevalent in studies done prior to this one did not have high ratings in this study. This study has its limitations. Since the surveys were sent out to participants on different continents, the ease of access for each participant varied. Some participants in Africa had to use their own money to complete the survey. This could have eliminated some participants from responding and the results could be skewed. Another limitation is the fact that the study was done in English. Since the survey was conducted all over the world, there were some participants that would not have had English as their primary language. Although the study had its limitations and the barriers were not the same across all continents studied, it was apparent that barriers for the use of ICTPBL do exist and pose a real problem for educators interested in this approach. Technology training is an issue that educators need to consider when implementing PBL.

Karaman and Celik (2007) wanted to explore the challenges of PBL as well as find solutions to those challenges. Two of their guiding research questions were: 1. What challenges are they exposed to during implementation? 2. What are their suggestions to overcome these challenges? For the challenges theme they came up with four categories: lack of time to finish project, increased stress and fatigue, lack of resources to carry out the project, and deficiencies of skills and knowledge.

The suggestions for PBL were: increase the amount of guidance from instructor, course content should be lectured in class, increase the number of checkpoints, students should play a more active role in determining the project, examples of projects should be given at beginning, and decrease complexity of project due to the lack of professionalism of students.

The researchers found that novice learners needed more guidance and less responsibility during the process. It is crucial that the correct amount of knowledge, skills, and enthusiasm of the instructor be available to allow for active learning and motivation of students.

Wurdinger, Haar, Hugg, and Bezon (2007) conducted a study to help their school integrate problem based learning into the curriculum. These researchers saw that students' interest in school has been declining over the years, and the number of students that are dropping out of school has increased greatly. They believed that project-based learning could be a way to get students more interested in their education while still challenging the students to learn.

The researchers looked at two interrelated elements: teacher acceptance and student engagement. Surveys, interviews, and staff training sessions were used to collect qualitative data during the 2005-06 school year. The researchers found that teachers started out with a weak understanding of project-based learning. Out of the 36 that took the survey, only two mentioned problem solving as a key aspect of the project-based learning process. They did find that although the teachers were not using project-based learning at the time, the teachers were able to identify benefits of that style of learning. Some of the challenges the teachers identified included time, fairness, and control. It was difficult for teachers to help identify meaningful projects that would challenge students and it was hard to relinquish some control over the class time. Teachers had to turn into a guide rather than a giver of knowledge. This method motivated the students at a higher level to learn more effectively than with a passive teaching approach.

Instructional Methods and Support for PBL

Schools have been challenged to equip their students with more than just knowledge. Now schools need to improve skills such as collaboration, communication, and problem-solving. Although PBL has been rapidly gaining acceptance, there are still teachers who are skeptical

about the idea. In order to provide a quality PBL experience for students, teachers must be able to utilize sound instructional methods and provide the proper support.

Instructional Methods to Increase Motivation

Research has been conducted to measure student motivation when PBL is used (Xu and Liu 2010). Lam, Cheng, and Ma (2008) conducted a study to see how the intrinsic motivation of a teacher is related to the intrinsic motivation of the students in project-based learning. The following two questions were asked: Is the association between the two variables an indirect relationship that involves mediators such as instructional practices? Or is this association a direct relationship that does not involve mediators but simply reflects inflection or modeling? Researchers hoped to help the educators who are concerned with project-based learning understand the mechanisms that enhance student learning motivation.

There were 126 teachers along with their 631 students that participated from four Hong Kong secondary schools. Each of the schools was part of a different district and had implemented PBL due to curriculum reform in Hong Kong. A teacher was paired up with a group of five to six students who studied a topic of their choice over the course of two to three months. At the end of the project, each group handed in a written report and gave an oral presentation on what they had learned. One to two weeks after submitting the project, each student completed a questionnaire. The teachers were also asked to complete a questionnaire and submit in a sealed envelope to ensure confidentiality.

Teacher intrinsic motivation was measured through four items on a six-point scale (1=strongly disagree to 6=strongly agree), and student intrinsic motivation was measured through six items on the same six-point scale. The cognitive support given by teachers was measured through 18 items with six subscales on the same six-point scale. Affective support for

students was measured through four items on the six-point scale. The means for instructional support and student intrinsic motivation were 4.09 and 3.68. The mean teacher intrinsic motivation was 3.99.

Teacher intrinsic motivation and student intrinsic motivation had a positive association with the students' perceptions of instructional support. There was a direct relationship between the teacher's intrinsic motivation and the student's intrinsic motivation; this may be due to imitative learning or modeling. A limitation is that all of the data collected was self-reports from teachers or students. A third limitation of this study is that it focused solely on intrinsic motivation and not behavioral outcomes. Teacher motivation plays an important role in student learning. This is important to understand as educators are promoting reform and advocating for project-based learning. Teacher motivation is correlated with teachers' instructional practices and the success of project-based learning.

There is a push by business/industry to give back to the educational community and internship opportunities are a way to do that. Internships are seen as beneficial to both the company hiring the intern and the interns themselves. Companies are able to get more work done for less money and interns are able to learn in a real-world setting. One problem that arises for an internship program is that certain internships become boring and wasteful if not run correctly. It is believed that using a PBL approach could help combat this problem and help increase the success levels of internship experiences. PBL or Learner-Centered approaches tend to have a component of intrinsic motivation tied to them.

Johari and Bradshaw (2006) conducted a study to discover the underlying reasons why a certain PBL internship program has been so successful, using attribution, self-efficacy and determination as their theoretical framework. All three showed through this study, but the self-

efficacy theory was the most evident. They used one primary question and three secondary questions. The primary question was: “What are the roles of tasks, learners, and mentors in these particular internship IT project-based learning environments?” The secondary questions were: “1. Does a successful project-based learning internship program encourage interrelationship among the roles? 2. Does a successful project-based learning internship program support intrinsic motivation? 3. Did the individual aspects of the internship program apply elements of cognitive motivational theories?” (p. 334).

Over the course of six semesters, eighteen undergraduate interns taking Capstone I and II were studied as they developed IT projects and learned organizational behavior. The researchers focused on four key cases in their qualitative analysis of the data. In-depth interview transcripts from interns and mentors, status review notes, individual appointment notes, mentor reports, and intern portfolios were used to collect data. Interns had to complete status reports during weeks 2, 4, 8, 10, 12, and 14. They presented their final projects Week 16. Notes were taken during two individual appointments (week 1 and week 14), and mentors wrote two letters to report to the academic advisor on how their intern did. The internship program strongly supported interrelated intrinsic motivation between the roles. There was substantial evidence of the three intrinsic motivational perspectives.

Johari and Bradshaw had significant findings from this study. The PBL nature of the internship program strongly supported the interrelated roles and intrinsic motivational assumptions made. The PBL environments can require more cognitively complex tasks and problem-solving of real problems, but there should be a collaborative element that helps make the task more doable. Learners will be more engaged in the project if they find it interesting and valuable. An internship with a PBL approach will be more successful if there is structure that

supports motivational elements related to the three roles of task, learner, and mentor. Significant planning is required to have a successful internship program.

Project-based learning has its limitations which has led many people to research where these limitations are in order to find ways to combat them. Hou (2016) conducted a study on project-based learning that incorporates online discussion in order to look at behaviors that occur. The end goal was finding where the limitations were and where there needed to be more guidance from instructors to improve the PBL experience.

Hou chose to use an analytical approach that has two methods: quantitative content analysis and sequential analysis. The 70 participants were college students studying management that had previously taken information-related courses and could use online forums. The students were assigned a project in which they needed to complete a collaborative project report with each other over a 14-day period. The students needed to collect data, make comments on its analysis, compile the findings and present the final report as a group. Throughout the process, the teacher was not allowed to help out in any way or provide any guidance.

The following items were measured: the initial analysis of the project, the presence of data collection relevant to the project, the initial evaluation of the collected data, the writing on and analysis of the project content, the comprehensive analysis, compilation of existing analysis, and data, proposing comments regarding task coordination, and discussions irrelevant to the project. Both the initial evaluation of the collected data and task coordination were not found through the study so they were not included in the results. The writing on and analysis of the project content was more frequently seen followed by the initial analysis of the project and the presence of data collection relevant to the project. The comprehensive analysis, compilation of existing analysis, and data and discussions irrelevant to the project made up only 5 percent of the

behaviors gathered. Writing and analysis made up 67.78 percent of the behaviors seen, and initial analysis made up 18.33 percent of the behaviors seen. The frequency of discussion was measured and the amount of discussion increased greatly as the project came to an end.

The participants lacked good time management and did not have sufficient initial data collection. Since the initial evaluation of the collected data and proposing comments regarding task coordination were completely absent, the discussion throughout the 14 days lacked structure and order. Hou listed two suggestions for teachers and educational system developers: 1. Teachers could provide incentives and increase student motivation towards the beginning of the project. 2. Developers of educational systems should look into the topic of embedding sequential analysis detection calculation into the e-learning system.

A strength of the study was that data collection was very objective. Another strength was that the instructor could not influence the students in any way so the behaviors were raw. On the other hand, the study is not generalizable due to the fact that the samples were all in higher education settings. There should be more studies with different education setting levels to see what outcomes are the same and what outcomes are different.

Online Delivery Methods

Online delivery methods are another instructional method used in PBL, and the internet is increasingly being used to access resources such as text documents, videos, and animations. Guthrie (2010) sought to improve her understanding of how students use technological resources in a PBL context. Guthrie realized that students become more active participants in their learning and use technology as a scaffold for their projects. The research question was: How are online resources used by students to support project-based learning? (p. 121).

Research was conducted in a second-year undergraduate introductory information systems class at a French business school. There were 382 students enrolled in the course, and the instruction was done in French. A case study was conducted to gain some quantitative and qualitative information. The class was divided into random groups of three and instructed to participate in a project under the PBL context. Each group identified and built a web site that would improve the way that a company operates.

The project was divided into three parts: design, development, and implementation. There were deadlines throughout the course for each individual part and a final deadline for the entire project. Throughout the course, online classes with reference materials that would be helpful in completing each section were made available to the students through a class website. Online resources, online classes, scaffolding classes, and project work were used to test the theory.

Data collection happened several ways. One way was through tracking online student activity. Any time a student accessed pages or files on the class web site, it was recorded to a log. Another way was through an anonymous online questionnaire that was distributed at the end of the class. "The questionnaire items measured student's perceived utility of online resources, perceived attainment of class objectives and learning style" (p. 124). The third way was through administrative records. This method allowed measurement of academic success.

Over the course of the class, there were 11,588 logins to the homepage and 6,313 hits on the online resources. On average, each student logged in 30.3 times over the 11 weeks but there were 11 students who had zero logins. As part of the questionnaire, students answered questions that showed their type of learning style as well as whether they found the online resources helpful or not. "There was no significant relationship between learning styles and the perceived utility of online resources. This result is contrary to expectations and invalidates our second

research proposition. Students with a preference for abstract conceptualization to concrete experience do not perceive online resources as more useful than other students” (p. 127).

Students were also asked whether they preferred a class that was 100 percent instructor-led, 50 percent online and 50 percent in-class instruction, 100 percent online class, or some other organization. Half preferred a 50 percent instructor-led/50 percent online organization, 40 percent preferred 100 percent instructor-led, and 2 percent preferred an online class. Students were also given space to provide suggestions to improve the organization of the class, and the most prevalent suggestion was that online classes should be a support for classroom activities.

Through the case study, Guthrie found that all three types of online resources were needed for their project work. This finding supported what Guthrie had expected, but the second finding did not. Guthrie believed that learning styles would have an impact on the perceived helpfulness of online resources, but the study showed that it did not. The third proposition was that students who have an assimilator (think and watch preference) and a convergor (think and do preference) learning style would perform better than divergor (feel and watch preference) and accommodator (feel and do preference). Guthrie concluded that this was not the case.

One of the limitations was the low number of returned learning style questionnaires. A second limitation was the organization of the class. “Some students expressed frustration with the pedagogy and would have preferred taking classes prior to submitting work. Such negative reactions to the pedagogy may influence perceptions of goal attainment and motivation to use online resources” (p. 129). Although there were some limitations, this study helped Guthrie better understand that teachers need to determine a way to build online learning environments that can support project-based learning throughout the different stages in a student’s learning cycle.

Hsu, Dyke, Chen, and Smith's (2014) conducted a study comparing the differences in science knowledge and argumentation skills between students who used a graph-oriented, computer-assisted application for their PBL and those who did not. It also addressed how a graph-oriented, computer-assisted application supported students' development of argumentation skills and affected the quality of collaborative argumentation between the conditions.

This study used seventh grade science students from a middle school in Chicago, Illinois. There was a total of 54 students in the PBL group, which was the treatment condition, and there were 57 students in the control condition. All of the classes were taught by the same teacher and each student worked in a group of three to five. All of the students engaged in verbal collaborative argumentation with their team and then argued with other teams. The treatment condition used a graph-oriented, computer-assisted application when arguing with the other teams while the control condition did not. After the first week of the class, all of the students were required to write essays. A rubric was created to assign a specific number of points to each essay. Two raters separately graded the essays to come up with more accurate results. The treatment group (those that used the graph-oriented, computer-assisted application) scored significantly higher in science knowledge than the control group.

Results showed that students' learning outcomes in a PBL environment can be improved through the use of graph-oriented, computer-assisted applications in support of collaborative argumentation. Results also showed that intensive cognitive processes that are being supported by a graph-oriented application may result in positive learning outcomes. Group size also can have an effect on results. Groups of three to five are ideal for PBL courses, and this study was able to allow for groups of that size.

Reflection

Reflection is seen as a tool to help learners enhance their experience and is crucial to any kind of experiential learning. Utilizing the web to collaborate with project-based learning opens up various ways to reflect and change the overall learning process. For example, Papanikolaou and Boubouka (2010) found that collaboration and promoting reflective thinking as it pertains to group work enhances metacognitive knowledge in a PBL e-learning context.

A study by Kim, Hong, Bonk, & Lim (2011) examined the effects of reflection variations on group performance and the inter-relationships among team effectiveness, reflection variation, participation, satisfaction, and performance in a Web 2.0 learning environment. The researchers in this study wanted to explore the different results of three types of reflection: self-reflection (SR), group reflection (GR), and instructor-supported reflection (ISR).

The most popular and active Web 2.0 community system in Korea was used to employ this study. The researchers formed a special course community with 12 group work areas. Each person that was part of the community created a personal profile which was displayed, and the group areas included email, text messaging, announcements, schedules, digital storage, and blogs. These tools were used for interaction among members and could be monitored by the researchers. The researchers chose to do a quantitative study in which an ANOVA (analysis of variance) was employed to analyze if there was a significant difference in the team effectiveness scores and the performance, participation, and satisfaction scores. Team Effectiveness scores as well as Performance, Participation, and Satisfaction scores were measured once at the midpoint of the study and once at the end of the study.

Groups had the same level of team effectiveness at the midpoint of the project and all of the groups had significantly raised levels by the end of the project. The difference between the

midpoint and the end was statistically significant for the self-reflection and the instructor-supported reflection, but not the group reflection. In all three areas (performance, participation, and satisfaction), the instructor-supported reflection results were the highest. The difference between performance in all three teams was statistically significant, but the difference between participation and satisfaction were not statistically significant. A strength of the study was its quantitative methodology. A limitation was the small sample size.

With these results, the researchers concluded that group vision was better shared, member roles were better understood, and overall interactions were improved toward the end of the 14-week span of reflections in the Web 2.0 learning environment. Instructor-supported reflection was the best method to improve team effectiveness and increase satisfaction. The group reflection members had difficulty discussing team problems and member contribution which played a role in the overall team effectiveness. Instructors were encouraged to monitor and take part in the learning process for PBL with reflection. Instructors should make suggestions, references, and provide resources to the learners for their projects. Although group reflection performed the lowest in relation to team effectiveness, it led to the highest levels of performance, which suggests that group reflection is important for higher level learning when online tools are used.

Collaboration in PBL

Project-based learning has been growing in popularity in the education world, and the integration of technology has been seen as a way to enhance the PBL environment. Xu and Liu's study (2010) found that PBL enhanced collaboration. The three key components of collaboration that the research focused on include the diversity among group members, the social skills among group members, and the technology used to facilitate collaboration.

Diversity Among Group Members

Project-based learning usually involves group work or collaboration, and there has been speculation on the best combination of group members for the best learner outcomes. In the past, there have been recommendations to have heterogeneous ability grouping when the group work is on a smaller scale. It has been said that this will help the higher achievers improve by getting practice explaining to the lower achievers, and it will help the lower achievers improve by providing them with encouragement and stimulation from the higher achievers. The problem is that not all research has supported heterogeneous grouping, and it has been shown that group functionality is a huge predictor of students' learning outcomes when it comes to PBL. A study was done by Cheng, Lam, and Chan (2008) to focus on how group processes would affect students' perceived efficacy while doing a group project. The researchers also wanted to look at the discrepancy between self- and collective efficacy.

This study used eight secondary schools from different districts in Hong Kong with a total of 1,921 students. All of the students were participants in PBL for the entire year. The students were divided into small groups in which they completed work on a single topic. Some of the groups were assigned randomly, some students chose their own groups, some groups were divided heterogeneously according to skills, and some students formed mini groups that the teachers then paired with another group. To measure the group processes and efficacy a questionnaire was developed to measure positive interdependence, individual accountability, equal participation, and social skills. Results showed that high achievers had lower perceptions of collective efficacy than low achievers, and a higher quality of group processes predicted a higher collective efficacy than self-efficacy. Both high and low achievers had higher perceptions of collective efficacy when the group process was of high quality.

Students had higher levels of collective efficacy in a situation where they had high quality group processes. High achievers had lower collective efficacy than self-efficacy. There were no connections found between the heterogeneity of the group (the gender composition and group size) and the amount to which each group reported their collective and self-efficacy.

A possible limitation of the study was that the data was self-reported. In addition, the study could have contributed more had it included other educational outcomes in its investigation. Future research should be done to look into strategies that would promote positive group processes.

Each year expectations get higher in education. Colleges continue to expect high school students to come to them more prepared than the previous year, and they not only expect knowledge in key areas, they expect skills as well. Many teachers are beginning to incorporate PBL in their curriculum to get students more prepared. A lot of studies have been done to determine the benefits and strengths of PBL, but not many have looked into the differences between male and female students as it pertains to applied learning projects. Farazmand and Green (2012) wanted to find out whether there were differences between the outcomes for male and female students who participated in PBL and what influenced their learning.

A group of marketing courses from an undergraduate business school were used in this study. 116 students (69 males and 47 females) participated in the study. The course began with teaching and learning information from a textbook and transitioned to a project-based learning environment during the second half. During the semester, each student was given three surveys [a pre-test, a mid-term test, and a post-test]. Data was also collected from the instructor in the form of exam and project scores and students' cumulative grade point average.

Male and female post-test results were compared using the t-test method, and there was only one category that showed a significant difference between the genders. Males rated that they would be more willing to work in groups in the future than females. Both genders had similarities when it came to knowledge, skills, and personal development as well as feeling favorable towards applied learning experiences. As for students' grades, females achieved significantly better scores than males, while males had significantly higher perceptions of the team assignment benefits than females.

The students' perceptions and their learning outcomes had a significant positive relationship, which shows that the students who were open-minded to different teaching strategies had higher levels of motivation and performed better. Teachers need to be proactive in showing the students the benefits of applied projects. When looking at the variables that were measured, male students experienced more benefits in four of the six items, but got lower scores. Partnerships between a male and a female or a female and a female performed better than a partnership between two males. This may show that men tend to be more individualistic and women tend to be more collaborative, but should be a topic of further research. The researchers found that women gained more through the applied learning strategies than other teaching strategies by increasing their motivation, improving from the learning experience, and advancing their professional development. Since the study was done with a specific undergraduate program, the results may not be generalizable to all undergraduate business students.

Social Skills

Lee, Huh, and Reigeluth (2015) studied how collaboration can be achieved as an instructional method using collaborative project-based learning (CPBL) to find what the causes are for task, process, and relationship-related intragroup conflict; they also examined how social

skills are related to intragroup conflict and collaboration. They wanted to find answers to the following questions: “What individual difference factors trigger each type of intragroup conflict in CPBL in high school classrooms? How does social skills impact intragroup conflict and collaboration during CPBL at individual and group levels?” (p. 563). They chose to conduct the case study in a high school located in a small Midwest city in the United States, and they did their research using two American studies classrooms.

The American studies classes were co-taught by two teachers. The classes contained students in 9th and 10th grade in which over half were male and the ethnic and racial backgrounds were mostly homogeneous. The classes met twice a week for an hour and a half, and the students worked in groups of two to five for their projects. The three projects contained a planning phase and a production phase. The data was collected using an online questionnaire and by conducting some follow-up interviews.

The survey measured the levels of intragroup conflicts, collaboration, and the use of social skills. They asked 181 students to complete the survey, and 156 of the students actually completed it. Out of the 53 groups that took the survey, thirty-seven reported conflict. After looking through the survey results, sixteen follow-up interviews were done with members of the groups who experienced conflict to figure out what the triggers for each type of conflict were.

The teachers felt that they could see the benefits of CPBL, but they also felt that the intragroup conflict that arose was a major challenge for the students and for implementation by the teacher.

There were several conclusions. Multiple types of conflict occurred simultaneously and group-level social skills were more influential than individual social skills in reducing conflict and enhancing collaboration. In addition, the combination of conflicts occurring simultaneously

may deter or outweigh the positive impact of the task conflict, and the lack of social skills can be detrimental to collaboration.

A limitation was that it was conducted in a small-town school in Midwest United States, and the findings could be specific to this context. A second limitation was that the data was self-reported, and it could be distorted. The third limitation was that the data analyzed may not be enough to examine all of the variables and relationships between conflict types.

Collaborative learning is often used alongside project-based learning, and the use of social skills is important to make collaborative learning effective. A study was done by Notari, Baumgartner, and Herzog (2013) in order to discover which social skills (both at the personal level and the group level) are predictive of the perceived quality of collaboration. Two of the research questions were: “Which personal social skills are predictive of communication behavior, satisfaction with performance and self-rated quality of collaboration in a collaborative PBL setting? Which group configurations of social skills (average level and within-group variability) are predictive of communication behavior, satisfaction with performance and self-rated quality of collaboration in a collaborative learning setting?” (p. 135). These questions are important to answer when trying to understand social skills and their impact on collaboration within project-based learning.

The study looked at two cohorts made up of 155 participants (92 females and 63 males – average age = 24.3) from a mandatory media education course in 2009 and 2010. The course required each student to complete a media project in groups of two or three over the span of three months. The study did not require a specific communication channel, but all email communication between the groups was automatically recorded. At the beginning of the course, each student took a questionnaire that assessed various social skills. At the end of the course, the

students were required to take a different questionnaire that focused on the group's performance and quality of collaboration.

The results for the first survey were broken down into five social skills: cooperation/compromising, prosocial behavior/openness, social initiative, leadership, and assertiveness. Three of the five were predictive of specific achievement outcomes. If students scored higher in leadership they saw the group interactions as less supportive, and they tended to send more emails. If students scored higher in assertiveness they saw less permissibility to bring their individual ideas into the work process. Although these correlations were predictive, there was low to moderate significant correlation between social skills, group process, and email communication behavior.

Having groups made up of students who have similar or dissimilar levels of certain social skills will produce different achievement and performance levels. The study was inconclusive on how the differences would affect the performance level. From the communication and performance aspect, there really was no significant correlation between email communication and performance. However, due to the fact that this was the only form of communication monitored and students could have been using other forms this is not a surprise. Students with high leadership skills tend to be less happy with mutual support in the group and students with high assertiveness had a hard time bringing their ideas into the project. Looking from a group perspective, there seemed to be better results when the members had a higher level of homogeneity in cooperation/compromising, prosociality/openness, assertiveness, and leadership. This study demonstrated the importance of social skills as it pertains to the group-level construct. Research was constrained by the sample size and the limited number of social skills that were

measured. In the future, there will need to be more research done on the validity of these results and additional social skills and their relevance in collaborative learning.

Du, Harvard, Adams, and Lee (2005), believed that collaborative learning accelerates knowledge construction; they conducted a study on an online class to examine how the online project-based learning approach would affect the cognitive skills development and motivation of the students as well as explore what factors would lead to a successful collaborative project.

The study was conducted with students who were enrolled in a Master of Science in Instructional Technology (MSIT) program in the southern part of the United States. The course that the students took was called multimedia design for instruction and it followed a WebCT database which allowed the instructor to record, manage, and support the interactive activities of the students.

The study was conducted over the course of two semesters. Students worked in groups. Learning was interactive, collaborative, multi-disciplinary, and student-centered. Group projects were given that would assess whether students were able to apply theoretical and technical requirements for multimedia design instruction.

The results showed that the behaviors within the group were contagious. If one member exhibited a behavior, it became a norm for other members to exhibit that same behavior. "Almost all the students reported accountability, responsibility, unselfishness, commitment, and dedication as major attributes that ensured the success of online collaboration. Students felt that their online collaboration on the project was more successful, because students in their group exhibited these characteristics" (p. 18).

There were differing styles of leadership exhibited in the various groups. The group that was the most successful had a team leader who coached the team by taking a step back and

letting each team member shine. The other group members felt as if they had ownership in the project and knew that their input was important. One group had a leader that needed to step down due to outside responsibilities. Due to this lack of leadership and the fact that no one else in the group took on the leadership role, this group became ineffective for an extended period. It was not until the instructor gave directives, that the group got back on track.

Setting common group goals was seen as a crucial part of having a successful project. It was important that the groups had a common vision and a set timeline that was followed and managed by the team leader. If one team member was late with his or her portion of the project it could cause another team member to be late and miss deadlines as well. The greater the communication and dedication to these deadlines, the better the project outcome. It was very apparent that the united strength of the group was much more powerful than a single member's strength or leadership.

Peer support was another important aspect of this group dynamic. Friendship, trust, receiving help from other group members, and receiving compliments from other group members helped make team members more self-confident which in turn created a more self-confident team. This dynamic helped students avoid disagreements and come up with solutions through open discussion. The success of the group depended greatly upon the leadership within that group, and groups that focused on the success of the group had better outcomes. Setting goals, peer support, and accepting responsibility also led to a better outcome. An aspect that made no difference in the outcome was the race or gender of the group members.

How Technology Builds Collaboration

With the growth of technology, many new forms of interaction have evolved and changed the way that people collaborate. Chanlin (2008) focused on integrating technology into a

scientific project-based learning environment. The main goal was to discover the tasks and outcomes of project-based learning as a result of the students' involvement.

Fifth graders from a science camp in Taiwan were the participants of the study. Each student was grouped with 3 to 4 other students to create a team that would participate in research activities. As the groups worked on their projects, students were told to keep a group journal. Other data was collected through observations, teacher journals, interviews, and questionnaires. Collected data was analyzed and placed into categories: action, cognitive achievement, and affective.

Through analyzation, qualitative results were recorded. Students who participated in a PBL environment felt that they had a positive learning experience, and students' skills in handling simple and complex tasks improved over time with the scaffolding from the teacher. Students also saw task and outcome as interrelated in a PBL environment. Since the students were using a self-directed approach, the teachers' involvement in guiding the students was crucial for success.

Students were able to derive completely new information through their own exploration. The teachers and students learned from each other's views. Students were also able to learn from one-another during the group interactions. Along with the group work came conflict, but the teachers were able to help the students learn how to work through conflict in a healthy way. A feeling of task accomplishment among students was developed due to the complexity involved in learning in this environment.

A case study was conducted in a virtual reality class by Morales, Bang and Andre (2012) in order to figure out two things: the first was to document the nature of learning activities and processes that were occurring in class, and the second was to describe the student learning that

was occurring. Since the class was set up with no teacher running it and the interactions were done primarily among the students in the class, the researchers wanted to understand and find answers to the question “how do the students’ interactions and collaborations influence the development of the learning community?” (p. 791).

Data was collected from 31 students between 15 and 18 years old. The average GPA was 3.11 out of a 4.0 scale, and ranged from 2.365 to 4.0. The science standardized test score mean percentile was 68.5. The students did not stand out from the general population. Six male students and two female students were selected from this initial group for some focus group observations, and three of these eight were recruited for a formal interview. Eight teachers and twelve parents or guardians participated in an online survey to provide triangulation for observation and interview data.

The first question that was addressed was: “What were the students’ social interactions in this class, and how did they influence project development, and student learning, and behavior?” (p. 798). The social interactions were identified and divided into various types including play, peer mentoring teaching, online peer teaching, collaboration, and global. Play helped generate ideas and creativity, peer mentoring teaching and collaboration helped knowledge-building and problem solving, online peer teaching helped develop mentorship relationships, and global helped enhance the learning in the classroom. The second question that was addressed was: “What academic content knowledge, understanding, and problem-solving skills were demonstrated in the student projects?” (p. 794). The researchers found that content knowledge and understanding was deepened through this process, and problem-solving skills were developed through the collaboration and mentorship relationships. Along with this, the teachers’ surveys showed that the students had growth in social maturity, leadership, responsibility, public

speaking, and creativity/inventiveness. Parents surveyed believed that their children grew in maturity and responsibility. Although there was mostly positive feedback, there were some parents and teachers who expressed concern about the unstructured nature of the class.

The researchers found that “in this very much student-directed learning environment, students developed a social system in which (1) knowledge is communal, (2) skill development is socialized, and (3) each individual student can draw from the collective pool of knowledge and skills of the group, to benefit his or her knowledge acquisition and skill improvement” (p. 801). Overall, the researchers found that PBL is authentic and is a student-driven collaborative activity.

This study has its strengths and limitations. One limitation is that since the researchers had to interpret the qualitative data, there is always room for error or personal input. On the other hand, all of the data was triangulated and analyzed across multiple sources.

Skill Development

There have been many skills developed through PBL including a sense of self-efficacy, life skills, and employability skills. For instance, Lepistö and Ronkko (2013) found that PBL helps develop creativity, courage, initiative, openness, self-esteem, and collaborative skills. Research has also found that PBL enhances life skills.

Wurdinger and Qureshi (2014) conducted a study to determine whether or not life skills could be developed during a Project Based Learning course. Time management, responsibility, problem solving, self-direction, collaboration, communication, creativity, and work ethic are the life skills that the study focused on. The study group consisted of 15 graduate students (ages 22-55) that were enrolled in a 16-week PBL course as part of a Master’s Degree Program in

Experiential Education or Educational Leadership. The group consisted of seven males and eight females.

The class that the students were taking was about PBL; it included PBL readings, PBL discussions, technology use with PBL, and time for students to work on their own projects. For the project, students were allowed to work together, but they all chose to work alone based on personal interests and project topic choices. Before beginning their projects, the students needed to complete a project proposal that covered what questions they wanted the project to answer, why the project was important/significant, and how the project would affect their lives outside of school. The first few class periods the students completed readings and had discussions. During the fourth class period the students turned in their proposals and got feedback from their peers in small groups. For the following eleven class meetings, the students networked with peers and experts to help them develop their projects. The final day of class was used to have students present a five-minute presentation about their finished projects.

They found from the survey that all eight life skills were seen as increased from the beginning to the end of the course, but not all of them increased at a significant level. There was not a significant increase for time management, collaboration, and work ethic, but there was a significant increase for responsibility, problem solving, self-direction, communication, and creativity.

Certain life skills can be developed during a PBL course, but they were difficult to assess due to the fact that life skills required a significant amount of time to develop and people improve upon them over time. In addition, other factors such as family life, extracurricular activities, or personal life experiences that were happening outside of the class may have had an impact on life skill development as well and there was no way to assess that. A third limitation

was that the sample consisted of graduate students who may have developed some of their life skills during their undergraduate programs.

The research did lead them to believe that PBL promotes an increased level of students' life skills especially as it pertains to problem solving, creativity, responsibility, communication, and self-direction. "PBL is an effective teaching methodology that motivates and inspires students to learn, as long as they engage in relevant projects" (p. 286). Wurdinger and Qureshi both believe that PBL should be considered as an effective teaching approach at the collegiate level.

Xu and Liu (2010) conducted a case study in China to look at the differences between traditional style courses and project-based learning courses in higher education. Higher education should cultivate creativity, critical thinking skills and other professional qualities, but many people in China are reluctant to attend higher education, believing the courses are outdated and work experience will be more beneficial. Xu and Liu wanted to determine if project-based learning could be the solution to this problem. They wanted to answer the question: Will a project-based learning approach be successful in providing post-graduate students with more autonomy and creative learning experience?

Based on the results, the researchers found that the students had positive feedback about the course which is unlike other similar courses at the University. The students also believed that they had developed their research capabilities by attending this course. The researchers concluded that the majority of the students learned a great deal through the course and agreed that the methods of using project-based learning, self-directed learning, teamwork and peer-review assessment helped improve innovation and collaboration. This method was more

beneficial for students with the proper academic background and motivation toward the subject matter.

Significance

Many studies have been done on project-based learning which are focused on whether or not PBL is successful. It is also important to look at the benefits of a PBL classroom and determine if there is self-efficacy involved. With so many available instructional methods it is important to know and use the ones that have been proven to increase student achievement.

Benefits of PBL

Karaman and Celik (2007) wanted to explore the benefits of PBL. One of their three guiding research questions was: What are the gains of prospective teachers who participated in PBL implementation? They conducted a qualitative study in which they collected data through an open-ended questionnaire that had seven items. The students were part of a 14-week class called Application of Authoring Languages in PC Environment. During this course, students were required to develop educational software and present their final projects. The survey was given and the researchers chose to group the responses to the 7 items into three themes: benefits, challenges, and suggestions about PBL.

Karaman and Celik created sub-categories with the responses to go under each of the three themes. For the benefits theme they came up with 13 categories. The benefit categories were: gained long life skills, increased opportunities to learn content and skills outside of course content, gained self-confidence, effectiveness of learning process, gained required skills to use in teaching, better course attendance, learned a planned manner of studying, improved imagination, better study habits, gained responsibility, increased patience, better problem-solving skills, and increased cooperation in group studying. The researchers concluded that “PBL is a convenient

learning approach to allow prospective teachers to gain numerous skills which may be interdisciplinary or multidisciplinary...” (p. 213).

Tan and Frank (2006) sought to answer the following question: Can problems modelled on real-world issues actually mirror real-life business situations? A case study was conducted that would explore whether or not a PBL program centered around entrepreneurship would enhance the students’ ability to think and respond to new venture creations. They studied the Republic Polytechnic Institution, because it practices PBL for all of its curriculum, and PBL is a strategy that can force students to work through a problem modeled on real-world issues.

Each class at the Republic Polytechnic is divided into 16 sections and each section addresses a particular problem. Through self-directed learning and peer teaching, students work to solve problems in small teams. The entrepreneurship program called Developing Enterprise (DE), is an elective for students who want to go deeper into the dynamics of entrepreneurship. The DE pilot program was what the case study was focused on.

The main learning objective that the DE hoped to have students reach was to have a broad understanding and feel of what it takes to develop a business. Since PBLs emphasize the application of knowledge over memorization of facts, the elective program has no exams that require the regurgitation of facts. Assessments are based on critical thinking, teamwork and individual participation. Reflection journals and monthly short understanding tests are used. Students are also to come out of the program equipped with the tools to anticipate and manage challenges of new venture creation. The development of cognitive processing skills is an important focus for the PBL program.

In order to develop cognitive processing skills and equip the students with the necessary tools to anticipate challenges in a new venture creation, the DE tries to model real-life problems

in the classroom activities. The DE integrates authentic problems through newspaper articles, video clips, excerpts from policy documents, company financial reports and role-play in its classroom activities. Their hope in providing these simulations, is to have students leaving their program a little more prepared for what they might encounter in the real world.

Tan and Frank wanted to determine if Republic Polytechnic's curriculum was successful in enhancing students' ability to think and respond strategically towards new venture creation. Some of the world's top ranked entrepreneurship education programs, such as those from Babson College, Stanford Graduate School of Business, MIT Sloan School of Management and the London Business School, were compared with Republic Polytechnic's curriculum.

Tan and Frank found multiple similarities between these schools and the republic polytechnic pilot program. They said, "Most of these successful programmes encompass a strong 'learning-by-doing' element through outside-the-classroom activities such as internships with startups, creating and running small ventures on campus and working on small consulting jobs" (p. 2). Another similarity was in final exams. The successful programs did not count these end-of-course examinations as a prominent figure in the program, and they placed a large emphasis on the development of a business plan. The use of an interdisciplinary approach, supporting infrastructure for curriculum development, a diverse student population, and staff that does research are characteristics shared by the reviewed programs.

The researchers identified three problems with their study. First, they discovered that it was difficult to take a real-world issue and condense it into a problem that can be solved in a day, which limits the comprehension of more complex business issues for the students. Second, they ran into a lack of financial resources. Third, entrepreneurship is a multi-disciplinary field and the

faculty may not know enough about every single discipline to provide sufficiently for the students.

Self-Efficacy in PBL

Project-based learning with collaboration is growing in popularity as an approach to instruction, and now people are looking into adding a cross-disciplinary component. By adding a cross-disciplinary component, instructors are forcing their students to go beyond the disciplinary boundaries and look at things from a new framework. There have been studies on how efficacy is affected in PBL environments, but these studies have not considered a cross-disciplinary component. This study done by Schaffer et al. (2012) seeks to discover how team context, team complexity, and individual characteristics can impact efficacy for students working together from different disciplines. One of the research questions was Does student efficacy for cross disciplinary team learning change over the course of the semester?

A service-learning program at a Midwestern University was used for this study. Undergraduate students were selected based on the fact that they were part of the service-learning program and taking a one or two credit semester-long course. The teams of students were a mix of freshmen to seniors, and most were studying a type of engineering. During the 2010 spring semester there were 303 students enrolled in the program. To collect data, students were given a questionnaire, and their performance was judged based on personal learning journals, peer reviews, team design documents, expert review of design presentations, and client reviews. A pre-project questionnaire was given at week four and the post-survey questionnaire (which contained the same set of questions) was given at week 15. There were 178 participants that took the pre-survey and 191 that took the post-survey.

The questionnaire included the following three elements of cross disciplinary team learning. The first element, identification, was the ability to self-identify skills, knowledge, and potential project contributions. The second element, recognition, was the ability to recognize others' contributions to the project. The third element, integration, was the ability to interact with other team members and be able to discover and clarify the various disciplinary perspectives. The degree of change in self-efficacy from the first survey to the second survey was examined. Results showed a significant increase in students' self-efficacy. In addition, of the four elements, identification changed due to individual and team level factors, but recognition and integration had no significant changes.

CHAPTER III: DISCUSSION AND CONCLUSION

The purpose of this literature review was to explore project-based learning and its use as an instructional methodology in middle and high school education. The intended outcome of this literature review was attained through focus on the following guiding question: Is project-based learning an effective method to increase learning in middle and high school education? This review had its basis from the theoretical framework of experiential learning and was divided into the following four sections: 1) Elements of PBL; 2) Barriers/Challenges of Implementation; 3) Instructional Methods; and, 4) Support, Collaboration, and Skill Development.

Certain elements need to be considered when deciding whether or not to utilize PBL. Cho and Brown (2012) were able to break down the strengths, weaknesses, opportunities, and threats of PBL and develop a SWOT analysis. Some strengths that they found, and other researchers also found, included opportunities for student leadership, higher student engagement, increased growth in maturity, teacher satisfaction, and building upon 21st century skills. Some weaknesses included student distraction, loss of power for teachers, and not an ideal way to learn for every student. PBL creates opportunities for innovation, creativity, vocation training, and collaboration; it is threatened by pressure from standardized testing, funding, and the difference between methods used in high school and higher education. Elements that are key for success include program cohesion and coordination, synthesis of past learning, the ability to monitor and evaluate the impact, and developing training for teachers and students. PBL turns teachers into facilitators and makes the learning process self-directed; it helps prepare students for work life and creates a path to future employment while developing student responsibility and leadership skills.

Planning and implementing a new practice in education comes with its challenges. The

studies have shown a variety of barriers that teachers come across when implementing PBL in their classrooms. A lack of PBL training and more specifically PBL technology training, the ability to identify meaningful projects, time to finish projects, resources to carry out the projects, and skills and knowledge make up some of the challenges for implementation (Karamen, Walker & Brill, 2007). Increased stress and fatigue and the inability or desire of teachers to relinquish control over the class time are also challenges of implementation. To overcome these challenges, there should be an increase in the amount of guidance provided by the instructor, course content needs to be lectured in class, teachers should provide regular checkpoints for the students, and students should be given a choice in determining the project (Karamen & Celik, 2007).

Using PBL with the proper instructional methods and support can make the difference between a successful and non-successful outcome. One of the main methods of support that was addressed had to do with increasing student motivation. There was a direct relationship between the teacher's intrinsic motivation and the student's (Lam, Chang, & Ma, 2008). Also, the PBL experience was more successful when instructors were able to support the motivational elements of the students (Johari & Bradshaw, 2006).

A second method of support was the use of online delivery methods or technology. It was very apparent that the use of technology supports improved the PBL environment (Guthrie, 2010). A third method of support was the use of reflection. When students were provided with instructor-supported reflection opportunities, they had the best results; even though group reflection did not help with the effectiveness of group performance, it led to high levels of performance (Kim, Hong, Bonk & Lim, 2011).

Collaboration is a way to enhance the PBL experience and there are many aspects that go into creating the proper collaborative environment such as the diversity of the group members,

the social skills that students have, and the use of technology for collaboration. When it comes to organizing the class into smaller groups, students must be paired up and not all students are the same level achievers. Although high achievers felt lower levels of collective efficacy than self-efficacy, there were no connections between having a heterogeneous group and the amount of collective and self-efficacy that was reported. When the group process worked well, the students (both high and low achievers) had high levels of collective efficacy (Cheng, Lam & Chan, 2008). As for gender differences amongst groups, males had higher perceptions of team assignment benefits and were more willing to work in groups, but females achieved better scores than males. The group size also played a role in effectiveness (Farazmand & Green, 2012).

Social skills played a role as well; a lack of social skills was related to group conflict and was detrimental for collaboration. Group social skills were more important in terms of a positive outcome than individual social skills and there were better results when the groups were more homogeneous (Lee, Huh & Reigeluth, 2015). Behaviors amongst group members were contagious and teams who were led by a coach that took a step back and let each member shine performed the best. The peer support was important for the group dynamic to avoid having disagreements and work together to come up with solutions (Du, Harvard, Adams & Lee, 2005).

The use of technology for collaboration allowed students to discover completely new information through their own exploration and group interactions. The ability of teachers to facilitate the group work and help students work through conflict was improved through the technology scaffolds (Chanlin, 2008). Technology made the knowledge communal, helped socialize skill development, supported the planning and completion of project work, and gave students a collective pool of knowledge and skills from which to draw from (Morales, Bang & Andre, 2012).

PBL plays a role in skill development. Students have been shown to develop their creativity, courage, initiative, openness, self-esteem, and collaborative skills by participating in PBL (Lepistö and Ronkko, 2013). They have also increased responsibility, problem-solving skills, self-direction, and communication (Wurdinger and Qureshi, 2014). Research capabilities and improved innovation have been shown to increase as well (Xu and Liu, 2010). All of these developed skills and the fact that teachers gain a lot of skills through this type of teaching in an interdisciplinary or multidisciplinary approach allow PBL to make a significant difference in the classroom (Karaman and Celik, 2007). PBL enhances the students' ability to think and respond strategically with new venture creations (Tan and Frank, 2006); it also enhances students' self-efficacy levels (Schaffer et al., 2012).

Professional Application

Since K-12 education is compulsory in the United States, but higher education is not, K-12 schools hold a great deal of responsibility on how they prepare students for careers and college. PBL is a research-based way for K-12 schools to provide opportunities for students to learn key skills that will help them succeed after high school. As one veteran Minnesota high school remarked, "PBL is an educational method that needs to be practiced by both students and teachers before it can truly be effective. Bits and pieces of it need to be practiced at the lower grades with additional steps added as students advance in their education. This will result in a more effective approach for high school students of a skill that is embraced and used extensively in business and industry for new product development as well as problem-solving" (L. BeMent-Jaroscak, personal communication, September 8, 2017). K-12 classroom teachers should always be striving to use research-based, effective instructional strategies that prepare students for college and career. Using PBL rather than some of the traditional instructional methods truly

makes a difference in the effectiveness of their teaching. It takes the learning to new levels and helps them make a difference in the lives of their students.

As a high school teacher, I have seen my students benefit from the PBL methodology. I used PBL to facilitate a senior seminar class. For this class, I had students select a project that would be meaningful to them. This particular PBL class came with its challenges but it had positive outcomes. It was challenging for some of the students to determine what their individual topics would be, and it was challenging to get these same students motivated to work on their projects. On the other hand, the students who were able to choose meaningful projects needed little to no motivation to work on them; it seemed that they had enough intrinsic motivation due to their passion about the topic of their projects. I observed students' research, collaboration, and problem-solving skills improve. I also saw many of these students more excited about class than I had ever seen them before.

There are challenges to implementing PBL. As a Minnesota veteran teacher said, "While the use of PBL has proven to develop/enhance a variety of skills, classroom teachers are feeling the pressure of mandated test scores and are somewhat hesitant to imbed PBL in their classrooms" (L. BeMent-Jaroscak, personal communication, September 8, 2017). On a larger scale, schools are being required to focus on core academic subjects like science and math due to the pressure of standardized testing, and unfortunately in some schools, this has caused the elimination of life skills courses. The use of PBL can provide the opportunity for students to develop these life skills no matter what subject they are studying, and they have the "potential to engage the student that is 'less enthusiastic' about school" (L. BeMent-Jaroscak, personal communication, September 8, 2017).

Teachers who would like to use PBL must develop authentic project ideas for their

students to complete. For example, in a psychology class, students could complete a project on how sleep affects the mind. In a language arts class, students could complete a project about language differences across various social media platforms. In a science class, students could complete a project about how germs effect the human body. In an economics class, students could complete a project about the effect the Olympic Games has on its host city. In a business education class, students could learn through a PBL approach by creating a financial portfolio and keeping track of how it does in real-time with the financial markets.

One of the barriers to using PBL is the lack of money available to teachers and students to support whatever the projects require. In order to overcome this particular barrier, teachers may need to apply for grants or work with students to find innovative alternatives so the need for certain supplies is eliminated. Teachers can ask local businesses for donations. Another barrier, discussed earlier in this paper, is professional development about PBL. Teachers can ask curriculum directors to provide training, work with other teachers to design projects together, observe classrooms that are doing PBL, and find out what lower grade levels are doing with PBL, if anything, in order to set students' expectations about PBL.

Limitations of the Research

There are limitations to this literature review. While collecting and analyzing research, studies about PBL in elementary schools were excluded. In addition, it was surprising that there is not a large body of literature about PBL in certain content areas that focus on experiential learning, such as business education. Finally, most of the studies were done using smaller sample sizes and individual cases. For example, Wurdinger and Qureshi (2014) conducted a case study that only had 15 students involved.

Implications for Future Research

There needs to be further research done on PBL. It would be helpful for teachers to be able to determine when it is appropriate to use PBL in middle and high school education based on the characteristics of the students in the class. This could be a topic for future research. For instance, it would be helpful to know if PBL is effective for subgroups such as gifted and talented, special education, and at-risk students. It would also be helpful to know the level of effectiveness of PBL using online delivery methods since online learning at the K-12 level is relatively new. There is also very little research on professional development to equip teachers with the right information to use PBL; this could be another area for further research, because organizing and administering PBL is very time-consuming. Finally, it would be interesting to learn what hardware and/or software tools increase the effectiveness for collaborative PBL.

Conclusion

Project-based learning is a growing field in education and it should continue to be studied. There are numerous benefits that PBL offers to education and the students and teachers that participate in that type of learning experience. Still, there are some aspects that need to be studied and refined before PBL can become the best option when it comes to an effective learning methodology in school settings.

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