MERIDIAN
A MIDDLE SCHOOL COMPUTER TECHNOLOGIES JOURNAL

GETTING A GRIP ON PROJECT-BASED LEARNING: THEORY, CASES AND RECOMMENDATIONS

Michael M. Grant

1 | 2 | 3

Abstract

Project-based learning is centered on the learner and affords learners the opportunity for in-depth investigations of worthy topics. The learners are more autonomous as they construct personally-meaningful artifacts that are representations of their learning. This article examines the theoretical foundations of project-based learning, particularly constructivism and constructionism, and notes the similarities and differences among implementations, including project-based science (Blulmenfeld et al., 1991), disciplined inquiry (Levstik & Barton, 2001) and WebQuests (Dodge, 1995). In addition, an anatomy of a model case will be considered using a WebQuest example developed by the author, describing seven characteristics common among the various implementations of project-based learning. Finally, practical advice and recommendations for project-based learning are discussed, including beginning slowly with the implementation, teaching students to negotiate cooperative/collaborative groups and establishing multiple forms of performance assessments.

Introduction and Background

Project-based learning is an instructional method centered on the learner. Instead of using a rigid lesson plan that directs a learner down a specific path of learning outcomes or objectives, project-based learning allows in-depth investigation of a topic worth learning more about (Harris & Katz, 2001). Through the construction of a personally-meaningful artifact, which may be a play, a multimedia presentation or a poem, learners represent what they've learned (Harel & Papert, 1991; Kafai & Resnick, 1996). In addition, learners typically have more autonomy over what they learn, maintaining interest and motivating learners to take more responsibility for their learning (Tassinari, 1996; Wolk, 1994; Worthy, 2000). With more autonomy, learners "shape their projects to fit their own interests and abilities" (Moursund, 1998, p. 4). So, project-based

learning and the construction of artifacts enable the expression of diversity in learners, such as interests, abilities and learning styles. This article will explore the theoretical foundations of project-based learning and examine cases from the literature to note variations and similarities of how project-based learning has been implemented. Next, the anatomy of a model case will be considered. Finally, some practical advice and recommendations for trying project-based learning in the classroom will be provided.

Theoretical Foundations

Project-based learning has a long history. As far back as the early 1900s, John Dewey supported "learning by doing." This sentiment is also reflected in constructivism and constructionism. Constructivism (Perkins, 1991; Piaget, 1969; Vygotsky, 1978) explains that individuals construct knowledge through interactions with their environment, and each individual's knowledge construction is different. So, through conducting investigations, conversations or activities, an individual is learning by constructing new knowledge by building on their current knowledge.

Constructionism takes the notion of individuals constructing knowledge one step further. Constructionism (Harel & Papert, 1991; Kafai & Resnick, 1996) posits that individuals learn best when they are constructing an artifact that can be shared with others and reflected upon, such as plays, poems, pie charts or toothpick bridges. Another important element to constructionism is that the artifacts must be personally meaningful, where individuals are most likely to become engaged in learning. By focusing on the individual learner, project-based learning strives for "considerable individualization of curriculum, instruction and assessment-in other words, the project is learner-centered" (Moursund, 1998, p.4).

Examples from the Literature

In the literature, examples of project-based learning vary in both context and implementation. In project-based science, for example, emphasis is placed on a driving question to guide an investigation (Blumenfeld et al., 1991; Marx, Blumenfeld, Krajcik, & Soloway, 1997). In teams, the class performs similar experiments and collects data to help answer the driving question, and the students help determine how the data is analyzed, what it means and how the results will be presented. This inquiry process takes considerable amounts of time and requires students to work well with each other (see e.g. Scott, 1994), but the process is representative of authentic scientific investigations.

Authentic and purposeful investigations are also the hallmark of disciplined inquiry (Levstik & Barton, 2001). In the social sciences, many students roll their eyes as they memorize names, dates and places. But, by encouraging students to "do history," Levstik and Barton underscore the contexts for studying the past: history is interpretive and history is often explained through narratives. "Doing history" involves in-depth understanding through inquiry, building on prior

knowledge, scaffolding learners and providing multiple forms of assessment (e.g. Hoover & Taylor, 1998). Though similar in structure to the project-based science example, disciplined inquiry seems to allow more flexibility for learners to make the learning more personally relevant by situating themselves into the content. For example, learners are able to ask themselves "What does this mean for us today?" or "How does this affect my family and friends?"

While the previous two examples were linked to content-specific domains, WebQuests (Dodge, 1995, 1998) can be created for just about any discipline and are typically interdisciplinary. WebQuests are also inquiry-oriented. They require an engaging task or project and use a predefined list of resources from primarily the World Wide Web, but may also include textbooks, CD-ROM's, videos, and subject-matter experts. By using a predefined list of resources, a learner's time is maximized by not having to search for references. Also, the resources have been prescreened by the instructor to prevent misinformation or to prevent students visiting inappropriate sites. The focus of WebQuests is on *using information* instead *of looking for it* (Starr, 2000). Like project-based science and disciplined inquiry, WebQuests can incorporate cooperative or collaborative learning and provide scaffolding for learners, often through templates for artifacts and guidance on cognitive and social skills. Also, like many of the projects in disciplined inquiry, WebQuests often include an embedded scenario or role for the student to play, sometimes called the anchor (see Cognition and Technology Group at Vanderbilt, 1992). However, while other examples of project-based learning may suggest reflection, WebQuests are explicit in providing an opportunity to reflect on the inquiry process and an individual's results (Dodge, 1995, 1998; Yoder, 1999).

Anatomy of a model case

Project-based science, disciplined inquiry and WebQuests are only three examples of project-based learning. Though all the models of project-based learning have distinguishing characteristics, there are common features across all the various implementations. These include:

(a) an introduction to "set the stage" or anchor the activity;
(b) a task, guiding question or driving question;
(c) a process or investigation that results in the creation of one or more sharable artifacts;
(d) resources, such as subject-matter experts, textbooks and hypertext links;
(e) scaffolding, such as teacher conferences to help learners assess their progress, computer-based questioning and project templates;
(f) collaborations, including teams, peer reviews and external content specialists; and
(g) opportunities for reflection and transfer, such as classroom debriefing sessions, journal entries and extension activities.

Meridian: A Middle School Computer Technologies Journal
a service of NC State University, Raleigh, NC
Volume 5, Issue 1, Winter 2002
ISSN 1097 9778
URL: http://www.ncsu.edu/meridian/win2002/514
Contact Meridian

Meridian is a member of the GEM Consortium

GETTING A GRIP ON PROJECT-BASED LEARNING: THEORY, CASES AND RECOMMENDATIONS

Figure 1 represents a model project-based learning example using a WebQuest with each of these elements highlighted. This example may also be viewed "live" on the web at http://www.ncsu.edu/meridian/win2002/514/holocaust. Additional information on each element is provided below.

Introduction. Many projects use an introduction "to set the stage" for, or anchor, the project. This often contributes to motivating learners. Occupational skills, such as graphic arts or webpage designers, typically use the domain as the anchor, since the skills are authentic to the profession.

Task. The task, guiding question or driving question explicates what will be accomplished and embeds the content to be studied. The tasks should be engaging, challenging and doable.

Resources. Resources provide data to be used and can include hypertext links, computers, scientific probes, compasses, CD-ROMs, eyewitnesses, etc.

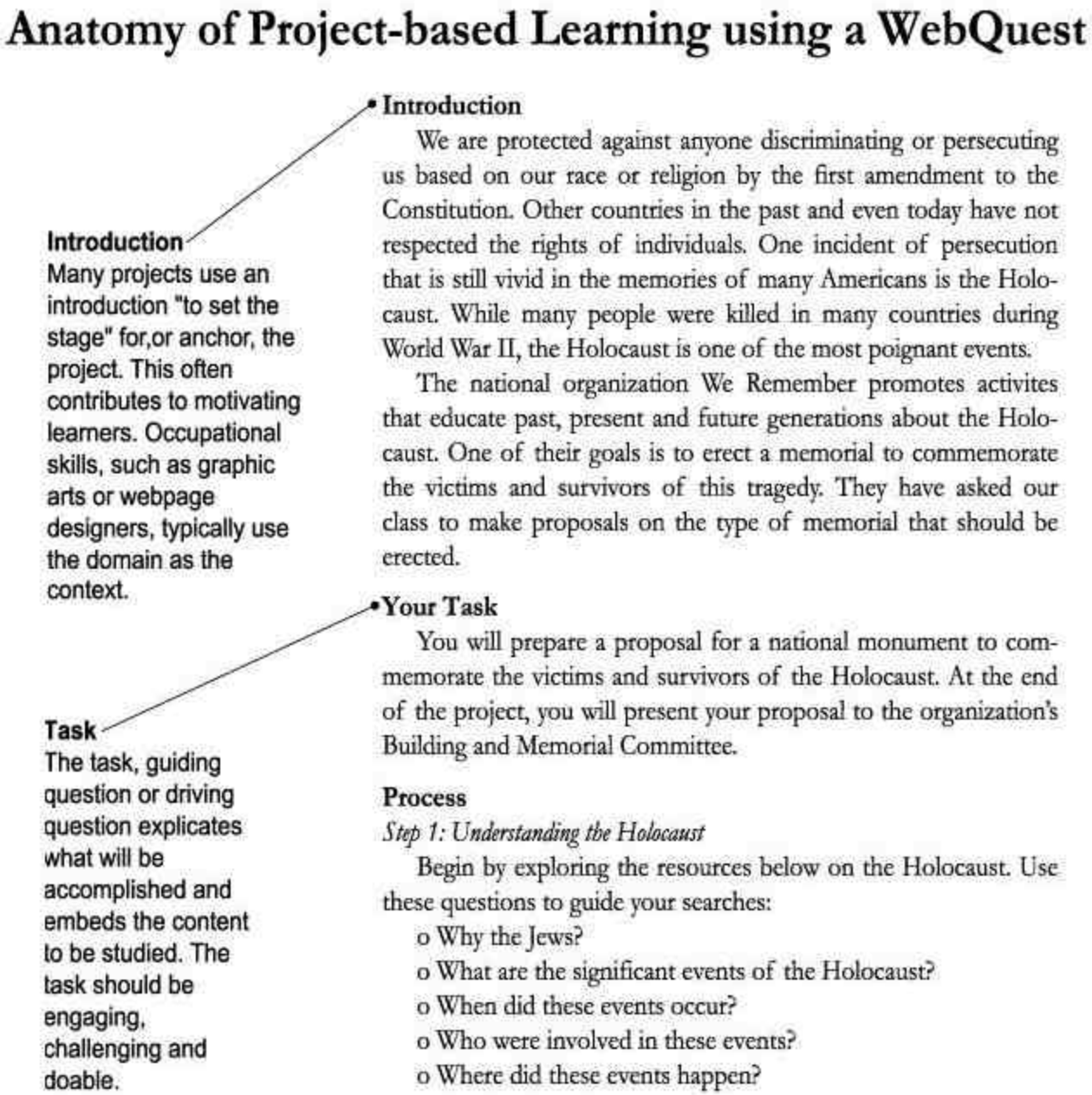
Process. The process and investigation include the steps necessary to complete the task or answer the guiding or driving question. The process should include activities that require higher-level and critical thinking skills, such as analysis, synthesis and evaluation of information.

Guidance and scaffolding. As learners need help, guidance and scaffolding will be needed. These can include student-teacher interactions, practice worksheets, peer counseling, guiding questions, job aides, project templates, etc.

Cooperative/Collaborative learning. Many projects include groups or teams, especially where resources are limited. But, cooperative learning may also employ rounds of peer reviews or group brainstorming sessions.

Reflection. The superior examples of project-based learning offer an opportunity for closure, debriefing or reflection. These may include relevant in-class discussions, journal entries or even follow-up questions about what students have learned.

Figure 1



Resources
Resources provide data to be used and can include hypertext links, computers, scientific probes, compasses, textbooks, CD-ROMs, eyewitnesses, etc.

1. History of the Holocaust timeline:
   http://www.remember.org/educate/mtimeline.html
2. Kristallnacht:
   http://www.remember.org/jean/Chap1/kristall.htm
3. "Final Solution":
   http://www.remember.org/jean/Chap1/solution.htm
4. Hungary Timeline
   http://www.remember.org/jean/Chap1/timeline_HUNGARY3.htm
5. Remember.org
   http://www.remember.org/
6. Holocaust Timeline
   http://www.historyplace.com/worldwar2/holocaust/timeline.html
7. The Holocaust/Shoah page
   http://www.mtsu.edu/~baustin/holo.html

Step 2: Timelining the Events

Using the information you gathered in Step 1, build a timeline of events for the Holocaust. Feel free to use a drawing/graphics software program, photographs, colored pencils/markers and paper. At the beginning of Chapter 24, page 700, (from The Americans, 1998, McDougal Littell, Inc.) is a sample timeline for events during World War II.

Make sure to review the rubric for evaluating this activity.

Step 3: Reviewing Your Work

After you have completed a draft of your timeline, choose a partner to exchange timelines with. Each person should refer to the rubric for evaluating timelines when reviewing. Make comments and suggestions as needed. Be sure to check for accuracy of events!

Prepare the final timeline.

Process
The process and investigation includes the steps necessary to complete the task or answer the question. The process should include activities that require higher-level thinking, such as analysis, synthesis and evaluation of information.

GETTING A GRIP ON PROJECT-BASED LEARNING: THEORY, CASES AND RECOMMENDATIONS

Finally, assessment of project-based learning can also be a challenge. Because learners are constructing artifacts that represent their learning, it is important to provide feedback that is constructive and authentic to the objectives of the assignment. Multiple-choice and true-false tests may be inappropriate to judge the quality of learning that has occurred. Two suggested options include portfolios and rubrics. Portfolios offer the opportunity to employ multiple forms of assessment through different types of works and allows the learner some choice over which items will be included (Levstik & Barton, 2001). In addition, portfolios for extended periods demonstrate progress to learners, parents and teachers. However, the disadvantages to using portfolios are that they can be time consuming to grade (Zvacek, 1999) and can be somewhat subjective.

Rubrics, on the other hand, allow assessment to be more objective and reliable across learners. When created prior to the project, teachers can communicate their expectations for the project in the rubric, and the students are more aware of how their work will be evaluated (Pickett & Dodge, 2001). Frederick Drake and Lawrence McBride (1997) offer one option for evaluating history and other social science projects. The rubric includes three constructs-knowledge, reasoning and communication-with levels of proficiency for each. This assessment tool is based on national history standards but could easily be adapted to fit another domain such as literature. The WebQuest team's Web site (http://edweb.sdsu.edu/webquest) provides a template for developing a rubric to assess WebQuest tasks. In addition to the template, this site hosts a variety of examples of WebQuests, so it should be easy to view sample rubrics used by classroom teachers.

Next steps

Reading about project-based learning is an important step in the implementation

process. However, there are other steps you can take to become even better prepared. It may be helpful to review some examples of project-based learning in action. Doing History (Levstik & Barton, 2001) is an excellent primer for social science and interdisciplinary studies. Directed at elementary and middle school students, numerous examples are included and margin notes specify references and synopses. In addition, the article by Drake and McBride (Drake & McBride, 1997) cited above includes a few examples of project ideas for secondary social science students along with the suggested rubric.

Project-based science can best be understood through the eyes of a teacher first (Scott, 1994) to understand how it has been implemented in the past. It may then be helpful to read a more foundational piece "Enacting Project-based Science" (Marx et al., 1997) that delineates the elements specific to project-based science and how they should be incorporated into the classroom. Also, the project-based science Web site (http://www.umich.edu/~pbsgroup/) collects many of the schools' contacts who have participated in implementing this pedagogy, but other information is sparse.

Becoming familiar with WebQuests is perhaps the easiest. Because the technique is centered on web resources, most of the examples, templates and support materials are also located on the web. The homepage for WebQuests (http://edweb.sdsu.edu/webquest/) also includes a significant number of examples from across the United States covering many content areas. To begin, it may be helpful by finding one that meets current curriculum needs and use it as a model for developing an original WebQuest. It may also be helpful to follow up with classroom textbooks and textbook companies. Many teachers' editions and publishing company Web sites provide supplemental or connecting materials and suggestions for extending teaching methods, such as using project-based learning (see e.g., http://www.mhschool.com/teach/ss/adventuresintimeandplace/teachres/weblesson/student_sheet/ss_6_1_2_1.html).

Summary

Project-based learning offers an engaging instructional method to make learners active constructors of knowledge. Rooted in constructivism, constructionism and cooperative/collaborative learning, project-based learning has strong theoretical support for successful achievement. Examples of project-based learning from the literature, such as project-based science, disciplined inquiry and WebQuests, offer an opportunity to compare and contrast how project-based learning has been integrated into various classrooms and domains. Suggestions for implementing these examples as well as other examples of project-based learning include: begin slowly, prepare learners for using cooperative learning and use constructive assessments. Finally, teachers interested in trying out project-based learning in their classrooms should refer to articles, literature and the Web sites mentioned above along with consulting their textbook for additional ideas.

About the Author

Michael M. Grant is a Ph.D. candidate in Instructional Technology at The University of Georgia and past president of their student association. He has taught at Clemson University, SC, in the Department of Graphic Communications, where he obtained his BS in Graphic Communications and Masters of Industrial Education. His research interests include learner differences, project-based learning and curriculum integration of technology. He may be contacted at:

mgrant@coe.uga.edu

604 Aderhold
The University of Georgia
Athens, GA 30605

References

Blumenfeld, P. C., Soloway, E., Marx, R. W., Krajcik, J. S., Guzdial, M., &

Palinscar, A.(1991). Motivating project-based learning: Sustaining the doing, supporting the learning. Educational Psychologist, 26(3 & 4), 369-398.

Cognition and Technology Group at Vanderbilt. (1992). The Jasper experiment: An exploration of issues in learning and instructional design. Educational Technology Research & Development, 40(1), 65-80.

Dodge, B. (1995, May 5, 1997). Some thoughts about WebQuests, [Online]. Available: http://edweb.sdsu.edu/courses/edtect596/about _webquests.html [2001, August 7].

Dodge, B. (1998, June 22-24). WebQuests: A strategy for scoffolding higher level learning. Paper presented at the National Educational Computing Conference, San Diego, CA.

Drake, F. D., & McBride, L. W. (1997). Reinvigorating the teaching of history through alternative assessment. The History Teacher, 30, 145-173.

Harel, I., & Papert, S. (Eds.). (1991). Constructionism. Norwood, NJ: Ablex. Harris, J. H., & Katz, L. G. (2001). Young investigators: The project

approach in the early years. New York.

Hoover, L. A., & Taylor, R. (1998). Exploring Vietnam: A multiple intelligence portfolio of learning. Social Education, 62(2), 93-96.

Johnson, D. W., & Johnson, R. T. (1989). Cooperation and competition: Theory and research. Edina, MN: Interaction.

Kafai, Y., & Resnick, M. (Eds.). (1996). Constructionism in practice: Designing, thinking and learning in a digital world. Mahwah, NJ: Lawrence Erlbaum.

Land, S. M., & Greene, B. A. (2000). Project-based learning with the world wide web:A qualitative study of resource integration. Educational Technology Research & Development, 48(1), 45-67.

Levstik, L. S., & Barton, K. C. (2001). Doing history. Mahwah, NJ: Lawrence Erlbaum.

Marx, R. W., Blumenfeld, P. C., Krajcik, J. S., & Soloway, E. (1997). Enacting project-based science. The Elementary School Journal, 97(4), 341-358.

Moursund, D. (1998). Project-based learning in an information-technology environment. Learning and Leading with Technology, 25(8), 4.

Perkins, D. N. (1991). What constructivism demands of the learner. Educational Technology, 31, 18-23.

Piaget, J. (1969). Science of education and the psychology of the child. New York: Viking.

Pickett, N., & Dodge, B. (2001, June 20, 2001). Rubrics for web lessons, [Online]. Available: http://edweb.sdsu.edu/webquest/rubrics/weblessons.htm [2001, August 7].

Scott, C. (1994). Project-based science: Reflections of a middle

school teacher. Elementary School Journal, 57(1), 1-22.

Socha, T. J., & Socha, D. M. (1994). Children's task-group communication. In L. R.Frey (Ed.), Group communication in context: Studies of natural groups. Hillsdale: NJ: Erlbaum.

Starr, L. (2000). Creating a WebQuest: It's easier than you think!, [Online]. Available: http://www.education-world.com/a_tech/tech011.shtml [2001, August 7].

Tassinari, M. (1996). Hands-on projects take students beyond the book. SocialStudies Review, 34(3), 16-20.

Vygotsky, L. S. (1978). Mind in society: The development of higher psychological processes. Cambridge, MA: Harvard University.

Wolk, S. (1994). Project-based learning: Pursuits with a purpose. Educational Leadership, 52(3), 42-45.

Worthy, J. (2000). Conducting research on topics of student interest. Reading Teacher, 54(3), 298-299.

Yoder, M. B. (1999). The student WebQuest. Learning and Leading with Technology, 26(7).

Zvacek, S. M. (1999). What's my grade? Assessing learner progress. TechTrends, 43(5), 39-43.

ACKNOWLEDGEMENTS

The author would like to thank Janette R. Hill and Joan M. Davis for their thoughtful comments and suggestions on an earlier version of this paper.

Meridian: A Middle School Computer Technologies Journal
a service of NC State University, Raleigh, NC
Volume 5, Issue 1, Winter 2002
ISSN 1097 9778
URL: http://www.ncsu.edu/meridian/win2002/514/3.html
Contact Meridian

Meridian is a member of the GEM Consortium