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Innovation in Design of Project-Based Learning for the K-12 Online Context

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Abstract: Research-based best practices that employ learning theories such as Project-Based Learning have not been thoroughly developed for the constraints of the K-12 online setting, nor have they been tested in this unique context. K-12 online teacher-developers face many constraints during the process of instructional design, and require additional supports to translate these learning theories into their lessons. The researchers of this study employed a design and development research method to co-develop three project-based lessons for a 9th grade literature course online. Resulting from documentation of a repetitive instructional design process, the researchers propose two models, the Project-Based Online Lesson Structure Model, which maps an order of content presentation to offer to learners, and the Project-Based Online Learning Instructional Design Model, which maps a step-by-step process for teacher-developers to follow in designing project-based online lessons for K-12 learners.

Keywords: Instructional Design, Online Learning, Project-Based Learning, Pedagogy, Virtual Schools

Introduction

Determining whether K-12 online students receive a better or worse education than learners in the K-12 brick and mortar schools is complex and debatable (Means, et al., 2010; Woodworth, et al., 2015); however, K-12 online school practitioners must move forward to continue improving the education they offer as it is unlikely that the trend of K-12 online schools will disappear after a decade of avid growth and investment (Watson, et al., 2015).

Research on the quality of content and pedagogy offered through K-12 virtual schools is limited given the proprietary nature of many K-12 virtual schools (Watson, et al., 2015). Additionally, many K-12 for-profit management companies repackage and sell their curriculum content to other smaller or locally-controlled virtual schools further limiting access to virtual school curriculum content for broad critical analysis. Identifying non-profit or public virtual schools who design, develop, and manage their own curricular content may be the best avenue for investigation about improving instructional design practice in K-12 virtual schools.

Many best practices founded in constructivist philosophies are already established and validated in the K-12 face-to-face classroom such as inquiry-based learning, authentic assessments, collaborative learning, etc. (Gitomer & Bell, 2016); still many of these best practices have not been thoroughly tested and reported on in the online context for the K-12 learner. For example, the Buck Institute has published extensively on best practice in the development and facilitation of project-based learning, with ample literature validating the model in the face-to-face context (Larmer, Mergendoller, & Boss, 2015). This model is touted as effective in both the face-to-face and the blended environments (Baines, & DeBarger, 2015; Ravitz, & Blazevski, 2014; Thomas, 2000;) and has been tested in teacher professional development (Dabner, N., Davis, N., & Zaka, 2012).

Still the literature has not explored what project-based learning looks like when K-12 learners and teachers are never working on the project in the same physical environment or even at the same exact moment in time while only connected virtually. Application of how such a model is translated into practice in a fully-online K-12 course has not been investigated and disseminated. This calls for a study that serves K-12 teacher-developers by investigating what prescriptive design steps lead to the design of effective project-based lessons online. To do this, this paper highlights the design and development process of a model of instructional design, which was tested and revised through a process of co-development of three project-based literature lessons for 9th graders online. These preliminary results will contribute to the larger design and development study intended to refine and validate this

prescriptive model of instructional design for project-based learning in the online classroom. Validation of the instructional design model is on-going in settings beyond the K-12 online setting.

Context

Gwinnett Online Campus (GOC) is the oldest online educational program in the state of Georgia serving students since 1999. GOC is a public district-controlled virtual school that serves nearly 500 full-time learners in grades 4 through 12. Although the full-time program is relatively small, GOC also delivers an average of 5,000 courses every year through a supplemental program which serves students across the entire district. This school is a fully-online full-time virtual school, that offers optional face-to-face support and labs on a brick-and-mortar campus. Gwinnett Online Campus is, and has consistently been, one of the largest district-level supplemental online programs in the United States.

All of GOC course content is designed by teacher-developers, individuals identified by the school's administration as strong in both content knowledge and pedagogy. GOC provides ample support to teacher-developers including a video production studio, technical expertise, and software collections. In efforts to enhance curriculum content, the school administrators welcomed support that would push student performances towards higher levels of learning leading to this design and development study of project-based learning in the K-12 online context. Administrators also sought a solution that could scale to support all teacher-developers in the instructional design process designing instruction for all subjects in grades 4 through 12.

Methods

Design and development research is "the systematic study of design, development and evaluation processes with the aim of establishing an empirical basis for the creation of instructional and non-instructional products and tools and new models that govern development (Richey & Klein, 2007, 1)." This method was chosen as a scholarly way of testing both the theory of project-based learning and a prescriptive design and development processes for this theory in K-12 online schools. Additionally, this study is intended to serve as validation of project-based learning theory, which has been unchallenged in the K-12 online context. This study is an account of a scholarly approach to instructional design and will use the six-stage design and development research approach to address this gap including (1) identify the problem, (2) describe the objectives, (3) design and develop the artifact, (4) test the artifact, (5) evaluate the testing results, and (6) communicate results (Peppers, et al., 2007). This paper, which

addresses the first five steps, will serve the culminating step. This study is part of a larger design and development study that seeks to develop a prescriptive instructional design model for project-based learning in the online classroom.

Six Stages

The Problem. The problem this study seeks to address is the difficulty in translating a project-based learning model to the K-12 fully-online context as expressed by the administrators and teacher-developers at the virtual school. The school's Administrator in charge of course development collaborated with a researcher to co-design several lessons for a 9th grade literature class online. Three of six units for the 9th grade literature course in 2015-16 school year were modified to culminate in project-based assessments. Several constraints influenced solution characteristics including principles of project-based learning, the school's learning management system, the curriculum management system, target curriculum standards, number of lessons permitted, collaboration tools, learner characteristics such as learner prerequisite content and technical knowledge, learner motivation, and learner abilities and disabilities. The process of instructional design needed to be developed into a model that could be replicated by other teacher-developers at the school.

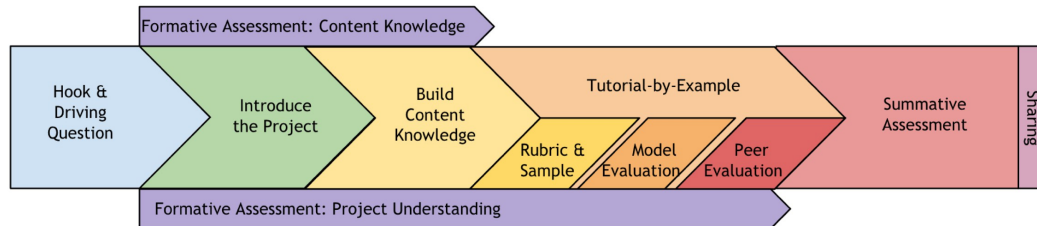
The Objective. Given that the GOC teachers found it challenging to translate project-based learning models like those presented by the Buck Institute through an online medium, the objective of this study was to develop a prescriptive model of project-based learning through documentation of the process of designing several project-based lessons for the 9th grade literature course. Project-based learning is "a teaching method in which students gain knowledge and skills by working for an extended period of time to investigate and respond to an authentic, engaging and complex question, problem, or challenge (Buck Institute, 2016)." This pedagogical framework includes seven key design elements: Challenging Problem or Question, Sustained Inquiry, Authenticity, Student Voice and Choice, Reflection, Critique and Revision, and Public Product (Larmer, Mergendoller, & Boss, 2015). As a framework for lesson characteristics, project-based learning informed the design process; however, it was not functional as a step-by-step instructional design model for K-12 lessons. To guide instructional design steps, the co-designers followed basic principles of backward design while noting and reflecting on the unique design processes and decisions they made with each design cycle.

The Artifacts. The instructional design model used to start the design process was relatively simplistic and evolved to be more detailed as the co-designers reflected on their design processes and decisions. To start the

process, the co-designers started with a skeleton backward design model that included 1) goals and objectives, 2) project assessment including description, student samples, and the rubric, and 3) build content knowledge.

Additionally, the co-designers discussed the order in which lesson content would be presented to the K-12 online learner. The model of instructional presentation that emerged was called the Project-Based Online Lesson Structure Model [Figure A].

Figure A. *Project-Based Online Lesson Structure Model*

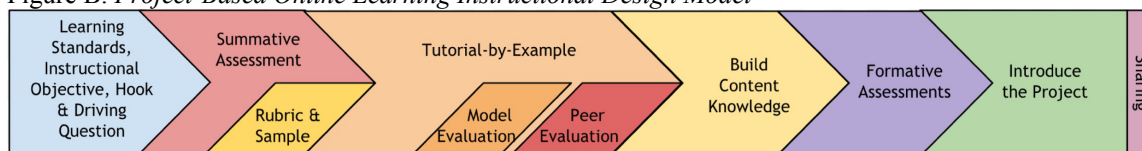


The major components of this model start at the left with the *Hook & Driving Question*. A driving question is “a statement in student-friendly language of the challenging problem or question at the heart of the project (Larmer, Mergendoller, & Boss, 2015, 92).” The hook may be a video or news story that places the driving question into a real-world context and stirs learner interest. Paired together, this part of the lesson should pique learner interest and provide authenticity for the project ahead. The second component the learner will encounter is *Introduce the Project*. The project introduction should explain the path the learner is about to embark upon. This may be a video of the teacher, text, or a graphic that explains at a high level the lesson path and project ahead. At this point, *Formative Assessments* may begin and continue on into the next several steps. Formative assessments were divided into two categories for this model. Formative assessments that gauge the learner’s knowledge related to the content and curriculum standards like short quizzes, and assessments that gauge learner understanding of the project requirements like graphical planning organizers. Distilling between content knowledge and project understanding was critical to targeting individual interventions or lesson changes. In the third lesson component, learners begin to *Build Content Knowledge*, which includes the readings, videos, and images that introduce the learner to new content for understanding and recall. The fourth step in the process is complex. It is called the *Tutorial-by-Example* and has 3 sub-components. The tutorial by example is intended to scaffold the learner’s understanding of the project expectations and processes. The learner is provided with an in-depth description of the project followed by a rubric and at least one student sample. Next, the learner is provided with at least one video where the teacher grades the student sample using the rubric. This model evaluation is likely a screencast video with

audio overlay. The Tutorial-by-Example then ends with a peer evaluation process, likely facilitated by discussion forums, collaborative web software, or a synchronous meeting. Finally, the learner submits his or her project for summative review by the teacher. This *Summative Assessment* step requires feedback provided by the teacher and likely an opportunity for revision before the student publishes the work for *Sharing*. This lesson presentation structure fit with current patterns of GOC curriculum and built off of the online teaching experience of both designers, while applying key principles of project-based learning.

Realizing that this lesson presentation order was not the same order of the design and development work, the co-designers documented their processes of design during the first design cycle. After the first design cycle, which resulted in a project-based unit addressing the classical text, *The Odyssey*, the co-designers had developed a first draft of the prescriptive instructional design model. During design cycles two and three, this model of instructional design was enacted with slight variations resulting in a modification. Projects from design cycles two and three related to texts *Romeo and Juliet* and the novel *Night* (Wiesel, 1960). The current draft of the Project-Based Online Learning Instructional Design Model follows [Figure B].

Figure B. *Project-Based Online Learning Instructional Design Model*



The Test. Two types of tests took place in order to test both the effectiveness of the design model itself and the effectiveness of the resulting instruction. First, the instructional design model was re-used by two teacher-developers for an online sociology course and an online chemistry course. Second, the resulting project-based literature lessons were delivered to 9th grade learners at GOC. Importantly, these two test processes overlapped. As each of the first two 9th grade literature project-based lessons was being implemented with students, the instructional design model was being employed to design the next project-based lesson. Instructional designer reflections, feedback from course facilitators and learners, and LMS-produced learner analytics were used to inform adjustments to the instructional design model and changes to the up-coming learning lessons still in the development phase.

Evaluate. Anonymized aggregate data of full-time 9th grade literature students was used to evaluate the outcomes of the three project-based learning lessons on the class of learners. While students who did not click within or enter the course showed no improvements, students who engaged with the content improved their course grades. In addition, standardized state-mandated End-of-Course assessments (EOCT) revealed that a larger

proportion of Spring 2016 9th graders at GOC exhibited proficiency or better as compared to the previous year when no project-based learning lessons were offered [Table 1].

Table 1: *GOC and State Percent of Students Proficient on EOCT 9th Grade Literature and Composition Georgia Milestones Test*

Term		Number of Students	Percent of Students Proficient	Mean Scale Score
Spring 2016	GOC	47	70%	546
	State-wide	117,109	41%	512
Spring 2015	GOC	36	56%	533
	State-wide	114,655	39%	510

*Note. Full-time GOC students already outperformed students state-wide.

In addition to reviewing student achievement data in each course, which incorporated the new project-based learning lessons, reviewing teacher-developer feedback contributes to the on-going evaluation of the model and further refinement. According to a teacher-developer’s reflection, “Overall, I think the PBL experience was great for not only the students, but for the teacher developing the course as well. The documents that were provided were easy to use for my course, but could be very easily manipulated to address many different courses and/or topics that we offered here at GOC. (Teacher-Developer-S)” More recently, a teacher-developer suggested that the instructional design model should end with an additional step of reflection and revision of the instruction. She felt after implementing the unit, she saw room for improvements. This type of evaluation of the instructional design model by actual K-12 teacher-developers will help the researchers to further refine the model moving forward.

Conclusions

The work of K-12 online teacher-developers is complex, and these professionals seek support in the instructional design process (Gyabak, Otterreit-Leftwich, & Ray, 2015). As evidenced in the literature, the co-developers in this study also faced several constraints when trying to apply a Project-Based Learning model to the K-12 online context. However, by documenting the design decision and creation process, they were able to develop a prescriptive instructional design model called the *Project-Based Online Learning Instructional Design Model* as well as a related model for presenting the materials to learners called *Project-Based Online Lesson Structure*. Future research should validate this model by testing and evaluating it when used in other subjects, grade-levels, and contexts including higher education. More immediately, this prescriptive instructional design model for project-based learning in the K-12 online environment may help other teacher-developers more easily translate project-based learning principles into the online school context, a much-needed support.

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