

Topic Outline

Goals of project-based learning

1. Project-based learning achieves four goals: acquisition of knowledge, skills, dispositions, and feelings (Katz & Chard, 1992).
2. Teachers perceive building students' creative thinking skills as the benefit most gained, followed by learning and understanding the subject-matter (Akinoglu, 2008).
3. The use of higher order thinking skills leads to the awareness of the students of their own metacognitive skills (Barron et al., 1998)

Design features of project-based learners.

1. Project-based learning focuses on a driving question where learners interact with the concepts and principles of a discipline, make connections, and construct their knowledge (Barron et al., 1998; Thomas, 2002).
 - a. The driving question should be feasible and worthwhile, where students have the prerequisite knowledge and skills to conduct the investigation (Krajcik, Blumenfeld, Marx, & Soloway, 1994; Marx, Blumenfeld, Krajcik, & Soloway, 1997).
2. The outcome of a project-based learning activity is an artifact constructed by the learners (Grant, 2002).
 - a. The artifact is the result of the students' investigation and use of higher order thinking skills (Grant, 2002).
 - b. The construction of a concrete artifact allows the learners to reflect on and revise their artifacts (Krajcik, Blumenfeld, Marx, & Soloway, 1994).

3. In project-based learning, students are required to analyze, synthesize, and evaluate information, elaborate and organize their thinking, emphasizing thinking rather than facts (Marx, Blummenfeld, Krajcik, & Soloway, 1997; Snyder, 2008).
4. The project activity is contextualized in real-life settings allowing for the authenticity of the tasks (Grant, 2002; Thomas, 2002).
5. Project-based learning is mostly based on collaborative work. Barron et al. (1998) call it “learning through social mechanisms” (p. 285) where learners collaborate with peers and outside audiences.
6. In project-based learning, scaffolds are provided to help learners benefit from the project-based learning experience through understanding rather than just following procedure (Barron et al. 1998; Grant, 2002).
 - a. Scaffolds provide the learners with resources on the subject-matter they are working with as well as on the manner in which to conduct inquiry activities and management of tasks (Grant and Branch, 2005; Thomas, 2002).
 - b. Teachers may design scaffolds that might not be used by their learners, nevertheless, these scaffolds should be made available just in case they the learners need them (Grant, ?).
 - c. Barron (1998) suggests two types of scaffolds that were found successful in providing scaffolding in project-based learning: problem-based learning to enable the development of concepts and solution strategies and contrast cases to help learners notice differences and common features.

7. Another component of project-based learning is having learners reflect on their work through class discussions or journal entries, internalizing the knowledge and assessing their learning (Grant, 2002; Seunghee, 2002).

Challenges for teachers in the implementation

1. Challenges teachers face in problem-based learning are: their ability to manage projects in a large classroom all the while maintaining the engagement of all students, the ability of the teacher to maintain a balance between the investigative aspect of the project and the interpretation and reflective activities, and the lack of experience of the students in inquiry and investigation (Kolodner et al., 2003).
2. Five challenges prevent students from engaging in meaningful investigations: motivation, accessibility to investigation techniques, management of extended activities, and constraints of learning contexts such as the availability of resources and fixed schedule (Edelson, Gordon, and Pea, 1999).
 - a. There is a direct association between the students and the teachers' intrinsic motivation in project-based learning (Lam, Wing-yi Cheng, & Ma, 2009).
 - b. Addressing the curriculum standards while maintaining the interest of the students can be achieved by negotiating the implementation of the project with the students (Mitchell, Foulger, Wetzel, and Rathkey, 2009).
3. Teachers are challenged by the students' poor time management skills and by the difficulty they face in accessing informative sources (Akinuglo, 2008)
4. Creating a balance between district curriculum, testing policies, and the large content that needs to be covered within a fixed schedule, as well as the successful orchestration of all the

features of project-based learning is another challenge facing teachers ((Krajcik, Blumenfeld, Marx, & Soloway, 1994; Snyder, 2008).

5. Another challenge facing teachers in project-based learning is the conflict project-based learning brings to the deep-seated beliefs of teachers in their approach to teaching (Thomas, 2000).
 - a. As teachers get introduced to project-based learning, they tend initially to rely on the transmission of knowledge approach, the way they have been used to teach and need time to transition towards the constructivist approach to project-based learning (Blumenfeld, Krajick, Marx, and Soloway, 1994).
4. Teachers may be challenged by their inexperience of designing adequate project-based activities or by their lack of training in critical thinking methodology (Akinuglo, 2008; Snyder, 2008).
 - a. In order for the students to be able to use critical thinking skills, teachers should be able to model the skills and coach the students because critical thinking is a learned skill that should be developed and practiced (Snyder, 2008).
 - b. These skills represent a developmental process that needs consistent practice by students and modeling by teachers (Kolodner et al., 2003).
5. Teachers may be challenged by the selection of project topics in project-based learning (Akinoglu, 2008).
 - a. Some of the criteria suggested for selecting a topic for project-based learning are: the topic must allow the integration of a range of disciplines, it must have sufficient potential for exploration and investigation, it must allow for the opportunity for

- problem-solving, collaboration, and cooperation and it must provide the opportunity for construction (Katz, 1992).
6. The ability of students to work together is one of the most difficult aspects of project-based learning (Kapp, 2009).
 7. Creating a classroom culture of collaboration, where students feel responsible of helping each other, and iteration, where they expect to make mistakes in order to learn from them is another aspect of project-based learning (Kolodner at al., 2003).
 8. A classroom environment that supports mastery and develop a constructive view of error is another important aspect of project-based learning (Meyer, Turner, and Spencer,1997).
 9. Assessing student achievement in project-based learning is another skill that teachers must address where teachers assess learning products and not only the final artifact (Grant (?))
 10. Assessing the artifacts does not measure understanding because sometimes teachers ask students to produce artifacts that do not require the use of critical thinking (Marx, Blumenfeld, Krajcik, & Soloway, 1997).

Technology integration in project-based learning

1. A Web-based system can support project-based learning through support for project management, feedback from teachers and provision of project alternatives for the learners, support for project collaboration and communication, and support for data analysis (Helic, Krottmaier, Maurer, and Scerbakov, 2005) .
2. Trying to incorporate technology in project-based learning, teachers are faced with the challenges of learning how to use the different equipment (Blumenfeld, Krajick, Marx, and Soloway, 1994).

3. Teachers are moving toward more student-centered and collaborative activities in their use of technology (Inan, Lowther, Ross, and Strahl, 2009).
4. Teachers may lack the skills and the confidence in incorporating technology in their teaching, as well as the resources such as Internet connectivity, training and technology support (Kramer, Walker, & Brill, 2007).

Assessment of project-based learning (Cases)

1. Students' interest in the project, their critical thinking abilities, their presentation and communication skills, and their ability to work effectively on a team were enhanced when multimedia were incorporated in project-based learning (Noe and Neo, 2009) .
2. Students' artifacts, such as their research papers and exhibits, revealed that they 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, while other abilities remained unused (Grant and Branch, 2005).
3. In classes where teachers used a multidimensional approach to project-based instruction, students achieved statistically significant better scores than the students in classes where teachers did not use a multidimensional approach to project-based instruction (Turnbull, 2010).
4. Students in intervention classes that integrated technology-assisted project-based learning demonstrated greater knowledge gain, more motivation and collaboration, when compared to students in the control classes, where a traditional approach to teaching was used (Hernandez-Ramos and Pas, 2009).
5. Physical education student teachers asked to develop a non-traditional teaching unit using digital-editing technology, showed deeper understanding of the content, exhibited group

cohesiveness and valued the fact that their projects can be used in real-life situations (Gubacs, 2004).