Project Based Learning in the K-12 Setting: Proponents, Components and Opponents

A Literature Review

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Abstract

Project-based learning is a catch all term that is often misunderstood. According to the Autodesk Foundation, project-based learning is a comprehensive instructional model in which project work is central to student understanding of the essential concepts and principles of the disciplines. The basic characteristics of project-based learning are that learning is student centered, learning occurs in small student groups, teachers are facilitators or guides, problems are the organizing focus and stimulus of learning, problems are the vehicle for the development of clinical problem-solving skills, and new information is acquired through self directed learning. The educational pendulum has swung to high stakes performance-based learning and assessment in recent years. The call to educational reform has become a dominant theme in the popular as well as the scholarly press.

One of its (Tanner, 2001) expressions involves persistent criticism of the way educators evaluate student performance. The criticism (Tanner, 2001) has substance. The tests that teachers administer sometimes offer poor content coverage (Tanner, 2001). But with the other swing (Clark & Clark, 2000) of the pendulum there are ideas of learning that have absolutely no assessment foundation to measure performance. This literature review will attempt to explain how project-based learning can be an effective means of instruction with inclusion of appropriate integration of technology and authentic assessment. This learning model is not without its critics and flaws. This review will also show the problems that exist with project-based learning and pose potential solutions; if possible, to reconstruct the learning model.

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Project Based Learning as an Effective Means of Instruction

We take a look at the traditional classroom where instruction is centered on the teacher as the passageway to knowledge. In project-based learning, the teacher plays a different role, more akin to a facilitator. The needs of today's students are quite different from those of their counterparts two or three generations ago. The world has experienced several social revolutions and a knowledge explosion that makes it almost impossible to "cover" more than a small part of what students need to know for a reasonably successful life. Cognitive and problem-solving skills, what some call metacognitive skills, are more important today than any particular piece of knowledge. The teacher-coach in the school environment must be a facilitator of learning, a guide who helps students find appropriate resources and engage in suitable learning activities (Keefe & Jenkins, 2002).

Project-based learning provides active learning experiences based on prior learning. When students are actively engaged in meaningful learning experiences, they are more likely to grasp significant concepts and to develop important skills. Participation in project-based learning and group investigations allows students to develop problem-solving techniques, acquire specific skills; locate, evaluate, and use information; and apply their learning through the development of authentic products (Gardner, 2003). At Central Park East Secondary School, NYC, (Prestidge & Glaser, 2000) classes are organized in seminar style. For their projects, students have been observed spending classroom time building replicas, writing books, transcribing interviews, making mathematical models, creating dioramas, developing photos, and engaging in debate about a classroom decision. Field work at school sites can consist of

collecting samples, interviewing resources, aiding in research, measuring, recording, searching, etc. What students are doing is learning by doing through genuine experience. In the final analysis, personalized instruction reflects deep concern for learners and the willingness to search for ways to adjust the teaching/learning environment to meet the learning needs of individual students (Keefe &Jenkins, 2002). Project-based learning, although collaborative in nature, allows for the opportunity to address individual learning needs because of its flexibility.

Singapore, (Chin & Chia, 2004) a city/state decided to implement collaborative project work to enhance curiosity, creativity, resourcefulness and teamwork to prepare their students for a more global economy in the information age. In the past, project work tended to be rather structured. Studies of structured activities have found that students become so caught up in carrying out prescribed procedures that they fail to think deeply about the underlying science concepts. Chin and Chia (2004) did a predominantly successful study that implemented project based learning in year 9 Biology at an all girls secondary school. Each group of students (4-5) was given an opportunity to choose a topic based on the theme, 'Food and Nutrition'. The project work ideas were integrated into teacher lessons focusing on enzymes, nutrients, food groups, diet, malnutrition diseases, and animal and plant nutrition. Students that were 'experts' the specific aspects of food and nutrition were then asked to share their knowledge of the topics and issues that were being raised. There were a total of five documented stages in the procedure: identifying the problem to be investigated by reading and sharing case studies, exploring the problem space by designing their own tasks based o n the problem, carrying out the scientific inquiry by gathering data to answer their questions, putting the information together, and presenting the findings, teacher evaluation and self-reflection.

In Singapore, (Chin & Chia, 2004) like the UK, students undergo rigorous GSCE testing (O levels). These students were not constrained by the standards and were allowed to research into areas beyond the standard just by what they were interested in. The main reason for learning success by these students did not depend solely on the openness of choosing topics as the students mentioned. Success was driven by highly structured forms and reflection logs that were used to guide students' knowledge construction and capture their thinking. Students were interviewed to find out what they had learned as to prevent cutting and pasting of work too.

During the 2001-2002 school year, 23 foreign language and ESL teachers and 650 students from eight states and three countries participated in an action research study to determine the impact of implementing the theory of multiple (8) intelligences in daily classroom activities (Haley, 2004). Students were assessed for intelligence profiles with an informal multiple intelligences survey. The purpose of this survey (Haley, 2004) to was to raise student and teacher awareness of multiple intelligences. One common thread throughout all of the results was the teacher's role as a reflective practitioner and facilitator with the student acting as a reflective partner.

When the pilot study (Haley, 2004) was conducted it was to identify, document and promote effective real-world applications of the multiple intelligence theory in foreign and second language classrooms. Results indicated that teachers were profoundly affected by these approaches: they felt that their teaching experienced a shift in paradigm to a more learner-centered classroom; they were once again energized and enthusiastic about the pedagogy, and they felt they were able to reach more students. Students demonstrated keen interest in multiple intelligence concepts and showed positive responses to the increased variety of instructional strategies used in their classrooms (Haley, 2004).The eight multiple intelligences fare a

compatible fit for project-based learning, which consist of the following: bodily/kinesthetic, interpersonal/social, interpersonal/introspective, logical/mathematical, musical/rhythmical, naturalist, verbal/linguistic, and visual/spatial.

Integration of Technology for Project Based Learning

Judith Oberlander and Carolyn Talbert-Johnson (2004) did a quasi-experimental post-test only comparison group study to examine the effectiveness of adopting project-based learning and technology-enhanced learning strategies in a constructivist context. The variables measured were: a.) years of teaching experience, b.) age, c.) previous technology training, d.) and familiarity with project-based learning. The group responses were collected as a range, rather than a specified age or year. The technology training received in the last five years was collected as a determinant of teacher familiarity or awareness of more current technology rather than a measure of knowledge and skill. The teachers were put into two groups the intervention group and the comparison group. The group I teachers had more experience teaching, were slightly older, and had more hours of technology training than the comparison educators. More educators had experience with project-based learning in the comparison group, but the differences between the groups were minimal.

The intervention group in this study (Oberlander & Talbert-Johnson, 2004) received an immersed technology-enhanced project-based learning experience similar to what the students might encounter when engaged in project-based learning. All educators received the same project-based learning experience problem. This problem was chosen because the problem met the criteria for an “ill structured problem”. The problem doesn’t contain enough information to understand the problem. Teachers went through a total of 7 sessions with prescribed agendas and accompanying technology integrated activities. Educators were put into specific teams for

the duration of the class. This quantitative study produced some interesting results. In the post intervention survey, 17 educators responded to the survey with 15 reporting that they have designed a project-based learning unit in their classroom as a result of the course. The technology coordinators noted that all educators had confidence, comfort level, and exposure with things they had no previous exposure to. The teamwork built up their confidence levels. The results of their investigation provide a rationale for employing technology –enhanced project-based learning strategies with a constructivist orientation in learning contexts. According to the authors, the nature of the true impact of project-based learning can only be evaluated when stakeholders advocate for activities that include elements of rich environments for active learning. Further research is needed to explore more fully the nature of project-based learning in instructional technology in various educational settings.

Classroom experiences indicate that students benefit by participating in the research, design, and presentation of multimedia projects (Prestige & Glaser, 2000). Multimedia projects are works that involve days to weeks of either individual or group based work. The usage of multimedia tools such as PowerPoint drives students to make many decisions regarding the design and construction in addition to developing the content. Multimedia integrated projects encourage students to multi-task, a skill needed in the real world (Gardner, 2003). While working in groups, students learn how to negotiate to have their design or content included. When these products are finished they are generally shared with an audience much bigger than their classroom. This audience can be school wide, community wide, or out to the web, thus being global. This raises the stakes to develop and perfect the project for an authentic audience (Gardner, 2003).

The greatest stumbling block for technology integration into project based learning today is the standards based reform employed by the "No Child Left Behind Act" (Oberlander & Talbert-Johnson, 2004). It is a contradiction in terms to have technology integrated PBL which measures the whole child and these large scale tests which only measure a portion o the knowledge skills and understandings that the standards represent.. Unfortunately, learning represented by technology integration into the curriculum and instruction is being put aside because these approaches may not link or be measure within the current standards or rising test scores.

There are three tensions that impact the relationship between standards-based education and professional development for technology integration: Traditional versus progressive pedagogy; standardized tests versus authentic assessment; and technology as central versus technology as peripheral to pedagogy (Keller & Bichelmeyer 2004). If excellent pedagogy becomes the foundation of a school's mission and the central focus of all professional development for educators, standards and technology integration will fit in their respective slots without the clash.

Assessment

Project-based learning will lack any form of substance without proper assessment. Unlike performance-based assessment which measures a limited amount of knowledge and learning, authentic assessment takes into account different aspects of learning. In designing appropriate assessment strategies for young adolescents, middle-level educators must have a clear understanding of assessment and its goals and purposes. Assessment should (a) complement the curriculum and encourage expansion, (b) encourage teachers to assume

professional responsibility for and ownership of evaluation, and (c) make schools accountable on their own terms, not those of politicians (Mitchell 1990).

Students need to have clear objectives of what they are supposed to be learning and given consistent assessment of their work. Parents should be kept in the pipeline in regard to their students work receive exposure through various communications about school expectations. This will aid parents in the assistance and encouragement process. Teachers and site administrators should know what students can do and set up strategies to help students become more proficient. Most important, before something like "No Child Left Behind" gets implemented, decision makes must have statistically reliable information about learning and achievement to make informed decisions. Schools that are developmentally responsive must have assessment programs that complement the curriculum and encourage expansion, involve teachers in the design and implementation of assessment, and provide students with a challenging, active learning environment (Clark & Clark 2000).

As teachers climb toward full implementation of alternative assessment practices, they pass through three levels on this implementation ladder (Corcoran, Dershimer & Tichenor 2004). Level 1, the beginning level, involves Rubrics, Portfolios and Checklists. Level 2, the intermediate level, includes journal entries, "I learned" statements, learning illustrations and self-assessments. Level 3, the top level, involves self-choice of medium and "I can teach" As a teacher ascends to the top level, the other levels and strategies are used on a regular basis and allow flexibility in their standard assessments.

The best authentic assessment practice is to show students the rubric prior to teaching. The rubric is a document that describes the achievement levels for different tasks indicating levels of acceptable to unacceptable performance (Farmer, 1997). Most teachers and researchers

are fairly well persuaded that student learning can be assessed even when the end product is an artifact or performance produced by a group. Researchers (Farmer, 1997) fear that the procedures for assessment will be much too time consuming and impossible to manage. The following rubric generating software tools have been suggested in the organization and time management process for development (Rubistar, 2000).

You can create your own rubrics from several templates in different content and age ranges (Staff Room for Ontario k-12 Teachers, 2002). Teacher created rubrics and other forms of assessment exist at this site (McGrath, 2003).

There are three phases of rubric implementation (Schultz, 2002). The first phase of implementation involved the use of a teacher derived rubric assessment scale that was passed out to participants as a project was assigned. The second phase of implementation involved getting participants marginally involved in developing rubrics based on their particular projects. In the third phase, the participants generated their own rubric scale based on the perceived strengths of their projects.

The three-phased process of rubric development process advocated by Schultz (2002) allows students to experience responsibility for their learning through a gradual changing of the guard. The teacher gradually shifts control to the students, while nurturing and supporting student self-esteem in the classroom. As students gain experience being responsible for their learning, the control over learning gradually shifts to them. Through this process, opportunities are provided for students to alter their perceptions and expectations based on experience with personal responsibility for learning in the classroom (Schultz, 2002).

The following are best practices for rubrics (Wiggins, 1998): a.) are sufficiently generic to relate to general goals beyond an individual performance task, but specific enough to enable

useful and sound inferences about the task, b.) discriminate among performances validly, not arbitrarily, by assessing the central features of performance, not those that are easiest to see, count, or score. c.) do not combine independent criteria in one rubric. d.) provide useful and apt discrimination that enables sufficiently fine judgments, but do not use so many points on the scale (typically more than 6) that reliability is threatened, e.) use descriptors that are sufficiently rich to enable student performers to verify their scores, accurately self-assess, and self-correct, and f.) highlight judging the impact of performance (the effect, given the purpose) rather than over reward processes, formats, content, or the good-faith effort made.

Obstacles to Project Based Learning

Common problems that students faced with project-based learning related to: unhealthy group dynamics; difficulties in getting group members to meet often enough because of different schedules outside curriculum hours; the narrow scope of the topic; lack of ownership of the topic; a lack of time; lack of focus and off task behavior; and encountering people who were reluctant to provide information. Researching via the Internet was time consuming. The overwhelming amount of information distracted some students from focusing on areas relevant to their problems (Chin & Chia 2004).

A similar case study which focused on the usage of a specific multimedia tool, ASTOUND, was conducted in Israel in two Grade 12 classes (Orion, Dubowski & Dodick, 2000). Their findings showed that an integration of laboratory exercises, field trips, and an independent study project, could lead to meaningful learning. However, although most of the students enjoyed using the multimedia program, there was no evidence to support the assumption that it contributed to knowledge acquisition. In fact, much of the time invested in multimedia authoring was devoted to producing decorative effects, reducing the time available for

meaningful learning. The discrepancy between how the students felt about their learning experience and the actual learning experience was wide. Surveys from students elicited answers like this, “Definitely yes. The experience of presentation-building was fun on the whole and teaches the material in an interesting and helpful way.” The results were different when viewing the charts that showed the division of tasks during presentation building based on an analysis of direct observations and video filming of class activities showed different results. After analyzing the student’s work during presentation –building an important finding emerged; students spent anywhere from 10 to 35% of their time developing content. Three problems were associated with the learning strategy developed for the program: Technical distractions, Time specifically regarding the learning of basic computer skills, and the software itself because the visual effects entice the students into playing at the expense of focusing on learning.

Authentic assessment offers a good deal of intuitive appeal. It is responsive to student diversity and it focuses on products which will have value beyond the classroom. There are component problems that advocates do not address (Tanner, 2001). Much of the appeal of alternative assessment practices is a knee jerk reaction to the norm-referenced, standardized assessments. When using the objective standards they offer no automatic solution because as specificity increases, so does the evidence of their arbitrariness. Let’s say a 7th grade year end science portfolio has a quality indicator for knowledge of related scientific principals. The teacher could decide that this particular element is worth 20% of the total grade. That could appear to be reasonable, but why not 25% or 15% instead. If there are content standards set by the state and federal government, shouldn’t there be some standards set for alternative assessment? Traditional assessment also can be measured by its reliability and validity. With such qualitative assessments can there be reliability and validity? Authentic assessment is a

harmony with real-world circumstances. The appearance factor is likened to face validity in norm referenced testing. To proponents of norm referenced testing face validity as a central tenet to authentic assessment is an oxymoron.

Rubrics as a measured tool for assessment can be limit curiosity and creativity for some students. One student involved in the three phases rubric assessment plan (Schultz, 2002) stated, "I used rubric scales in my classroom without realizing that I was not effectively including my students in any part of the evaluation process. Yes, they used my rubrics as guides to compete their papers, but I lost sight of the fact that my rubrics only made my expectation clearer to the kids. They didn't have to guess at what I wanted, but at the same time, they didn't include anything beyond what was detailed on the rubric tools.

Where there are levels of limitations imposed by teachers on students when constructing rubrics, there is accompanying frustration. When teachers moved into trying to generate a rubric they became frustrated in the same way that students became frustrated. They felt that by expending all of the time on developing the rubric took a way from creative time on developing their project it self.

Potential Solutions

Throughout the PBL process, the teacher has to be an active facilitator. If students face difficulties in identifying a problem, she needs to provide seed ideas by posing appropriate guiding questions and giving examples to help them overcome the activation barrier. She also needs to keep the students on the correct track by checking that the information they gather from the media is relevant to their problems, and that they critically evaluate the validity and reliability of the information amassed (Chin & Chia 2004). Although project-based learning can be open ended, it appears that the more successful experiences that are attained by teachers had a

lot of preparation involved and structure built in for students. Chin and Chia, (2004) claim that to help students structure and organize their thinking, plan the next steps of action, and document their progress, the use of graphic organizers and guide sheets such as the problem logs, Need-to-Know worksheets, learning logs, and project tasks allocation forms is necessary. If learning is taken beyond the confines of the classroom, professionals within Industry and the community at large need to see themselves as partners in education. An alliance between education and industry should be symbiotic.

When technology is used in the classroom by students, the equipment should be up to date and technical support should be provided. Students should be versed on the technology before delving into the project. There needs to be ample amount of preparation time or examination of prior learning of the software applications before embarking on the specific project. The students should also arrive at the presentation-building stage following a learning unit, which provides them with a basic understanding of the subject. This will allow them to more readily select the subject of their independent study (Orion, Dubowski & Dodick 2000). Also modeling by providing previous examples of the multimedia project being assigned is helpful as a guideline as to what is expected of the students.

Rubrics in conjunction with the development of projects should not be the primary concern while constructing the project. It should be emphasized in professional development that the Rubric for assessment is important but is still the by-product of the project. With more mature students it is suggested to consult the students in the building of the rubric. For younger students, the rubric should not be introduced into the project until students have had ample time to be engaged in curiosity of the subject and have started to develop the project. At that time the

teacher can introduce the rubric or change the rubric according to the current students learning ability levels.

Project-based learning is a tool to expand the horizons of the learner. It might not be a learning modality for all students. Collaborative aspects of project based learning can inhibit some learners. Although project based learning appears to be tailored for the individual learner, there is evidence that the collaborative aspect of project based learning needs to be addressed for assessment concerns and for the individual learner (Schultz, 2002).

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