

Participatory prototyping: Improving faculty involvement in technology-mediated instruction

Jason K. McDonald^{*1}

¹ 3800 HBLL, Brigham Young University, Provo, UT 84602, United States of America

This paper reports the results of a trial to help university faculty members better participate in the development of technology-mediated instruction, as well as to develop methods for faculty to create their own media that maintains an acceptable level of instructional quality. Using low-cost technology development tools and software templates, faculty members produced a technology-mediated lesson for a university statistics course. While the quality of their attempt was not acceptable to help facilitate student learning, this trial ultimately acted as a prototype of different instructional strategies for the course, which later were produced using higher-quality media. We called this the “participatory prototyping” approach, and find value in this approach both to include faculty members in important decisions during an instructional development process, as well as to help them remain enthusiastic about technology-mediated instruction while they are participating in its development.

Keywords Rapid prototyping; Media development; Faculty development; Design research

1. Introduction

Some educators have become aware that technologically rich instruction can sometimes be too expensive to flexibly use in practical contexts. This can occur for a number of reasons, including the practice of pre-defining all instructional elements so they can be operationalized in the technology product, as well as the pressure to recover costs of technology development by using the instruction unchanged for as long as possible [1]. This issue has become an increasing concern at Brigham Young University (BYU), as faculty using technology-mediated instruction have experienced inflexibility first-hand. Some faculty have discovered that instructional technology sometimes does not give them the freedom they desire to respond to situational constraints or opportunities that arise during their courses, ultimately leading to a less rich experience for their students.

One good example comes from BYU’s department of Statistics. The university’s media production facility developed dozens of instructional media objects for use in the department’s introductory statistics course. This development, which took approximately five years, ultimately resulted in every course lecture being fully supplemented by some type of instructional media. Problems quickly arose with this approach, however. Individual faculty members wanted to adjust the content or sequencing of the media to reflect their teaching style or areas of expertise. Additionally, the department gathered large amounts of data on student performance in the course, and discovered areas of possible improvement that could lead to better student outcomes. However, neither the department nor the university administration was interested in investing more money in the course because of the high costs of the initial technology development. In fact, the administration additionally requested that the Statistics department return money granted during the initial course development, because of the department’s original promise that developing the media would allow each instructor to teach a larger number of students without a decrease in the quality of students’ learning.

A solution seemed to be to make the course media more flexible, so the department could maintain and improve the course themselves without contracting with high-cost, media production resources. Additionally, the department hoped that giving faculty members more control over the course would improve their enthusiasm for the media, as well as give them the flexibility they needed to react to

* Corresponding author: e-mail: jkmcDonald@gmail.com, Phone: +1 801-422-8675

changing circumstances as they taught. And finally, the administration requested that the format of the lesson facilitate student self-study, so as to decrease the time necessary for an instructor to administer the course. To give the Statistics instructors more flexibility in how they developed and delivered their technology-mediated instruction, we first looked to the work of Gilbert [2], regarding the use of low-threshold applications (LTAs). LTAs are inexpensive and easy-to-learn technology applications that do not require instructors to fundamentally rethink how they teach. A growing community of online users is generating examples of LTAs that show promising results in allowing faculty members to improve their instruction through technology, without being locked into a method of presentation or development that does not fully meet their needs, or that prevents them from accomplishing goals they consider important [3]. Additionally, we speculated that in cases where an LTA would not be effective, the use of professionally prepared software templates might also be beneficial. Software templates provide a reusable container for basic visual and programming elements, and have often been found to be helpful in allowing novices (such as faculty members) to easily create new course materials following a standard format [4]. As we began this study our hypothesis was that by providing two low-costs methods of course development, faculty members in the Statistics department would be more willing to participate in technology-mediated instruction. We also hypothesized that faculty would be able to maintain and improve the introductory statistics course media themselves without decreasing the instructional quality of the course.

2. Method

We chose one lesson in the course to test these hypotheses, specifically the topic of probability. This topic was chosen because it was taught early in the semester. Faculty members reasoned that if the study failed they would still have enough time to help their students learn the necessary material.

We chose a lesson format similar to other, successful, self-study lessons created by the university. The lesson format consisted of a frame containing the instructional media earlier produced for the course, accompanied by narration by the instructor to further explain and elaborate lesson concepts. A disagreement arose as to whether video narration of the instructor was necessary, or if audio only narration was sufficient. Faculty members preferred video, because including video more closely mimicked a self-study accounting course which was very popular at BYU. Other design personnel preferred the audio only option, because of concerns about video development costs as well as the value added to student learning by the video. However, because of the low-cost methods of development used, the team decided to test both options and see both how much it cost to add video as well as whether students preferred one version over the other.

The lesson was produced using Apple's Quicktime Pro™ software. At the time of this study, Quicktime Pro cost approximately \$30 (US), and contained many easy-to-use editing features, accessed with commands similar to those found in a word processor. The university's professional Quicktime developers also created a template to load within the Quicktime software, allowing faculty members to include more advanced program features in the lesson. One instructor recorded both audio and video for the lesson using consumer quality recording equipment, then assembled the lesson in the template with the assistance of a student employee. The total time to create both the video and audio versions of the lesson, after the recording was complete, was approximately two hours.

The lesson was given to 377 students enrolled in the introductory statistics course. Students randomly received one of the two lesson versions, were instructed to watch it outside of class, and then complete an online evaluation survey. Using a five point Likert scale, the survey measured student satisfaction with the lesson as well as their subjective thoughts about how well they learned the topic. Frequency tables were computed to determine the spread of student responses. The survey also included some open-ended questions, to provide more insight into patterns in the ordinal data collected. Students received credit equivalent to one class quiz for completing the lesson.

3. Results

The first result of note was that by participating in this study faculty members in the Statistics department were more willing to participate in technology-mediated instruction. Furthermore, with the use of the LTAs and software templates, some faculty members were willing to dedicate time to ongoing lesson production and maintenance, under their developing belief that with little outside help they could produce lesson content themselves. In fact, as a result of this study the department chair gave one part-time faculty member the task of converting all course topics into the format used in this study, with the goal of providing at least one section of the course that was exclusively self-study. However, it must also be noted that even with the LTAs and software templates, a student employee was required to successfully complete development on the lesson. Faculty members reported that even though these methods of development were easier than those they had experienced previously, they still did not have time to learn all the skills necessary to assemble course lessons.

The study appeared to be less successful on our second hypothesis, that instructional quality would not be decreased by faculty members creating and maintaining course lessons themselves. During lesson production faculty members and design personnel noticed quality problems in the video and audio produced by the faculty. The problems appeared to be caused by the inexpensive equipment used and the lack of experience of the faculty in producing media. These problems were not unanticipated, and in fact we discussed early in the study that to best determine what the faculty were already capable of we would leave them untrained. Yet as we saw the final product we anticipated that students would have difficulty learning from it, because much of the media, particularly the audio, was difficult to understand.

Evaluation with the students confirmed this impression. 227 students evaluated the lesson, for an overall response rate of 60%. 121 students reported using the lesson with video narration, 103 reported using the version with audio narration only, and 3 did not report which version they used. One third of students disagreed or strongly disagreed with the statement, "overall, I liked this computer administered lesson." Nearly one fifth disagreed or strongly disagreed with the statement, "I felt comfortable doing this computer administered lesson." While admittedly many factors could have contributed to student dissatisfaction with the lesson, in their open-ended comments many students reported technical difficulties affected their levels of satisfaction, including some significant problems understanding the audio portion of the lesson.

Yet we also found indicators that if media quality were improved students would have responded positively to the lesson and the instructional quality of the course would not have decreased. Despite the difficulties encountered by some students, many other students did report positive reactions. Qualitative data gathered indicated some of the reasons why students reacted positively. One student said, "I paid better attention to the presentation than I sometimes do in class. I felt like it was a lesson just for me and I could go at my own speed." Another student responded, "I liked the parts where I could practice myself and check my answers the best. In the stats class there [aren't] too many [opportunities to do] a problem then check it on your own, i.e. the homework. The lesson helped a lot in this aspect to see if I understand the concepts." 79 students made some comment about how the features of the lesson helped them to learn.

A final finding, while not directly related to our hypotheses, also deserves mention. The disagreement about video or audio narration was also tested with students, with some questions on the survey evaluating how much students thought the video contributed to the lesson, or how much students felt they were deprived because they only received audio narration. While some students reporting liking the video, others reported that the video was distracting. Conversely, while some students reported that they felt their instruction was incomplete because they only received audio narration, others thought that the audio narration was sufficient for what they were learning in the lesson. Our evaluation of student responses also showed there was no correlation between whether or not students used the video or audio lesson and their reports of learning, satisfaction, or comfort in using the lesson. Additionally, there was no difference in time-to-completion between students using the two lesson versions.

4. Discussion

Despite the quality problems with the lesson, we did conclude that our results were valuable for the development of future lessons. First, at low levels of training and experience, it appears unrealistic to expect faculty members to produce media of an acceptable quality to facilitate student learning. While others have found LTAs to be very effective, most of the reported examples are not in instructional settings where production quality can affect student performance as much as in a situation where audio or video is integral to students even understanding the presentation [3]. In these cases, it seems clearer that a more professional method of production is required to develop media resources that students will respond to, and learn from.

An additional result was unanticipated at the beginning of this study, but upon reflection it appeared to be of great value to the business of ongoing lesson production. When the project began we anticipated that if our trial were successful, faculty members would be able to use the same development process with each course topic, until the course was fully available in a self-study format. However, we discovered that the process we used was only partially successful. While the format itself showed promise, the quality of the media was an impediment to success, and higher quality media would be necessary to fully test the value of the format. Yet what became important to us was that our trial provided enough evidence of probable success that we could justify investing additional resources into producing higher-quality media. In other words, the lesson created for this study acted as a prototype for the development of future lessons. Prototypes have long been recognized as a valuable method to test design ideas before committing production resources to full development [5, 6]. Additionally, Collis and de Boer proposed that involving faculty members in the prototyping process can also help ensure that their necessary input is included when determining what design alternatives to pursue [7]. The same was true during this trial, most notably in our creation of two lesson prototypes to test whether or not video narration added value above that provided by the audio narration alone. An abstract debate about whether or not to include video could have been a costly endeavor, not only in time and resources but also in damaged trust among team members if they did not perceive others to be acting in the best interests of the project. But because it only required about two total hours to create the lesson, including approximately fifteen extra minutes to create an audio only version after the full video version was created, we were able to base a decision on evidence relevant to our local situation, rather than endlessly wondering about the applicability and generalizability of abstract findings from other studies. It appears to be a valuable practice, then, to use LTAs and software templates to allow faculty members to develop prototypes of design alternatives throughout the development process, rather than using potentially more expensive or time-consuming methods of decision making.

In addition to this value, we also concluded that using LTAs and software templates could be a helpful approach to helping faculty members remain interested and involved throughout an instructional development cycle. Some of the Statistics faculty, particularly the one member who recorded the narrations for the lesson, became energized as a result of participating in this project. They began to believe that they could create something valuable and significant for their students. Some of them had developed a negative attitude towards the technology-enhanced lessons, because of the inflexibility they had previously experienced when teaching with them. But participating in this study helped them to change their perceptions both of the media developed for the statistics course as well as the value of technology as applied to instruction. This is consistent with the conclusion of thinkers such as Hagner and Schreebeck, who noted that it is sometimes challenging to keep faculty members engaged in instructional technology projects, and so it is important to create environments that interest and reward them for expending effort during the process [8]. If development teams find that the faculty members with whom they work are not significant participants in the project, a participatory prototyping method may be a helpful way to keep them interested and in a position to give their necessary input throughout the life of the project.

It may be of interest to the reader to become acquainted with some of the events transpiring since the completion of this study. At the time of this writing (October 2006), the Statistics department has been able to convert approximately half of the sections they teach each semester into an online, nearly self-study format, saving hundreds of hours of instructor time every year. Unless students have difficulties

with individual topics and request individual assistance, each section only meets for one hour a week, for the purpose of answering student questions or addressing new topics of data analysis. This achieves one of the important goals set by the university administration, and as a result their pressure on the department to cut costs has lessened. Additionally, the Statistics department has started to evaluate learning outcomes between the students who use the self-study, technology-enhanced, lessons and those who do not, which will provide a better measure of learning effectiveness that cannot be discovered through student self-reports alone.

The Statistics department has also taken complete management of the development of the technology-enhanced lessons, freeing the university to use central development resources to impact more departments on campus. The department addressed the problems of quality noticed in this study by having the narrating faculty member record her audio commentary in a professional sound studio (no video narration is currently being used in the course). They also hired a technically-minded student employee to assemble the lesson content and to maintain and improve the lesson templates. Even though the lesson technology has been upgraded since the completion of this study, the underlying strategies we prototyped are being used, with further refinements made through the testing of additional prototypes created by the department. The Statistics department has also sold the publishing rights to the course to a commercial textbook publisher. At this point, all involved consider the project, and the course, to be a success.

5. Conclusion

In conclusion, this study should be of interest to those who are trying to help faculty members participate meaningfully in the production of technology-mediated instruction. In this study we used a prototyping approach that capitalized on low-cost methods of production. This allowed faculty members to participate in meaningful instructional development decisions, as well as try their ideas with their students, before committing expensive production resources to full instructional development. In addition, this participatory prototyping approach can help keep faculty members interested and engaged throughout the life of an instructional development project. We recommend that producers of instructional technology extend this work by attempting a participatory prototyping approach, and adding their results to the body of knowledge about how to help faculty members more fully participate in technology-mediated instruction.

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