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

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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.

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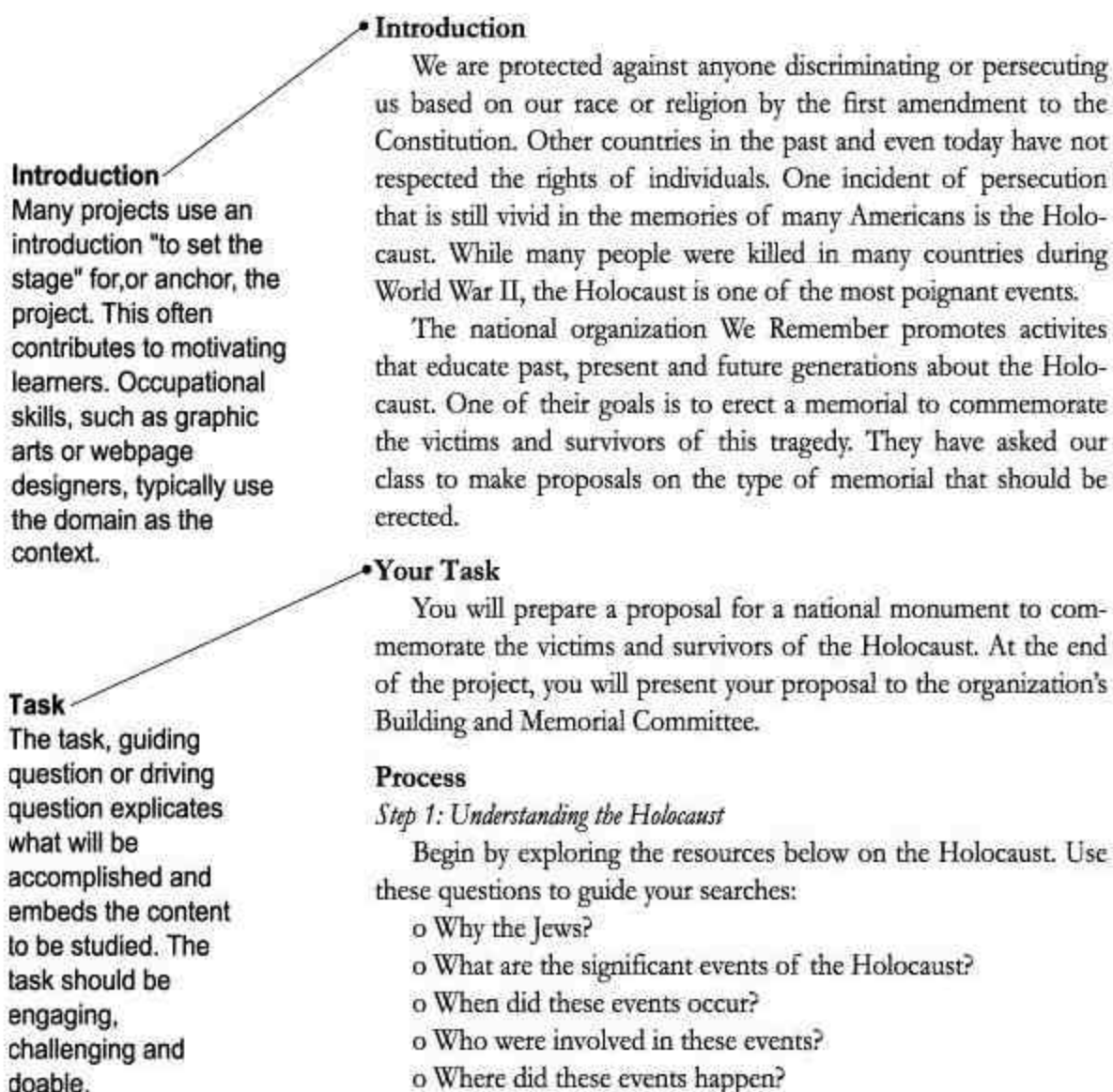
Guidance and scaffolding. As learners need help, guidance and scaffolding will be needed. These can include student-teacher interactions, practice worksheets, peer counseling, guiding questions, job aides, project templates, etc.

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

Anatomy of Project-based Learning using a WebQuest

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 context.

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

• Introduction

We are protected against anyone discriminating or persecuting us based on our race or religion by the first amendment to the Constitution. Other countries in the past and even today have not respected the rights of individuals. One incident of persecution that is still vivid in the memories of many Americans is the Holocaust. While many people were killed in many countries during World War II, the Holocaust is one of the most poignant events.

The national organization We Remember promotes activites that educate past, present and future generations about the Holocaust. One of their goals is to erect a memorial to commemorate the victims and survivors of this tragedy. They have asked our class to make proposals on the type of memorial that should be erected.

• Your Task

You will prepare a proposal for a national monument to commemorate the victims and survivors of the Holocaust. At the end of the project, you will present your proposal to the organization's Building and Memorial Committee.

Process

Step 1: Understanding the Holocaust

Begin by exploring the resources below on the Holocaust. Use these questions to guide your searches:

    o Why the Jews?
    o What are the significant events of the Holocaust?
    o When did these events occur?
    o Who were involved in these events?
    o Where did these events happen?

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.

Step 4: Examining Existing Memorials

Visit the website below to explore existing Holocaust memorials. Use these sites to help brainstorm elements to include in your proposed memorial. Ideas to think about may include:

- o What type of building would be appropriate?
- o What audio/visual materials will you include?
- o Are there any interviews or personal accounts available?
- o What's the goal or purpose of the existing memorials?
- o What's the goal or purpose of your memorial?
- o Where are the existing memorials situated?
- o Where will your memorial be built?

Download and jot down your ideas on the Brainstorming sheet.

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

1. Yad Vashem Holocaust Memorial (Israel)
   http://www.yad-vashem.org.il/
2. U.S. Holocaust Memorial Museum
   http://www.ushmm.org/
3. Miami Beach Holocaust Memorial
   http://www.ci.miami-beach.fl.us/newcity/tourism/holocst.html
4. Inventing and Invoking Tradition in Holocaust Memorials
   http://www.temple.edu/isllc/newfolk/memorials1.html
5. Concentration Camp Memorial Neuengamme
   http://www.hamburg.de/Neuengamme/welcome.en.html

Step 5: Designing Your Memorial

Design your memorial. From the ideas you have brainstormed in Step 4, choose the elements you would like to include.

Think about these questions when designing your memorial:
- o What's the goal of your memorial?
- o What features will your memorial have?
- o How will it be similar to existing memorials?
- o How will it be different from existing memorials?

Hint: *You do not have to draw the memorial. If you are more comfortable describing the memorial or using images and photographs to design your memorial, that's fine. But simple sketches may be helpful for you and others to visualize the memorial.*

Step 6: Exchanging with Peers

When you and two other students have completed initial drafts of the designs for your memorials, describe your designs to each other. Each of you should follow the peer evaluation checklist when reviewing a design. Listen to the description and ask questions as necessary. On the checklist provide suggestions, comments and constructive criticisms for your peers.

Exchange checklists when you're all finished. Review the comments and decide whether to incorporate the suggestions.

Step 7: Constructing your proposal

Based on your memorial design, construct a proposal to present to Building and Memorial Committee for We Remember. You may create a PowerPoint presentation, a webpage, or your proposal may be print-based using Microsoft Word or a drawing. You may use one of these methods or a combination.

Be sure to include:

o the elements of your memorial design,

o where it would be situated,

o why you included those elements and

o what you were trying to achieve with the memorial.

Step 8: Presenting Your Proposal

We will choose dates and times in class for our proposal presentations. Outside visitors will be visiting, including the Building and Memorial Committee for We Remember.

Step 9: Looking to Today

More recently, Bosnia experienced an ethnic cleansing. How was this event similar and how was it different from the Holocaust? What prompted this persecution? Use the following links to explore Bosnia's tragedy:

1. In Bosnia, ethnic cleansing scars are difficult to heal
   http://www.cnn.com/WORLD/9708/31/bosnia.pm/
2. Ethnic cleansing in Bosnia continue
   http://jinx.sistm.unsw.edu.au/~greenlft/1995/207/207p19b.htm
3. Ethnic Cleansing in Kosovo from US State Department
   http://www.state.gov/www/regions/eur/rpt_9905_
   ethnic_ksvo_toc.html

Step 10: Expressing Your Thoughts ●━━━━━━━━━━━━━━━━━

In your journal, write a one-page reflection comparing or contrasting the tragic events in Bosnia to the Holocaust in World War II and how you feel these unfortunate events could be prevented in the future.

Reflection
The best 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.

Practicing Project-based Learning

Implementing project-based learning in the classroom may be daunting for experienced teachers and even more overwhelming for novices. The following are some of the barriers to implementing project-based learning with helpful hints and practical advice for making project-based learning work in the classroom.

First, because project-based learning focuses on in-depth investigations while constructing personally-meaningful artifacts, the tone of a classroom may change. This may be uncomfortable for the students and the teacher. Different students will be researching different topics, so the role of the teacher, as well as the role of the student, may change. It's important to begin slowly. One experienced teacher with twenty-five years under her belt suggests her "comfort zone would include two projects…rather than a continuous series of project-based science units" (Scott, 1994, p. 92). The class time necessitated by project-based learning forces the discussion of breadth versus depth to resurface. The in-depth investigations require more time, so less time may be spent on other content in the curriculum. By beginning slowly, teachers can design projects that reflect state or national objectives and continue to meet standards.

Next, almost all the examples of project-based learning attempt to capitalize on the successes of cooperative or collaborative learning in some manner (e.g. Land & Greene, 2000; Marx et al., 1997). Students that are inexperienced with working in groups may have difficulties negotiating compromise (Johnson & Johnson, 1989; Socha & Socha, 1994). If these methods have not been used before, then it may be necessary to teach learners how to interact within groups and manage conflict within groups. Also, sometimes groups are used for other more practical reasons, such as insufficient copies of books, manipulatives and even computers. Making sure all learners have opportunities to interact and develop skills with resources may be necessary. However, if access to resources is not an issue, then teachers may want to be more creative with the incorporation of cooperative or collaborative learning, such as peer reviews and external expert interviews (Marx et al., 1997).

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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.

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