Chapter 3
Collaborative Systems for Design-Based Learning

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ABSTRACT

This chapter explores use of Design-based learning (DBL) and digital tools to facilitate collaborative learning through design-based projects. Design-based learning (DBL) is an educational approach that incorporates hands-own, authentic, multidisciplinary design tasks to identify problems and design solutions. With DBL, students typically work in teams and are tasked designing solutions to open-ended problems. Teams develop conceptual solutions to problems and then work through the design process to arrive at the creation of an actual artifact. This artifact may be fully functional or simply a model, prototype, or other representation of the complete system. STEM instructors and students should give careful attention to selecting the digital tools for collaboration. Some collaborative tools offer affordances and features that compliment the communication processes in one phase of the design process while another other tool may be better suited for the tasks specific to another phase.

INTRODUCTION

This chapter explores use of design-based learning (DBL) and digital tools to facilitate collaborative learning through design-based projects. Design-based learning is an educational approach that incorporates hands-on, authentic, multidisciplinary design tasks to identify problems and design solutions. As STEM educators seek new ways of incorporating inquiry-based methods, DBL provides a valuable method of bringing student-led learning to the forefront.

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With DBL, students typically work in teams and are tasked with designing solutions to open-ended problems. Teams develop conceptual solutions to problems and then work through the design process to arrive at the creation of an actual artifact. There are five basic phases to the design process. In the first phase, students identify the key issue or problem to be addressed and then brainstorm potential solutions. In the early phases of the design process, students become proficient in identifying the criteria for selecting an optimal solution. This initial phase requires a high degree of collaboration and one-to-many communication streams. Next, students gain experience in determining requirements for the chosen solution and documenting these requirements. These requirements serve as the blueprint for what will be accomplished during the project and what features are determined to be within its scope. In the final phases of the project, students will implement and evaluate the artifact created as a result of the process. This artifact may be fully functional or simply a model, prototype, or other representation of the complete system.

STEM instructors and students should give careful attention to selecting the digital tools for collaboration. Certain collaborative tools offer affordances and features that complement the communication processes in one phase of the design process while another other tool may be better suited for the tasks specific to another phase. The tools used during the first phase of the design process must be suitable not only for communicating, but also capturing and refining free-flowing ideas. As students endeavor to select a design project choice among competing ideas, students need collaboration tools that support a systematic and logical approach to selecting the optimal choice. The mix of collaboration tools used in the final phases should allow teams to communicate the status of the project to a larger audience and receive feedback on the resulting artifact.

Misappropriation of digital communication tools can undermine team efficiency and focus efforts on technical struggles with software applications rather the design project itself. However, when used effectively, the tools outlined in this chapter can support all phases of design-based learning in a manner that is effective yet unobtrusive to the learning process.

The design-based learning pedagogical approach has the potential to increase students' understanding of the design process through engaging in active and authentic learning projects. STEM students must have expertise in applying a systematic process to translating technological innovation to create value-added solutions.

This chapter explores electronic resources for use in design-based STEM education. Using design-based learning can improve knowledge of design processes and increase competence in problem-solving and student motivation. Specifically, this chapter discusses the use of collaborative tools for project creation, collaboration, peer assessment, and knowledge management. The discussion includes a number of technologies (e.g., email, text messaging, social media, wikis, project web sites, and

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