A Case Study of Designing an Online Module for an Interdisciplinary Non-Science Major's Course

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Abstract

In the Master of Education in Instructional Technology program at Sam Houston State University, the culminating project for the degree is an online training package. The Dick and Carey model, a ten steps of instructional design process was used in the design, development and delivery of this online training package. Using the Learning Management System, Blackboard, this pilot study of an online learning module was created and implemented in an interdisciplinary non-majors' science course. A total of 18 short (>3 minute) video clips were created for one lab module to simulate a group discussion. This paper shares the experience of designing an online training package to replace the team discussion boards. The student feedback was overwhelmingly positive.

Keywords: Online Learning, Online Teaching, Module Design Process, Learning Management System, Dick and Carey Design Process

1. INTRODUCTION

This paper chronicles the experience of using a step by step process for designing and implementing an online training package. The step by step process used was Dick and Carey's design process. The process they first introduced in 1978 in "The Systematic Design of

Instruction" has continually been used by Instructional Designers because it treats learning as a system instead of just addressing separate pieces of the process. In short the nine steps are: identify the goals; complete analysis of instructional materials; find learner characteristics; create performance objectives; build assessments; use learning theories to

inform a strategy; develop the activities and the last two steps are formative and summative evaluations. After using the process to develop the instructional materials, the entire process can be repeated indefinitely until the course content is ideal. Dick and Carey's design process for the creation and refining of a training package form a cycle like a rock tumbler for the developing of online materials. The process empowers the instructional designers and subject matter experts to continually grind down the rough edges of the course materials until they are polished enough to be shown off. However, unlike the rocks produced from the tumbler, the course contents are never going to be polished enough to put on the shelf and admired forever. The course refinement process never really ends because the instructional designers and the subject matter experts will always be learning new things that can be implemented in their future courses. Additionally, the subject matter itself can often need updating to keep up with discoveries and inventions. Additionally, the technologies used to create and deliver the content can be made obsolete over shorter periods of time than we are prepared for. All of this leads us to the process of creating and refining the course content and delivery by following Dick and Carey's design process.

Interdisciplinary Non-Science Majors' Course
This course was designed for non-science majors to gain a basic understanding of a wide range of different domains of science. The lab portion of the course is comprised of ten modules that are each a case study focusing on one of ten different issues. The primary problem addressed by this project was that the program is planning on expanding the number of online sections. This problem then became the central focus, as the revelation of the second needs assessment discussion. There will not be a budget increase for student TAs, and the lab's online discussions are led by the TAs. A plan was formed to develop a self-paced module from one of the ten online modules. The self-paced module with built-in assessment functions would then replace the need for hiring more staff to moderate discussions.

The plan was to have the project consist of eighteen videos in six different sets of three with only a short amount of dialog and would each cover one-third of the topic for that set. The delivery method was initially going to be facilitated with the use of embedded Google forms so the students would be able to choose a path through the material.

Further analysis and needs assessment determined that this was not going to work for the course, as the dialogs were not robust enough to warrant in-depth questions. The switch away from Google allowed for a Blackboard Exam to be used as the delivery method instead. This was possible because of the shedding of the binary nature of the initial dialog scripting, which allowed for much more in-depth questioning of the simulated group member's dialog. The dialogs were rewritten so that each student discussed all elements of that video-set's topic in under three minutes. Therefore, instead of simply stating whether the simulated group member's dialog was correct or incorrect the writing of multiple-choice, fill-in-the-blank and short answer questions were to be used as part of the module. The next part of this paper will focus on a step-by-step analysis of the construction and implementation of the training package.

This paper will first focus on the implementation of this process to design an online training package. Valuable findings from the literature reviews, learning management system analysis, and the evaluations from this online training package will follow after.

2. LITERATURE REVIEWS

The literature reviews for this project covered essentially every aspect that concerns online learning and teaching. The following sections are included because they were particularly valuable in the development of the online Haunting lab module, one of the ten lab modules.

Demographics and learning styles
Before we offer any online teaching strategy, the first question we must answer is "Who are these online learners?". Yukselturk and Top (2013) stated that the student profile has been changing to a more diverse population including young and adult, male and female, employed and non-employed. The most intriguing finding revealed that students are still not highly proficient in using commonly technologies and related processes, such as sending email attachments, accessing a specific website given its URL, hyperlinks and using word processing software (Hunte, 2010).

Online learning environments are fully capable of maximizing the learning style preferences by designing a course that is both visually engaging

and has reading and writing assessment methods employed (Hunte, 2010). Dispelling the myth that the next generation of learners will be markedly more skilled with computers helped guide the project design process, Yukselturk and Top (2013) showed that the overly elaborate pathing that we had originally planned was simply not a good fit for the project. Including the information from the learning styles, Hunte (2010) throughout the design process was instrumental in keeping the focus of the project on the goal of having a visually engaging training package.

The Course Environment
In regards to the ability of the students to get into the online learning environment, Higgs (2012) noted that not all students could access the course content off campus. While half of the online students could benefit from the flexibility of online learning, others had to come onto campus and compete with other students for using computers. Higgs (2012) also addressed a large number of the ethical concerns relevant to online learning, such as that some academic colleagues objected to the cost cutting they saw as the primary motivating factor of an implementation.

Meeting the learners where they are
Online students mentioned their difficulties with issues such as confidence, identity, privacy and feeling pressured. This hesitation to interact is based on fear and can only be addressed by creating a situation where the learners feel comfortable enough to face these fears, according to Higgs (2012).

Ensuring access and inclusiveness
Online interactions can take place completely out of the awareness of the instructor, without any idea of the power struggles that can be taking place. According to Anderson (2007), the access to educational opportunity is unequally distributed among class members when power relations between students develop or are re-enacted in classrooms. Higgs (2012) found that the online learning environment itself was actually conducive to creating a safe place for student discussions.

Online learning is especially valuable to what we call non-traditional students because their lives are already busy even without school, notes Reamer (2013). However, Reamer also cautions that people with physical or cognitive limitations may find that some online learning setups are "inaccessible or unrealistic". The lack of non-verbal communication in the online environment giving access to some and restricting it from others and the potential for oversharing of personal information are all potential pitfalls for online instructors to beware (Reamer, 2013).

The literature that was reviewed from Higgs guided the project towards online materials that were going to be delivered in the most efficient method possible, thereby limiting the burden placed upon any students that may have data caps. For this project, Kaltura's video server space was used through the Blackboard LMS to store and deliver the videos to the students as streaming videos.

The learners' cognitive abilities and needs showed that the project's focus on an online, self-paced format lined up well with the learners. The literature from Reamer largely informed the process of writing the scripts and turning them into their respective video clips. Each script was looked at for believability, but also so that each viewpoint was considered on its merits as they related to the course content. The pre-scripting of the student group's dialog allowed for the creation of a simulated dialog that would require reflection from the students, without any of the power struggles present in group projects.

Learning Management System (LMS) - Blackboard
The course is taught in the Blackboard LMS, but the selected module existed in a purely text-based format prior to this project. The Blackboard Exam format was chosen after analyzing all of the different Blackboard tools, third party plugins, and technical limitations.

The exam format allows for the embedding of multiple videos into the same question text area, so formatting the module in a visually appealing way becomes possible. Blackboard's exam includes many different types of question, including multiple-choice, short answer, matching, essay, etc.

The exam format provides for secure and timed delivery of the module. Blackboard's Adaptive Release tool was used to set a conditional release of the module contents so that the students could not even begin the module until they had scored 100% on the Prelab Quiz.

Blackboard
Blackboard offers various plug-in functions to work with third parties, in order to provide functions of asynchronous tools, embed HTML

and applets. Blackboard (2016) strongly encourages the clients to integrate Community Engagement and Content Management licenses to increase critical institutional hierarchy capabilities. Virtually any kind of file type can be uploaded into Blackboard. Blackboard has the ability to import information from a large number of external assessment sites and tools, including SCORM data. The University of Oregon Teaching Effectiveness Program (2016) also stated that Blackboard's assessment features provide instructors with tools for building online assessments using different question types which lead to the following potential benefits:

- Increase student engagement in the curriculum
- Provide detailed and immediate feedback
- A painless way to integrate technology
- Location and time independent
- Automatic score recording
- More frequent assessments
- A time-saver
- Practice with technology-based test formats
- Introduction of website and media
- Timeliness

3. METHODOLOGY

Dick and Carey's design process was utilized to create this online training package. The training package was then delivered to the students in one section of the online course in April of 2016. The students were emailed by their instructor to let them know the content was available and that they had seven days to complete the module and submit the anonymous survey.

3.1. Needs Analysis
The initial research was focused on the group of teaching assistants that run the labs for the semester as the targeted recipients of the trainings, but as the process of needs analysis progressed, it became obvious that we were not making the best use of this project. This naturally lead us back to the needs assessment portion of information gathering and thankfully the second time through the process we were then able to identify a way we could use the existing, and already paid for, technologies to more effectively deliver the online lab portion of the course to the students instead of the current deployment method.

3.2. Identify the Technology Goals
The first step on the process for this project was to identify the organization's technology goals. Sam Houston State University is a public

university and is therefore mirroring the national goals put forth by the Department of Education. The Office of the President of Sam Houston State University also releases a strategic plan every few years. This project lines up with several of the goals listed in the 2012 summary of the strategic plan, and this project will:

- "Increase and develop university resources and infrastructures that support the intellectual transformation of students.
- Cultivate a continually sensitive and proactive response to the ever-changing needs of our constituents. (Sam Houston State University)"

3.3. Conducting the Technology Analysis
The next step was to analyze the current technology situation for the university and this project's direct audience: current and future interdisciplinary non-science major students. On the main campus, the computer network and infrastructure is managed by the Office of Information Technology, known as Distance Learning Center. On the Sam Houston State University website the location and operating hours for the various on-campus labs are posted for the students to easily access remotely. There are four open labs on campus. In addition to these labs, there are also currently thirteen computer labs spread out over the main campus.

This project would be delivered entirely online and it was evident to us after looking at the availability of on-campus computers, that local students would be easily able to access the materials. Any students at a distance would already be expected to complete their module online, although the new project for the module contains videos which can be problematic for some rural areas. The videos themselves were embedded in Blackboard through the Kaltura video server space utilized for online classes.

3.4. Analyzing achievement toward technology goals
According to the US Department of Educational Technology Plan, we, as educators are expected to:

"3.1 Expand opportunities for educators to have access to technology-based content, resources, and tools where and when they need them. " (Teaching: Prepare and Connect)
"3.3 Use technology to provide all learners with online access to effective teaching and better learning opportunities and options in places where they are not otherwise available and in blended (online and offline) learning

environments. (Teaching: Prepare and Connect, 2010)"

Expanding online course offerings, is one way that the Distance Learning Services is directly addressing the demands listed above from the US Department of Education. If this project was used as a template to rebuild all ten of the online modules, it will ensure that the program will be able to expand enrollment without the need to hire more teaching assistants.

3.5. Developing and Designing Objectives

The objectives for the course are directly reflected in the selected module as well and they are:
1. "Understand and apply scientific terminology pertaining to the nature and conduct of science, such as hypothesis, law, theory, control group, placebo group, confirmation bias, and double-blind study;
2. Apply methods of reasoning used by scientists: i.e., the scientific method based on the requirements of falsifiability/testability, logical consistency, comprehensiveness of evidence, intellectual honesty (objectivity), replication of results, and sufficiency of evidence;
3. Analyze and evaluate common logical fallacies and perceptual biases that interfere with the ability to draw reasonable and/or correct conclusions, as well as the difference between facts, informed opinions, and uninformed opinions;
4. Learn key concepts and theories from a variety of scientific disciplines, especially physics, biology, and geology;
5. Demonstrate how to distinguish science from pseudoscience by scientifically evaluating a wide variety of extraordinary claims that are common in our culture today.
(Excerpted from the course syllabus for Spring 2016)"

Furthermore, the objectives for this module were to increase student interaction with the material, their self-reflection over the materials, and their satisfaction with the learning experience itself.

3.6. Development of Assessment

The module already has a pre-lab and post-lab assessment built in, so for this project all that was needed was to directly assess the learner experience with the module's new format. There are two pieces of information particularly valuable from Condreanu and Vasilescu (2013) which shared that "[a]dults, unlike children, are self-directed" learners (2013, pp127). Secondly, it was shared that "the adult learner is committed to the learning experience if s/he takes part in its planning and operating" to be relevant to the assigned project (p. 127). By surveying the learners at the end of the module, their feedback can be implemented in the reshaping of the module for future delivery (Codreanu & Vasilescu, 2013). After the students complete the module, they were asked to fill out a google survey form.

3.7. Funding and Management strategy

This project was designed to make use of the resources that are available for online instruction. These resources include a studio with the production equipment needed to shoot all of the video segments, and the Blackboard Learning Management System. Management of the learner experience is handled within the training package itself with on-screen guidance and the professor written feedback that accompanies each question.

The management of the technology needs of the students during the project will be addressed with three different providers. The physical aspects of the project will largely take place on the personal devices of the students in the course, and these students all have the ability to call the service desk for on campus computer issues. However, all online students can also call the Online support desk with any of their problems relating to their online courses. These two helpdesks/service desks together can address almost all of the technology needs of the learners in this project. The delivery of the learning modules and assessments will all take place in Blackboard. If any of the learners do need assistance with the use of a google form, or a video issue, it can also be sent to the Online helpdesk to be solved. The video recordings were made by the Distance Learning Services Online video team, and they expertly handled the technology needs of the video creation portion of the project.

3.8. Developing the Training Package

The training package was developed, and then regularly re-developed as the team continued to meet and discuss the unique needs of the program's online lab component. A draft of the set of scripts was written that greatly expanded the initial dialogs, thereby turning them into a much more robust simulation of a group dialog. Three group member's dialogs were written from the module's six subtopics and the professor wrote a series of questions to be embedded after

each of the six sets of videos. Each of the questions has an attached feedback from the professor that will guide the students to the lecture notes or reading materials that directly relate to that question's contents. These eighteen simulated group member's dialogs and their following questions with attached feedback together covers the entirety of the Haunting module's online lab, with an additional video and questions added on by the professor as a type of bonus question. The module was built into a Blackboard module, styled similarly to the already used module format in the other online lab modules. The introduction to the module was delivered via text in the module description text box and it contains not only a description of the module, but also the relevant objectives in the module and a concept map that shows the students exactly what to expect.

3.9. Evaluating the Training Package
The process of evaluating the training package took place all throughout the other stages of the project, in each of the steps. The first formalized evaluation effort of the training package was a guided walkthrough of an early draft of the project with a professor that had previously taught the course. Only three of the scripts had been recorded at that time, while the rest of the scripts were included as text. The feedback from this walkthrough was almost all incorporated into the training package.

The second formalized evaluation effort for this training package was delivered much later in the development process and involved six teaching assistants (TAs).

The third evaluation of the training package was after the delivery of the materials to the students, when the students were surveyed about their experiences using the module. The students were overwhelmingly in support of this module format design and implementation.

3.10. The finished product
In order to revise the training package to address the feedback from the various evaluation data gathered, the data was converted into a graph to make it a better visual representation of the students' feedback.

Before the training package was finalized, the identified weaknesses were addressed in this design. The major area that was revamped towards the end of the project was the guided feedback for each question. Which was setup to be delivered to the students for each incorrectly answered question.

The underlying mechanism for this evaluation and revision process is taken from The Systematic Design of Instruction and their phases "Expert Judgement" and "Field Trial", as explained in The Systematic Design of Instruction (2011). Expert judgement phase is the walkthrough of the material by an expert in the content and delivery methods. The field trial phase was the small group reading of the scripts with the teaching assistants. However, if this project is to be expanded to the rest of the modules, then this entire training package is a field trial for the possible overhaul of the course. This process would then be repeated for the contents of each module, so that the entire course could be built into a self-paced and self-assessed module with questions designed to get the students thinking about the material. There would also need to be feedback written by the instructor of the course for any incorrectly answered question.

4. ASSESSMENT

In "Effects of Distance Learning on Learning Effectiveness", the authors analyzed the differences between the two assignment methods, and "It was discovered that team learning appeared higher Learning Effectiveness than individual learning did on computer-based curriculum; besides, team learning presented significant promotion on Learning Effectiveness of low-achievement students." (Liu, 2014, p.577.) They quote a study done by another team that found the opposite and that in their "computer-based course, no remarkable difference in Learning Effectiveness among the individual, the extended interactive, and the random interactive groups [was found] (Liu, P.).

Brindley, Walti and Blaschke (2009), found limitations in group learning, and that a set schedule of live interaction could cause extra stress on the students. A possible solution for this is presented in "Effects of group reflection variations in project-based learning integrated in a Web 2.0 learning space(Brindley)". When they recommend an authority figure's inclusion that is focused on delivering "guidelines on role stability and assigning grades and points for specified contributions. (Kim, 2011, p.340)"

When they do attend the small group meetings it turns out that "students are often ill-equipped… to collaborate (in general) or peer-

review and often see colleagues as rivals. In such cases, peer reviewing… is often superficial, unhelpful, and/or judgmental. It takes time to establish community, and 12 weeks… is sometimes insufficient for those new to online learning to develop both the requisite skills and confidence to fully participate in collaborative learning." (Brindley, 2009, p.2) "When the group work is required by the instructor feelings of resentment can be fostered in the students. (Brindley, 2009)"

Synchronous vs. asynchronous
In regards to the collaborative functionality of an asynchronous interaction, students found it very inefficient time-wise to be forced to wait for each other to complete the various steps of the project or needing to ask for more time because of group members that were not working as hard as others (Kim, et al. 2011).

Evaluation of the assessments
4.1. Peer
While it is a positive activity, it is also possible that the students are more than willing to join in, but that they do not understand how they are to engage in peer reflection online. (Brindley, 2009, p.9) Attaining a state of "deep learning" is the result or group reflection and should be encouraged in all project-based learning assignments in online learning communities. However, "discussing specific problems regarding the team… was certainly a significant burden for them and… deemed highly ineffective." They continue by stating that "awkwardness exists in online group learning when members of the group have to openly share critical comments about a teammate or the team. (Kim, et al. 2011)"

4.2. Self
Self-reflection has many of the same benefits of peer reflection, but also self-reflection can be utilized as a "learning reminder, analyzer, and planner." (Kim, et al. 2011) Some activities lead themselves more towards individual performance and subsequent reflection than toward group collaboration (Kim, et al. 2011).

4.3. Teacher
In the study by Kim, Hong, Bonk and Lim the data suggests "that ISR (instructor supported reflection) was the most effective team assessment and reflection method among the three different methods employed." (Kim, et al. 2011, p.340) In all of the findings from this study, the "means of performance, participation, and satisfaction of ISR were highest, suggesting that the instructor-supported team performed the best with highest participation and satisfaction. (Kim, et al. 2011, p.340)"

The conflicting information about the effectiveness of group assignments versus individual work led to the melding of the two into a simulated group member's dialog that incorporates elements of both. As a bonus, the self-paced format of this module would alleviate any of the schedule induced stress the students might experience normally according to the paper from Brindley. This module would need to represent the epitome of group dialog because the discovery that many students were simply ill equipped to participate in a robust online discussion meant that we have been asking the students to use a skill they may not have at all. This module could be used as an example of effective group discussion etiquette. The literature about synchronous and asynchronous delivery styles informed us that students felt encumbered by their colleagues when they were forced to wait on them and even more so when their grades were linked to each other's efforts. The removal of many of the negative aspects of group work should make sure this module is successful, all of which was revealed during the literature review assignment's research. The instructor written feedback that accompanies each of the questions in the module is directly answering the need discovered in the literature review research process for a strong centralized authority figure. This guidance will be very beneficial to the learners as they progress through the modules.

5. CONCLUSION

Eighteen students participated in the module and were extremely satisfied with the experience. One problem that was identified by one student out of the group was that the audio was too low in the videos. The actors were each wearing lapel microphones, and none of the other students had any complaints about the audio. To address this in the future delivery of the module, a recommendation will be made for the students to use a headset or earbuds while watching the videos. The data from the student surveys shows that we did achieve our training goals and objectives and that the students were very excited about the change in format. The three foundational assignments in this project, Dick and Carey's design process, the LMS analysis and the Literature Review function just like the rock tumbler and can be used again and

again. This online module is now refined enough to be presentable, just like the tumbled rocks.

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