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Definitions and Uses: Case Study of Teachers Implementing Project-based Learning

Suha R. Tamim and Michael M. Grant

The purpose of this descriptive study was to explore inservice teachers' definitions of project-based learning (PjBL) and their accounts on the meaning of their PjBL implementations. A purposive sample of six teachers from grades four through twelve in public and private schools participated. Three themes evolved from inductive analysis: (1) teachers define PjBL through its perceived advantages on learning, (2) teachers vary in their use of PjBL over the continuum of the learning process, and (3) teachers adopt student-centered approaches in PjBL. Interpretations and implications of the findings are also presented.

Keywords: project-based learning, constructivism, teachers' perceptions, student-centered approaches.

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Introduction

Project-based learning (PjBL) is an instructional model that is based in the constructivist approach to learning, which entails the construction of knowledge with multiple perspectives, within a social activity, and allows for self-awareness of learning and knowing while being context dependent (Duffy & Cunningham, 1996). Thomas (2000) sets five criteria for PjBL: projects should be central to the curriculum, focused on problems that drive the students to struggle with major concepts, involve the students in constructivist investigation, student-driven, and realistic. Furthermore, Grant (2002) discusses that common features to PjBL implementation are an anchor of the activity, a task, an investigation, provision of resources, scaffolding, collaboration, and opportunities for reflection and transfer.

As an instructional model, PjBL has several benefits on the learning process. However, it also poses challenges to teachers. To shed the light on what teachers face when using PjBL in the classroom, this literature review will focus first on the goals and benefits of PjBL on learning; second, it will focus on the challenges that teachers encounter in PjBl implementation.

Goals and Benefits of PjBL

Project-based learning has been found to bring several advantages to the learning process. In this respect, Wolk (1994) describes PjBL as an "outlet for every student to experience success" (p. 44) as a result of its potential to foster intrinsic motivation, and develop a range of abilities and skills. In PjBL, students gain knowledge and skills through different activities and in a variety of domains. In addition, they develop dispositions or tendencies to act in a certain manner and they develop feelings such as self-esteem and confidence (Katz & Chard, 1992). A number of studies examined the effect of PjBL on learning outcomes. For example, Noe and Neo (2009) stated that students' interest, critical thinking abilities, presentation skills and communication skills, and their ability to work effectively on a team were enhanced when they worked on a PjBL activity. Moreover, Grant and Branch (2005) reported that artifacts, research papers, and exhibits produced in a PjBL activity showed that students were able to move from novices to experts in the domain of knowledge, and that they blended some of their learning abilities in the production of the artifacts. In addition, Hernandez-Ramos and Pas (2009) indicated that students learning through PjBL did not limit themselves to the reporting of facts but attempted to interpret the information, were more motivated about working collaboratively on their presentations, and expressed a more positive attitude towards learning history. Therefore, evidence of the potential of PjBL to heighten learning gains and motivation levels of students is well documented in prior research.

Moreover, teachers also relate perceived positive outcomes of PjBL on the learning process. Investigating teachers' perceptions of PjBL, Akinoglu (2008) described that teach-

ers reported that building students' creative thinking skills as the benefit most gained, followed by learning and understanding of the subject matter. Similarly, surveying teachers about their use of PjBL, Ravitz (2008) stated that the strongest reasons given by teachers for PjBL use was the teaching of skills beyond the content, making learning more personalized and more varied, as well as teaching academic content more effectively. Consequently, the documented evidence on PjBL effectiveness and teachers' perceptions of it indicate that PjBL is not simply an instructional model that aims at gaining knowledge about specific content areas, but it is one that targets the building of the learner as a whole.

Challenges in Implementing PjBL

When teachers choose to use PjBL in their classroom, they might face certain challenges (Blumenfeld, Krajick, Marx, & Soloway, 1994; Kolodner et al., 2003; Mitchell, Foulger, Wetzel, & Rathkey; 2009). Among these challenges are taking on the constructivist approach, adopting new instructional strategies, curriculum and selection of topic, management and design of PjBL, assessing PjBL, and the nature of collaboration.

Taking on the Constructivist Approach

In a review of literature on PjBL, Thomas (2000) argued that some of the challenges that teachers face when approaching PjBL are the conflict it brings to the deep-seated beliefs of teachers in their approach to teaching and the degree of balance needed between student control and teacher control over the activities. As teachers get introduced to project-based leaning, they tend initially to rely on the transmission of knowledge approach, the way they have been used to teach (Blumenfeld et al., 1994). They need time to transition towards the constructivist approach of PjBL, whether it is in sharpening their skills or changing their beliefs. Moreover, Grant and Hill (2006) discussed at great length the influential factors that play a role in a student-centered pedagogy. They explained that teachers must be able to recognize and accept a shift in their function and become comfortable with implementing student-centered pedagogies, such as PjBL.

In addition, teachers need to tolerate the ambiguity and flexibility of the dynamic environment created by the student-centered approach. Also, they should promote an environment of inquiry and challenge, which is key to gaining an intrinsic value of learning (Hertzog, 2007). However, teachers might not find it easy to do so. For example, assisting first grade teachers to move from the traditional approach to teaching to a PjBL approach, Hertzog (2007) stated that teachers felt that they would not be able to complete the required curriculum because of the time needed to spend on projects and were concerned about losing control over the topic, as well as the behavior of the students. As a result, teachers had difficulty giving their students the time needed to build their skills; instead, they felt that they needed to teach the students the skills before embarking in the project.

Therefore, to achieve the goals of PjBL with its student-centered approach, teachers of PjBL have to be motivated, open to a change in their teaching practices, and ultimately allow for flexibility in planning the learning experiences of the students.

Adopting New Instructional Strategies

Teachers do not always adopt new instructional strategies seamlessly. Ravitz (2003) posited that, even when teachers show enthusiasm about the constructivist teaching approach after participating in professional development workshops, they might not find it easy to implement it in their classrooms. Similarly, Vratulis, Clarke, Hoban, and Erickson (2011) stated that teachers would not always take full advantage of new instructional models they get exposed to in their training because of challenges they face during implementation. The authors highlighted the need for teachers to understand how to shift to more student-centered approaches and how to adopt new instructional pedagogies to grade levels and classroom contexts. Exploring how three teachers implemented PjBL for the first year, Park Rogers, Cross, Gresalfi, Trauth-Nare, and Buck (2010) reported that teachers had different views on their roles, different views on the compatibility of PjBL with their views on teaching and learning, and difficulties in helping students "adjust to a new style of learning" (p.905). They asserted that teachers' orientation and past professional experience affect the degree to which they implemented PjBL, and that teachers needed guidance on what instructional strategies to use to support the implementation of PjBL.

Therefore, teachers adopting PjBL need professional development and support to hone their skills on how to implement this instructional model, even after they express interest and show motivation to PjBL. Moreover, they need appropriate resources in order to overcome the barriers that hinder their implementation of PjBL to its fullest potentials.

Curriculum and Selection of Topic

Teachers face the challenge of creating a balance between district curriculum, testing policies, and covering all necessary content within a fixed schedule (Krajcik, Blumenfeld, Marx, & Soloway, 1994; Snyder & Snyder, 2008). Furthermore, teachers may be challenged by not having enough expertise on the subject they are teaching to be able to coach the investigation properly or by students exploring areas that are not necessarily familiar to them (Grant & Hill, 2006; Howard, 2002). Additionally, teachers might not find it easy to select topics suited for PjBL, which should allow the integration of a range of disciplines, have sufficient potential for exploration and investigation, allow for the opportunity for problem-solving, collaboration, and cooperation, and provide the opportunity for construction (Akinoglu, 2008; Katz & Chard, 1992).

Consequently, teachers' inexperience in designing adequate project-based activities or lack of training in critical thinking methodology, which teachers need to model,

creates more barriers to adopting PjBL (Akinuglo, 2008; Kolodner et al., 2003; Snyder & Snyder, 2008).

Management and Design in Project-based Learning

Teachers also face the challenge of the successful orchestration of all the features of project-based learning (Krajcik et al., 1994; Snyder & Snyder, 2008). For instance, the ability of the teacher to manage projects in a large classroom, all the while maintaining the engagement of all students, and the ability of the teacher to maintain a balance between the investigative aspect of the project and the interpretation and reflective activities is an example of such a challenge (Kolodner et al., 2003). Another example is the need to orchestrate multiple resources, information sources, and learning contexts. This is in addition to planning, monitoring, scaffolding, adjusting and troubleshooting strategies (Thomas & Mergendoller, 2000). Therefore, in PjBL, teachers need to act as project managers, overseeing and organizing a handful of factors. These factors can be overwhelming for teachers and can affect if and how they implement PjBL.

Assessing Project-based Learning

Teachers need to address the skill of assessing student achievement in PjBL. In some instances, they ask students to produce artifacts that do not require the use of critical thinking and assessing these artifacts would not measure understanding (Marx, Blumenfeld, Krajcik, & Soloway, 1997). Subsequently, assessment should include not only the final artifact but also several learning products such as portfolios, rubrics, whole class discussion, performance assessment, written journals, weekly reports, and self-assessment (Grant & Hill, 2006; Barron & Darling-Hammond, 2007). Formative assessment that targets critical thinking, the planning and the organizing of the activity should also be part of the assessment (Barron & Darling-Hammond, 2010). Additionally, teachers need to provide their students with clear expectations about the project requirements for better assessment (Grant, 2011). Moreover, teachers need to be able to evaluate individual work as well as group work (Kolodner et al., 2003). Therefore, teachers need to look at assessment in PjBL as multifaceted. It targets individual and group performance, concrete products and cognitive and metacognitive skills, as well as learning and social skills. Such type of assessment constitutes another overwhelming task to teachers, especially when dealing with large classrooms.

The Nature of Collaboration

As a constructivist instructional model, PjBL entails a social learning experience that involves group work. Kapp (2009) described the ability of students to work together as the most difficult aspect of PjBL. On the other hand, Kolodner et al. (2003) pointed to the creation of a classroom culture of collaboration where students feel responsible for

helping each other and of iteration where they expect to make mistakes in order to learn from them. In this respect, Meyer, Turner, and Spencer (1997) stressed the importance of creating a classroom environment that supports mastery and develops a constructive view of error, especially since students might defeat the learning goals of the project if they worried about failing more than succeeding. They added, that by collaboration, students would try out ideas with their classmates and learn from mistakes. Therefore, collaboration is an important aspect of PjBL and teachers need to ensure that the process results in a positive and rewarding experience that enhances learning and performance. When teachers lack the skills or the confidence in creating such collaborative environments, they might feel challenged by this aspect of PjBL.

Therefore, PjBL might pose many challenges to teachers. These teachers need to be open to its constructivist nature, they need to be skilled in taking a student-centered approach with their students, they need to have the motivation and the abilities to adopt a new instructional strategy, and they need to be confident in managing the PjBL activities, especially when they have large classrooms. In order for teachers to implement PjBL successfully, they need to be able to overcome these challenges.

Hence, PjBL leads to a variety of learning gains. However, teachers using PjBL are faced with challenges that affect how they perceive PjBL and consequently how they use it in the classroom. Therefore, the purpose of this study was to investigate how school teachers define and how they report on their use of it in their classes in order to shed the light on their perceptions on what PjBL is and how it can be implemented. Two research questions guided this study:

1. How do teachers define PjBL?
2. How do teachers choose to use PjBL?

Method

Design

A case study approach was used to answer the research questions. The unit of analysis was the teacher in the bounded system of activity of the implementation of PjBL. A multiple case approach was adopted where the case was a teacher implementing PjBl. Several teachers were selected in order to get a broader view on how teachers define and use PjBL and to allow for finding particularities and common features between them (Creswell, 2007; Stake, 2003).

Participants

A purposeful sample of six teachers, who satisfied the criteria for selection, was chosen for the exploration of the research questions. The criteria for selection were as follows:

1. Teachers had to be involved in PjBL for more than one school year to eliminate novice teachers who have no prior experience with PjBL.
2. A diversity of public and private schools and grade levels were sought.
3. Teachers were willing to participate in the study.

Professional contacts were used to identify possible teacher participants using PjBL in their schools. These contacts were asked to recommend teacher colleagues who were implementing project-based learning in their classes and who would be willing to participate in the study. Because this study was interested in exploring how teachers defined PjBL, no definition of PjBL was provided to the possible participants or the professional contacts. This allowed for the exploration of similarities and differences of PjBL definitions and reported uses among the teacher participants. Teachers were contacted by email to introduce the research topic and to set the appointments for the interviews. The resulting sample of teachers covered grades 4 through 12, included four females and two males, and represented three public schools and one private school. The teachers selected ensured variation in the sample between gender, types of schools, and grade level. None of the teachers was exposed to professional development on PjBL. Following is a description of each teacher.

Greg

Greg is a Caucasian middle-aged teacher who teaches 12th grade English in a public school, in a relatively small city. He has been teaching for eight years and using PjBL with his students for six years. His class size is big, comprising thirty students.

Audrey

Audrey is a young African American teacher who teaches 9th grade English in an inner city school. She has been teaching for two years and doing PjBL for a year and a half. Audrey teaches a special course in English targeting struggling readers. Her class size is small, comprising twelve students that she divides into different activity groups.

Diane

Diane is a young Caucasian teacher who teaches 5th grade math and science in a campus school in the city. She has been teaching for five years and using PjBL all through her teaching career. Her class size is medium, comprising twenty-four students.

Martha

Martha is a middle-age Caucasian teacher who teaches 5th grade social studies in a private school in the outer city. She has been teaching for twenty-two years at the 4th grade level and has been using PjBL all through her teaching career. Her class size is relatively small, comprising seventeen students.

Brenda

Brenda is a young Caucasian teacher who teaches 4th grade reading, math and social studies in a private school in the outer city. She has been teaching for four years at the 4th grade level and has been using PjBL for two years. Her class size is relatively small comprising fourteen students.

Scot

Scot is a middle age Caucasian male who teaches 6th grade math and science, in a public campus school in the city. He has been teaching for eight years and he has been using PjBL all through his teaching career. His class size is medium, ranging between eighteen and twenty-eight students.

Data Collection

Two data collection methods were used.

Interviews

A semi-structured individual interview was carried out with each of the participants. The interviews lasted between 20–45 minutes, they were conducted during school hours, and they followed the protocol determined by the research questions. The interview protocol (see Appendix A) was pilot tested prior to data collection.

All interviews were recorded using the Audacity computer software. The audio files were stored on a laptop to be retrieved later for transcription. Each file was transcribed and saved as a Word document.

Document Collection

Planning materials such as lesson plans and evaluation instruments were also collected from the teachers.

Data Analysis

Analysis of the data followed a constant comparative method (Glaser & Strauss, 1967). The inductive process of data analysis started by the researcher gathering information through open-ended questions and fieldnotes. These were put into themes and categories that became broader through analysis (Creswell, 2003).

Iterative rounds of data reduction began with open coding directly from the interviews. Similar codes were grouped into categories and similar categories were grouped into themes. Raw codes were highlighted on the text printout of the transcripts then cut out. Then, these codes were transferred to an online visual thinking tool called Webspiration, which allowed the creation of a concept map. On Webspiration, codes and categories

were color coded to facilitate their identification. Later, similar categories were grouped together to form a theme. Finally, themes and subthemes were reviewed and organized through a peer debriefing and using a whiteboard.

Additionally, profiles were created for each participant on their use of PjBL. These profiles were generated through a careful reading of each of the teachers' interviews in order to highlight their special characteristics of PjBL implementation. This was supported by the reflective notes taken by the researcher after each interview, highlighting personality traits and first impressions of the teacher's approach to PjBL. Similar to the interviews, peer debriefing was carried out on the profiles using a whiteboard.

Lastly, the documents collected from the teachers were studied to look for similarities with the content of the interviews on the design of the PjBL lessons or activities, evaluation methods, technology integration, or examples of artifacts. The collected materials varied in the type of information they provided. Nevertheless, they were helpful in corroborating the data collected from the interviews. The analysis of these documents followed the document protocol (see Appendix B). Instances where data from the document answered to the protocol were highlighted and these were compared to the codes created from the interviews for triangulation.

Rigor and Trustworthiness

Four strategies were used to ensure the rigor and trustworthiness of this study.

Triangulation

Two sources of data collection were used in order to ensure triangulation: semi-structured interviews and documents (Esterberg, 2002). The semi-structured interviews were based on the interview protocol and consisted of open-ended questions. The documents were studied to look for corroboration on the content of the interviews.

Member Checks

The transcript and a profile of the teacher were sent through an email attachment to each of the teachers asking them to review them and make necessary changes (Creswell, 2008). All teachers responded with approval on their profiles with no changes. Only one teacher responded with no changes on the transcript.

Peer Debriefing

Several peer-debriefing sessions were held with a faculty member where codes, categories, and themes were discussed as well as the construction of the teacher's profiles (Creswell, 2007). These discussions were based on concept maps and outlines displayed on a white board. Additionally, discussions covered how rigor was achieved.

Audit Trail

The researcher kept a journal on the coding process and the creation of categories and themes. Furthermore, after each interview, the researcher documented her reflections on the personality traits of the teachers and their reactions during the interview. These reflections helped in the construction of the teachers' profiles.

Limitations

This study has several limitations. First, for some participants, the duration of the interviews was short. Since these interviews were done on site and during school hours, the length of the interview was limited to the time available for teachers in between classes. A longer interview would have allowed for more probing and would have generated more data. Second, only one interview per teacher was carried out. Subsequent interviews would have permitted follow-up on the preliminary findings with the teachers and would have enriched the data further. Third, the data was collected through interviews and document collection. However, in-class observation of how PjBL was being implemented would have also added another perspective on the findings. Additionally, the documents collected varied in nature among teachers, which may have weakened the triangulation of the data. The limitations in the data collection process were due to the data being collected towards the end of the school year that would have made scheduling subsequent visits difficult.

Findings and Discussion

Three themes emerged on how teachers reported their use of PjBL in their classrooms. The first theme related to the first research question (RQ1) and the second and third theme related to the second research question (RQ2).

Research Question 1: How do teachers define PjBL?

One theme emerged on how teachers define PjBL. Only one theme emerged because all the teachers in this study showed agreement on this research question. They all defined PjBL through its perceived advantages on learning and they all revealed similar perceptions on the nature of these advantages.

Theme 1: Teachers define PjBL through its perceived advantages on learning

On this theme, teachers revealed four sets of advantages: support and facilitation of the learning process, differentiation and creative abilities, motivation and engagement, and collaboration.

Support and facilitation of the learning process. Teachers reported seeing several benefits of PjBL on the learning process of their students. When involved in a project,

students' performance was improved, they worked harder and they gave better quality of work. Moreover, teachers found that their students learned more, became more informed, and got a better understanding of the topic at hand in a PjBL activity. Brenda said:

> They do more quality work when they are given the chance to show what they know in different ways. . . . They want to put a positive image out there and so they absolutely work very hard for it. . . . The kids learn a whole lot more and it's so much more authentic what they produce.

In addition to the increased performance, quality of work, and improved learning, teachers saw that students acquired a variety of skills in PjBL. For example, Martha said, "They're exposed to so many more skills that way. They're reading, they're writing, they're finding information, they're composing, they're editing." Similarly, Brenda added, "But they've learned . . . not only the content, but some life skills along the way in the whole process."

Critical thinking was one skill that teachers saw their students acquire. Scot explained how:

> I want them to explore, to ask why, how, and those are the really important questions to me, to get them to wonder. . . . They will give me much more information . . . [if I] have them in an inquiry mode. . . . Especially when you're doing projects, you want them . . . to be a little more critical in their information gathering.

Other important skills that the teachers saw develop during PjBL were research skills, communication skills, cooperation skills, time management, project management, and discipline.

Therefore, increased effort and performance, improved learning, and the acquisition of a variety of academic and non-academic skills are what teachers perceived as the facilitation and support that PjBL brought to the learning process.

Differentiation and creative abilities. As students used and learned a multitude of skills, they were also being creative. Describing the project her students were working on, Audrey explained, "It was a lot of creative thinking that came out of that and it was just from main ideas which could be pretty boring. . . . The student's creativity is supposed to be just wide open for them." Similarly, Diane described, "[With PjBL] You get a lot more creativity, in my mind, because they can put their own personal touches on it."

This creativity and the use of different skills brought about by PjBL lead to the ability of the teachers to differentiate their teaching and their assessment. Different abilities of the students were unveiled that would otherwise remained unnoticed in a traditional learning and testing environment. For example, Martha pointed out that PjBL was an op-

tion for teachers to differentiate among students, "When we differentiate with them and give them a chance to choose the best way for them to learn, that's when I give them the choices of all the different ways to present."

On the other hand, the nature of assessment in PjBL was one major point stressed by all the participants for differentiating among students as expressed by Greg and Audrey.

> Greg: Some students don't shine on tests. . . . PjBL gives them a chance to excel in other means.

> Audrey: [Some students] don't really want to speak and talk in class. . . . Their product can a lot of times be their voice.

Therefore, through PjBL, teachers found a way to have students choose the way of learning they are most comfortable with as well as assess abilities that may be masked in traditional learning settings.

Motivation and engagement. Having students work on projects was perceived by teachers to increase their motivation and engagement. Scot explained, "It gives them more buy-in and they feel like it's something that they want to do, they're motivated to do this rather than it being imposed upon them." Describing the attitude of his students when he tells them that they will be working on a project he said, "You could almost see a shift that was like an ahh, good, let's get this done, that's good." Moreover, teachers reported that, in PjBL, students took ownership and pride in their work; they got a chance to show their learning. Greg, describing an iMovie project said, "The kids literally took the ball and ran with it." Similarly, Brenda said:

> We [teachers] think, okay, here are our goals and then we get into the unit and see that the kids have taken it in a whole other direction. So then, we have to shift with them because that's their train of thinking . . . they feel successful and proud of themselves about what they've produced.

Therefore, teachers liked to use PjBL, not only because they perceived it to have a better impact on the learning process, but also because it motivated their students, kept them engaged, and gave them a sense of ownership.

Collaboration. Another skill learned by students as they worked in groups in PjBL is collaboration. This is a skill which teachers like Diane and Scot gave great importance.

> Diane: Because, to me, part of projects is the fact that they can work together, and they are able to listen to other people's ideas. Because I want them to be cooperative learners and not just be thinking about themselves . . . how their social learning is just as important as their academic learning.

> Scot : The idea behind it is for them to help each other learn, and instead of being a teacher-directed, it is a student-directed activity . . . they also have to be ready to learn from the other students . . . they have to watch and listen to their peers.

So, teachers described using PjBL to teach their students how to function in a group setting, communicate, and resolve conflict effectively.

Therefore, in defining PjBL, teachers elaborated on its advantages of being a teaching method that improved the learning process and allowed students to be creative, showing their learning in their preferred styles. Moreover, teachers believed that by bringing authenticity to the learning process, students in PjBL acquired necessary life skills for working environments. Here, teachers' perceptions are similar to what has been reported in the literature on the advantages of PjBL and the perceptions of other teachers of the advantages of PjBL. Enhancing multiple skills among students, developing a range of abilities, moving from novices to experts, and personalizing the learning with intrinsic motivation are all advantages highlighted in the literature on PjBL and stressed by the teachers in this study (Grant & Branch, 2005; Neo & Neo; 2009; Ravitz, 2008; Wolk; 1994).

This finding indicates that teachers who choose to use PjBL do so because they observed and experienced its return on the learning gains they aimed for. Consequently, these teachers developed positive perceptions about PjBL that led them to believe in it and value its advantages.

Research Question 2: How do teachers choose to use PjBL?

Two themes emerged from teachers' description of their implementation of PjBL. On the first theme teachers varied in their use of PjBL over the continuum of the learning process but on the second theme they were similar in focusing on student-centered approaches when using PjBL.

Theme 2: Teachers vary in their use of PjBL over the continuum of the learning process

Teachers differed in how they described their use of PjBL. While the sample was small, four profiles of PjBL teachers emerged from the data: teachers reinforced learning (reinforcer), they extended learning (extender), they initiated learning (initiator), or they navigated among these three trends according to need (navigator).

Reinforcer. A reinforcer, indicated by Greg, perceived the benefit of PjBL as its potential to supplement and reinforce content that has been completely taught.

Greg. Greg is a teacher who enjoyed the use of projects in his classes. He strongly believed that it is a good approach to motivate students. He used PjBL to increase the

students' interest in the material they are learning which they sometimes perceive as dry. In addition, Greg took advantage of their high technology skills and opened the door for his students to make use of them, in another attempt to motivate them. However, Greg used projects to supplement and reinforce his teaching. In this regard he said:

> Well, I think, what I try to do is a supplement to what I'm already teaching. For example, if we're reading a novel or a play, then I will test them, of course, over their knowledge of the content. But then, in addition, what I try to do is some sort of PjBL, it sorts of supplements and reinforces the content.

This idea of reinforcing and supplementing his teaching with projects was recurrent all through the interview. The projects came in after the content had been taught to the students and their knowledge on it has been tested. Greg perceived the benefit of PjBL in its potential to supplement and reinforce a content that has been completely taught. In that sense, Greg reinforced learning through PjBL.

Extender. An extender, exemplified by Diane and Audrey, used PjBL by having students problem-solve and use critical thinking skills to take their learning a step further from what had been already taught.

Audrey. Defining PjBL, Audrey revealed her constructivist approach to teaching. She said, "Basically it's an opportunity for the students to learn in a different way and to investigate things and work together and put it together and just come up with their own solutions." Audrey chose to use PjBL in her class because she believed it motivated the students, it engaged them in critical thinking and creative work, and provided them with authentic learning experiences. However, Audrey saw that PjBL was best suited to complement the content material she was covering in class. She said:

> It is complimentary to what we are working on already because to me, sometimes it's difficult to just open a whole new can of worms and then, we still have this material to cover. So I go from whatever we are reading or doing in class, and then whatever I think can complement that, and help them understand it better.

In this respect, Audrey extended learning through PjBL.

Diane. For Diane, PjBL was a way for students to learn by doing and produce a product or an artifact that shows what they have learned. On the other hand, Diane viewed the potentials of PjBL to be in its use as a culminating activity to the units taught in class:

> I have typically put projects towards the end of the unit. I feel like it is more of a culminating activity . . . so that they can take everything that they have learned throughout that unit and put it into a project.

Therefore, Diane did not teach her content through PjBL, but her approach was to cover the content first and then move to the project next. However, in doing so, her projects were not repetitive of the content but they allowed students to delve farther, reaching the objectives through critical thinking and learning by doing. She explained:

> We wanted to do something where the kids were taking things from different subjects. . . . And we knew that we wanted them to be thinking critically. We looked at the objectives that were our state standards, what skills we wanted the kids to be able to accomplish through this project and then we looked at the materials that they have already learned about and what new skills they might need to be taught before they would be able to accomplish the project.

So, basic knowledge was covered before the project. For Diane, this was a necessary step that enabled the students to use higher order thinking skills and deepen the focus of the content. As a result, students would then show their knowledge and skills in the artifact they produce. In this sense, Diane extended learning through PjBL.

Initiator. The profile of an initiator, indicative of Martha and Brenda, launched a unit of learning for their students with research questions, continued with a journey of discovery and critical thinking, and led to the production of an artifact.

Martha. Martha explained her use of PjBL as a method through which learning takes place. Talking about a project on Canada, she said:

> [PjBL is] the way we cover the unit. We did use our textbook to cover background reading on Canada. . . . But I found out that if you do let them search for the information and work with the information rather than reading out of the textbook they tend to remember it better and they are learning and they are exposed to some many more skills that way. . . . I just try to introduce them to it and then provide them with different places to go to do their own research. But typically, when they find it on their own, they learn more from it, and they are more drawn into it.

Therefore, with PjBL, Martha took her students to where they constructed their own knowledge through research. In addition, Martha put an effort in scaffolding their learning, as well as including the element of reflection in her PjBL activities. On the other hand, a strong element in Martha's implementation of PjBL was her multidisciplinary approach towards it. Supported by the whole 5th grade teaching team, Martha was fully aware of how a multidisciplinary approach to projects enriched the learning experience of the students and made it more authentic.

Therefore, Martha was the teacher who used PjBL to guide the learning of her students with research questions that took them on a journey of discovery and critical thinking,

leading to the production of an artifact that demonstrated their learning. Therefore, she initiated learning through PjBL.

Brenda. The first impression one got when talking to Brenda was the vivaciousness of her personality. She described her experience with PjBL with great excitement and details. In doing so, Brenda revealed a deep understanding of the potentials of PjBL, even without having had any professional development on it. This is how she explained how learning happens through her PjBL:

> The way I see PjBL is you need to have a focused idea or set of ideas that you want the students to learn but the approach is students learn through different projects. . . . It is hands-on learning and learning by doing. That is the way that I would in a nutshell describe it.

For Brenda, the importance of PjBL lied in students learning by doing, learning in different ways, showing what they know in different ways, all the while strongly emphasizing a student-centered approach. In addition, Brenda saw the potential of PjBL in providing the students with authentic learning experiences. To her, collaboration and teamwork were of great importance for they prepared her students for the true nature of work in the real world. Moreover, Brenda emphasized the importance of showcasing her students' work, which aligned with her efforts to offer her students authentic learning experiences. She was very resourceful in providing showcasing opportunities for the students' projects. For that purpose, she shared the artifacts with several members of the school community, her colleagues, students from other grades, and parents.

Therefore, Brenda used PjBL to bring authentic learning experiences to her students. The aim of her teaching was not only to enrich the student's knowledge and skills, but she took it a step further to prepare her students, even at a young age, to real life. Brenda also added the element of reflection to her PjBL, and in creative ways such as journaling, drawing, and debriefing. Another strong element in Brenda's use of PjBL was her multidisciplinary approach and her collaboration with other teachers. On collaborating with other teachers she said, "You have to work very closely with your teaching partner, for sure and decide that this is for sure what we want our students to learn and what our students need to learn."

In conclusion, Brenda is the type of teacher who embraced PjBL because it aligned with her conviction and understanding of what learning is about. With PjBL, Brenda could bring her students to where they learned by doing, used higher order thinking skills, discovered, collaborated, reflected, and produced authentic artifacts that stem from the different representations of learning among them. She did not use PjBL to supplement her teaching. On the contrary, she taught through the use of PjBL. In that sense, she initiated learning through PjBL.

Navigator. A navigator, evidenced by Scot, uses PjBL in any of the forms described earlier according to the learning needs of the students.

Scot. Scot responded with "it depends" when characterizing almost every stage of implementation during his discussion of PjBL use. Whether asked about how he decided to do a PjBL activity or how he assessed it, or how he formed the PjBL groups, his answers were always based on the need for every situation. For Scot, PjBL seemed to be a fluid and malleable process. This "it depends" characterization reflected his level of comfort in designing PjBL in his classes. He was continuously assessing where his students were and acting accordingly, using projects to fulfill their learning needs.

As a result, he saw two potentials for PjBL. One was to strengthen weaknesses and insecurities about content matter among students. The other was to deepen their level of understanding beyond curricular demands, allowing them to "fly." He told them, "We're doing this because you guys are very secure in this, so I'm going to give you a chance to really, really fly, really get a chance to show what you know." In this sense, Scot showed his skills in navigating through the curriculum, weaving PjBL through it, with the ease of an expert.

On the other hand, and in order to motivate his students in addition to using PJBL, Scot was keen on integrating technology in the projects whenever possible. He says, "Well, I tell you what, when it comes to technology, they are dialed in, they are amped, they have more available to them and they can move through it quicker than you would ever believe."

In essence, Scot aimed at bringing his students to master their learning by discovery and exploration. For him, this became possible when students were motivated. He knew that he could achieve both motivation and mastery through PjBL. His eight-year teaching experience enabled him to navigate and place his projects strategically in the curriculum where needed. Therefore, Scot was the "navigator."

The profiles of the participants reveal that those teachers who were selected for this study for their exemplary work in PjBL shared common characteristics in some aspects of it but differed in others. They all aimed at making the learning experience of their students more interesting and more meaningful, and they all involved their students in hands-on activities.

However, these teachers differed in their perceptions of how PjBL should support learning. They revealed that PjBL could be used at different points over the continuum of the learning process. It can be used to initiate the construction of learning from minimum background knowledge, it can be used to extend learning after core elements have been taught, it can reinforce learning and strengthen it after the content has been taught, or it can be used in any of these three forms to meet the needs of the students. The teachers profiles thus described vary in conformity with the criteria that

have been reported in the literature on the essential components of PjBl. For example, Thomas (2000) stated that the project must be the curriculum where students struggle with the concepts through the project. Similarly, Grant and Branch (2005) argued that the task in PjBL should embed the content. However, the extenders and reinforcers in this study preferred to teach the concepts first and then extend or reinforce the learning through the project. Whereas, the initiators "conformed" with Thomas's and Grant's and Branch's recommendations, the extenders and the reinforcers and extender did not, and the navigator switched between the three. This variation in how teachers implemented PjBL indicates that, even though teachers valued the positive learning outcomes of PjBL, how they used depended on their belief of when and where a PjBL activity is most conducive in the learning process.

Theme 3: Teachers adopt student-centered approaches in PjBL

As teachers described how they were using PjBL, another theme emerged on what they perceived their roles to be in a PjBL activity. This theme revealed four student-centered approaches that were adopted by the teachers: scaffolding, managing team work, assessment and reflection, as well as collaboration and integration.

Scaffolding. Participants in this study saw their role as facilitators, monitors and guides. These roles are portrayed in the PjBL literature as essentials where teachers support learners in building subject matter as well as in acquiring management and inquiry skills (Barron et al., 1998; Grant, 2002; Kintsch, 2009). It is along these lines that the participants explained how they go about supporting their students in moving forward with their projects. They scaffold the learning process through clarifying goals and expectations, facilitating, and providing guidance.

Clarifying goals and expectations. Teachers were keen on clarifying the goals and expectations of the tasks before the implementation of the project. For example, Audrey explained, "Well I do have to give very strict guidelines like a rubric, and give them a model for them an example of what I want."

Facilitating. Another important component of PjBL is the facilitation of knowledge construction. Diane and Brenda explained how they accomplished that.

> Diane: Mrs. Bell and I really were hands-off in terms of telling them what the city was supposed to look like. We wanted them to maybe make some mistakes and learn through them . . . they had to check in with us along the way . . . to make sure that they were on the right track.

> Brenda: As the teachers, we're really just walking around, kind of guiding them. . . . I don't ever want to just give them the answer; I want to lead them to the answer. And often there are times that I don't know the answer too.

So, teachers aimed at having their students construct their knowledge and improve their thinking and inquiry skills. They facilitated this process by supporting students and steering them in the right direction.

Providing guidance. Other than clarifying the goals and expectations and facilitation, in some instances, teachers provided guidance to help the student work through the project. Diane and Martha explained by example.

> Diane: I might do some type of web quest or something based on the project that we're working on or the skill. . . . Or they might have a sheet that they can use as a guide to help them guide their research.

> Martha: I try to make the introduction or the background. . . . I just try to introduce them to it and then provide them with different places to go to do their own research.

Hence, teachers made an effort to provide the students with resources that guided them as they developed their subject matter.

Stone (1998) described scaffolding as a "continuing cycle of communicational tension and resolution" (p. 354). In describing how they guided their students, the teachers reflected this cycle and revealed a good understanding of the scaffolding process that is needed in PjBL in specific and in constructivist student-centered learning environments in general (Grant, 2002; Tobias & Duffy, 2009).

Managing team work. Besides being attentive to scaffolding and guiding the students as they pursue the development of their projects, teachers also gave great importance to team building and group dynamics. For that purpose, teachers were careful in making team work a successful and productive endeavor. Their role here was to set the rules for conflict resolution and to ensure effective participation of all the members on the team. Martha, Diane, and Brenda explain how they maneuver the process.

> Martha: Finally, I say to them when it comes down to something you can't agree on, we would use the majority rules deal, . . . in that process they kind of learn as they go and we try not to intervene more than we have to.

> Diane: I'll sit with them and we will work out whatever is going on, but I don't allow them to just leave the group because I don't feel that that is successful for anyone. I think they need to work through their problems and I view this class as a community. . . . I'm big on voting on things.

Therefore, not only did teachers invest their effort in the knowledge building process but also, they spent time cultivating skills that helped their students become successful

team members. Creating a classroom culture of collaboration and a classroom environment that supports mastery and leave room for students to learn from their mistakes are essential features in PjBL and these teachers were keen on incorporating it (Kolodner et al., 2003; Meyer, Turner, & Spencer, 1997).

Assessment and reflection. Teachers mainly used rubrics to assess the PjBL activities. The rubrics were shared with the students before the project in order to clarify the expected quality of the end product. Several skills were assessed as well as group and individual contribution. For example, describing her rubric, Audrey explained:

> It has a peer critique as well; I always try to include that because if there's one member of the group that's not participating then they know to participate just because they know their part is going to be in their rubric. . . . And then when I do group work, especially everybody has to have an assignment or something they personally have to produce otherwise they'll just lean on other people, some people and they won't do anything.

In addition to assessment, some teachers spent time on reflection and they did it through different ways. Martha called a "debriefing." Scot held it through informal discussions, "As a group, afterward, we talk about the different projects . . . they get a chance to critique their own work and their group work." Brenda described a more detailed approach, "There is a reflection piece that they write. They actually draw a picture and write about their experience. . . . We have them do . . . a written reflection . . . and they get to reflect back on the whole year."

It is interesting to note the differentiation that Diane made between critiquing and feedback. Diane says, "I have not had them be actually critiqued but they have given feedback, positive feedback to the groups, so . . . we always do three comments and a question at the end." Nevertheless, whether distinguishing between critiquing and giving feedback or not, all teachers pointed out the importance of teaching students about constructive criticism. Martha said, "We talked about positive messages, you know, positive critiquing and so forth." Similarly, Brenda explained, "We definitely have the kids encourage each other, give support, give ideas, suggestions along the way."

The way the teachers went about their assessment reflected their views on how PjBL allowed for nurturing and assessing many more skills than a traditional learning or assessment setting. They targeted skills that went beyond the acquisition of knowledge and empowered the students to succeed in authentic environments. In this respect, these teachers allowed their students to experience success and to learn from their mistakes (Kim & Lee, 2002; Wolk, 1994).

Collaboration and integration. In the planning and implementation phases of PjBL, most of the teachers in this study collaborated with other teachers. In addition to

facilitating their task, collaboration enabled them to integrate different subject-matter areas in one project. Diane and Martha elaborated.

> Diane: We wanted to do something where the kids were taking things from different subjects . . . really try to pull it throughout the whole curriculum. And we knew that we wanted them to be thinking critically. . . . I would recommend collaborating with another teacher if you wanted to start to do a PjBL . . . it shouldn't be all one sided because other people bring such good ideas to the table.

> Martha: We've also done it in the past with, say the Civil War . . . and [the language arts teacher] would use . . . a historical novel. . . . [The science teacher] talks about the scientific aspect. . . . So you tie everything together. . . . It's very easy to work as a team . . . you have a math teacher, a science teacher, a social studies teacher, and a language arts teacher and we're provided with teaming time.

In contrast, Audrey's collaboration with other teachers is not planned early in the year. She explained:

> We didn't start out the year saying we're going to definitely plan to do so many projects together, but most of the things that we do like that it's just as we talk, say, "Well, why don't we work together and try to do, you know, something."

Still, for Greg, collaboration does not seem to come easy. He said:

> I think we don't do as good a job on that as we should . . . because I do think that subjects could lend to each other, especially English. We could probably help social studies, science, every subject, more, but we don't. We should do a better job.

So, collaborating with other teachers enhanced the planning of the projects and the integration of several subject matters, and it facilitated the whole task of PjBL. Some teachers had a built-in purposeful approach to it, others planned as they go, and still others did not find it easy to move forward with it.

In their use of PjBL, the teachers in this study employed student-centered approaches where they facilitated the construction of knowledge, targeted academic and non-academic skills, cultivated life skills, and turned learning into a comprehensive and authentic experience. By doing so, they created the necessary conditions for constructivist learning environments, which PjBL is a part of (Grant & Branch, 2005; Jonassen, 1999; Mergendoller, Markham, Ravitz, & Larmer, 2006). However, these teachers chose to implement PjBL

activities in different phases of the learning continuum, as was revealed by their profiles. Consequently, these teachers who showed a belief and comfort with the constructivist student-centered learning environment of PjBL, did not share the same belief and comfort of where to place it during the learning process. This finding could reflect the different level of comfort of these teachers with their PjBL skills as well as strong beliefs of how PjBL can support the learning process.

Summary

In summary, teachers defined PjBL as a teaching method that supports, facilitates and improves the learning process. It also allows for differentiation between the individual students and enriches their creativity. In addition, the teachers characterized PjBL as engaging and motivating, allowing the students to work collaboratively. Furthermore, teachers used student-centered approaches in their implementation of PjBL. They emphasized scaffolding, through goal clarification, facilitation, and guidance. They also gave great importance to healthy group dynamics. In addition, teachers assessed a comprehensive set of both individual and group skills and they allowed for reflection during and at the end of the project. An important aspect of their role in PjBL was their collaboration with other teachers and their effort to integrate different subject matters in one project. However, teachers used PjBL for four different purposes, depending on their beliefs on how learning is best achieved. Some teachers used PjBL to teach the content, others to extend it, one teacher used PjBL to reinforce it, still, one teacher seems to be able to use it different ways, based on the needs of the students.

Implications

In the absence of professional development in PjBL, the teachers in this study practiced PjBL based on their perceptions and beliefs on how optimal learning can be achieved. It is apparent that they appreciated the constructivist characteristics of PjBL. They used it in their classes because of the advantages it brought to the leaning process when compared to the traditional didactic approach. They wanted their students to use higher order thinking skills, they initiated social learning, they asked their students to show their knowledge through the production of authentic artifacts, and they assessed the outcome of learning outside the limitations of traditional testing. This is precisely what the literature on constructivism implies in that it aims at the construction of knowledge with multiple perspectives and within a social activity. It is also context dependent, and it allows for self-awareness of learning and knowing (Duffy & Cunningham, 1996; Jonassen, 1999).

However, the differences observed in how teachers implement PjBL, whether reinforcers, extenders, initiators, or navigators, reflected their teaching and learning philosophy

which is shaped by their beliefs about the effective use of PjBL. Ertmer (2005) points out the confusion around labeling and defining the beliefs of teachers. She states that this confusion is due to the difficulty in determining the difference between pedagogical beliefs and knowledge. She also states that beliefs carry an affective element absent in knowledge. These differentiations are of particular importance in this study in explaining why teachers differed in how they used PjBL.

At the affective level, all the teachers embraced PjBL as a teaching model. Therefore, they carried positive pedagogical beliefs about it. At the knowledge level, these teachers understood constructivism, but they were not as equally knowledgeable about the essential components of PjBL, as described in the literature (Grant, 2002; Thomas, 2000). They implemented PjBL to the best of their abilities without any professional development in its particularities. Therefore, the difference observed in how they implemented PjBL may be due to the lack of an in-depth exposure to what it can bring to the learning process. This difference may also be due to a strong belief about where PjBL can best be placed on the continuum of the learning process.

Moreover, teachers' use of PjBL may have reflected their comfort level in creating a balance between curriculum and testing needs on one hand and their aspirations towards employing constructivist strategies on the other. To that regard, Ertmer (2005) notes the importance of sorting out how teachers' beliefs affect their practice. Whether reinforcing, extending, initiating learning, or navigating through all of three uses, the teachers' perceptions lied in how the manner in which they used PjBL was proving to be beneficial and successful in their respective classes.

An important question that poses itself here is whether all teachers should be encouraged to become initiators, the profile mostly aligned by the PjBL description on the literature (Grant, 2002; Thomas, 2000) or if PjBL could in fact be implemented effectively in any of these uses? Moreover, can PjBL use be regarded on a continuum starting from reinforcement of learning ending in initiation of learning? Thomas (2000) states that for a project to be considered a PjBL activity, it should be central and not peripheral to the curriculum, where students struggle with the concepts of a discipline, and where they construct and transform new skills and understandings. However, do Thomas' recommendations contradict the concept of PjBL's use over a continuum? Comparing learning achievement of students between the different uses of PjBL emerging from this study as well as providing professional training for teachers already using PjBL followed by tracing changes in their use may shed the light on these questions. Ravitz (2010) posits "no two teachers implement PjBL the same way" (para. 10). He also states "it does not seem reasonable to expect teachers to learn about and use this approach entirely on their own. . . . Effective use of PjBL requires extensive planning and professional development" (para.12).

Several studies reported results on how teachers begin to use PjBL after they have been exposed to it through professional development. Most of these studies showed that teachers struggled when trying to implement PjBL in the classroom even after being energized and enthusiastic about it during the training (Ravitz, 2003; Ravitz et al., 2004; Park Rogers et al., 2010; Vratulis et al., 2011). In fact, Levine et al. (2010) specifically pointed at the struggle in playing the new role required by teachers in PjBl, the struggle in managing the project environment, in scaffolding, and in assessment. It is interesting to note the contrast of these results to the results of this study. Teachers in this study have not been exposed to professional development in PjBL and yet did not show any concern over the challenges in implementing it. This brings back the importance of the belief system of the teachers in the learning process. Believing in the importance of PjBL as a student-centered constructivist model seems to enable the teachers to work around the challenges of its implementation. Consequently, professional development can build on this belief system to enhance the extent of its implementation.

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Appendix A

Interview Protocol

Hello! Thank you for consenting to participate in this study on PjBL. Once again, let me go over the purpose of the study. The purpose is to get a deeper understanding of how teachers perceive PjBL and how they implement it. Our interview will consist of a series of probing questions that will help me collect the data that I need for the study. I will also be taping our interview for the purpose of accuracy of the data, and I will be taking some notes. Do you have any questions for me before we start the interview? (Give teacher clarifications as needed). Great! Let's start then. First I will collect some demographic variables to help me describe the sample in the study.

Number of years you have been teaching at this grade level	
Number of years you have been teaching in total	
Number of years you have been using PjBL	
Subject-matter you teach	
Private or public school	
Class size you teach	
Ethnicity	
Age	
Gender	

1. **How do teachers define PjBL?**
   a. What does PjBL mean to you?
   b. Can you give me an example of a PjBL activity that you have implemented?
   c. What do you perceive the role of the teacher to be in a PjBL activity?
      - Can you describe for me how you present the PjBL activity and how you go through the process with your students?
   d. What do you perceive the role of the student to be in PjBL?
      - Can you describe for me how your students go about implementing the PjBL activity?
   e. When you plan a PjBL activity, what are the components that you include in your plan?
   f. How many years have been using PjBL?
   g. Have you received any form of professional development in PjBL?
      - Can you describe it?

2. **How do teachers choose to use PjBL?**
   a. When do you choose to implement a PjBL activity?
      - What triggers your decision to give a PjBL activity to your students?
      - Are there certain skills that you target? Can you give examples?
      - Are there certain domains of learning that you target? Can you give examples?
      - Are there certain sections of the curriculum or aspects of the content material that drive your choice for PjBL? Can you give examples?
      - Are you required by the administration to include PjBL in your teaching activities?
   b. How do you feel about collaborating with other teachers on the same project?
      - Have you experienced this scenario?
      - Was it multidisciplinary?
      - How do you plan such activity?
      - What is your evaluation of it?
   c. How do you describe a successful PjBL activity?
   d. How do you measure the success of the PjBL activity?
      - What types of assessment tools do you use?

3. **How do teachers use technology to support their PjBL activity?**
   a. How comfortable are you in incorporating technology in the PjBL activity?
   b. Can you give me examples of how technology is used?
      - Do you use it to facilitate documentation? Can you explain how?
      - Do you use it to facilitate communication? Can you explain how?
      - Do you use it to facilitate collaboration? Can you explain how?
      - Do you use it to facilitate production? Can you explain how?
   c. Who provides you with the technology support that you need? Does it satisfy your needs and ambitions with respect to PjBL?

Appendix B

Document Protocol

1. Does the document reflect the teachers' definition of PjBL?
2. Does the lesson plan present a problem to be solved or the creation of an artifact?
3. Does it require collaboration among students?
4. Does it target higher thinking order skills?
5. Does it give choices for students?
6. Does it provide resources for students?
7. Does it provide guidance for the students?
8. Does it provide scaffolding?
9. Are the expectations clear?
10. Is the assessment clearly identified? Does it tie in to the objectives stated?
11. Does the document show the integration of technology?