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About
The Journal for Applied Instructional Design

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The purpose of this journal is to bridge the gap between theory and practice by providing reflective scholar-practitioners a means for publishing articles related the field of Instructional Design.

JAID's goals are to encourage and nurture the development of the reflective practitioner as well as collaborations between academics and practitioners as a means of disseminating and developing new ideas in instructional design. The resulting articles should inform both the study and practice of instructional design.

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Editorial

Don Robison, Ph.D., CPT
Eastern Virginia Medical School

Seriously Practical Things: Unicorns, Giants, and Game-making

Welcome! We are excited to serve up this latest issue of the *Journal of Applied Instructional Design* (JAID). This issue we present novel solutions to the challenge of generative learning in diverse authentic contexts. This is a very practical issue.

How is this for practical? You will read about giants and unicorns and students creating games to learn.

Interestingly, you will read about effective instruction with pre-service teachers from two different perspectives. I hope you find both the description of the learning experience of the teachers, and the idea that preparing instructors prior to their instruction interesting. We can design great instruction, but if it is delivered poorly, the design is of little impact.

Check out our new regular feature, REALDESIGN. In our effort to make this journal useful to practicing instructional designers, each issue we will be calling on experts in our field to share their real-life experiences with you. How do they practically do the things they say we should all do? Where have they blown it? How do you really *do* instructional design? Our first installments of this feature will be led by the authors of the upcoming eighth edition of *Designing Effective Instruction*. I'm excited about this feature because we take the theoretical and we take the models and we essentially say, "this is how you really do that."

We close with an essay by yours truly describing my own experiences with giants in our field, and models of a generous professionalism. I must say that I have met some of these giants in ways you would not want to emulate. For example, I hope he doesn't remember this, but I met Michael Molenda when I was ordering him around thinking he was a graduate student my office had employed. It is a long story, but suffice it to say, we talked on the phone a few times and he did everything I told him to do. He was actually a great graduate assistant (only he wan't). But enough of that for now. If you are interested, please read and enjoy.

What is our responsibility to our profession? Or, perhaps better, what is our continuing joy towards it? How do we make it better?

I'm always amazed by the diversity of our authors and the wide range of topics they address, take a moment to notice that in this issue.

Ours is an amazing journey… we get to creatively, systematically, imaginatively, and with developed discipline design the experiences that lead people to great accomplishment. It is psychology, it is communications, it is art, it is discipline, and it is expert judgment. It is science and evidence and the human experience. What we do is pretty cool, enjoy it!

Best to you, Don

Don Robison, Ph.D., CPT

2018 AECT International Convention

Learning for All

Kansas City, Missouri
October 23 - October 27 2018

Workshop Sessions: Tuesday, October 23; Wednesday, October 24; and Saturday October 27
Concurrent Sessions, Posters, Panels & Roundtable: October 24 - October 27

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REALDESIGN
PERSPECTIVES FROM THE FIELD OF INSTRUCTIONAL DESIGN

REALDESIGN is a regular feature that brings leaders in our field to you discussing their challenges in actual design contexts. For the next issues, we have invited the authors of the soon-to-be-released next edition of *Designing Effective Instruction* (Morrison, Ross, Morrison, & Kalman, in press) to share some of their practical design experiences.

Know your audience, or in our world, know your learners.

Jennifer Morrison, Johns Hopkins University

A while back, one of us was tasked with designing a workshop for teachers on evaluating educational technology products. The plan was to present principles of instructional design and then examples of existing ed-tech products that exhibited these principles. This presentation would be followed by an activity where teachers evaluated programs according to whether or not they exhibited the principles. Identifying the principles wasn't a problem but finding good examples of ed-tech products proved to be quite the challenge. There were plenty of non-examples out there (showing what not to do), but not a whole lot of good examples. One of the programs we stumbled across was a clear shining star. This science program exemplified many of the principles we were presenting in the workshop and we were really impressed. It was evident that the program developers had done their due diligence and the program design was clearly influenced by research. We held the workshop, teachers (hopefully) increased their ability to evaluate ed-tech products, and we returned to our day job of conducting independent program evaluations.

Flash forward a couple of years. An email comes over from a program developer who is interested in an independent evaluation. We look at the name of the program and low and behold, it's the shining star we reviewed for the workshop! We're really excited because we like the program and think it has a lot of potential. We're eager to see first-hand the program implemented in schools. We have our call with the program developer and he explains that the program has seen great success in his country and he's interested in entering the U.S. market. Given that his needs are more formative in nature, we plan for a case study type evaluation where the program will be used in a small number of willing schools. We'll visit schools to conduct interviews with teachers, observe the classrooms using the program, and administer surveys to teachers and students.

Once our team returns from the site visits, they bring some terribly awful news. This shining star program appears to be failing miserably. According to teachers, the reading level is substantially too high for the kids! Student survey results indicate the same: the kids are struggling to understand the content. This program that we had high hopes for is showing very lackluster evaluation results. If the kids can't read the content, they're not able to learn from the program. Since the kids aren't learning from the program and the teachers are frustrated, the results of our evaluation are not very positive.

What went wrong with our shining star program that had such great potential? The program developer didn't consider the learners. Granted, the program had great success in his country, but the reading level in U.S. schools has been documented to consistently fall below standards (U.S. Department of Education, 2015, 2017). The reading level in the schools the developer selected for participation in the study was no different; kids were performing below grade level on reading assessments.

Considering the learners who will experience your program is a key component in our instructional design model (Morrison, Ross, Morrison, Kalman, in press). We note that learners of all ages are composed of a variety of types of people and it's critical that designers consider learner characteristics when designing any sort of training or instruction. We propose that a learner analysis considers two characteristics described by Heinich, Molenda, Russell, and Smaldino (1999) including general characteristics (e.g., age, gender, work experience, education) and specific entry characteristics (prerequisite skills). We also add academic information, personal and social characteristics, culturally diverse learners, learners with disabilities, and adult learners.

Perhaps you, as an instructional designer, are short on time and need to get your program or training developed as quickly as possible. The example above should illustrate the importance of knowing your audience through conducting a learner analysis. Even if you're short on time, our "Lean Instructional Design" (Morrison, Ross, Morrison, Kalman, in press) approach suggests at the very least speaking with a sample of instructors or teachers to obtain a reliable description of the learner audience. You may also find that the subject-matter expert and key stakeholders have insight into the characteristics of your learners.

Fortunately, not all of our evaluations uncover that developers neglect to conduct learner analyses. A positive example of learner analysis is evidenced in a recent evaluation performed by our center of a STEM enrichment program ("The STEM Academy) developed for urban high school students in Baltimore. Teenagers have many after-school activities in which they typically would prefer to engage over sitting in optional math and science courses. The program designers, however, used learner analysis from pilot offerings to orient the program to tapping into students' career and personal interests, making participation activities varied and engaging, and promoting interactions with STEM professionals and peers. The result was high attendance and persistence by students as well as positive reactions to both the program and interest in future STEM experiences and careers.

Jennifer R. Morrison is an assistant professor of research at the Center for Research and Reform in Education (CRRE) at Johns Hopkins University. CRRE specializes in conducting independent evaluations and research on educational products and services.

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From Passive Players to Active Developers: Undergraduate Biology Students Developing Their Own Digital Learning Game with Twine

Jordan Clark, Sam Houston State University
Rachel Baxter, Sam Houston State University

Abstract: Undergraduate microbiology students were tasked with creating a digital learning game. The purpose of this project was to change the student role from passive player of educational games to active developers. The microbiology course curriculum does not require programming knowledge nor dedicate instructional blocks to computer skills. Students were instructed to apply microbiology concepts and clinical case studies to create an interactive text-based digital game using the open source program Twine. A pre-project survey showed concerning attitudes towards gaming. The course students reported spending fewer than two hours per week engaged in casual game play and preferred a mixed approach to learning through traditional formats. Over 50 percent of the class expressed uncertainty in the skills required for this project. Despite the initial uncertainties, projects grades were above 90%. Rubric assessment, compared from the course instructor to an independent grader, showed high marks for science application, creative play, and instructional intent. Over 50 percent of the students reported a positive experience with many reporting increased confidence in their abilities to create a digital learning game. This study shows that students can create their own digital learning game with minimal programming knowledge and instructions.

Keywords: Digital learning game, game development, undergraduate science course, microbiology, student project

The popularity of digital games in America has provided a potential new medium for educational tools. Several structural elements of games are attractive to players. These include, but not limited to, structured rules, defined objectives, conflict, and interaction (Garris & Ahlers 2002; Wilson et al. 2009). Educators can motivate students to learn by applying these game characteristics (Butler et al. 2014). Digital games as educational tools, or serious digital games have become popular in STEM courses (Breuer & Bente 2010; Halpern et al. 2012). Research suggest that digital games can enhance learning of scientific concepts and promote scientific thinking (Ravenscroft 2007; Halpern et al. 2012; Morris et al. 2013) Student learning motivation and engagement may increase when incorporating digital gaming compared to non-gaming methods (Miller et al. 2011). However, the complex stimuli and cognitive demand of some digital game interfaces may overwhelm students (Zaphiris et al. 2007; Chen & Huang 2013). Prior experience and knowledge of digital games may also influence a student's attitude when incorporating such media into a learning protocol (Blumberg et al. 2008; Orvis et al. 2008).

Individual learning styles may bias a student's attitude towards digital game learning. Though the taxonomy and measurement of learning styles remains controversial (Curry 1990; Coffield et al. 2004; Liu 2007), research has shown some benefits in educational strategies that address unique learning styles (McParland et al. 2004; Kolb & Kolb 2005; Wang et al. 2013). However, style-specific teaching strategies like digital game learning may alienate those who prefer different or traditional methods of instruction. These discrepancies in attitudes and learning styles represent a critical obstacle in realizing the full potential of digital games in the education.

Recently, educators have addressed these concerns through student-created games. Changing the student's role from a passive learner, as the case when playing educational games, to an active designer can foster empowerment through ownership (Yang & Chang 2013). This new role for the student helped create the theory of Digital Game Authorship (DGA) (Yang & Chang, 2013). Some of theoretical basis for DGA describes the creation of knowledge through application of experience and increased attention to tasks (Yang & Chang,

2013). An important aspect of DGA is the opportunity for collaboration, planning and socialization that may encourage critical thinking skills (Triantafyllakos et al. 2011; Carolyn Yang and Chang 2013).

Given the academic potential for DGA and game-based learning, we wanted to assess the ability of undergraduate microbiology students to develop their own digital learning game (DLG). The immediate challenge of this project is integrating computer-programming skills into an already demanding course curriculum. The priority of the microbiology course is learning of basic microbial features, application to human illnesses, and analytical lab experiments. Requiring students to develop a digital game may distract from the course objectives. Some may deem game development as an unnecessary learning component and jeopardize class performance. Optimally students would need software that requires little programming knowledge. This would also benefit teachers unfamiliar with digital games, allowing them to spend minimal instructional time on software use. Twine is open source software that allows users to develop digital text-based games (Chris Klimas, 2009). Twine requires minimal programming skills and is free to use on a browser or downloaded to a desktop. Game play is structured in a nonlinear format allowing players to choose multiple story lines that may result in different outcomes. The simple design of Twine software and user-friendly tools allows students to focus primarily on accurately integrating science concepts and creative storytelling without the complexity of programming language. By using Twine, we hypothesize that students can create a digital learning game with minimal programming experience. Additionally, we hypothesize that challenging students to create a digital game will positively change their attitude towards knowledge application, computer and problem-solving skills.

Methods

Participants

The Twine DLG project was assigned to an undergraduate class of approximately 80 students enrolled in Introduction to Applied Microbiology at Sam Houston State University. All the students in the course were pre -nursing majors.

Introductory Block

Students were advised to form groups of two to four people, though single student projects were permitted. The class received an in-class tutorial about the website Twinery.org with instructions on navigating the website's tools(Chris Klimas, 2009). Next, the instructor demonstrated how to make a Twine DLG using a simple campus navigational story (see Figure 1). The demonstration game was shown in editing mode emphasizing how placing of double brackets at the beginning and end of words create clickable links leading to different story passages (see Figure 1). Next, the Twine demonstration DLG was shown in game-play mode. The double brackets inserted around text in the editing mode appear as hyperlinks that take the player to different panels (see Figure 2). Students were provided links to a series of basic video tutorials on Twine and archives of twine stories with themes of science fiction, mystery, and comedy. Students were advised to spend one week exploring the various twine stories while creating a demonstration game to become familiar with the programming requirements.

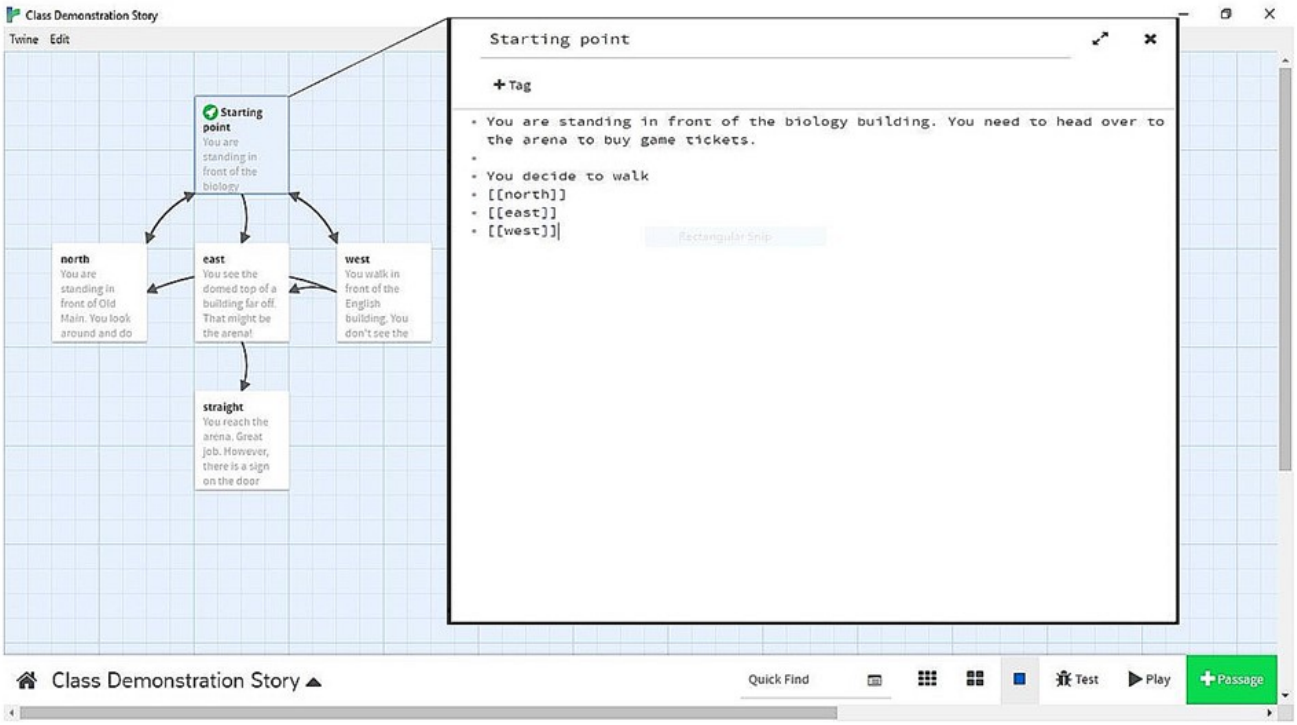

Figure 1. Instructor demonstration of Twine story in editing mode.

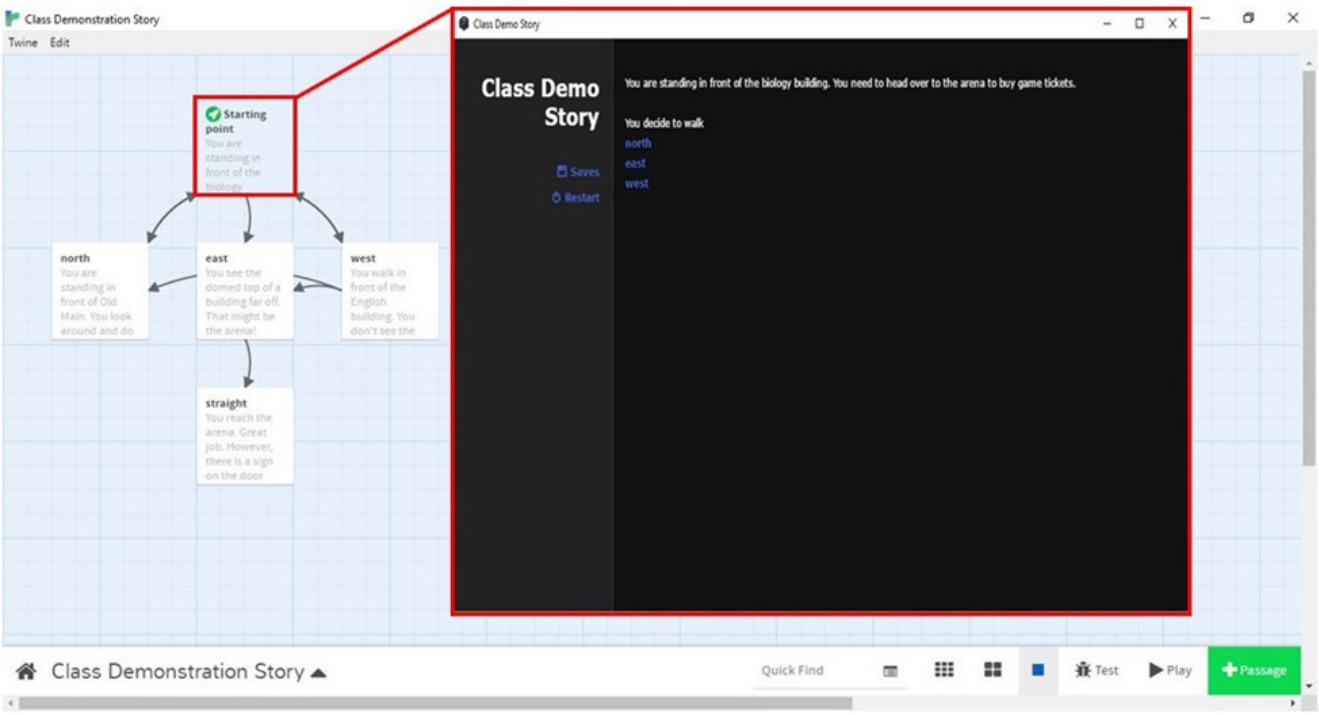

Figure 2. Instructor demonstration of Twine story with game-play mode panel.

Development Block

Following the two-week introductory block, students were instructed to select a topic in microbiology. Microbiology clinical case studies were recommended as a template for their DLG. Students were given the following guidelines on how to make a thorough DLG with Twine.

1. Create a case study or fictional story about a character or characters who contract a microbial disease
2. Give the player options that may be correct or incorrect.
4. Make the incorrect options logical and plausible.
5. Make sure the science is accurate.
6. The length of the game should require a minimum of 5 minutes playtime.
7. Be creative. Your story can take place anywhere and anytime you chose.

After completion of a rough draft, students were introduced to some advanced programming techniques, such as adding images, formatting text, variable and hook markups. These advanced programming techniques were not mandatory for inclusion in their game.

Evaluation

All students in the study were required to read and sign given privacy notices as proof to participate, as per the IRB requirements of the Sam Houston State University. Students were given time during and out of class time to complete the survey, and it is 100% volunteer at the time of this paper. Student Twine DLGs were graded using a 16-point rubric (see appendix A). The course instructor and a blinded independent grader scored the student Twine games.

Pre-and post-surveys were administered to students to assess background and attitudes towards gaming and the DLG project (see Table 1 and Table 2). Surveymonkey.com was used for administration and collection of survey data. This survey received face validation from an expert in the field of Learning Technology at the University of North Texas Dr. Tandra-Wood for the Analysis of Research in Learning Technology PhD course work completed in the summer of 2017. Analysis of all survey questions included

- Correlation/comparison between pre-and post
- Correlation/comparison within post survey: max of 2 comparisons

Twine submissions were graded using a 16-point rubric (see appendix). Twine project grades were averaged into the student's overall course grade.

Results

Final DLG Project Grades

All DLG projects were submitted as an HTML file to the instructor. Projects were scored using a 16-point rubric by the course instructor. An independent blinded grader scored the projects and compared the averages to the instructor's scores. A 2-sample T-test showed no significant difference between the instructor's project averages (μ=15.48, SD=.508) and the blinded grader (μ =15.10, SD=1.45);t=-1.41; p=.168. An example of a high scoring student DLG project, titled "Mrs. Johnson (see Figure 4), was modeled in the story format on traditional microbiology case studies (see Figure 2). The story proceeds briefly in a linear fashion allowing the player to preview Mrs. Johnson's medical records. In the advance story sequences of "Mrs. Johnson" (see Figure 5) the player is given the option of a selected a biopsy and provided the results of a possible infectious

Table 1. *Pre-Survey on Student Background and Attitude Towards Games*

Pre-Project Survey
1. Age Range 18-22 23-26 27-30 31-35 36-40 40-45 50+
2. Male or Female
3. When it comes to learning things I prefer: *Paper or traditional text Digital or online Both*
4. I play games in such formats as digital, home console, and/or computer games on average per week: *Never(0 hrs) Rarely(1 hr) Sometimes(2-3 hrs) Often(4-5 hrs) Frequently(6+hrs)*
5. I am confident that I have the problem solving and/or computer skills needed to create a storytelling digital media, to be used to create an online game and/or teaching tool. *Strongly Disagree Disagree Uncertain Agree Strongly Agree*
6. My learning style(s) percentages are *Visual 0-20 21-40 41-60 61-80 81+* *Aural 0-20 21-40 41-60 61-80 81+* *Verbal 0-20 21-40 41-60 61-80 81+* *Physical 0-20 21-40 41-60 61-80 81+* *Logical 0-20 21-40 41-60 61-80 81+* *Social 0-20 21-40 41-60 61-80 81+* *Solitary 0-20 21-40 41-60 61-80 81+*

microbe. The player must decide the morphology of the presented microbe. The student developers used a gaming technique that presents the player with identical story paths regardless of the option selected. This technique allows the player to proceed for some time despite selecting a wrong answer. The player will eventually come to an erroneous conclusion and must backtrack through their options.

Pre-survey Assessment

Students' experience and attitudes of gaming and class instructions were assessed using a pre-project survey (n=36). Responses for Like/Strongly like and Disagree/Strongly disagree were collapsed due to low n. A decision was made to remove two of the questions asked in the survey. The question asking age was removed because only 1 of the 36 respondents was not in the 18-24 age range. Question number two for male or female variable was removed because only 3 of the 36 respondents were male. A factor analysis was run on the 36 pre-survey responses, even though n is below the ideal of 108 responses or 12 responses for the 9 possible variances that remained. The variables used in the factor analysis were 1) Preference on learning; 2) Confidence in problem solving skills to create the Twine; 3) Time spent playing digital games; and 4) Learning styles. For variable 4, the individual learning styles assessed were visual, aural, verbal, physical, logical, social, and solitary. The Oblimin factor analysis reported with a determinant of 0.089. Review of the correlations (see Table 3) show no factors with as correlation of 0.8 or higher, thus no multi collinearities or variables were combined.

A Keiser-Meyer-Olkin measure showed that the relationship strength among the variables was high making the analysis acceptable (KMO=.56). The Bartlett's test of sphericity was significant for correlations in the matrix (χ^2 (74.734), p=.004). Review of the Scree Plot show only the first four (4) components are above the Eigenvalue cutoff value of 1.0 (see Figure 3). To ensure using the most accurate data a Monte Carlo PCA for Parallel Analysis was employed (see Table 4). Results

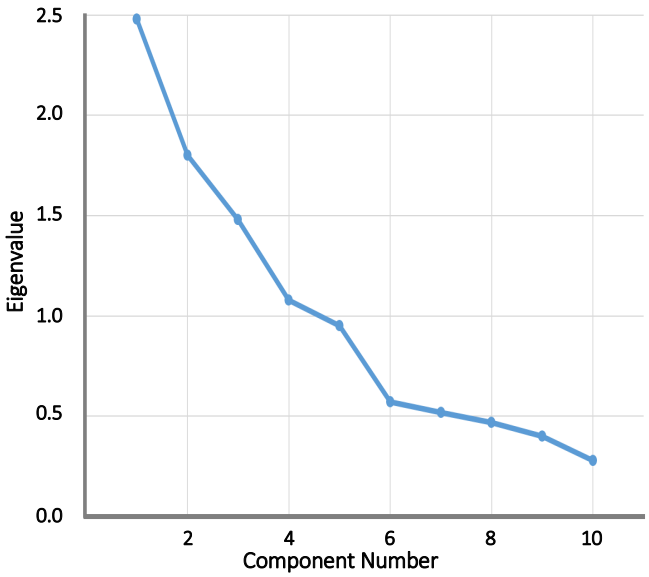

Figure 3. Twine pre-survey scree plot.

Table 2. *Post-Survey on Student Attitudes Towards Games*

Post-Project Survey
I am rating my overall experience using Twine as:
Horrible I barely survived Neutral This was fun I loved doing it
I am confident now that I have the problem solving and/or computer skills needed to create a storytelling digital media, to be used to create an online game and/or teaching tool.
Strongly Disagree Disagree Uncertain Agree Strongly Agree
My learning style(s) may have an effect on how you did on the Twine project.
Strongly Disagree Disagree Uncertain Agree Strongly Agree
5. I am confident that I have the problem solving and/or computer skills needed to create a storytelling digital media, to be used to create an online game and/or teaching tool.
Strongly Disagree Disagree Uncertain Agree Strongly Agree
By completing the Twine project, I feel that I have learned more about microbiology (or subject) than I would have if I was doing traditional readings and "pen and paper" assessments like a test or paper.
Strongly Disagree Disagree Uncertain Agree Strongly Agree
Teachers using more storytelling digital media like Twine would be more engaging for students and thus learn more.
Strongly Disagree Disagree Uncertain Agree Strongly Agree
Suggestion on how to improve the Twine project.

showed that *preference* that they had the problem solving or skills to create the Twine had the greatest effect, followed by item 3- How often in a week do they play games and the learning styles of and item 2- Preference on how they like to learn.

Post survey assessment

An Oblimin factor analysis was run on the post-survey responses (n=48), but the solution could not be rotated. A qualitative approach was used to further extract results. Post survey results showed that 52%(n=25) students had a positive experience using Twine while 12.5% (n=6) students reported a negative experience using Twine. 35.42%(n =17) reported a neutral response to using Twine. For post-project confidence levels 68.75% of students agreed they now have the skills necessary for creating a DLG (n=33) while 10.42% disagreed(n=5). The remaining 10 student respondents were uncertain. 66.67%(n =32) of the respondents agreed they learned more by completing the Twine project than if they had just focused on traditional pen/ paper exercises. DLG while 18.75% disagreed(n=9). 60.42%(n =29) of students agreed that they would be more engaged in course material using projects like the Twine while 16.67% disagreed (n =8).

Discussion and Conclusion

The academic potential for digital learning games (DLG) is promising (Miller et al. 2011) . However, when using DLGs in a classroom, students typically assume a passive role of participants. A unique approach to this learning setting by allowing students to become the creator, taking ownership of learning content (Yang & Chang 2013). Students developed their text-based game using Twine, an open source programming software. This study showed that students could successfully create a DLG with minimal programming knowledge. In addition, students responded positively to the experience and challenges of the developing process.

There are many measurable components when introducing a game development project. However, the primary focus of this project was on the creation of the game. This presented a challenge, as the core content of a microbiology class is rigorous. Expecting students to develop computer games in addition to learning science concepts may be overwhelming. Thus, before assessing

Table 4. *SPSS Total Variance Compared to Monte Carlo Analysis*

Component	SPSS Total Variance Explained	Monte Carlo PCA Parallel Analysis
Preference	2.466	1.7913
Confidence	1.824	1.4961
Time Play	1.475	1.3279
Learning styles	1.106	1.165

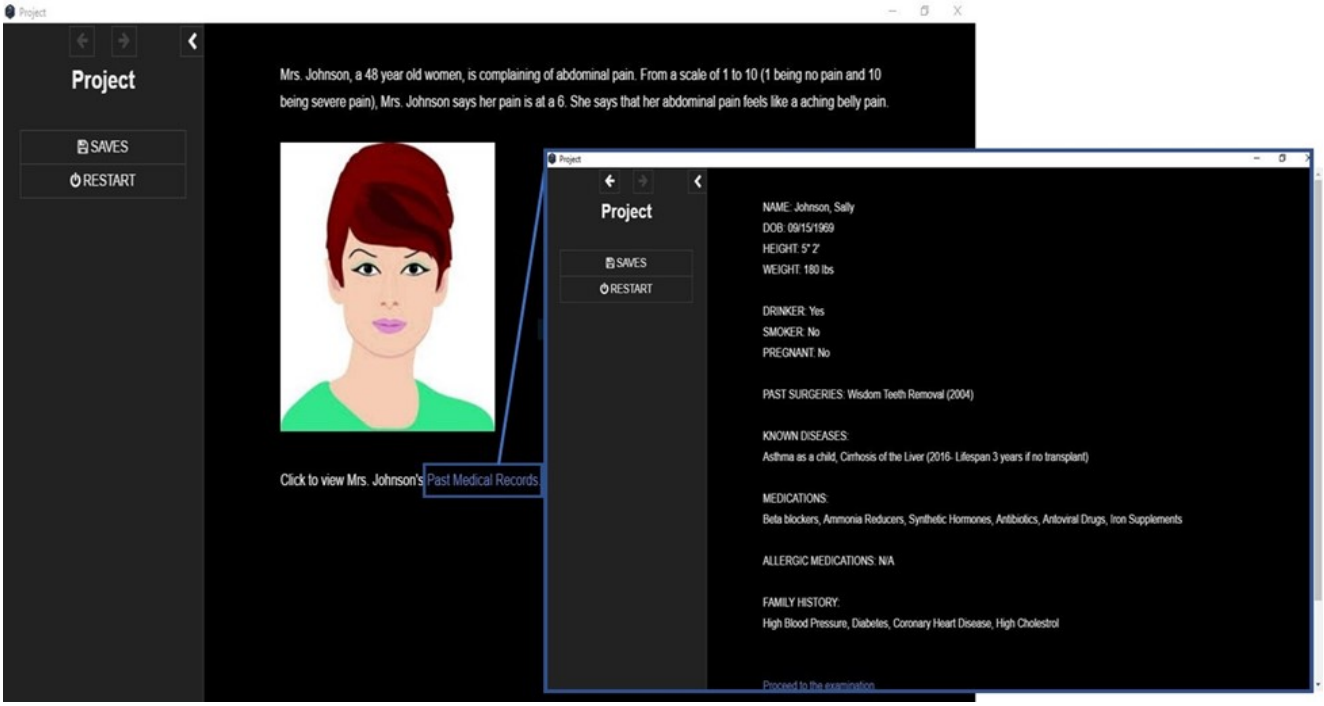

Figure 4. Student DLG project "Mrs. Johnson" opening scene in game-play mode panel.

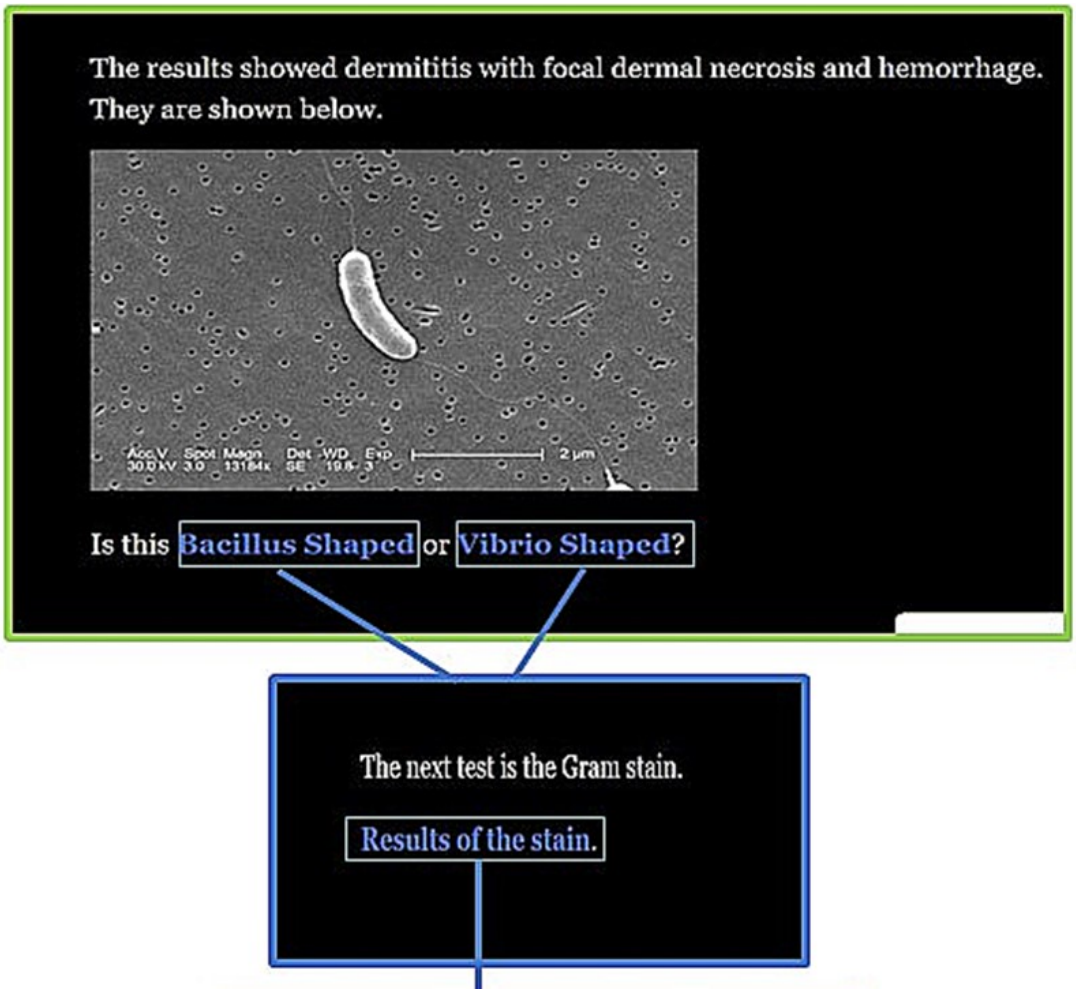

Figure 5. Advance story sequence of student DLG project "Mrs. Johnson." Photomicrograph courtesy of Janice Haney Carr, CDC, Public Image Health Library, 2005.

Table 3 *Oblimin Factor Analysis Results-Pre-Survey Correlation Matrix*

		Prefer to learn	*Confi-dent they can problem solve & make a Twine*	*How often play games per week*	*Visual*	*Aural*	*Verbal*	*Physical*	*Logical*	*Social*
Correlation	*Prefer to learn*	*1.000*	*.205*	*.151*	*.151*	*.041*	*.104*	*-.087*	*.032*	*-.014*
	Confident they can problem solve & make a Twine	*.205*	*1.000*	*-.024*	*-.024*	*-.312*	*.074*	*-.032*	*.255*	*.097*
	How often play games per week	*.028*	*.064*	*1.000*	*.189*	*.035*	*-.125*	*-.156*	*-.081*	*.300*
	Visual	*.151*	*-.024*	*.189*	*1.000*	*.465*	*.009*	*.441*	*.280*	*.335*
	Aural	*.041*	*-.312*	*.465*	*.465*	*1.000*	*-.078*	*.349*	*.070*	*.263*
	Verbal	*.104*	*.074*	*.009*	*.009*	*-.078*	*1.000*	*-.096*	*.190*	*-.209*
	Physical	*-.087*	*-.032*	*.441*	*.441*	*.349*	*-.096*	*1.000*	*.460*	*.162*
	Logical	*.032*	*.255*	*.280*	*.280*	*.070*	*.190*	*.460*	*1.000*	*.216*
	Social	*-.014*	*.097*	*.335*	*.335*	*.263*	*-.209*	*.162*	*.216*	*1.000*
	Solitary	*-.079*	*-.137*	*.288*	*.288*	*.214*	*.396*	*.322*	*.486*	*-.199*

improvements in content learning and critical thinking, it is important to show that students could successfully create a DLG. Success was defined as accurately applying learned science concepts in an instructional and creative context. The class average for the projects were above 90%. This average was consistent in comparison to a blind grader independent from the course.

Preconceived student attitudes of technology may affect their motivation and experience in the project (McParland et al. 2004; Liu 2007). Pre-survey results showed that learning preferences had the greatest effect on project attitudes and abilities. Interestingly, students did not favor a specific style of learning in comparison to other styles. A majority preferred a mixture of traditional and digital strategies. This response illustrates the problems of exclusive incorporation of a learning strategy. Relying solely on digital or traditional means may discourage student motivation and participation (McParland et al. 2004; Liu 2007). The final component affecting attitudes was time engaged in digital games. Students reported spending less than two hour a week with digital games. We expected a higher response of engagement factoring in the popularity of digital games. This may explain the challenges we experienced when promoting the dynamics of DGL to the students.

Another component affecting project attitude and ability was confidence levels. This was expected as creating a digital game might require unique problem-solving strategies. Composing non-linear stories may be a unique skill unfamiliar to many. Students were asked how confident they were in problem solving and computer skills. Over 50% of the students were uncertain or disagreed that they had the skills necessary to create a digital game in the pre-survey. These responses further emphasize the importance of selecting game software with minimal programming knowledge.

Following completion of the project students were administered a survey to reflect on any changes in attitude and perception toward creating a digital learning

game. Over 50% of the students responded having a positive experience developing their game. No specific variable, such as confidence or game exposure, as being a major factor in their positive response. Students previously reported confidence concerns in creating a DLG. Upon completion of the project, approximately 68% reported an increase in confidence. Despite such a high response, this was not a significant change compared to pre-project confidence levels. One possible reason is that approximately 40% of students reported some confidence in in their abilities before the start of the project. A larger and more consistent survey response may support a significant increase in confidence.

A project requiring students to create a digital learning game can be a daunting proposal. There is risk in compromising the core intent of the class for demonstrations in game development. Twine is attractive for its ease of programming and self-directed tutorials. This benefits not only student, but also instructors who may have little experience in game development. For this unique project, students assumed an active role in development of educational media, applying learned material and claiming authorship of a digital game. The next phase of this project will examine changes in students' problem skills following development of a Twine DLG. These skills are critical for experimental design, as multiple outcomes must be accounted for. Incorrect conclusions or design flaws must be linked back to the source of error with selection of correct procedures. Twine DLG may provide a unique platform for developing the skills needed for laboratory experimental design.

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Appendix

DLG Project Rubric

	1	2	3	4	*Total*
Accuracy	The science was not accurate. Explanation and use of concepts were full of errors.	The science was somewhat accurate with some concepts used or explained with error.	The science was mostly accurate with few concepts used or explained with error.	The science was accurate with no concepts used or explained with error.	
Originality	The story lacked any originality. The story did not follow the nonlinear format in a creative manner.	The story was somewhat original. The story somewhat followed the nonlinear format in a creative manner	The story was mostly original. The story mostly followed the nonlinear format in a creative manner	The story was very original. The story completely followed the nonlinear format in a creative manner	
Instructive	The story did not instruct nor educate the reader.	The story somewhat instructed or educated the reader.	The story mostly instructed or educated the reader.	The story was very educational and instructional for the reader.	
Grammar	The contained too many grammatical errors.	The story contained some grammatical errors.	The story contained few grammatical errors.	The story contained no grammatical errors.	

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Using Digital Stories to Address Sustainability Literacy: Designing a University Hybrid Course to Inspire and Engage Millennial Learners

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Abstract: Sustainability Science for Teachers is a semester-long hybrid course designed for preservice teachers to explore real-world sustainability topics while developing new ways of thinking about the world's threatening problems. The course aims to empower future teachers to engage in society and their future classrooms as sustainable citizens. We explore the rationale for developing such a course, and then examine how it was designed, implemented, and evaluated over five years since its inception, to serve over 1,600 students to date. We discuss design considerations relevant for producing a hybrid course that appeals to millennial learners, while leveraging the skills of an interdisciplinary team.

Keywords: hybrid course design, digital stories, interdisciplinary design team, preservice teacher education, sustainability education

Introduction

Instructional design, at its core, is a systematic approach to developing educational materials with specific intended learning outcomes, teaching strategies, and evaluative mechanisms for gathering feedback (Gagne, Wagner, Golas, Keller, & Russell, 2005). It is this process that has enabled Arizona State University (ASU) to create an innovative hybrid course designed to address one of the major challenges facing the 21st century: the idea of creating a more sustainable future. This notion of sustainability is widely defined as, "…a concern for intergenerational equity" and the ability to meet a generation's needs while not putting the ability for a future generation to meet its needs in danger (Nolet, 2009, p. 413). Considering the increase in the number of people across the globe without access to life's basic necessities, issues of sustainability are more central than ever before.

To confront this problem, education is an essential component that must be addressed (Nolet, 2009). We seek to prepare future leaders to address complex challenges and contribute to a more sustainable way of life. Our answer to this call is the Sustainability Science for Teachers course, which is one of the first university-level courses in the United States to clearly and systematically address sustainability topics, problems, solutions, and new ways of thinking with preservice teachers in a teacher preparation program. In this article, we examine the instructional design process utilized to create this hybrid course, which has served over 1,600 students over the last five years. We conducted a qualitative analysis of three sets of learning reflections during the semester (beginning, middle, end), where students responded with what they found most engaging in addition to presenting ideas for improvements. We explore the rationale for developing the course, and examine how the content was developed, implemented, and evaluated iteratively by an interdisciplinary design team.

A Need for Sustainability Science Education

The field of sustainability places a focus on intergenerational equity, the Earth's processes, and caring for the world's poor (Our Common Future, 1986). Sustainability is at the forefront of the 2005-2014 United Nations Decade of Education for Sustainable Development (UNESCO, 2004). These efforts highlight a core mission of higher education institutions to educate the next generation and prepare them for a changing world (Nolet, 2009). Preservice teacher education represents a promising means to achieving large-scale social transformation, and preservice programs need to work to challenge the status quo with respect to sustainability in order to produce the next generation of scientifically literate and globally-minded citizens (Carney, 2011). However, as Nolet (2009) observes, "In the United States, educational leaders, particularly those concerned with the preparation of teachers, have yet to respond

meaningfully to the issues of over-consumption, human -caused environmental damage, and the global and human catastrophe we are creating" (p. 411).

To develop sustainability literacy, relevant curriculum should address 1) intergenerational perspectives, 2) stewardship, 3) social justice and fair distribution, 4) respect for limits, 5) systems thinking and interdependence, 6) importance of local place, 7) economic restructuring, 8) nature as model and teacher, and 9) global citizenship (Nolet, 2013). Sustainability literacy also involves the ability to take a global perspective and see that issues, people, and places are interconnected; understand how complex systems operate; and think critically and make informed choices (Church & Skelton, 2010). Despite the call for an increased focus on sustainability within teacher education, these topics are often not systematically addressed in existing coursework, even as future educators indicate their eagerness to incorporate them into their teaching (Carney, 2011).

Sustainability Science for Teachers

To address the need for sustainability education for preservice teachers, the hybrid course, Sustainability Science for Teachers (SSFT) began in the fall of 2012. The course aims to develop sustainability and science literacy to empower future teachers as citizens and to enable them to integrate sustainability concepts in their classrooms. Major themes for the course, based on the need to advance sustainability literacy (Stibbe, 2009) include:

- **We are seeking solutions to problems.** Sustainability is about achieving a society where people's needs are met now and in the future. No human need is being met globally in a sustainable way now so each need becomes a problem seeking a solution.
- **There are limits to resources.** Meeting human needs requires resources that come from nature. There are limits to all resources and therefore there will be limits to the number of people whose needs can be met fairly, in a justice fashion, under our current practices.
- **Advances in technology can reset the limits, although limits still exist.** While technological solutions may delay or alter previously identified limits, it is vital that we examine and deliberate the effects of STEM related solutions through various lenses—for example, sociocultural or financial.
- **We are dealing with complex systems.** All natural and human made systems have various components that interact and collide with other systems in play or previously enacted. One system component that is quite unpredictable is humans.
- **Solutions require collaboration.** We must borrow insights from many fields of expertise to understand nature and human interaction with it. Successful solutions can only be achieved if all the stakeholders are involved.
- **Problems and solutions are both global and local.** Natural cycles, commerce, and fixed physical infrastructures such as transportation and telecommunications provide essential services to industry and society, but at the same time actions taken at the local level have global consequences because of inherent relationships.
- **Solutions must be fair.** Social justice, equity, and inclusion must be enacted when policies and procedures are drafted and executed. Compliance to policies that achieve sustainable solutions depend on treating everyone fairly (Stibbe, 2009).

Applying Design to Sustainability

When approaching the instructional design process, we utilized a trusted and true model, ADDIE (Analysis, Design, Development, Implementation, and Evaluation) as described by Gagne, Wager, Gola, and Keller in 2005 (Gagne et al., 2005). More than 100 different variations of the model are in existence, but nearly all reflect the general five step process that includes determining needs, design and development of materials, and then evaluation of the effectiveness (Allen, 2006). According to Allen (2006):

> Principles of ADDIE have evolved during the past three decades. ADDIE is more than a tool for applying behaviorally oriented learning principles to classroom instruction. This advancement has been through step-by-step procedures designed to enable anyone to develop instruction on sophisticated models concerned with complex technological and cognitive and attitudinal issues that require experienced instructional design experts to sort out ADDIE (p. 434).

Allen (2006) described the essential function of instructional design process described by a revised ADDIE model to include a) analyzing and determining what instruction is needed, b) designing instruction to meet, c) developing instructional materials to support system, and d) implementing the instructional system requirements with evaluation taking place throughout.

Embracing this conceptualization, one of the first steps in the SSFT development process was to consider the learners, instructors, and their respective characteristics, together with the delivery options and pedagogical considerations.

SSFT is a required semester-long course for undergraduate elementary education majors, taken in the third year of study. Approximately 150 - 250 students enroll each semester, necessitating five to nine section instructors. Most students are under 25 years of age and report limited prior knowledge regarding sustainability and world events but are active in the community and have strong university school pride in spite of rigorous time commitments outside of school. Instructors include individuals who apply to teach the course and also those who are assigned by the university. They are pedagogical experts, sustainability content experts, or a mix of both.

Accounting for these factors, a hybrid format was selected that employed a flipped model that allowed students to investigate weekly unit topics including population, poverty, food, water, fossil fuels, new energy, ecosystem services, biome stories, production, disposal, governance, translation, and change at home prior to attending class. In weekly face-to-face (FTF) class meetings, hands-on activities explored classroom appli-

cations of that week's topic, the goal of which was to develop students' pedagogical content knowledge (Shulman, 1986). The hybrid structure was selected because it provided: (a) consistent content presentation across diverse instructors, (b) flexibility for instructors to capitalize on their unique strengths in the FTF class, and (c) student flexibility to participate in the online activities at will, 24 hours a day from any computing or mobile device.

To date, the online content has been iteratively developed over ten semester instantiations. Below, we describe the design process as it relates to the two main aspects of the online content: digital storytelling video vignettes and real-world application assignments.

Digital Storytelling Video

A hallmark of SSFT is that digital storytelling videos have been used as the primary content, rather than traditional written chapters or articles. Digital stories are video vignettes that convey compelling narrative stories, invoking a particular feeling, capturing that which cannot be best shared in print, and challenging preconceived notions with visual impact (Robin, 2008). This medium was selected to appeal to the millennial student population. In a recent Pew study, 78% of online adults watched or downloaded videos on video sharing sites such as YouTube, with educational videos being among the most popular (Purcell, 2013). This percentage increased to 95% among 18-29 year olds. We saw this as an opportunity to engage students with this relevant and modern medium, aiming to make sustainability topics accessible for this lay audience.

Through the design and development phases, we created video segments that explored gripping case studies related to global and national issues of sustainability in a documentary-style. Ten-minute video segments spanned approximately 60 minutes for each unit. Content was produced by an interdisciplinary team consisting of content experts in sustainability and education, volunteer reviewers, a video editor, and a graphic designer. The following steps outline the design and development process:

1. **Initial Brainstorm:** In an initial meeting, the group considered potential storylines that connect with the weekly unit topics, and brainstorms learning outcomes together with the motivating questions for each topic. A lead content area expert was selected as the point person for each content topic. He/she constructed an understanding of the group's ideas, researched the topic, outlined overarching and topical learning outcomes, and shared the materials with the group via an internal wiki. The group later met to evaluate the materials and set a timeline for the revision process.
2. **Script Writing:** Upon group consensus regarding the initial ideas, the lead content area expert prepared a written draft of a video script, sharing it with the team for feedback. It is important to note that the team always started with a written script to assure that the learning outcomes were addressed. At this point, the content expert began to storyboard the video, making notes as to footage that needed to be created and identifying outside media to be used. At that point, where necessary, the team requested permissions from outside sources to be able to use selected media.
3. **Source Documentation:** Next, the team drafted instructor notes, detailing background information and notes on the material for the instructor as well as documenting all materials used in creating the digital story from journal articles to external videos. We used RefWorks, a bibliographic software program, to track and store this information.
4. **Video Production and Revision:** The final script was then recorded and saved in audio format. The videographer and graphic designer worked closely together to create a rough cut, stitching together audio and video layers using the video editing software Adobe Premiere. Once completed, the new video was uploaded to Wistia, a secure hosting site, and shared with the team to ensure that the ideas from the content area expert were correctly portrayed and that nothing important was left out. If needed, an iterative re-record and re-design of the digital story took place.
5. **Video Upload:** Finally, a completed final cut was uploaded to a secure host. We also prepared a transcript of the video and finalized list of citations documenting the information used.

Through this process, we capitalized on the strengths of an interdisciplinary team and innovative technologies for creating engaging video content. For an example, see the Big Themes video, which provides a course overview:
http://sustainabilityscienceeducation.asu.edu/course/sustainability-competencies/,
and a video preview of the unit on Water:
http://sustainabilityscienceeducation.asu.edu/course/topic-areas/water/

Online Course Assignments

In addition to the digital stories, each unit contained an online assignment designed to expand students' thinking both as citizens and future educators. To make assignments relevant to the students' lives, each assignment began with a local connection, presenting an ASU Sparky and You fact that encouraged students to explore what their university is doing to address sustainability problems. For example, students learned about university efforts to reduce water consumption in campus restrooms or campus dining options with healthy local foods, as a way to make sustainability relevant to their lives and locale.

The assignments also contained a second portion which took a variety of forms. Some assignments centered on students as citizens and promoted civic action, such as starting a letter writing campaign to advocate for the pros (or cons) of micro loans in developing countries or exploring fast fashion at student-selected clothing stores and considering voting through purchase decisions (conscious consumerism). Other assignments focused on students as future teachers and prompted them to evaluate example lesson plans, consider how state and national science standards apply to sustainability topics, and develop simple sustainability classroom resources. The assignments were designed to appeal to preservice teachers' university pride as well as their affinity for action-oriented outcomes and learning that

Table 1. *Survey methods used in SSFT*

Survey Title	Survey Distribution		Outcomes	
			Informed new iterations of the course	Provided data for scholarly publications
Pre- and Post- Conceptions of Sustainability Survey	Fall 2012 – present	Administered to all current SSFT students in the first and last class meeting of the semester.	X	X
Reflective Learning Survey	Fall 2012 – Spring 2013	Administered to all current SSFT students at 3 time points: after class 3, after class 6, after class 9.	X	X* *These data are presented in the current study.
Engagement in the Course Survey	Fall 2013 – present	Administered to all current SSFT students at the end of the semester.	X	
Conceptions of the Four Ways of Thinking Midpoint Survey	Fall 2013 – present	Administered to all current SSFT students half-way through the course.	X	
Quiz Format Survey	Fall 2013 – Spring 2014	Administered to all current SST students in the last class meeting of the semester.	X	X
Alumni Survey	Summer 2014 and Spring 2017	Administered to former SSFT students.	X	

relates directly to classroom applications. Over time, new iterations of the assignments have been incorporated to make assignments clearer, easier to follow, with current, engaging content.

Ongoing evaluation was an important part of the design process. We used survey methods throughout the course to identify areas of strength and improvement, and to contribute to the body of scholarly work at the intersection of sustainability education and educational technology. Surveys were used to understand students and instructors' perspectives on the course and course concepts cross-sectionally, in addition to more informal one-time surveys investigating students' perspectives on select class activities, instructors, and general educational preferences. Table 1 presents the types of evaluative measures we administered throughout the design, development, and refinement of the course. It also displays the timeframe for data collection, the targeted participants, and how the outcomes informed our course iteration and/or provided data for scholarly work.

For this article, we focused on the reflective learning surveys to provide an overall sense of which aspects of our design process yielded positive feedback from students as well as elements students identified for improvement. These reflective surveys provided evaluative insights that we could analyze and use to iteratively improve the content. The surveys were administered to all students enrolled in the first two semesters of the course, at three time points across the semester. Qualitative responses were collected for two open-ended questions regarding (a) what aspects of the course students found to be most engaging and (b) what aspects they suggested might be improved. Across an aggregate of the data collected at the three intervals during the semester (beginning, middle, end), 208 students responded with what they found most engaging and 205 students responded with ideas for improvements. Students' responses were analyzed using open-coding to identify recurring themes (Hatch, 2002). Over a series of iterative passes, themes were condensed and added, and axial coding was used to organize themes and explore their interrelations (Strauss & Corbin, 1998). We organized the themes by category and tabulated the total frequency for each (Tables 2 and 3). Below, we discuss the most prevalent themes in each category.

Most engaging aspects of the online content. Table 2 shows the aspects of the online content that students found to be most interesting. Nearly half of students believed the most engaging aspect of the online content were the digital storytelling videos (46.6%). One student explained, "The videos are easy to understand and they maintain my interest. It's like watching TV, but I'm learning. My whole family watches them with me! Seriously." The next most popular themes indicated that students believed the online content was informative and interesting (23.1%), had real world

application and relevance of the concepts (16.8%), inspired students to make personal changes or feel directly impacted (15.4%), and they enjoyed that it included narrative stories of real case studies (14.4%). One student expressed, “These topics were not just talking about issues that other people around the world have to deal with they topics that are being directly linked to us and can be very shocking and eye opening.” Another elaborated on her personal connection to the content, "The video content usually initiates conversation within my own household." In highlighting the value of the narrative stories, another student said, "I found the videos to be engaging because they were providing real life stories and real life scenarios. For example, in the water

Table 2. *“What Did You Find Most Engaging About the Online Content?” (n = 208)*

Theme	Frequency	%	Definition
Most Engaging Aspects of the Content			
Informative and Interesting	48	23.1	Student was most engaged with the informative and interesting content.
Real World	35	16.8	Student was most engaged by the real world application and relevance of the concepts learned.
Personal Change / Impact	32	15.4	Student reflected being inspired to make personal changes and/or described being impacted personally, as a result of their participation in the course.
People / Stories	30	14.4	Student was most engaged with the case studies presented online - the stories of individual people and opposing viewpoints told in the digital storytelling videos.
Teaching Application	12	5.8	Student was most engaged with online content that could be applied to their future classroom.
Multiple Perspectives / Critical Thinking	10	4.8	Student was most engaged by the presentation of multiple perspectives and promotion of critical thinking.
Data	6	2.9	Student was most engaged with the use of data and data visualizations.
Most Engaging Course Tasks and Structures			
Videos	97	46.6	Student identified the videos as the most engaging aspect of the online portion of the course.
Discussion	10	4.8	Student believed that writing written reflections of the video and/or participating in the online discussion board was engaging.
Learning Checks	6	2.9	Student believed the post video quizzes and/or written reflections supported their learning.
Response Not Applicable	29	13.9	Student did not address what aspect of the online course they found to be engaging.

videos they showed a woman who talked about how dirty excrement water would flood her home. I think it's interesting to see real people and what they are going through." Overall, students overwhelmingly reported that the videos were engaging, because they integrated interesting content, inspired personal connections, and connected to the real world through the use of narrative case studies.

Students also described areas for improvement in their reflections. Table 3 presents an analysis of the issues that students identified within their reflections. These include issues with structure, issues with content, issues with resources or tasks, and areas for other improvements.

Suggestions for improvement. The most prevalent themes regarding areas for improvement focused on issues with the course structure. Specifically, students suggested reducing the workload (27.8%) and giving more time for assignments / adjusting the schedule (19.0%), explaining that if the workload was reduced, "the quality of work would be stronger" and "students would view the assignments as helpful and interesting instead of viewing it as another timely class assignment." A common request regarding adjusting the schedule was to remove accessibility restrictions for the online content so students could work ahead or take more time to reflect on their assignments following their face-to-face meeting.

Suggestions for improving the course content were also mentioned. First, students suggested connecting the course content more to how it might be used in their future classrooms (13.2%), to better "see how we can implement in our classroom in conjunction with other content areas." Students suggested that this could be realized by, "Having videos of how this would be taught in various classrooms for 1-8. Short clips of how to topics could be taught would help. This way there's more application." Or simply by, "Making the discussions more about how we can implement the content we learned into our future classroom." They also cited a number of general content suggestions (13.2%), including reducing bias, making content more engaging and focused, suggesting solutions, and providing more connection across the weeks. One student explained, "I watch the videos and discuss in class but no one is giving us solutions. So we now know the problem! What do you [/]we do about [it]?" Another student suggested, "I would have liked to see the weeks more interconnected: maybe provide references back to different thinking, or concepts that were explored again in subsequent weeks."

Other suggestions focused on improving the resources or assignments in the course. The most common suggestion was improving the videos (13.2%), making them, "Shorter, less complex… [because] too much information at once causes me to block out some of it," or modifying the videos to be more exciting with better narration, because, "The voice in the videos… some are too monotone."

Finally, we highlight a set of suggested improvements regarding the themes *No value* (4.4%) and *Instructor* (7.3%). While the frequency of these themes was relatively low, the meaning of them is particularly interesting, simply because they reflect very strong feelings. Students reflecting ideas that the course had *No value* said things like, "SHOW US how to use this in our classroom. With all the core content there isn't enough time for, there is no way to add this on it's own. No offense to this class, but this was a waste of three credits when we could have been learning lesson planning or other essential things for our teaching career. …I don't feel prepared and am very upset that three credit hours are given to something, although important, that I can't use in my classroom." Similarly, 7.3% of students had strong feelings about areas of improvement for their particular *Instructor*, including critiques of their grading, class structuring, sensitivity, and accessibility.

Discussion

When developing a hybrid learning experience using an instructional design model, there are a number of achievements and obstacles experienced as the course evolves. This is especially true when aiming to coordinate the efforts of an interdisciplinary team, use innovative technologies, support a diverse array of course instructors, and appeal to approximately 200 millennial university students each semester. Both successes and challenges are discussed below.

Successes

By and large, the most predominate success of designing online content for SSFT was the use of digital storytelling to convey difficult sustainability concepts. Digital stories leverage the power of vivid images and narrative stories to convey difficult content in an approachable way. Nearly half of pre-service teachers (46%) indicated that the videos were the most engaging aspect of the online portion of the course. Students do not only find digital stories engaging, but we have found that when teaching sustainability topics, digital stories are an effective way to promote student learning gains (Shelton, Warren, & Archambault, 2016). Other researchers concur, suggesting that interactive video in university settings is productive for learning because it makes learning active, scaffolded, and engaged (Delen, Liew, & Willson, 2014; Merkt, Weigand, Heier, & Schwan, 2011; Zhang et al., 2005). Likewise, stories foster a deeper sense of understanding of the material while supporting future transfer and retention of knowledge (Baldwin & Ching, 2017). However, a relatively small number (13%) felt that the videos needed to be improved by enhancing the narration and/or including more specific examples and stories. Others mentioned reducing the workload for the course (28%), which could be achieved by shortening some of the videos. To address these concerns, the design team systematically reviewed and redesigned specific videos mentioned, reanimating the iterative design and development process described earlier, with the goal of producing more engaging online content. Considering that the majority of today's preservice teachers use video and other technologies constantly in their daily lives (Project Tomorrow, 2015), the use of digital storytelling as a primary delivery mode is a powerful medium for facilitating exploration of real-life interdisciplinary topics like sustainability.

Table 3. *"In Your Opinion, What Might be Improved in the Course?" (n = 205)*

Theme	Frequency	%	Definition
Issues with Structure			
Reduce the workload	57	27.8	Student indicated that the assignments and/or videos were too long or intensive.
Give more time / Adjust the schedule	39	19.0	Student suggested allowing more time to complete the online assignments and/or modifying deadlines.
No hybrid	10	4.9	Student suggested making the class either all online or all face-to-face.
Increase student collaboration and/or active learning	9	4.4	Student suggested making the online and/or face-to-face activities more collaborative and/or active.
Issues with Content			
Connect content to future classroom application	27	13.2	Student suggested modifying the content so it applies more to their future classrooms.
General content suggestions	27	13.2	Student suggested general content modifications, including reducing bias, making content more engaging and focused, and providing more connection across the weeks.
Issues with Resources or Tasks			
Improve the videos	27	13.2	Student suggested improvement to the videos, for example, enhancing the narration and including more specific examples and stories.
Improve the quizzes	20	9.8	Student suggested improvement to the quizzes, for example modifying question forma and providing more scaffolded support.
Improve the assignments	17	8.3	Student suggested improving the assignments, for example making assignments less repetitive and more hands on.
Improve the online / face-to-face connection	9	4.4	Student suggested increasing the connections between the online content and face-to-face class for any given week
Other Improvements			
Instructor suggestions	15	7.3	Student indicated areas for improvement with specific course instructors.
No value	9	4.4	Student response indicates that the student does not see value in the course as a whole, reflecting the idea that it should not be required in the major.
Technological Technology difficulties	6	2.9	Student described technological issues like login problems, slow download speed for videos, and issues with the learning management system.
No Suggestion for Improvement	59	28.8	Student did not suggest improvement.

Challenges

The *No value* and *Instructor* themes reflect two major tensions that we faced in the design and implementation of the course. When the course was first deployed, students expected their plans of study to be adjusted to integrate this new course — *Sustainability Science for Teachers* into their required curriculum. There was some inherent push-back as students reported being frustrated that their classroom management class had been cut. Similarly, it was a challenge to integrate professors assigned to teach the course, and acculturate them into the course philosophy, as they were not necessarily equipped or prepared to teach a course of this type. To address this issue, we built an internal wiki for all of our instructors that included a wealth of resources, such as in-class lesson plans, alignment documents showing the connection between course content and national/state standards, and a series of short podcasts discussing the intended flow for each week from both a design and pedagogy perspective. The intent of the wiki is to build a shared space of both content and pedagogical resources that instructors can use to supplement and bolster their skills.

Continuing to balance the sustainability content focus of the course with the teaching pedagogy and relevance for the elementary classroom has proven difficult. This highlights the inherit difficulty that may be posed when innovating a new course created by an interdisciplinary team. Using a reflexive design process is important so that revisions can be made to best meet the needs of students while achieving cutting edge university curriculum goals. Initially designed to focus on sustainability science content, it was clear from student feedback that a greater emphasis needed to be placed on the application to the future classroom. As a result, we modified more than half of the assignments, placed a greater emphasis on modeling ways the concepts covered in the online content could be translated to teaching, and focused on explicitly building and communicating the rationale for a course on sustainability to our preservice teacher audience. Using the updated ADDIE model described by Allen (2006), we carefully built in evaluation measures throughout the process of implementing the course so that we could assess the aspects that were working and those that were not. Evaluation and subsequent iterative changes are critical particularly when developing online or blended course content (Brew, 2004).

Conclusion

Teaching sustainability as a relevant topic that is directly related to K-12 classrooms is an important endeavor — and necessary if we are to prepare future generations to address problems surrounding intergenerational equity and environmental degradation around the world (Nolet, 2009). Through the efforts of an interdisciplinary team, we have been able to analyze, design, develop, implement, and evaluate innovative online content designed to inspire the teachers of tomorrow to ignite the change agents of the next generation. Using a careful design process, we have worked to provide tangible, relevant methods for empowering our students *as citizens* who can make sustainable change in their own lives and world, and also *as teachers* who can implement sustainability content and ways of thinking in their future classrooms.

Using an iterative design process, we found that digital storytelling is a powerful strategy for relaying complex, value-laden sustainability topics, while appealing to millennial learners. By the same token, we learned that digital videos are best received when they are distributed into short segments of 10 minutes or less, contain a coherent narrative arc, and have a captivating story to which students can relate. In addition, while conveying science content continues was major goal of the course, we realized that it was necessary to strike the right balance between content and pedagogy for preservice teachers to see value in the course. Crafting course materials that kept the goals and needs of the intended audience in mind was essential in order to offer something that was truly creative and useful. We learned that our instructors also need support, as many have content-area expertise but may not be familiar with the elementary classroom. Gathering formative and summative evaluations from our students and instructors over this five-year experiment has supported the design team in making appropriate changes that result in a stronger hybrid course. But there is always room for improvement. We must continually weigh the potential benefits of making new course improvements, against potential costs for funding and time allowances, to ensure that *Sustainability Science for Teachers* provides a quality and compelling learning experience for preservice teachers.

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Design and Implementation of a Structured Academic Controversy for Preservice Teachers in a Computer Education Licensure Program

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Abstract: Developing skills to navigate and address potential controversial issues can be beneficial for preservice teachers and their future teaching careers. The implementation of a Structured Academic Controversy (SAC) instructional model is one method to help preservice teachers better understand controversial topics from multiple perspectives. This study found that preservice teachers in a Computer Education Licensure (CEL) program who were exposed to a SAC had positive perceptions about the implementation of this instructional model, and stronger beliefs in their own abilities to address controversial issues in their future schools and classrooms.

Keywords: structured academic controversy, instructional design, preservice teachers, computer education licensure, technology integration

Introduction

Navigating controversial issues and being able to explore those issues from multiple, diverse perspectives is an important skill for educators to foster with their students (Avery, Levy, & Simmons, 2013; King, 2009; Parker & Hess, 2001). Incorporating controversial issues into the classroom can also help engage students more deeply with their curriculum (Hess & Posselt, 2002; King, 2009) as well as give students a safe space to explore ideas that differ from their own (Avery, Levy, & Simmons, 2013). The Structured Academic Controversy (SAC) instructional model is one strategy that can be beneficial in providing students the opportunity to approach controversial issues from multiple perspectives. This collaborative learning strategy was developed by Johnson and Johnson (1979; 1993) in order to help students learn how to address controversial issues in a structured (i.e. scaffolded) nature, and in an academic setting (Avery, Levy, & Simmons, 2013; Johnson & Johnson, 1979; Khourey-Bowers, 2006; Parker & Hess, 2001). Typically, SACs are centered around a single issue, which is to be approached from a "Pro" and "Con" perspective by student groups (Avery, Levy, & Simmons, 2013; Johnson & Johnson, 1979). SACs have been implemented both with preservice teachers and across a wide variety of K-12 subject areas (Avery, Levy, & Simmons; 2013; Johnson & Johnson, 2009; Khourey-Bowers, 2006; Parker & Hess, 2001). Research has demonstrated the potential for SACs to help students develop a more positive attitude towards conflict and towards working with others from diverse backgrounds (Johnson and Johnson, 1979; 1993; 2009). Additionally, in a 2009 meta-analysis of 39 studies involving SAC, Johnson and Johnson found that "SACs compared favorably to debate and individualistic learning in terms of student achievement, cognitive reasoning, perspective taking, motivation, attitudes toward task, interpersonal attraction, sense of social support, and self-esteem" (Avery, Levy, & Simmons, 2013, p. 109).

Prior to beginning an SAC, there are several instructional design decisions that must be made. These consist of: (1) Choosing the topic; (2) Preparing instructional materials; and (3) Structuring the controversy (Johnson & Johnson, 1979). The topic should be one that engages the students, connects to the curriculum, and involves some form of controversy (Johnson & Johnson, 1979; Parker & Hess, 2001). The instructional materials should include a clear description of the task, the different positions, and resource materials to help the students structure their arguments (Johnson & Johnson, 1979). Finally, the structure of the controversy should involve heterogeneous student groups to support "spirited and constructive argumentation and increase [d] appreciation of different views" (Johnson & Johnson, 1979, p. 60).

The implementation of SACs involves multiple steps as well. Once students have been grouped and assigned to a different position or viewpoint by group, they will begin the "Learning positions" stage where they will research their positions and build their argument. Next, student groups will present their arguments and other groups will ask clarifying questions. Following presentations, a class-wide discussion will be held where students will challenge and support the arguments that have been raised. Reversing perspectives is often included in a SAC at this point as well, and students will present the opposite viewpoint from their original presentation. Finally, students will be asked to reach an individual decision on the controversial issue and provide justification and rationale for their decision (Avery, Levy, & Simmons, 2013; Johnson & Johnson, 1979). Overall, the benefits of SACs arise not only from the research, presentation, and discussion over each group's position, but also from the consideration of controversial issues from multiple perspectives.

Method

The purpose of this study was to implement a SAC with preservice teachers in a Computer Education Licensure (CEL) course in order to better prepare preservice teachers to handle controversial issues they may face as future teachers and technology leaders, and to better understand the perceived effects, benefits, and limitations of the implementation of the SAC model. In this study we sought to answer the following two research questions:

1. What are the effects of implementing a SAC on students' perceptions towards controversial technology-related issues?
2. What are the perceived instructional benefits and limitations of implementing a SAC in a preservice teacher education course?

Context and Participants

The Computer Education Licensure (CEL) program is a 21-credit add-on licensure program that prepares preservice teachers to teach K-12 computer science and serve as technology leaders in schools (e.g. integration specialists, technology coaches, etc.) upon graduation. The implementation of the SAC was conducted at a large Midwest university in one of the required courses of the above described CEL program: "K -12 Technology Leadership." The focus of the course was to examine technology leadership and integration from school-wide and district-wide perspectives. Twelve students were enrolled in the semester-long course; two were sophomores, ten were juniors, and all were members of the CEL program.

Instructional Design and Implementation

The choice to implement a SAC in this course was based on feedback the instructor had received from previous student evaluations. Multiple students had requested additional activities that offered real-world connections in order to help them better understand the benefit of course material outside of the classroom. Field experiences were already being used throughout the course; therefore, to address this specific need the instructor decided to implement a SAC, with the addition of an expert panel representing different stakeholder perspectives.

For the implementation of the SAC the instructor followed the steps outlined above with minor modifications which will be discussed below. Prior to beginning the SAC, the students were given the pre-survey instrument to complete [Appendix A]. The instructional design and implementation occurred as follows:

Design:

Choosing a topic: The topic for this SAC was "Should 1:1 iPads be rolled out school-wide in K-4 classrooms?" This topic was selected because a nearby school district was engaged in a public debate over this issue with parents, teachers, administrators, and technology leaders arguing for and against the rollout. The positions members of these groups held in this debate were utilized exactly in the SAC implementation (parents: con, administrators: con, teachers: pro, technology leaders: pro). This topic was a natural fit for the SAC model, offered clear real-world connections to the students, and was in alignment with the course content

Preparing instructional materials: A presentation was prepared outlining the topic, student grouping, and resources for research. The presentation also included an actual news video showing the discussions amongst the local school district and was used as the hook for the SAC. Finally, the presentation included the four different perspectives and their positions, the assigned student groups, a breakdown of the position presentation requirements and format, and suggested resources to explore while conducting research.

Structuring the controversy: Students were assigned into four groups with three students in each group. The groups included a mix of grade levels (elementary/secondary), subject areas, and experience levels in an attempt to create the most heterogeneous groups possible. Students were told that each group would be given 10-12 minutes to present which would be followed by a 15-minute question and answer (Q&A) session where members of the audience and the expert panel would ask clarifying or challenging questions.

Implementation:

Learning positions: Students began this activity by researching their positions and creating a presentation (using Google Slides or PowerPoint) to support either the "Pro" or "Con" side of the argument they had been assigned. One class period (3 hours) was dedicated to this research task, and students were allowed to continue their work outside of class prior to their presentation which took place the following week.

Presentations: Students were given 10-12 minutes to present their positions for their classmates. The order of presentations alternated between "Pro" and "Con" perspectives. Following each presentation, a 15-minute period for questions and answers was held in order for the audience and expert panel to ask clarifying or challenging questions.

Discussion: At the conclusion of all four presentations a 10-minute class-wide discussion was held over the topic in which students asked questions, supported their arguments against challenges that were raised, and continued the discussion of issues that were not addressed during the presentations and Q&A sessions.

Expert Panel Remarks: An expert panel to represent each of the stakeholder positions was invited to the presentation class (3 hours). The expert panel included 4 experts: A parent of elementary school students; a technology leader and early elementary iPad integration expert; a previous school administrator; and a 4th grade teacher. In addition to their contributions during Q&A sessions, each member of the expert panel took five minutes to provide concluding remarks and offer additional questions, insights, and ideas for the students to consider moving forward.

Decision-Making and Reflection: At the end of the presentations and discussions students were given the post-survey instrument [Appendix B] during which they were asked to make their final decision on the issue, provide justification, and answer additional reflection questions about their experiences regarding learning with a SAC.

The decision to include the expert panel (which is not typically mentioned as a SAC step) was made in order to better provide students with feedback from professionals from the field. Though not outlined as a necessity in SACs, the instructor believed the inclusion of this expert panel would be highly beneficial for the students to meet their desire for making real-world connections.

Data Sources

Data were collected via the pre and post student surveys. The pre-survey consisted of five open-ended questions and sought to capture students' perceptions about controversial technology-related issues prior to beginning the activity [Appendix A]. The post-survey consisted of 12 open-ended questions and acted as a culminating reflection. Additional questions were also added to the post-survey; these asked the students to reflect over their experience, perceptions of SACs, and the handling of controversial issues [Appendix B]. Both surveys contained a final question used for anonymously connecting pre- and post-survey responses in order to compare the change in each individual's responses before and after the SAC implementation.

Data Analysis

Content analysis (Patton, 2002) was used to uncover core consistencies and patterns across the data and then to identify emerging themes from those patterns found within student responses. Once the emerging themes in the response data were identified, they were categorized between the two research questions this study sought to answer. In order to improve the reliability of the findings the authors utilized an investigator triangulation (Patton, 2002). All themes were identified and categorized individually before the two researchers came together to reach agreement on any differences. Finally, descriptive statistics were used in order to analyze quantitative information (e.g. how many students said they would use a SAC in their future classrooms, how many students said they found the expert panel to be beneficial, etc.).

Limitations

The primary limitation of this study was the self-reported nature of the survey data which was inherently prone to self-presentation bias (Baker, 1994; Baldwin, 1999; Bielefeldt, 2002). Additionally, 12 students were enrolled in the course that semester, and therefore the potential sample size was limited. Finally, two weeks (6 hours of class time) were available in the course curriculum for the implementation of the SAC. This implementation time over the two-week period limited the amount of preparation time that students were given for their culminating presentation, and did not leave time for the "reversing perspectives" step that is often included in the SAC model.

Results and Discussion

Student Perceptions Towards Controversial Technology Issues

At the conclusion of the SAC implementation, 100% of the students (n=12) stated that the SAC was beneficial in preparing them to think about controversial technology-related issues in new and different ways. For example, one student stated:

> [The SAC was] a very eye-opening experience, seeing the perspectives of so many, and also perspectives of well-respected leaders (our panel). It was nerve wrecking (sp), but it is a reality I need to prepare for in order to be the best tech coach or teacher I can be in the future. It's also good to practice controversy - especially in an area you are pursuing - because it prepares you better for conflict and helps you improve.

This sentiment was echoed by the other students who agreed that the SAC was beneficial in helping them think about and approach controversial issues differently in the future. Additionally, students' ideas of what constituted a controversial issue differed from pre to post-survey. Following the SAC, 83% (n=10) students discussed additional controversial technology issues that they did not mention prior to the SAC activity, and that they believed they might potentially encounter in their future careers (e.g., student privacy and data security (n=4), technology costs and budgeting (n=4), and screen time (n=2)).

Therefore, in answer to the study's first research question, these results would suggest that the implementation of the SAC was beneficial in increasing students' understanding of what constitutes a controversial technology issue, as well as in helping students think about how they might approach such issues in future professional settings.

Benefits and Challenges of the SAC Implementation

Upon completion of the SAC, 100% of students (n=12) said they would use SACs, or a similar approach, in their future classrooms. Additionally, three main themes emerged from analyzing student survey responses with regard to the benefits of the SAC: (1)

Benefits of the expert panel; (2) Benefits of examining the issue from multiple perspectives; (3) Benefits of real -world connections. Three themes related to challenges also emerged from analyzing student data: (1) Lack of scaffolding and structure; (2) Lack of diversity of opinion; and (3) Lack of time.

Benefits of the Expert Panel. The inclusion of the expert panel was perceived as beneficial by 100% of the students (n=12). This benefit was described by students as being "helpful," "practical," "awesome," etc. One student emphasized this by stating, "I really enjoyed the panel because they gave great feedback and questions that made me really think about the issues behind technology in the classroom." Another student commented, "I loved it! [The panel] provided us with great insight from their real-world experiences!" These results would suggest that, although expert panels are not necessarily considered to be a necessity for SAC implementation, this addition might be beneficial for those instructors looking to help preservice teachers make additional real-world connections. The authors noted that the expert panel also helped to facilitate what Parker and Hess (2001) describe as "scaffold[ing] students into impressively demanding discussion which otherwise may be beyond their reach" (p. 277). This was particularly evident during the Q&A sessions where students consistently exemplified advanced understandings of the topics at hand. Thus, the authors suggest while implementing a SAC that bringing in experts to represent various perspectives improves students' buy-in and reinforces their learning experiences during the culminating activity. If physically bringing experts into the classroom is not possible due to time, travel, cost, etc., then bringing experts in through online means (i.e. Skype, Google Hangouts, etc.) might make for easier implementation and provide similar outcomes.

Benefits of Examining the Issue from Multiple Perspectives. When asked, "How did being exposed to multiple perspectives affect your understanding of controversial issues in a school setting?" all students (n=12) responded positively. Student responses indicated that examining a controversial issue from multiple perspectives helped them think of perspectives and ideas they had not thought of before, build empathy, and rethink ideas and misconceptions they previously held. One example comes from a student who reported:

> Being exposed to both sides helped to open my eyes to other people's opinions on why they may not want [iPads] in the classroom for their children. Being able to hear why they thought it was not a good idea has helped to prepare me for how to answer any questions and concerns they may have.

In regards to rethinking previous ideas and misconceptions, one student wrote, "There were a lot of different perspectives, like administrators, that I did not think of before." These results would suggest that implementing a SAC might help students consider opinions outside of their own as well as to potentially revise previous understandings or positions on controversial issues. The authors believe that if time allowed, the incorporation of the "Reversing perspectives" stage of the SAC would have been additionally beneficial in helping students relate to perspectives outside of their own.

Benefits of Real-World Connections. Finally, many students (n=9) mentioned that this activity helped them make real-world connections through the incorporation of the expert panel, and through the subject matter and activity design. For example, one student stated:

> I found it extremely valuable to get feedback from our panel of experts. I always love to hear advice and input from people who have been a part of the education system and know what it is like. I also liked that we got to hear multiple perspectives on the issue because that is the best way to form an informed opinion on an issue.

Another student echoed this idea:

> I think that some strengths were the eye-opening perspectives it gave, the dynamic of politely presenting these dynamics and being okay with disagreement, and preparing ourselves for what may come in the future as we enter a field that people might not always be on board with.

These findings would suggest that the incorporation of an expert panel, as well as the careful selection of a topic that connects to both the curriculum and to real-world situations, can be beneficial in helping students better understand how what they are learning can be potentially applied once they enter the field.

Challenges Due to Lack of Scaffolding and Structure. Several students (n=5) mentioned that they would have benefited from increased scaffolding and structure, as well as from more clear expectations as to what was to be included in their presentation and how to handle controversy that arose during the Q&A sessions. For example, one student stated, "I would have liked there to be guidance on how to handle challenges just because it seemed like there were challenges and disagreements more than recognizing any of the positive points the groups had made." Another student mentioned how they struggled with the controversial nature inherit within the SAC:

> I felt people didn't want to try and fight for a different side. They struggled a lot with putting their mindset somewhere else and fighting for a different view. Also, students didn't realize that just because someone was fighting for a side didn't mean that they were believing in it.

These findings would suggest that in addition to a more clearly defined structure, students may benefit from a pre-SAC briefing on how to discuss controversial issues in a positive manner, and a reminder that the opinions expressed during the presentation are not those of the individual, but rather those of the perspective they are representing.

Challenges Due to Lack of Diversity of Opinion. Multiple students (n=5) also expressed difficulty arguing against a perspective that the rest of the class and half the expert panel supported. In other words, as the students were in the CEL program, the majority held a positive belief towards the implementation of iPads in the classroom. All but one student (n=11) favored the rollout of iPads in K-4 classrooms when asked about their individual perspective in the pre-survey. Therefore, these students found it difficult to not only take on

a perspective outside of their own, but also to argue that perspective for an audience who was largely invested in technology integration. One student explained, "Most of the people on our panel supported 1:1 iPads. I wish there were more people we could have seen support against the 1:1 iPads." Another student followed up by stating, "Arguing against a topic everyone in the room was for was extremely difficult and uncomfortable at some points." Despite these claims, as mentioned above, all students (n=12) found benefit in examining this issue from multiple perspectives. Therefore, these results would suggest that if possible, finding a topic that not only has real-world connections, but also has more of an even breakdown of opinion between the "Pro" and "Con" side may be beneficial. Additionally, while diverse student opinions might have existed, even with half of the panel presenting the cons of the 1:1 iPad rollout, students may have felt uncomfortable expressing those opinions if they perceived themselves to be in the minority, as Hess (2009) argues can occur.

Challenges Due to Lack of Time. Two students mentioned that they would have preferred additional time while preparing their presentations. Students were given three hours of course time, in addition to one week outside of class to prepare for the presentation, and 3 hours for class presentations and the expert panel; however, additional time would have been helpful in order or all students to feel comfortable and prepared. SAC preparation and implementation takes a relatively longer time to implement compared to other instructional methods, and a longer time for students to prepare themselves to defend their positions. As students were able to present and defend their positions successfully in the presentation week, the feeling of not having enough time may be due to the novelty of the SAC model implementation or to having an expert panel physically in the classroom. More frequent implementations of SACs may help students gain efficiency in the research and preparation process and may help with their confidence in presenting to peers and an expert panel.

Conclusion

This study would suggest that the SAC instructional model is a beneficial approach specifically for preservice teachers studying educational technology, as well as more generally in any classroom in which teachers aim to provide a space for students to learn more about addressing controversy in a positive way. This study also supports Parker and Hess's (2001) argument that SACs "encourage [preservice teachers] to uncover and feature the controversies that suffuse the subject matter they are planning to teach" (p. 276) as shown through the preservice teachers' willingness and excitement to incorporate SACs in their future classrooms. Additionally, and whenever possible, the incorporation of an expert panel to assist in providing feedback and real-world connections appears to be beneficial. In summary, fostering students' abilities to navigate controversies and examine issues from multiple perspectives are beneficial skills, which can be addressed by the implementation of SACs in the classroom. By implementing a SAC in a college classroom, instructors can help preservice teachers consider multiple perspectives to controversial issues in their future workplaces, and also provide preservice teachers with first-hand exposure to SACs as an instructional approach that they might potentially incorporate in their future classrooms.

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Appendix A – Pre-survey questions

1. Do you think there are controversial technology-related decisions that might need to be made in your future school or classroom? If so, please provide some examples. What makes these examples controversial?
2. Do you feel prepared to make decisions about controversial technology-related issues in your future school or classroom? Why or why not?
3. Do you feel prepared to look at controversial technology-related issues from different perspectives, outside of your own? Why or why not?
4. What consequences do you think might arise from having to make controversial technology-related decisions in your future school or classroom?
5. What is your opinion on 1:1 iPad use in K-4 elementary classrooms? In other words, should K-4 students be given 1:1 iPad tablets to use in their classrooms? Please provide justification and reasons for your opinion.
6. Please enter the last 3 digits of your phone number (To keep track of answers between pre- and post-survey)

Appendix B – Post-survey questions

1. After completing this activity, do you think there are any additional controversial technology-related decisions that might need to be made in your future school or classroom? If so, please provide some examples. What makes these examples controversial?
2. Do you feel prepared to make decisions about controversial technology-related issues in your future school or classroom as a result of this activity? Pease explain.
3. How did being exposed to multiple perspectives affect your understanding of controversy in school settings?
4. What consequences do you think might arise from having to make controversial technology-related decisions in your future school or classroom?
5. After completing this activity, what is your opinion on 1:1 iPad use in K-4 elementary classrooms? In other words, should K-4 students be given 1:1 iPad tablets to use in their classrooms? Please provide justification and reasons for your opinion.
6. What do you think were the strengths of our Structured Academic Controversy Activity?
7. What do you think were the weaknesses of our Structured Academic Controversy Activity?
8. Are there any differences in how you will approach technology-related controversies in your future school or classroom as a result of this activity?
9. Do you think our Structured Academic Controversy activity was helpful in preparing you to think about controversial technology-related decisions in new and different ways? Why or why not?
10. What were your thoughts on having a panel of experts asking questions and proving feedback?
11. Would you consider using a Structure Academic Controversy activity in your future school or classroom? Why or why not?

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Graduate Teaching Assistant Pedagogical Training: A Case Study

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Abstract: A graduate teaching assistant professional development program was designed and implemented as part of an effort to provide pedagogical training to those instructors who generally receive little to no training and who historically teach large, gateway courses. A formative evaluation was conducted to determine the effectiveness of the program. Participant attrition during the second semester impacted the data collection, but attitudinal data was used to make formative revisions for subsequent program offerings.

Keywords: graduate, higher education, teaching, learning.

Over the past decade, student enrollment rates in higher education institutions (HEIs) have seen a sharp increase with no indication of regressing. A recent study conducted by the National Center for Education Statistics (NCES) indicated that in Fall 2015, 20.2 million students were expected to attend colleges and universities within the United States. This statistic is, upon first glance, quite appealing in that more and more individuals are deciding to further their education and professional endeavors. However, it must be noted that U.S. university student enrollment rates will have increased by 4.9 million from the year 2000 to the projected enrollment rate of 2015 (National Center for Education Statistics, 2013). With such a large increase in student enrollment rates combined with expected future projections, the need for a more acceptable teacher to student ratio merits attention. As of 2011, the NCES (2013) indicated that after calculating the number of faculty at public, private, and private for-profit degree-granting institutions, a total number of 1,524,000 employed faculty were identified. This elicits an alarming need for a higher prevalence of employed faculty in U.S. universities and degree-granting institutions. Thus, the history of utilizing graduate teaching assistants (GTA) remains a common method for reducing the ever-increasing workload of university faculty employees, particularly when resource constraints (funding, facilities, and staffing) are present (Park, 2004). However, the sole use of GTAs is not to reduce faculty workloads, but also to foster teaching and research skills necessary for professional development.

The larger and more research-led North American universities have a long history of using GTAs to teach undergraduate courses, assist in research projects, lead laboratory sections, and other scholarly duties (Park, 2004). A vast majority of graduate students presumably seek assistantships to aid in financial support and often secondarily do so to acquire valuable teaching experience skills; others may simply be testing the novel waters of duties related to university faculty positions. Lowman and Mathie (1993) highlighted an important relationship between teaching and graduate school by noting, "Experience in teaching undergraduate students as a teaching assistant to a professor or as a novice instructor with full responsibility is almost a universal part of contemporary higher education in psychology" (p.1). Many prospective or current graduate students anticipate such a task, whereby teaching an undergraduate course(s) fosters their overall academic experience by challenging their interpersonal and time management skills, and particular competencies (Lowman & Mathie, 1993).

Teaching a course can potentially be a very nerve-racking task, particularly for a first-year graduate student with no formal training in teaching methods. Some individuals find teaching to be relatively easy, while presumably most will find that effective teaching practices are not simply intrinsic, but rather are learned over time from a variety of different resources and experiences. In fact, many U.S. universities have developed and implemented GTA training programs based on the premise that teaching can be learned, practiced, and improved (Park, 2004).

The quality of such GTA training programs is of paramount importance in that a number of challenging ethical and social issues could arise that must be handled with extreme care, so as not to inadvertently cause harm to someone. For example, learning basic cultural competency and communication skills will help foster healthier student-teacher communication while also decreasing accidental instances of micro-aggressions. The following section will provide readers with a brief review of two existing teaching assistant programs.

Existing Graduate Teaching Assistant Training Programs

Muhlestein and DeFacio, in their (1974) study, sought to assess the direct effects of a course designed to prepare physic graduate students for their subsequent teaching experiences. The University of Missouri-Columbia requires all first-year physics graduate teaching assistants (GTA) to take a two to three-hour course entitled "Study of Techniques of Teaching College Physics". Muhlestein and Defacio (1974) laid out an extensive curriculum to cover a number of primary goals which included: (1) improve the quality of the undergraduate physics laboratories and (2) improve the teaching quality of GTAs. Further, the required course consisted of three major concepts: (1) formal learning theory and teaching techniques; (2) special student projects; and (3) on-the-job training and evaluation. Throughout the course, four informal lecture discussions were held to emphasize the importance of critical and effective thinking during the actual act of teaching. The topics of discussions included important issues regarding departmental procedures and constraints placed on courses, formal learning theory, important teaching techniques, and methods for evaluating and grading undergraduate assignments. During the second and third week of the course, all individual graduate students were required to meet privately with the professor, to discuss student short and long-term goals and what experience they expect to gain from the training course. Based off the private discussion, the professor and graduate student jointly decided on a potential project that was to be completed by the student and presented via written and oral reports during three informal meetings held at the end of the course. Results of the study indicated a number of positive outcomes stemming from the class which included: (a) a dramatic increase in the quality of physic laboratories; (b) GTAs were much more aware of their influence on students; and (c) the graduate students became involved in teaching as active participants.

Sharpe (2000) conceptualized a useful framework that helps prepare and support new teaching assistants at the University of Plymouth in the UK. Sharpe's framework is based on the underpinning theory of how professionals learn and develop professional skills as well as accounting for the variety of experiences and responsibilities participants endorse. Three steps were highlighted within the framework that were ultimately designed to foster individual development: (1) discipline-specific briefing and training events; (2) further development of an original one-semester short course; and (3) building a portfolio for Staff and Educational Development Association (SEDA) Associated Accredited Teacher status. In the first step, participants took part in a number of informal workshops where concerns related to teaching were expressed. Subsequent workshops were designed to target the specific concerns by collectively tackling issues regarding: roles and responsibilities of demonstrators; characteristics of ideal demonstrators; preparing for courses; supporting students; and providing an overview of health and safety policies. The second step consisted of a comprehensive, one semester course designed for GTAs. The course was designed to take participants through a learning cycle based on their own teaching styles, while also providing participants with methods for tackling new situations in the future. The final step in Sharpe's framework offers GTAs the opportunity to develop the reflective skills required to develop a teaching portfolio. Additionally, Sharpe noted that GTAs should, at this stage, be able to notice patterns in their teaching style as well as to be cognizant of any changes they have experienced regarding the development of their personal teaching style.

A number of effective GTA training programs already exist within the realm of higher education, however, research on training programs based on the Teacher Concern Model had only recently been conducted. The present study aims to assess the effectiveness of a year-long, innovative professional development GTA program developed based on the Teacher Concern Model, and designed to provide pedagogical training to GTAs who typically receive little to no formal training in effective teaching methods.

Teacher Concern Model

Staton-Spicer and Bassett (1979) further developed Fuller's (1969) Concerns-based Adoption Model into three stages that new teachers progress through as they enter either pre or in- service. Cho, Kim, Svinicki, and Decker (2011) summed up those stages as:

- concern about self - concern about adequacy and survival as a teacher;
- concern about task - concern about instructional duties;
- concern about impact - concern about pupil learning (p. 268).

This developmental model is widely used in PK-12 education and for teacher education but has only begun to be used as a framework for supporting Graduate Teaching Assistants in higher education. It is regarded as a useful lens through which to view educational change, whether that is through traditional education or professional development and training (Saunders, 2012).

Nyquist and Wulf (1996) extended the three stages of concern to those of GTAs as they move through their teaching duties, adding clarification to Staton-Spicer and Bassett's (1979) model:

- "Concerns about the self and survival, (e.g. What shall I wear?). Will the students like me? Will I fit the role of teacher? GTAs here want to feel needed by their students. Not feeling very different from being a student themselves, they struggle with the type of personal relationships they should have with their students.

- Concerns about their level of teaching skills, e.g. How do I discuss or lecture? Will I be able to mark papers? Will I be able to maintain discipline? Here, GTAs begin to view their students in a more detached way.
- Concerns about whether the students are 'getting it', e.g. How are students learning? How do I know what they are learning? They start to develop professional tutor/ learner relationships with their students without taking their behavior too personally" (Sharpe, 2000, p. 134).

According to Nyquist and Wulf (1996), GTAs also experience five different types of concerns that are all inter-related: control over the class, external evaluation, tasks, impact, and time/communication. All five of these concerns were positively correlated with the perceived value of the concerns themselves. Class control, external evaluation, task concern, and time/ communication concerns were all negatively correlated with the perceived confidence of the GTAs (Cho, Kim, Svinicki, & Decker, 2011).

Program Design

In coordination with the Director for the Center for Excellence in Teaching and Learning and the Dean of Graduate Studies, an instructional designer planned and implemented a year-long professional development program for Graduate Teaching Assistants. The program was designed for monthly face-to-face meetings over the course of two semesters. Participants who completed the program were issued certificates from the Center for Excellence in Teaching and Learning.

The course was planned as a blended course, with prerecorded lectures and readings loaded into the learning management system. Participants were expected to come to each session prepared to complete active learning activities. Group and individual activities were designed to allow participants to both explore the content and practice teaching methods at the same time. Role-play, think-pair-share, one-minute essay, audience response polling, muddiest point, and other classroom assessment techniques were used to provide formative feedback to students and to create an open environment of learning and dialogue.

Individual assessments and a capstone project were designed to assist participants in both creating artifacts for their own courses and also to encourage participants to begin thinking about professional development and scholarly activity as a whole. Participants began by creating their own syllabus and move into creating a prerecorded lecture and posting it online. The final project required students to submit a teaching philosophy, submit a professional development plan, and to resubmit their original syllabus revisions based on what they learned over the course of the program.

The goal of this certificate program is to empower GTAs to develop, create, and execute innovative and engaging lessons in their courses that map to good principles of teaching. The following course-level objectives were identified as aligned with the program goal:

- Learners will identify their own immediate teaching needs and select appropriate resources to address those needs.
- Learners will apply instructional design theories and techniques to their own teaching experiences.
- Learners will examine teaching techniques that engage learners in their classroom.
- Learners will compare techniques to create a 21st century learning environment.
- Learners will discuss opportunities to participate in the Scholarship of Teaching and Learning.
- Learners will apply the principles and techniques to their own course syllabus.

From these objectives, five main areas of concern were identified as content module topics for the program. These areas were scaffolded according to the Teacher Concern Model, moving from areas of immediate need on to areas of long-term need.

- Immediate Teaching Needs (concern about self)
- Designing Instruction (concern about task)
- Engaging the Learners (concern about task)
- Creating a 21st Century Learning Environment (concern about impact)
- Scholarship of Teaching and Learning (concern about impact)

Following a backwards-design model (Wiggins & McTighe, 2005), learning outcomes were identified and assessments and activities were constructed to align with those outcomes (Appendix, Table 1).

The program was advertised through email, brochures, and word-of-mouth. Graduate program coordinators were contacted at the end of the Spring 14 semester and again just prior to the Fall 14 semester. The Graduate Studies office sent out a notice to all graduate students prior to the beginning of the Fall semester. Twenty-two graduate teaching assistants committed to enrolling in the program.

Method

Participants

At a medium-sized public comprehensive university in the Mid-West, there are approximately 250 graduate assistants who either teach or conduct research. During the 2014-2015 academic year, 22 Master's-level graduate teaching assistants participated in the certificate program. The participants were evenly split between male and female between the ages of 23-30. 12 (54%) of the participants were in their first year of their graduate program, with the remaining 10 (46%) completing the second year of their graduate program. Three of the six academic colleges at this institution were represented by the participants:

- College of Arts and Humanities (14%)
- College of Allied Health and Nursing (18%)
- College of Social and Behavioral Science (68%)

Participants were either teaching a course or planning to teach a course within one semester. All participants were planning on either pursuing a Ph.D. or teaching positions in higher education at the time of graduation.

Procedure

A mixed methods research study was planned as part of the formative evaluation process for this program. Quantitative data were collected using a pre and posttest design and qualitative data were collected from participants to expand upon and explain the quantitative data. Institutional Research Board permission was sought and granted to complete this study.

Participants were asked to sign consent forms at the beginning of the course if they agreed to participate in the study. Those who agreed were randomly assigned participant numbers to preserve anonymity. They were issued a pretest which was scored and recorded only by the participant number. The researchers were not aware of the identity associated with each participant number.

At the end of the program, a posttest was administered, and participants identified themselves only with the same participant number as was used with the pretest. Changes in scores between the pretests and posttests were analyzed to determine if the program had impacted participant knowledge on any of the five critical topics identified during the analysis phase.

Examples of questions from the pretest and posttest include (correct answers are marked in bold):

What purpose does a syllabus serve?

a. It is a contract between you and your students
b. It is a chance to sell your students on the class
c. It is a type of resume for the instructor
d. All of the above
e. A and B
f. B and C

Accessibility means:
a. Being in your office during office hours
b. Captioning your videos
c. Making special accommodations for students who require them
d. Designing your course for every learner
e. All of the above
f. B, C, and D

Attitudinal surveys were designed for both participants and their departmental mentor faculty. Example questions from the participant survey include:

- *What was the most helpful or constructive aspect of this course?*
- *What could have been most improved about this session?*

Faculty were asked questions about their observations regarding the skills and behaviors of their graduate teaching assistants who participated in this program. Example questions from the faculty attitudinal survey include:

- *What was the most helpful or constructive aspect of this course based on what you have observed in your graduate assistants this academic year?*
- *What could have been most improved about this session based on what you have observed in your graduate assistants this academic year?*

No mentor faculty responded to the request for survey completion, therefore, no data on that instrument are included in this report. In addition, due to scheduling and other unforeseen conflicts, only three participants who completed the pretest were able to complete the post-test. While the analysis data are included, the results cannot be used to empirically support formative changes in program design. Additional implications of this attrition will be addressed in the discussion section.

Results

A formative evaluation was conducted to assess the effectiveness of the GTA program through the use of descriptive pre and posttest assessments. Due to attrition rates, a subsample of nine participants from the original sample (N = 22) completed the pretest before the GTA intervention was implemented. Further, only three participants of the pretest subsample (n = 9) successfully completed both pre and posttests and were used in the data analysis for Tables 2 and 3.

Table 2 (see Appendix) provides participants' (n = 3) mean and standard deviations for pre and posttest assessment. As seen in the evaluation of the GTA professional development program, there is not sufficient evidence to determine the effect on participant learning and instruction. Data were further analyzed to identify if there was an improvement in participant pretest scores based on the five test domains.

Table 3 (see Appendix) provides participants' (n = 3) pre and posttest mean scores and standard deviations for each of the five test domains. As indicated, participants displayed the largest improvement in the domains SoTL and Engaging as well as a decrease in mean scores in the domain Creating.

Table 4 (see Appendix) includes the study's pretest subsample of participants (n = 9) in order to identify what types of knowledge participants seem to be lacking upon entering the GTA professional development program; analyses were based on the five test domains. As seen in Table 4, within the domain Immediate, 7 (78%) participants in the pretest subsample incorrectly answered the question "What purpose does a syllabus serve?". Additionally, within the domain Scholarship of Teaching and Learning (SoTL), 6 (67%) participants of the subsample incorrectly answered the question "What does SoTL stand for?". These results suggest that participants interested in enrolling in a GTA training program, similar to the one used in this study, may benefit from initially familiarizing themselves with information regarding the use of a syllabus and what SoTL stands for, before the program's initiation; generalizing these results to a diverse population is difficult given the small sample size and lack of diversity.

Half of the original sample of participants (n = 11) completed the attitudinal survey at the end of the program. The results of the survey indicated that the majority of respondents (73%) found the resources helpful. Moreover, 45% of respondents indicated that the most useful part of the program was the exposure to technology tools. The majority of the respondents (73%) indicated that they were able to attend all of the in-person workshop sessions. However, only 55% indicated that they completed all of the required readings and activities after the sessions. All participants indicated that they expected to receive a certificate of completion for the workshop.

The qualitative results from the attitudinal survey indicated three major areas of the program that the participants found useful. The availability of resources both in the learning management system and on campus was cited as the primary useful aspect of the program by 64% of the participants. Other useful aspects of the program included technology tool training (18%) and exposure to the idea of the Scholarship of Teaching and Learning (9%). Suggestions for improvement of the program included a reduced workload or higher meeting frequency. Multiple participants (73%) indicated that they felt that additional meetings would be beneficial to explore topics in more detail in a guided way rather than having a heavier workload of "homework" for each session. Technology tool training (27%) and department-specific professional development (27%) were cited as two areas for additional professional development for graduate students. In addition, participants indicated that they would like specific training on various teaching techniques and methods such as role-play and flipped instruction (18%).

Discussion

The two-semester model with in-person meeting sessions seemed to contribute to the participant attrition as schedule conflicts and capstone project requirements conflicted with attendance and program workload. From the small number of participants who completed both pre and posttest assessments, no conclusions are able to be drawn about the effectiveness of the program on learning and instruction. Without the ability to triangulate the data with supporting evidence from mentor or supervising teachers, the researchers were also unable to verify any direct impact the program had on teaching and learning in the courses facilitated by the GTAs.

The data from the pre and posttests combined with the attrition rate for the second semester may indicate that once the concerns about Self and Task are met, the concerns about Impact, while considered interesting, are less of a motivator for program completion. The Teacher Concern model is useful in implementing GTA training, particularly as incoming or first-time GTAs are truly concerned with their immediate needs as a new instructor. However, to truly impress upon participants the need for both scholarship and professional development in the pedagogy of their respective fields of study, cooperation from the departments must support those notions. Maintaining motivation for what GTAs do not see as "immediate needs" is a challenge if no department support or resources reinforce the importance of scholarship and development in pedagogical arenas.

The attitudinal data would seem to indicate that this pilot program provided GTAs with much needed resources and support during their initial weeks as new instructors. Additionally, the attitudinal data provided a series of suggestions that could be used to reformat subsequent iterations of the program for future GTAs.

Based on the data acquired, a second program was rolled out in Fall of 2015. Revisions to the original program included a more self-paced model and required in-class observations towards the end of the program to determine the extent to which program content was actually being implemented in the classroom. Readings and resources were condensed to address the concerns over the amount of material presented. Additional resources were added for the areas in which the pretest data indicated a higher need for practice. More specific activities were designed to give students the opportunity to explore both the purpose and importance of the syllabus. Arrangements were made to provide graduate students opportunities to participate in other professional development programs offered by the Center for Excellence in Teaching and Learning, specifically in the area of the Scholarship of Teaching and Learning.

A third iteration was also developed, specifically for the College of Social and Behavioral Science GTAs. This college-specific program condensed the content into one semester, meeting every week. Guest speakers were scheduled to cover the content areas and no course observation or capstone project was required from participants.

Future research opportunities in this area include additional empirical studies to determine the impact of the program on classroom practices of the GTAs. Additionally, a study that could quantify the impact of the program on the learning of the students in the GTAs' classrooms would have the most significance in determining the program's worth to the university as a whole.

Limitations to this study included the attrition rate during the second semester, particularly in regard to the pre-post test data. The present study's small sample size made statistical analyses difficult to conduct, hence the use of descriptive statistics. It is nearly impossible to control for attrition rates; however, the authors of the present study highly recommend a large sample size so as to ascertain whether the intervention elicited statistically significant results, and more importantly, provides researchers with an opportunity to run a greater number of statistical analyses that would allot greater insight into the variances between subjects. Also, the lack of feedback from the GTA mentor faculty severely limits the conclusions that can be drawn from the study.

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Table 1. *Program Outcomes, Assessments and Activities*

Topic/Theme	Essential learner outcomes	Assessments	In Class Activities
Session 1: Immediate Teaching Needs	The learners will: 1. *identify* the essential elements of a syllabus 2. *identify* the components of their D2L course shell 3. *describe* various classroom management techniques 4. *locate* immediate university teaching resources 5. *locate* accessibility resources 6. *identify* the processes for submitting grades and issuing a grade change or an incomplete 7. *identify* the proper contacts for escalation of student issues 8. *review* graduate student policies 9. *recognize* data privacy and safety requirements and administrative resources available 10. to them	Discussion: 1. List the parts of a syllabus 2. Questions about the LMS 3. LMS Future Plans 4. Addressing Accessibility 5. Discovering plagiarism 6. Who to contact list	• Q&A • Classroom Management Role Play • FERPA case studies and audience response • Pretest
Session 2: Designing Instruction	The learners will: 1. *compare* major learning theories 2. *write* measurable learning outcomes based on Bloom's Taxonomy 3. *select* classroom activities that support their course's learning outcomes 4. *create* classroom assessments that align to the learning outcomes 5. *design* rubrics to support their assessments 6. *review* the quality matters template and rubric	Discussion: 1. Revise or create learning objectives 2. Creating aligned assessments 3. Creating rubrics	• Q&A • Think pair share learning objective & assessment creation activities • Muddiest Point exercise
Session 3: Engaging the Learners	The learners will: 1. *practice* Socratic methods of engaging learners 2. *apply* active learning techniques to classroom activities 3. *construct* student-centered activities for their own course 4. *describe* the culture of their classrooms and identify best practices for culturally responsive pedagogy 5. *use* SMARTboards 6.	Discussion: 1. Writing Socratic Questions 2. Create a SMARTboard activity	• Fish bowl Q & A • Peer teaching activity - SMART boards • One-minute paper - what's the most important thing you learned today
Session 4: Creating a 21st Century Learning Environment	The learners will: 1. *describe* various instructional techniques 2. *explain* the importance of developing critical thinking skills 3. *identify* technology tools that they can use in their classrooms 4. *discuss* the availability of open and/or electronic resources in their discipline 5. *explore* the options for lecture capture	Discussion: 1. Create a PBL problem for your course 2. Create an audience response poll Assignment: 1. Create a flipped classroom video	• Technology scavenger hunt • Overview of Web 2.0 Tools • Think Tank group brainstorming session • How can you flip your classroom? • Tech tools you can use • Implementing PBL • Power of reflection • What can you take from this workshop? • OERs
Session 5: Scholarship of Teaching and Learning	The learners will: 1. *Identify* multiple Professional Learning Networks and Communities in the area of pedagogy and technology tools 2. *Select* multiple professional organizations and explain their relationship to teaching and learning 3. *compare* various resources for teaching and learning 4. *create* a teaching portfolio 5. *identify* opportunities for continuing professional development 6. *explain* the benefits of mentorship and identify potential mentors within their department	Discussion: 1. Identify 3-5 professional learning networks or communities Assignment: 1. Create a graphic organizer of the available professional organizations in your discipline 2. Create a teaching portfolio 3. Create a teaching philosophy 4. Create a professional development plan	• Professional Network Concept Mapping • What will your classroom look like in 10-20 years? • Post-test

Table continued on page 42.

Table 1 (continued from page 41). *Program Outcomes, Assessments and Activities*

Session 6: Capstone Projects Presentations	The learners will: 1. Analyze a syllabus and identify areas for improvement based on workshop guidelines	Assignment: 1. Revise original syllabus using concepts and theories from this program	• Go over changes to syllabi • What have you changed/ implemented from the program? • Certificates

Table 2. *Pre and Posttest Mean Scores for GTA Professional Development Program*

	Pretest		Posttest	
N	*M*	*SD*	*M*	*SD*
3	.80	.05	.80	.09

Note: Only the scores from the subsample of participants who completed both pre and posttests were included in the analysis.

Table 3. *Pre and Posttest Scores for All Five Domains in Terms of Percentages*

			Pretest		Posttest	
Domain	*n*	Total Items	*M*	*SD*	*M*	*SD*
Immediate	3	9	.74	.06	.78	.11
Designing	3	4	.83	.14	.83	.14
Engaging	3	1	.67	.58	1.0	0.0
Creating	3	3	1.0	0.0	.78	.39
SoTL	3	3	.66	0.0	1.0	0.0

Note: Only the scores from the subsample of participants (n= 3) who completed both pre and posttests were included in the analysis. Total items= number of questions within each domain.

Table 4. *Most Commonly Missed Questions During Pretest for Each Domain*

Domain	Question	*N*	*IC*	%
Immediate	What purpose does a syllabus serve?	9	7	78
Designing	Which of the following are learning theories?	9	3	33
Engaging	Which of these are instructional techniques?	9	3	33
Creating	Technology tools that you have available to you at MNSU include:	9	2	22
SoTL	SoTL stands for?	9	6	67

Note: *N*= number of participants who took the pretest. *IC*= number of participants who got the question incorrect. % = percentage of participants who got the question incorrect.

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Unicorn Acts and Thinking Hats: Preservice Teachers' Situated Learning Through Imaginative Contexts

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Abstract: In this article we describe how imagination was explored as a method of reconceptualising teacher education at a private university through a decentralized collaborative approach for preparation, creative imaging and creative transforming involving four university courses and four local private preschools. Preservice teachers involved in the *Journey on a Unicorn's Back* project travelled having imagination as their compass, engaged in aesthetic experiences anchoring flexible thinking and planned activities for preschool children for an event at the university library. Reflections on the project suggest that imagination can be a successful strategy for developing situated creative problem solving contexts. A general multimodal and flexible scheme to symbolize creative problem solving for instructional design is important for enabling learners to perceive and pay heed to qualities ordinarily obscured by the conventional and routine.

Keywords: arts-based learning, creative problem solving, imagination, situated learning, learning context, case study

Annibale Carracci's (1560-1609) early 17th century fresco in Palazzo Farnese, Rome, shows the gentle and pensive maiden as only she has the power to tame a unicorn. It takes, indeed, considerable pensiveness in order to invite unicorns – with all the thinking qualities that they may represent – in educational processes. In this article, we describe the design and application of an educational process we called Journey on a Unicorn's Back, at the Department of Education of the University of Nicosia, Cyprus. Through this process we explored imagination as a method of reconceptualising teacher preparation at the university through a decentralized collaborative approach involving fifty six undergraduate preservice teachers enrolled in four university courses, and four local private preschools. More specifically, the goal of that attempt was to develop opportunities for preservice teachers to engage in related studies and experiences that would enable them to plan meaningful creative problem solving activities for children in an imaginative context. Creative problem solving was facilitated through de Bono's technique of the Six Thinking Hats (de Bono 1999), a technique that encourages flexible thinking. A collaboration among three university instructors teaching Art History, Cognitive Psychology, as well as Activities of Pre-Primary Education and School Experience, led to curriculum modification to provide a situated learning context in a journey throughout the content of each course. During the period of one semester, preservice teachers travelled having imagination as their compass, engaged in aesthetic experiences anchoring flexible thinking and planned problem-solving activities for preschool children for an event at the university library.

Imagination is not only the ability to form mental images; it is also the power to mould experiences into something new, to create fictive situations, to grasp and reach out allowing what is perceived to be transformed. It is what allows a half-blind artist to create landscape masterpieces in a floating studio, a deaf composer to write music, it is the transaction between inner and outer vision which enables the individual to move beyond becoming aware and pay heed, provoke, extend, think about alternatives. Imagination alerts the teacher to the severity of current situations, encourages consideration of other possibilities, makes the deficiencies of current situations visible and inspires working towards repairing them. The passivity, carelessness, feelings of malaise, hopelessness, powerlessness an educator might observe in schools today, can be altered through the cognitive, perceptual, affective, imaginative undertakings, which release individuals to use their imagination and provide a sense of alternatives to those who can see and hear, and enhance the consciousness of possibility for those who had learned how to attend and developed a sense that things can be otherwise than they are (Greene,1995; Greene, 2001).

The changes in contemporary society require constant reflection on not only the content but also the context of educational processes. Reflecting upon our practices in the specific courses previously mentioned, the instructors pointed out the need for modifying curricu-

lum context as an effort to avoid what Greene (2001) calls *anaesthesia,* that is, the opposite of aesthetic, the numbness and emotional incapacity that prevent people from questioning and transforming the world. In order to make the learning process meaningful to our students across disciplines, we decided to modify our curriculum contexts and facilitate the development of creative imagination. This effort was supported by Bertling's (2013) conclusion that imagination has the "ability to make things that are invisible visible, things once nebulous clear, things far away and abstract close and in concrete form" (p.39).

Imagination as a Compass and Thinking Hats as an Anchor to Situate Knowledge

Brown, Collins, and Duguid (1989) argued that knowledge is situated, that is, learning is in part a product of the activity, context, and culture in which it is developed and used. They suggested that by ignoring the situated nature of cognition, education defeats its own goal of providing useable, robust knowledge. To situate learning means to place thought and action in a specific place and time; to involve other learners, the environment, and activities to create meaning; and to locate in a particular setting the thinking and doing processes used by experts to accomplish knowledge and skill tasks (Stein, 1998). Situated learning is not a new concept in education. The particularity of our project, however, lies in the fact that our attempt to situate learning and therefore embed learning in activity, making deliberate use of social and physical contexts, had imagination as a compass and de Bono's (1999) technique of the Six Thinking Hats as an anchor through a journey on a unicorn's back.

Imagination is defined as a mental quality that enables people to go beyond actual experience and construct alternative possibilities (Perdue, 2003). Hsu, Liang and Chang (2014) described in their study several noticeable characteristics that differentiate imagination from fantasy. Some of them are related to psychology aspects, such as exploration, intuition, sensibility and crystallization, and others are more practice-oriented, such as effectiveness, novelty, transformation and elaboration.

Scholars such as Colello (2007) classified the activities of human imagination in reproductive imagination and creative imagination. Reproductive imagination enables individuals to reproduce mental images described by others or images from less accurate recollections of reality, whereas creative imagination emphasizes the attributes of initiation and originality and is often perceived as a facilitator for the great discoveries and scientific, literary, artistic or technological achievements. Dziedziewicz and Karwowski's (2015) theoretical model of creative imagination with its applications in early education sees creative imagination as composed of three interrelated components: vividness of images, their originality, and the level of transformation of imageries. They emphasize the importance of analyzing creative visual imagination as both a process (understood as a cognitive mechanism) and typologically (revealing different types of creative imagination).

Hsu, Liang and Chang (2014) pointed out that imagination can be perceived as the basis for cultivating creative thinking and that many imaginative education programs tend to see their role in either stand- alone activities or via artistic subjects. Egan (2005) argued that effective stimulation of imagination should take place across curricula in diverse subjects, but the average classroom is not successful in stimulating imagination and sparking students' creativity. The instructors in the present study were challenged how to modify the context of university courses so as to situate course content and make it meaningful for preservice teachers and at the same time to facilitate flexible thinking for instructional design. They envisioned a decentralised approach for curriculum planning, which would allow them to utilize imagination to expand the learning context for preservice teachers and the learning possibilities offered in specific university courses, reach a meeting point between the university and the local community through identifying common perspectives or aims, and subsequently enrich learning for everyone involved.

The first and most basic design principle of decentralized educational programs is the principle of subsidiarity, which states that higher levels of the system should play a subsidiary role to lower levels of the system (Healey & Crouch, 2012). Instructors arranged to meet with inservice teachers and administrators from four local preschools in order to initiate a collaborative foundation for curriculum planning as an attempt to empower inservice teachers in the process of planning learning opportunities for university students and preschool children. Planning imaginative contexts in which to situate learning was initiated by preservice teachers' specific school experiences at the time, during which they defined children's current interests revolving around imaginary beings, such as fairies, mermaids, elves, and dragons. Whereas learning is usually situated in realistic contexts asking learners to apply knowledge to everyday life experiences, the instructors chose to situate learning in an imaginative context in order to spark their creative imagination and enable them to plan meaningful creative problem solving activities for children. The metaphor of a journey on a unicorn's back allowed instructors, preservice teachers and children to experience learning as an adventure. Unicorns are wondrous creatures, symbols of innocence and enchantment that travel and appear, wherever, and whenever they wish throughout all realms and dimensions. Since the focus of instruction at the university was to engage preservice teachers in creative problem solving through flexible thinking, a unicorn seemed an appropriate symbol to guide the journey, adopting multiple thinking perspectives.

The instructors' aim to engage preservice teachers in creative problem solving and flexible thinking was facilitated through de Bono's Six Thinking Hats technique (de Bono, 1999). This technique encourages problem solving utilizing six different modes of thinking symbolized by six different 'thinking' hats. De Bono suggested that when undertaking a problem, mind tensions might be similar to the bingo machine randomly drawing numbers. In order to avoid confusion and reach a solution in an efficient way, a problem solver needs to direct thinking towards one type of thinking at a time. Six colored hats (blue, white, red, yellow, green, black) represent six modes of thinking. The *blue hat* allows for coordination of the thinking process. A person who is

familiar with the Six Thinking Hats technique usually is chosen to wear the blue hat so as to be able to control the sequence of the hats that will be used by thinkers and pose questions that will prompt thinkers to think. When wearing the *white hat*, one focuses on information available, the objective facts of the problem, what is needed and how it can be obtained. The *red hat* encourages thinking of emotions, feelings, intuition, and hunches about the alternatives. The *yellow hat* represents optimistic thinking, asking thinkers to list the benefits of the ideas proposed. Wearing the *black hat*, engages thinkers in a devil's advocate role, being judgemental and critical about the merits of the ideas. Finally, the *green hat* encourages creative thinking. When wearing this hat, one can generate as many ideas as possible on how the problematic case could be handled.

In our study we replaced the thinking hats with gemstones of similar colors (Table 1). These gemstones symbolized the cognitive value of each type of thinking that a learner would acquire when anchoring at each kingdom of the Fantasy World to practice each thinking mode with the guidance of a blue unicorn.

The instructors considered the gemstones as more appropriate symbols than the hats to emphasize the value of thinking that learners engage in, as part of a treasure hunt, while wandering in an imaginative context. Gemstones symbolized anchors throughout a journey in a Fantasy World where thinkers were encouraged to adopt a certain mode of thinking while solving problems within course activities. The sapphire, symbolizing wisdom and deep contemplation, was the stone of the Blue Unicorn Valley where unicorns would direct thinking during problem solving. In the Mermaid Kingdom, the white hat was replaced by the pearl, a symbol of clarity. Mermaids would represent factual thinking and attention to evidence. Ruby, the stone of emotional activity, was placed in the Fairy Kingdom. Fairies would encourage expression of emotions as well as looking after feelings and intuitions. The topaz gemstone signified joy and positive energy and could be found in the Land of Fairy Tales. Fairy Tale characters would encourage positive thinking in a problematic situation. In the Dragon Kingdom, the black diamond symbolized stability and order. Dragons encouraged critical thinking. Finally, the emerald, symbol of vitality and humour, was a characteristic of creative thinking taking place in the Elf Kingdom. The Fantasy World Kingdoms as a different metaphor for the Six Thinking Hats approach for flexible thinking during problem solving guided the modifications of the context of four university courses engaging preservice teachers in problem solving.

Table 1. *Gemstones Replacing de Bono's Thinking Hats in the Fantasy World.*

Gemstones	Fantasy World
	Blue Unicorn's Valley
	Mermaid Kingdom
	Fairy Kingdom
	Land of Fairy-tales
	Dragon Kingdom
	Elf Kingdom

Preservice Teachers' Journey on a Unicorn's Back

The journey of preservice teachers on a unicorn's back begun when three university instructors of the Department of Education of the University of Nicosia, Cyprus, two of which are the authors of this article, collaborated to provide a situated learning context for their students. Four groups of students attending Art History (7 female and 1 male freshmen), Cognitive Psychology (2 male and 8 female sophomores), Activities of Pre-Primary Education (17 female juniors), and School Experience (20 females and 1 male seniors) participated in the journey throughout the content of each course. During the period of one Spring semester, those different groups in each course travelled with imagination as their compass, engaged in aesthetic experiences anchoring flexible thinking and planned problem-solving activities for preschool children for an event at the university library.

For reconsidering the curriculum of the four courses when planning the 'Journey on a unicorn's back' project, the instructors considered the four characteristics of reproductive imagination and employed them for guiding preservice teachers gradually through the imaginary context: crystallization, dialectics, effectiveness and transformation (Liang et al., 2013). Instructors cultivated, through flexible thinking, preservice teachers' ability to express ideas by using concrete examples, to seek improvement by logically analyzing ideas, to generate effective ideas about the target, and to perform tasks by transforming what one knows across multiple fields of knowledge. Dziedziewicz and Karwowski's (2015) model of creative imagination (i.e. preparation, imaging, and transforming) was employed as a matrix to describe the activities that took place during the Journey on a Unicorn's Back project. All activities of the project had a three-stage structure within each of the following four courses attended by preservice teachers: Art History, Cognitive Psychology and Development, Activities of Pre-Primary Education, and School Experience. All four courses were taught in the same university classroom whose physical setting was evolving throughout a period of one semester.

Preparation Stage. The preparation stage initiated the theme, which was the journey in Fantasy World guided by a unicorn. The instructors of each course focused on initiating the theme and prepared the students for the activities based on course content through a quest for information about the theme. The students gathered information, and organized and structured it within the theme. In the preparation stage, the instructors included curious facts, as well as other amusing or surprising information about the theme and encouraged

Figure 1. The map of the Fantasy World initiating the theme in the preparation stage.

students to adopt a flexible thinking problem-solving approach.

The starting point for all course work was a Fantasy World map (Figure 1) and a presentation of the general symbolism for each type of creature in the Fantasy World. The map was a result of a collaborative brainstorming among the instructors in order to provide a context for the six thinking modes that would be used throughout the semester. The specific imaginary creatures were chosen based on preschool children's current interests as indicated by preservice teachers' school experiences. Instructors decided which imaginary being and which symbol would represent each mode of thinking. More specifically the Blue Unicorn's Valley, representing the coordination of thinking, was symbolized by a gate as an entry to the fantasy World. A leaf was a symbol of vitality and fun for the Elf Kingdom. A castle on clouds and a pair of wings within a star-like outline represented the sentimentality of the Fairy Kingdom. A dragon outline and a volcanic landscape signified the need for attending to difficulties and critical thinking in the Dragon Kingdom. A shell with a white pearl represented the purity of thought during factual thinking at the Mermaid Kingdom. A central point in the Fantasy World is the Land of Fairy Tales which was denoted by a storybook. The outline of each symbol (gate, shell, leaf, star, dragon, storybook) was shaped by continuous repetition of each kingdom's name.

The Art History course began with an introduction to the content area, which included the mythological creatures in the art history of the ancient world, impressionist landscapes, surrealism, abstract expressionism, pop art, cubism, and futurism. Each student selected a Fasntasy Kingdom and initially looked for and studied information about fantasy creatures and prepared as a course assignment a presentation of a creature's profile. Class dialogue at the preparation stage guided students towards transferring knowledge of art techniques to the Fantasy World setting. Figure 2 shows examples of Art History students' drawings of the fantasy creature of their choice after studying the related mythology sources individually, presenting them in class, and discussing with classmates and the instructor their options of artmaking techniques from an art history perspective to illustrate the creature they had studied. For example, the students brainstormed ideas of how to utilize pointillism and expressionistic patterns to prepare the Fantasy World creatures' garments. Fantasy world guided by a unicorn. The instructors of each course focused on initiating the theme and prepared the students for the activities based on course content through a quest for information about the theme. The students gathered information, and organized and structured it within the theme. In the preparation stage, the instructors included curious facts, as well as other amusing or surprising information about the theme. The starting point for all course work was a Fantasy World map (Figure 1) and a presentation of the general symbolism for each type of

Figure 2. Students utilized knowledge of art history to present Fantasy World creatures.

creature in the Fantasy World. The map was a result of a collaborative brainstorming among the instructors in order to provide a context for the six thinking modes that would be used throughout the semester. The specific imaginary creatures were chosen based on preschool children's current interests as indicated by preservice teachers' school experiences. Instructors decided the basic fit between the modes of thinking and the imaginary beings. More specifically the Blue Unicorn's Valley, representing the coordination of thinking, was symbolized by a gate as an entry to the fantasy World. A leaf was a symbol of vitality and fun for the Elf Kingdom. A castle on clouds and a pair of wings within a star-like outline represented the sentimentality of the Fairy Kingdom. A dragon outline and a volcanic landscape signified the need for attending to difficulties and critical thinking in the Dragon Kingdom. A shell with a white pearl represented the purity of thought during factual thinking at the Mermaid Kingdom. A central point in the Fantasy World is the Land of Fairy-tales which was denoted by a storybook. The outline of each symbol (gate, shell, leaf, star, dragon, storybook) was shaped by continuous repetition of each kingdom's name.

In the Cognitive Psychology and Development course the concepts that were introduced to students included visual perception, visual and auditory attention, visual mental imagery, Piaget's assimilation and accommodation, memory and mnemonics, and problem solving. Students were asked to brainstorm ideas about how to apply content knowledge to design educational materials and activities through active participation in a whole class discussion during the course. For example, during the unit of perception students were guided to think about how they could engage children in tasks that would challenge their visual and/or auditory perception in the context of a Fantasy Kingdom (i.e solving riddles consisting of sounds presented by elves or spotting the differences between two pictures illustrating elves' hats).

The preparation stage of creative imagination in the Activities of Pre-Primary Education course also included an introduction to content knowledge and more specifically, introduction to creativity in education, interdisciplinary approaches for learning and teaching, such as the project-based approach, instructional design, and techniques for language development and creative writing. Students in the Activities of Pre-Primary Education course focused on studying the profiles of the fantasy creatures and brainstormed on what type of activities could be designed based on that profile. For example, fairies were associated with artmaking activities, elves with playful problem solving, dragons with argumentation activities, and mermaids with tasks requiring documentation.

The senior students in the School Experience course at the preparation stage of the project engaged in brainstorming about how to design and implement a creative action plan in a preschool to promote creative imagination. Specifically, when the instructor announced the

Figure 3. Objects and settings for the Fantasy World in the university classroom .

Figure 4. Collaborative mixed media art work-Fantasy World landscape .

theme of the project students were asked to think about how to set up goals and design activities to guide children in a Fantasy World journey taking into consideration the different subjects of preschool curriculum.

Imaging Stage. Students' imaging ability developed as a second stage of creative imagination during the 'Journey on a unicorn's back' project through the four courses. At the stage of imaging, the activities "are focused on developing creative ideations that take shape from the material of past observation, but significantly stray away from remembered reality" (Dziedziewicz & Karwowski, 2015, p. 389) in order to stimulate students' creative image abilities through creating symbols and metaphors within an image code, animating representations, using personifications and imaging fantastic stories and tales. The students in the Art History course were guided, for example to imagine and create a creature from the Fantasy World based on a given pictorial image of a face or combination of two given images, such as the Butterflish, a combination of a butterfly and a fish. The Art History students also created objects and settings for each Kingdom of the Fantasy World, such as clouds, a waterfall, unicorn belts with pouches for gemstones, and a Fantasy World treasure hunt booklet and utilized the classroom space to set up presentations of their work. The classroom settings stimulated imaging activities for students in all courses involved in the project since all class meeting were scheduled to take place in the same classroom.

At the second stage of creative imagination in the Cognitive Psychology and Development course the students became designers in The Extraordinaires' Design Studio where they imagined and drew useful objects for the Fantasy World creatures. They proposed, for example, a swing to modify a fairy's seat. They were also presented with a 'Where is Waldo' challenge and imagined how this task could look like in the Elf Kingdom. Additionally, the students perceived visual and auditory patterns in the Elf Kingdom and imagined the attributes of given fairy figures that would be used in a memory game at the Fairy Kingdom. They also imagined how the six thinking hats approach could be applied in the kingdoms of Fantasy World as a treasure hunt and how the means-end analysis approach could be applied in the unicorn valley.

Imaging in the Activities of Pre-Primary Education course took the form of imagining and writing riddles in the Elf Kingdom, creating symbols of the Fantasy World alphabet. Students also imagined Leo Lionni's Pezzettino character (Lionni, 2012) from the homonymic children's book in the Fantasy World and engaged in related creative writing and storytelling. They, additionally, imagined a unicorn outside the Fantasy World (i.e. university classroom, museum, library, preschool) and designed educational activities based on each idea.

During the imaging stage of creative imagination in the School Experience course, students thought about how to design and implement a creative action plan in a preschool to promote creative imagination. Building on the ideas that they brainstormed during the preparation stage, each student considered the specific school context where he/she was placed to complete his/her practicum, to animate representations of the fantasy creatures, and to illustrate imaginary stories.

Transformation Stage. At the third stage of creative imagination, students' transforming was viewed as the ability to change and control imagery employing thinking strategies such as reintegration, multiplication, perseverance, animation, color, and spatial inversion. Transforming students' representations was mostly related to changing selected characteristics of an imagined object (e.g. appearance, structure, function, or use). Transformations in the 'Journey on a unicorn's back' project were surprising, inventive, and atypical, but still made sense. In the Art History course the students created a collaborative mixed media art work for representing a Fantasy World landscape (Figure 4). They also transformed spaces of a university classroom into Fantasy World areas and that offered intercourse communication opportunities through exchange of messages left by students of each course on a cloud, in a shell and a nest. Transforming in the Art History course, however, reached its peak with students' spatial inversion of the university library into Fantasy World Kingdoms.

In Cognitive Psychology and Development students transformed a memory board game into a game in the Fairy Kingdom that encouraged the use of mnemonic techniques and problem solving with emphasis in emotions. They also prepared educational materials and activities based on visual perception and attention in the Elf Kingdom (i.e. tricks, spot the differences, visual/auditory challenge) and planned activities for children's active participation and engaging in critical thinking tasks related to an erupting volcano problem at the Dragon Kingdom in the Fantasy World.

In the Activities of Pre-Primary Education course's final stage of creative imagination, students' linguistic inversion of a given story led to adding a unicorn character in Leo Lionni's Pezzettino story (Lionni, 2012). In the original story a wise being advises Pezzetino to start a journey in order to discover its identity. Through a whole class discussion, students pointed out that the wise being shared attributes associated with the unicorn's profile.

In the School Experience course, the unicorn character was multiplied in a theatrical play to lead different groups of children in their quest of the valuable stones in the Fantasy World Kingdoms. The plot that the students wrote included interchangeable transformation of worlds (reality and fantasy/dream) to teach preschool children how to solve a real-life problem related to identity crisis.

Children's Journey on a Unicorn's Back

The preschool children's journey took place at the university's main library on April 23rd, World Book Day. For practical purposes, two groups of twenty preschool children and their teachers participated in the planned activities during the morning and the other two collaborating preschools visited the university in the afternoon of the same day. The four specific preschools were located close to the university campus and hosted the students from the School Experience course during their practicum. The three instructors initiated a collaborative foundation for curriculum planning with the inservice teachers from the specific preschools from the beginning of the project.

The ground floor corners and central space of the library, as well as a connected reading room were decorated by preservice teachers and transformed into the six areas of the Fantasy World. Preservice teachers' library transformations varied from creating and hanging foliage between bookshelves for each kingdom based on the color of the respective thinking mode, to compositions of three-dimensional artifacts symbolizing each kingdom, such as shells, a volcano, a mushroom-house, etc. The preservice teachers' decision to create a magical setting with hidden stations in a space with tall shelves and narrow corridors in between proved to be a very successful motivational tool for children's active participation and development of imagination. The ele-

Figure 5. Objects and settings for the Fantasy World in the university library.

Figure 6. Personal booklets distributed to children as guides for the Fantasy World space and activities in the library.

ments of mystery and surprise were evident characteristics of both the settings and the activities of the event.

Upon their arrival at the library, the children were welcomed by two fairies and led to the central open space of the library, which was set up as the Blue Unicorn's Valley. The majority of the children were dressed up as creatures from the Fantasy World, which enabled them to adapt to the imaginary elements of the environment easily. Children's introduction to the activities started with a short theatrical narration of the story of a child who falls asleep having negative thoughts concerning her identity and dreams that she is Leo Lionni's Pezzettino from the homonymous story book (Lionni, 2012), a simple square shape in search of the value of itself. The original story, whose pictures were projected on a large screen while our Pezzettino was sleeping, stopped at the point when Pezzettino meets with the wise man to ask about the importance of his existence. Instead, the preservice teacher enacting Pezzettino met with a wise blue unicorn, who invited her to travel with him in the Fantasy World in search for what she was looking for. While the unicorn was describing the various kingdoms, the preschool children presented related songs or choreography they had prepared at their schools. The wise blue unicorn then equipped the children with a personal booklet (figure 6), which included the map of the Fantasy World and assigned other unicorns as guides for each group of ten children. Following the unicorn's instructions, the children wandered through the library corridors, from kingdom to kingdom, from challenge to challenge, in order to solve problems by utilizing different modes of thinking. Upon completion of the challenges in every kingdom, the unicorn-coordinator rewarded each child with a sticker gem for the last page of their booklets.

Every group followed a different path throughout their journey until all groups had anchored at all five kingdoms and met again back at the Blue Unicorn Valley. The activities that the preservice teachers had planned in collaboration with their instructors required activation of a specific mode of thinking based on de Bono's thinking hats. To win the green gem the children participated in humorous activities based on illusions, riddles, and brainstorming initiated by stories regarding a lazy elf and a chameleon. In the Valley of Sweet Memories at the Fairy Kingdom, the children swung on clouds to recall a pleasant memory and describe it to a fairy. They also played a memory game that required understanding and expressing feelings, and decorated an oversized dream-catcher with their own cut-shapes from adhesive pattern paper, colorful ribbons and feathers, to capture and preserve pleasant dreams. In the Mermaid Kingdom, the children assumed the role of reporter's assistants and collected data from the still frames set-up by student-teacher mermaids. Receiving the black diamond from the Dragon Kingdom required role play, thinking about the dangers associated with volcanoes, decision making concerning how one should move around an exploding volcano and assessing peers' personifications of volcanic explosions. In the Land of Fairy Tales, a visiting author presented a problem faced by known story book characters and facilitated children's adoption of positive thinking to help the characters solve their problem. When all children had finally returned to the Blue Unicorn Valley, the wise blue unicorn summarized the process and brought children's attention back to Pezzettino's initial problem concluding that if one looks at a problem from different perspectives, one is more likely to reach a gratifying unexpected solution.

Reflecting on the Journey on a Unicorn's Back

The Journey on a Unicorn's Back project was an attempt to situate learning of content knowledge taught in various university courses in an imaginative context so that preservice teachers would develop skills to plan and implement educational activities that would encourage the use of imagination in education. De Bono's Six Thinking Hats turned into gemstones symbolizing anchors throughout a journey in Fantasy World where imaginary creatures motivated both preservice teachers and preschool children to be focused, productive and mindfully involved in the activities that enhanced their imaginative capacities. This project provided practical examples of how imagination can be used as a tool of engagement in education with the learners becoming more knowledgeable and creative in their thinking across subjects. In order to cultivate imagination as a cornerstone of creative learning, instructors decided to present university course curricula in a way that would be meaningful to their students. Continuity between university courses through common learning contexts for students was based on the instructors' collaboration and attempt to take only a small step towards a democratic stance in curriculum development in order to make learning meaningful for preservice teachers within a broader context than what they were used to in traditional classrooms. Modifying each course context while maintaining the content was challenging but imagination proved to be a successful technique towards

that end. Imagination allowed instructors and preservice teachers to view course content from different perspectives in order to make learning meaningful for everyone involved.

However, taking into consideration subsidiarity, an important design principle of decentralized educational programs, we question the supplementary role of the instructors of the four courses since they maintained a high degree of controlling the planning and implementation of the project. As a result, even if preservice teachers were actively engaged in and successfully completed all activities and course requirements, they faced difficulties in elaborating on the value of flexible thinking as a tool for problem solving for instructional design. Similarly, inservice teachers expressed enthusiasm in participating in the Journey on a Unicorn's Back project, however they were not immersed in creative problem solving for instructional design. Decentralization would have been more successful if all agents of curriculum planning and implementation (university instructors, preservice teachers, inservice teachers, preschool children) had a more in-depth collaboration in order to facilitate flexible thinking beyond the meaningful context of a one-day event.

The different functions and roles required during problem solving, symbolized by hats, needed to be situated in order to be meaningful for specific individuals and conditions. Reflecting on the project, we point out the need for developing symbolism for the multidimensional spectrum of thought related specifically to instructional design. Preservice teachers participating in the Journey on a Unicorn's Back project, demonstrated clear understanding of the six types of thinking and were able to plan activities for preschool children that enhance each type separately. However, if instructors adopted a decentralized approach, thereby making their own thinking transparent during collaborative problem solving in monitoring the project, the project's benefits for preservice as well as in service teachers perhaps could have been long-term. A more detailed framework to guide creative problem solving through flexible thinking for designing educational contexts, which would at the same time be easily adapted to different situations is important for training future teachers.

We questioned learning in formal educational environments in their aspects of striving towards accountability and standardization in ways that minimize, if not outright exclude, imagination and situated learning. Even though it was an exciting journey for everyone involved, several questions emerged while travelling on a Unicorn's back: How can we develop situated learning contexts that place imagination at the core of efforts to enhance creative problem solving in the classroom and in the community at large? How well can we apply a unitary model of imagination in diverse sociocultural contexts around the world? There are no easy answers for such questions. What we, as researchers and educators, can do is to continue raising these issues and collaborate to decentralize educational experiences and illustrate the value of imagination in different contexts. Educators can release learners for the kind of seeing that enables them to perceive and pay heed to qualities and appearances ordinarily obscured by the conventional and routine, when they themselves are able to recover "the imaginative mode of awareness that makes painting available, and poetry, and sculpture, and theatre, and film" (Greene, 1978, p. 186). Educational experiences, which provoke interest and push individuals to reach beyond themselves, empower them with the freedom of viewing things from alternative perspectives and eventually pursuing their own possibilities.

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EDITORAL

When Giants Stooped: The Lasting Effects of A Generous Professionalism

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I have a gift. No, really… I have this knack for meeting great people in really stupid ways.

Take for example, Allison Rossett, she of giant stature in our field. I was a Coast Guard officer and heavily involved in the analysis and performance design of a new recruiting, training, and transition-to-the-field process for the Coast Guard's newest recruits. My friend and colleague, Chris Hall, and I were at the book table at a large conference and I was looking at a group of books that had all been written by Allison Rossett (she of great stature in our field).

My response to seeing all the books was very professional:

"Allison Rossett… again?! Man, it is 'Allison Rossett this' and 'Allison Rossett that', I... am… so… sick… of Allison Rossett!" [I slowed my speech to emphasize my point.]

The woman standing immediately to my left leaned forward over the table, turned her head towards me, and glared.

At this, my friend Chris, who had studied with Dr. Rossett, gave me one of those 'I cannot believe you just said that' amused-yet-condescending grins.

Looking at the woman who was standing between us who was looking at me like I had grown a second head, he asked, "So, I suppose you don't want to meet her?"

"Don," he continued, "Allow me to introduce you to Dr. Allison Rossett."

To her credit, her countenance quickly transitioned from dismay (an appropriate expression under the circumstances) to smiling. She held out her hand and we were well met.

But my worst walking-with-giants meeting was when thought I had a graduate student at Indiana University running errands for me. I knew him only by his first name, Mike. He had a very youthful telephone voice. I thought we had arranged to pay for this student's work, so I just piled on the demands (mostly strange requests from my superiors). The requests went like this:

- How can we design the optimal classroom presentation system given our budget and available technologies?
- Is there an optimal color for classrooms?
- Do we need to worry about desk colors and designs distracting students?
- Is there an optimal screen size to classroom size ratio for presentation screens?

He went off and consulted with top people in various fields (cognitive psychology and interior design, for example) and the third time we talked on the phone, he told me his whole name, "Michael Molenda." But this time, because I am so quick, it rang a distant bell. From where I sat at my desk, I looked across my office at my professional bookshelf straight ahead of me. There at eye level was one of my textbooks from my days at Florida State University (FSU). The author was Molenda.

"Ummm, Mike Molenda? Are you the same Mike Molenda who authored *Instructional Media and Technologies for Learning*?"

"Yes, that's me."

You see my dilemma, right? So here I am a recent graduate of FSU's Master's program and I had been ordering around one of the *giants* in our field. How should I respond? Was there any way I could come out of this without looking like a complete jerk?

I apologized profusely. You know: "Uh, I didn't realize…" and, "I am so sorry…" and that sort of thing.

But he was completely un-phased, "Don't worry about it at all. Actually, I found it interesting." I never have actually met Dr. Molenda in person, but I must say, he was very gracious to me and he did do *great* graduate assistant work for us.

I have other embarrassing stories like this, but that is not the point here. Why would a young Coast Guard officer be sick of Allison Rossett? Why would we always be talking about her? Why would I even have had the opportunity to be embarrassed about taking advantage of Michael Molenda?

Because in both cases they were over-generous in investing their considerable expertise in us, in our project. They were *with* us in it.

But there's more… We had a straight-up all-star cast working on this project: John Keller helped us create the "Cape May Motivation Model," Walter Dick provided advice when we were in the course design phase, Roger Kaufman was involved with the needs assessment, James Pershing helped us develop our analysis tools, and many others pitched in, as well. They helped a group of young Coast Guard officers—all recent graduates of their respective programs—to completely redesign the Coast Guard's accession system. Why would they do that?

I think the best answer is that they were *generous professionals*. They believed in what they did, they believed in its efficacy, and they thought it would be of value to share their expertise, their wisdom. It is quite humbling, even now, to consider their generosity.

I'll be honest, I do not default to that type of professional generosity, but it is something to which I aspire.

Time has passed, and I have no idea what is going on with that system we designed today. But I know this: the generosity of those giants made our solutions demonstrably better than they would otherwise have been. I am so thankful to have been mentored, if only for a moment, by such experts.

But, lest you think I am just reminiscing here, I have a more direct purpose in this essay:

I propose that you and I commit to a generous professionalism. I'm not talking about "giving back" (though that is appropriate), I'm talking about a paradigm shift—a professional lifestyle—a way of conducting ourselves not primarily because of duty, but because of the joy of it.

What if we all were generous with our time and our expertise? I could provide many specific ideas for action, but won't. I will simply say this, what we do as instructional designers is great, the expertise we develop over time is valuable, there are great things to be done with it.

It is wonderful when giants stoop to help, but it is also good when we do. I sometimes wonder, were they giants because they stooped, or was it their habit of stooping to help others that made them giants?

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Redesign of an Introductory Course in a Master's Program in Instructional Design and Performance Technology

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Abstract: This article examines a systematic approach to redesigning an introductory course in a graduate program in Instructional Design and Performance Technology (IDPT) to produce a more efficient and effective learning environment and to foster persistence in the course and program. The course redesign employed the systematic process of instructional design using the basic phases of the ADDIE process (Analysis, Design, Development, Implementation, and Evaluation). This paper highlights the steps taken to redesign the introductory course, as well as the collaborative approach to developing its instructional materials, course content, and student performance outcomes. The online course was developed in BlueQuill, Franklin University's proprietary learning management system (LMS), and includes several multimedia learning objects developed using Camtasia Studio and Articulate Studio. Results of this redesign are presented.

Keywords: course redesign, ADDIE, instructional design course

Instructional design is the practice of creating "instructional experiences which make the acquisition of knowledge and skill more efficient, effective, and appealing" (Merrill, Drake, Lacy, & Pratt, 1996, p.2). This practice typically includes the use of an instructional design process to guide the creation of these materials. For this course redesign, we followed the ADDIE process, a model with roots in the U.S. Army (Branson, Rayner, Cox, Furman, King, & Hannum, 1975) and a general process for creating instructional materials. ADDIE is based on a systematic product development concept and remains one of the most widely used tools for creating instructional products and materials (Reiser & Dempsey, 2012).

The ADDIE process follows five general phases: analysis, design, development, implementation, and evaluation (Gagné, Wager, Golas, Keller, & Russell, 2005). In the analysis phase, the designer typically identifies the gaps in the knowledge and skills of the learner. In the design phase, the designer plans out the instructional materials to be created. This can include the creation or refinement of learning outcomes, the organization of instructional materials, and a basic design plan for assignments, multimedia, discussions, classroom trainings, and other instructional materials. In the development phase, the instructional materials are fully developed and placed within a content or learning management system. In the implementation phase, the instructional materials are used by the learners. Finally, in the evaluation phase, the instructional materials are evaluated on their effectiveness and are revised based on the evaluation results.

Process

In this article, we describe the team-based approach used in the redesign of IDPT 600 Principles of Learning Theory, the introductory course in the Instructional Design and Performance Technology (IDPT) program at Franklin University in Columbus, Ohio. We first share the background and context for the redesign of the course. We then describe each phase of the course redesign, including the unique steps taken in each phase. Finally, we share the results of the course redesign.

Background

The IDPT Master's degree program at Franklin University provides students with proven approaches for improving employee and organizational performance (https://www.franklin.edu/). This program, which began offering courses in 2010, offers courses in (1) instructional design, and (2) human performance technology. Instructional design encompasses a systematic process utilized in the creation of instructional materials "intended to improve learning and performance in a variety of settings, particularly educational institutions and the workplace" (Reiser & Dempsey, 2012, p. 5). Human performance technology also encompasses a systematic process but focuses on identifying underly-

ing causes of performance problems, linking business goals and strategies with the workforce responsible for achieving the goals, and recommending non-instructional solutions along with instructional solutions (Van Tiem, Moseley, & Dessinger, 2012). The program was designed to equip students with the skills of effectively providing instruction while at the same time implementing additional strategies for increased employee and organizational success. Students are required to complete a total of 37 course credits in this program.

The primary audience of Franklin University has historically been adult learners who attended class at the Columbus, Ohio campus. Over the past several years, Franklin has expanded to offer all of the classes online, as well as at 14 regional locations and 11 global locations. The typical student in the IDPT program is a professional working full-time in a business setting; many are already active in some facet of instructional design and want to obtain the credential that this program provides. The IDPT program offers a centralized curriculum in which all course materials, instructional materials, assignments, and activities are standardized for each section of the course offering.

IDPT 600

IDPT 600 Principles of Learning Theory is the introductory course in the IDPT program. This course is designed to provide students with a foundation of the learning theories influencing the field of instructional design. In addition, the course serves as an introduction to graduate studies and provides students with some of the foundational skills for success in a master's program. The course is six weeks in length.

The Need for Change

Near the end of the first year of the program, we began to realize that there was a potential need to redesign IDPT 600. As the subsequent courses in the IDPT program continued to be developed, we became aware that we should reconfigure the course to provide a more effective foundation for later courses in the program. This awareness, coupled with an informal review of student course evaluations, student evaluations of faculty, and anecdotal feedback from graduate student advisors, warranted further analysis from our design team, which we describe in our process below.

Instructional Design Team

Because of the importance of course design quality, it was critical that we include multiple perspectives on the course redesign team, including students, teaching faculty, instructional design faculty, and program leadership. We employed a team-based approach similar to that described by Hawkes and Coldeway (2002) in which "a team of experts is assembled to plan, design, develop, produce, and eventually deliver the course" (p. 433). This course redesign process was very collaborative in nature and involved the following individuals:

- IDPT Program Chair, led the redesign project and participated heavily in the development of the course materials
- Adjunct Faculty Member, experienced online instructor who had recently taught IDPT 600, who designed the new course structure and assignments and was involved in all other phases
- Two IDPT students, provided insights throughout the redesign process and helped develop and implement the course

Prior to the redesign of the course, the adjunct faculty member taught IDPT 600 for the first time. An experienced instructional designer with over 10 years of online teaching experience, the faculty member identified several issues, and that initial experience formed the foundation for the redesign of the course.

Analysis

As we approached the redesign of the course, we conducted an analysis to identify what problems or issues existed with the current version of the course. This analysis included the following data sources and analysis strategies:

- *Student course evaluation feedback* – we reviewed student course evaluations for items with low ratings. We also conducted a thematic analysis of student comments to identify potential areas of weakness to address.
- *Faculty member survey* - we sent an informal survey to faculty members who had taught the course to identify issues with the course design, as well as common student concerns and struggles in the course.
- *Design team focus group* – we met as design team to further identify issues and coalesce the findings from other data sources into clear themes.
- *Student success data* – we also reviewed student success data, including final course grades and retention rates 86.8%.

This analysis revealed the following issues which are summarized in the first column in Table 1.

Course Outcomes – Several of the seven course outcomes seemed extraneous or repetitive. To aid in the effective redesign of the course, we determined that combining repetitive outcomes and eliminating extraneous outcomes would help guide the effective redesign of the course.

Number of assignments - Our analysis revealed that students felt overwhelmed with the workload and the number of assignments. In the original course, there were a total of 25 assignments, an average of four assignments per week.

Textbook - The needs analysis revealed that the textbook from the initial IDPT 600 course iteration focused on various adult learning theories rather than on foundational learning theories. In addition, the text did not focus on the application of theory, which did not align with the applied nature of the program.

Misplaced Theoretical Focus - The initial design of the course had a strong focus on many varied adult learning theories. In addition, the focus was on the description of theory and not on the application of that theory. Based on interviews with several faculty in the program who had taught the course, we concluded that this broad approach distracted from the applied nature of design, and we surveyed the teaching faculty in the

Table 1. *A summary of key analysis findings, including our designed response to the issues identified.*

Problematic Findings	Our Solutions
Repetitive, excessive course outcomes	Revised, clarified, and consolidated outcomes
Textbook misaligned with course purpose	Selected textbook that focused on application of appropriate theories
Misplaced theoretical approach	Identified and focused on key learning theories
Team assignment issues	Eliminated team assignments; enhanced discussions to improve social interaction; added individual application assignments
Need for writing support materials	Utilized university writing support, created supplemental support, embedded writing and writing support into assignments
Need for program introduction	Created video overview of program outcomes, courses and sequence; created video introducing the subsequent course in program
Need for introduction to graduate studies	Created graduate skills for success; created multimedia describing graduate skills for success; created assignment including self-assessment on graduate skills and plan to build those skills

program to have them identify the theories that were most crucial in the field. As a faculty, we separately identified those theories and models which we felt were most critical for our students to learn. We compared our results and found that we were in nearly total alignment. The results of this survey indicated that a shift to focus on a few key learning theories would be more appropriate.

Writing support materials - Based on our interviews with faculty who had taught this course, feedback from graduate advisors, and the students participating in this redesign, we found that some of the students struggled to be effective in their writing. It became clear that student success in 2 key writing assignments was below the required level of performance. In addition, several faculty mentioned that student application of APA was not adequate. Reviewing the grades in previous sections of the course revealed that a team paper and several individual writing assignments presented a challenge for some students. We concluded that students shifting to writing at the graduate level needed extra support, including feedback and guidance on the use of APA formatting.

Need for program introduction - We also found that there was a general lack of introduction to the IDPT Program and is curriculum. This lack of introduction was apparent in the comments of current students in the program who found it difficult to see the big picture of the curriculum. This was critical because this course was the first in the program, and students needed an orientation to what they were learning and how the program functioned as a whole.

Need for introduction to graduate studies - For most of our students, this was their first exposure to graduate studies. We therefore noted a need to aid students in easing into graduate studies, including the skills required for success in graduate studies.

Group project issues - The needs analysis revealed that the team-based project requirement presented several issues for adult students. The time constraints of working in small groups in an online collaborative project was challenging during a six-week intensive course delivery format. In addition, most of our students are working adults and have limited flexibility in schedules due to full-time work and life responsibilities.

Course Redesign

We redesigned the course to address the specific needs identified in the analysis. Our intention was to specifically address these issues by targeting solutions to those problems. We describe these solutions below.

Course Outcomes - As noted above, the course outcomes were revised and consolidated to increase clarity. We made these changes based on feedback from faculty members and based on our analysis of the course needs. The goal was to focus our efforts in design and teaching and to provide the students with clarity on the purpose of the course. Table 2 compares the outcomes with the revised outcomes.

Reduction in number of assignments - To reduce the cognitive load experienced by the students, we clarified instructions in several of the assignments and eliminated several of the extraneous assignments. We reduced the number of assignments from 25 to 13, resulting in an average of two assignments per week, a reduction of almost half. We also worked to focus these assignments more fully on the course outcomes.

Textbook selection - Based on our analysis, the adjunct faculty member recommended that the Driscoll (2005) text *Psychology of Learning for Instruction* be adopted as instructional materials based on her familiarity of the textbook content and first-hand use of the book during her doctoral studies. This text fit our requirement to focus on the use of theory for instruction

Table 2. *A comparison of the original and revised course outcomes.*

Outcomes Before Redesign	Outcomes After Redesign
Demonstrate an ability to write and communicate at a level consistent with the expectations of a graduate student.	Demonstrate ability to research and write at a level commensurate with graduate student aptitudes and proficiencies.
Research theories, philosophies, and principles of learning by using relevant library databases and other scholarly resources.	Research philosophies, theories, and principles of learning using scholarly resources.
Analyze the impact of theories, philosophies, and principles of learning on the design of learning events.	Analyze how learning theories and principles inform practice (are applied) in learning and performance scenarios.
Evaluate theories, philosophies, and principles of learning, including each philosophy's pedagogical implications.	Identify the pedagogical and andragogical implications of learning theories and principles.
Critique a unit of instruction using applicable learning/ instructional theories.	
Implement turnitin.com as a tool to prevent plagiarism.	
Create a learning event that applies learning theory and principles appropriate for the audience.	

and aligned more appropriately with the purpose of our course and with the core theories identified in the analysis.

Theoretical emphasis - As noted in the analysis, there was a need to focus attention on key theories in the field of instructional design. Based on the recommendations of several IDPT faculty members, we determined to focus on behaviorism, cognition, and constructivism, theories which have had great influence on education and learning (Mayer, 1992). This shift in focus was facilitated by the change to Driscoll's (2005) textbook, which gives these theories ample emphasis.

Writing support - As noted above, our analysis revealed a need to provide additional support to aid the students in their initial attempts at graduate-level writing. To do that, we created a three-step process for providing students with feedback on their writing. First, students were required to submit their paper to grammerly.com, an online tool designed to provide grammar and writing feedback. After students received this feedback they were required to submit their paper to the university's writing center for feedback from a live writing tutor. Students were then directed to submit their writing to the instructor for grading and feedback. In this way the students received multiple sources of feedback and could then apply it to improve their writing in subsequent writing assignments.

Core writing assignments - The course redesign included the revision of the writing assignments in the course. In the new course design, students were required to write three papers in which students applied a major theory of learning to an instructional situation. Students first applied behaviorism, then cognition, and finally constructivism to real-world instructional scenarios.

Introduction to IDPT Program - To help students understand the IDPT program more fully, we designed and later developed a multimedia introduction to the program. This video overview shared the outcomes of the IDPT program and previewed each of the courses in the program, highlighting learning outcomes from each course. In addition, a link to information on the final two courses in the IDPT program—the capstone project course and the portfolio course—was provided at the end of this introductory course to help the students to begin their studies with the end in mind.

Graduate skills for success - We also worked to provide a more robust introduction to graduate studies. To do this, the design team collaborated to identify key skills for success in graduate studies, including the following: research, writing, critical thinking, presentation, technology, accessing Franklin support, communication, and study skills. We developed a multimedia piece that presented a high-level overview of these skills and created an assignment that had students self-evaluate themselves in these areas and develop plans for improving. See *Appendix A* to review the graduate skills for success self-evaluation. At the end of the course, students also created a skills for success self-improvement plan, which was designed to aid them in planning for future self-development and success in graduate studies.

Multimedia - To help students focus on the key concepts, we planned to create multimedia that highlighted and summarized key concepts in the course. We also planned to create multimedia that would introduce students to graduate studies, the IDPT program, and the course following IDPT 600. Examples of these fully-developed multimedia pieces can be found in Figures 1 and 2. Our design plan included the creation of the following multimedia pieces:

- *IDPT Program Overview* – an overview of program outcomes, courses, and key assignments
- *Graduate Skills for Success* – an overview of key graduate skills for success
- *Introduction to Behaviorism* – a description of behaviorism with examples of behaviorism in action
- *Introduction to Cognition* – a description of cognition with examples of cognition in action
- *Introduction to Constructivism* – a description of

constructivism with examples of constructivism in action

- *Looking Ahead to IDPT 610* – a preview of the next course in the curriculum, provided to help students bridge their learning from one course to the next

Developing the Course Materials

The development team consisted of three faculty members and two IDPT students. The overall development was completed primarily by the program chair, who created course content, developed assignment structures and developed multimedia to be used in the course. The course materials were developed over a three-month period. The development team met bi-monthly to brainstorm ideas and review progress on the development of course materials. A PowerPoint template guided the development of the three learning theory videos, and the program chair developed the multimedia pieces in either Articulate Studio or Camtasia Studio.

Our Development Process

When developing instructional materials, we followed four general steps in the development process, described below. Figure 3 presents a visual representation of these four steps.

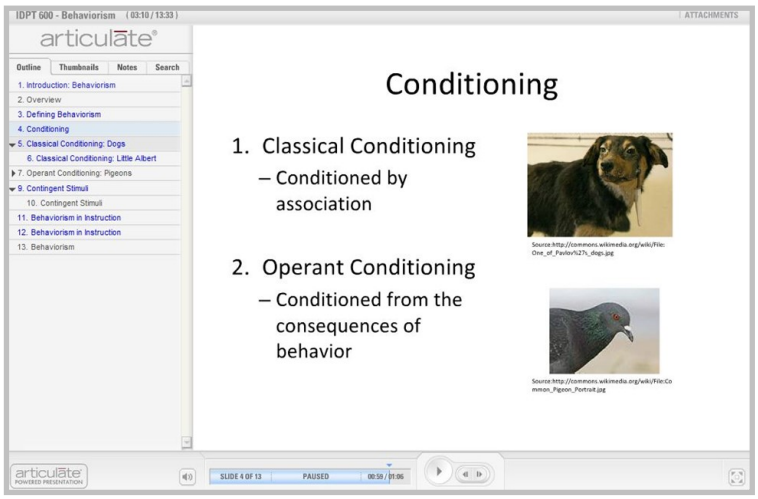

Figure 1. A screenshot of the behaviorism multimedia piece developed in Articulate Studio and hosted on Franklin University servers.

Figure 2. A screenshot of the graduate skills for success multimedia piece developed in Camtasia and hosted on YouTube.

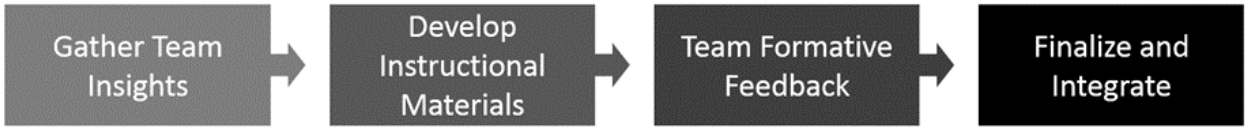

Figure 3. The Team-based development process used to develop instructional materials.

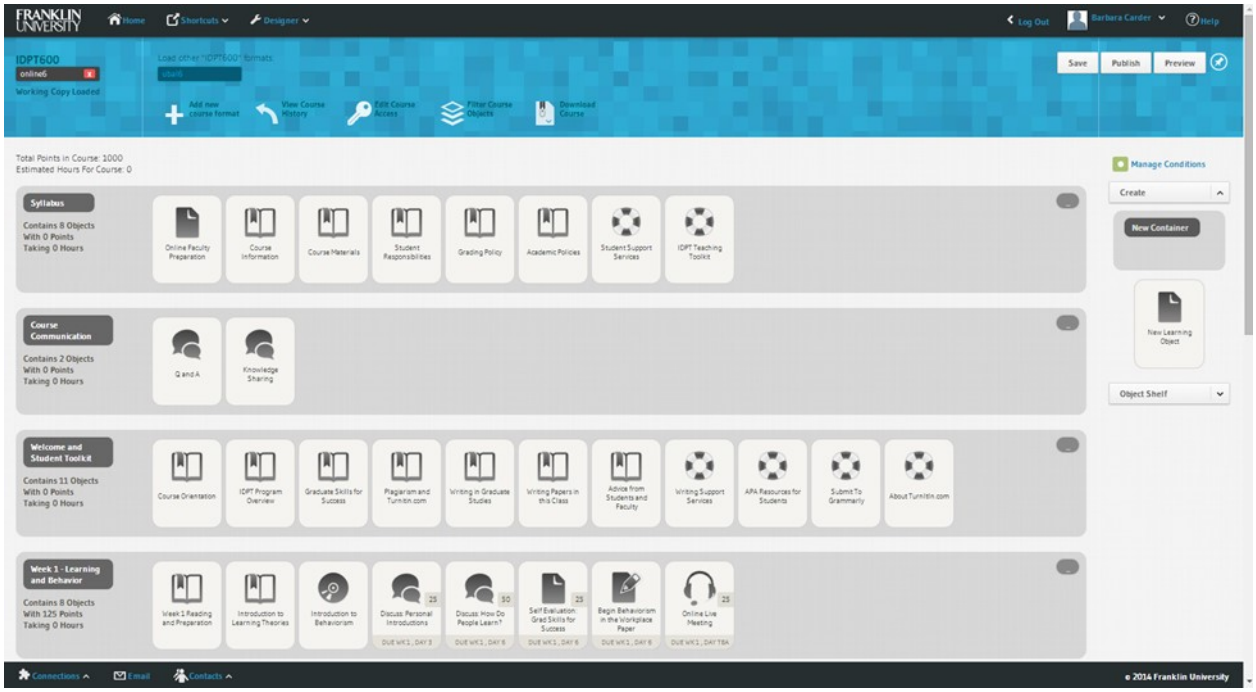

Figure 4. The visual layout of IDPT 600 within the BlueQuill learning management system.

Gather Team Insights - We first gathered insights from members of the design team on key design issues. This typically involved short surveys, interviews, or focus groups to gather insight and form consensus on how to move forward in the development. For example, the previous analysis identified a need to help students gain graduate skills for success. To understand what these skills are, we surveyed the design team and several additional IDPT faculty members. This survey provided excellent insights and helped us frame the graduate skills out more effectively, and the program chair compiled a list of graduate skills with descriptions of those skills. The list was reviewed and critiqued by several design team members and was refined based on feedback. We summarize our design solutions in the second column of Table 1.

Develop Instructional Materials – After the insights were gathered, one of the team members developed the assignment or instructional materials. In our graduate skills example, the adjunct faculty member developed the graduate skills for success self-assessment, which included the descriptions noted above.

Team Formative Feedback – The prototype was then reviewed and critiqued by members of the design team. For example, the graduate skills for success self-assessment was reviewed and approved by the members of the design team.

Finalize and Integrate– The prototype was then refined and finalized by the team members. In our graduate skills example, the self-assessment was revised based on any feedback received and was then uploaded to the LMS.

This development process was followed in the development of each major component of the redesigned IDPT 600 course. Multimedia pieces, instructional materials, course assignments, and course development within the LMS were all developed using this approach.

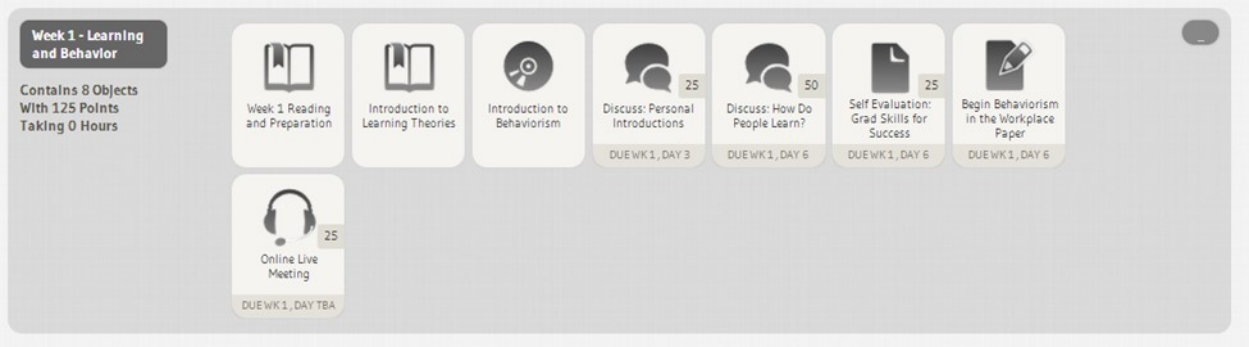

Figure 5. The visual layout of a week within the BlueQuill LMS in IDPT 600.

Learning Management System

This course was developed in BlueQuill, Franklin University's proprietary learning management system. This learning management system uses what might be called an object-based approach to the visual layout of the course. Figure 4 demonstrates the visual layout of IDPT 600 within BlueQuill.

From a design perspective, containers are used to organize the course. A container can house one or more objects, which include instructional materials such as assignments, course content, discussions, and multimedia. See Figure 5 for an example of a container in IDPT 600. The week 1 container in Figure 5 includes all of the assignments and instructional materials to be completed by students in week 1.

Implementation

The revised six-week course was first implemented and taught in both online and face-to-face formats, with 13 students in the online section and 4 students in the face-to-face section. Thereafter, the course continued to run on a bi-annual basis, though we ceased offering the face-to-face option due to low enrollment.

Evaluation

Formative Evaluation

After we ran the redesigned course in three successive trimesters, we gathered the student responses to the course and faculty survey. We reviewed survey results and conducted a thematic analysis of the student comments in the survey to identify the strengths and weaknesses students identified. We summarize these themes below.

Strengths – Student comments noted that they learned a lot from the course and indicated that they liked the textbook and felt it gave a great theoretical foundation. For example, one student wrote, "The course is useful in providing background knowledge in instructional design and educational psychology principles." Another student wrote, "… I see how helpful it is to learn about different learning and teaching styles." Finally, a third student wrote, "I feel I was able to master the subject matter because of the readings and examples provided."

Other students noted appreciation for the weekly discussions in which they applied their theory to a real world example. One student wrote, "The discussions with peers also helped a lot to enhance (my) understanding."

Some student comments also noted that the weekly online meet sessions helped enhance understanding and build a sense of community. One student wrote, "I really enjoyed our weekly online meetings, they made me feel like 'I'm not in this alone'… (They) introduced additional thoughts to the content and gave me a feeling of inclusion."

Suggestions for improvement –Informal students comments to faculty members included suggestions for fine-tuning some of the assignments in the course, such as explicitly linking back to readings and making action items more explicit. They gave suggestions for refining the writing assignment template and also suggested the creation of a community of practice.

It was also apparent in student comments that this course created a very high cognitive load for the learners. Students struggled to keep up with the materials, and one student mentioned that he just didn't have time to access and use all of the learning materials. Another student wrote, "I believe three papers within a 6 week course is a lot, on top of the rest of the assignments… A six week course goes really fast and trying to fully grasp all of the information in a short amount of time can be challenging." We are keenly aware of this problem and are continuously working to balance the cognitive load while still maintaining a rigorous graduate-level course.

Student Evaluation Results

After two years, we made a comparison between students' course evaluations before and after the course was redesigned. The course evaluation completed by students asked for the student to rate their level of agreement to statements such as the following: "The graded assignments in this course assisted me in learning the course content," and "The classroom activities in the course assisted me in learning the course content," and "The classroom activities in this course encouraged me to engage with my classmates." Students were given four options when rating these items: Strongly Agree, Agree, Disagree, and Strongly Disagree.

Graded Assignments Assisted in Learning – Student responses to the statement "The graded assignments in this course assisted me in learning the course content" showed an increase in the number of "Strongly Agree" responses and a decrease in "Disagree" responses. See Figure 6. These responses were analyzed using a *t* test. Results indicated that students rated the course significantly higher after the course redesign ($p = 0.016$).

Students Recommending Course - Student responses to the question "Would you recommend this course to other students?" were analyzed. Student recommends increased from 83% before the redesign to 100% after. See Figure 7. These responses were analyzed using chi-square to determine if there were significant differences in student response between course designs. Students recommended the course significantly more after the course redesign $\chi 2$ (2, N= 84) = 0.014.

Course Student Retention. Based on the available data, student retention in this course was increased from 86.8% before the redesign to 96.2% after the redesign.

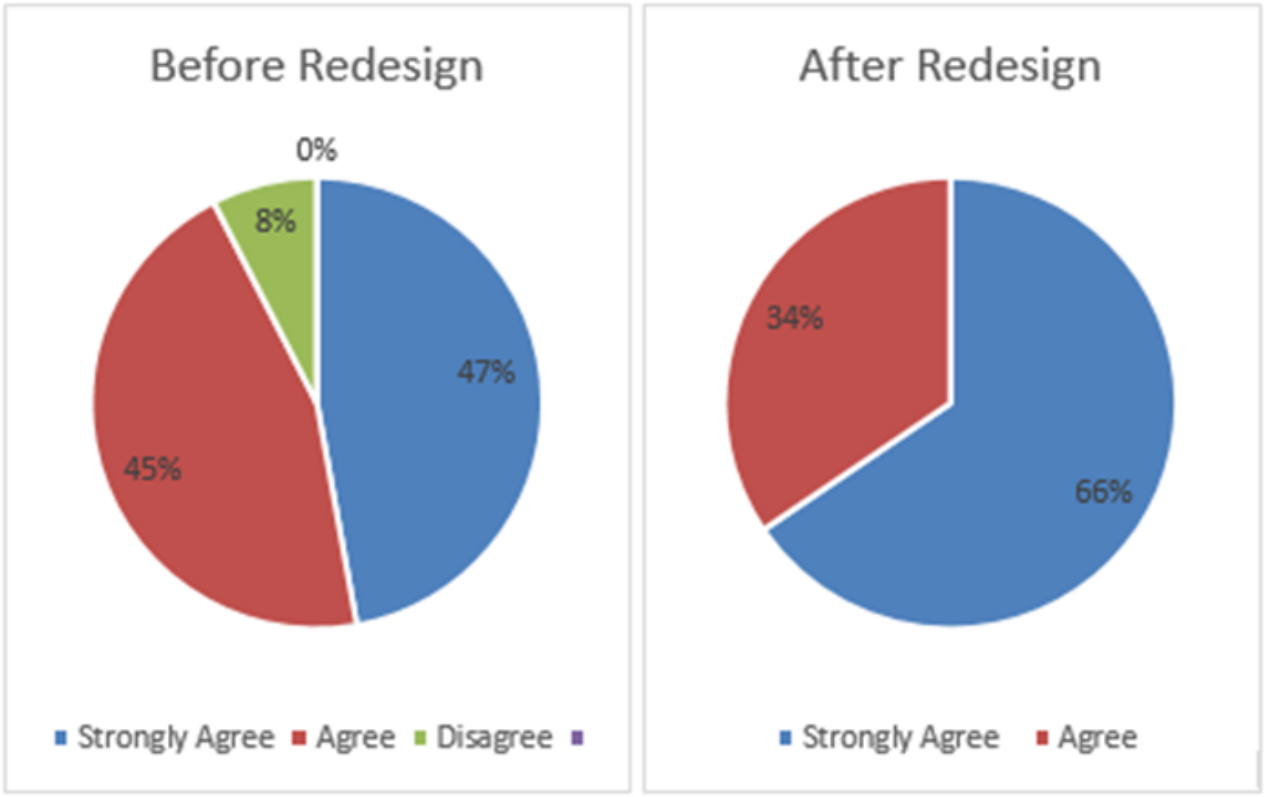

Figure 6. Student responses to the item "The graded assignments in this course assisted me in learning the course content."

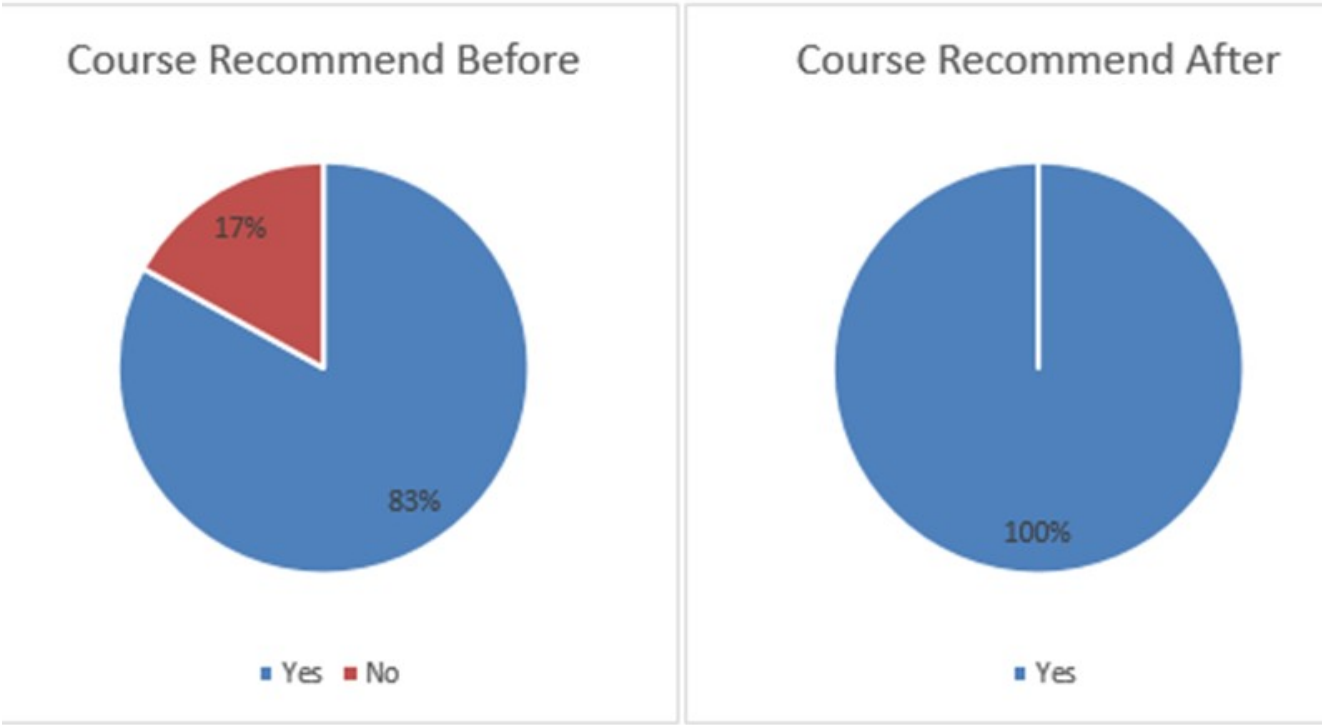

Figure 7. Student responses to the question "Would you recommend this course to other students?"

While this results is encouraging, our analysis indicates that this increase in student retention was not statistically significant $\chi 2$ (2, N= 92) = 0.092.

Discussion and Conclusion

In this section, we conclude our article with reflections on our experience in this course redesign.

Working as a Student-Faculty Team

While complexities and interpersonal issues can sometimes make a team-based approach difficult (Hawkes & Coldeway, 2002), we had a very positive experience as a student-faculty team. All team members were responsive and made substantial contributions to the project. During design sessions, all contributions were accepted and considered. All members of the design team felt comfortable offering ideas and making suggestions during all phases of this project. As experienced designers and professionals, we believe that this positive, collaborative approach actually enhances our ability to design creatively and effectively. Like Hawkes and Coldeway (2002), we found that the team approach enabled us to identify potential problems and correct them before running the course.

Our approach most closely resembled the Interdisciplinary Team Model (Care & Scanlon, 2001), in which "participants met as a team on a regular basis to develop the course, problem solve, and discuss issues as course development unfolded" (p. 1). Based on our experience and the valuable contribution of all team members, we believe that there is validity in Caplan's (2004) assertion that "Quality courseware production requires a highly organized, concerted effort from many players" (p. 186).

Student Contribution

From a faculty perspective, it was very insightful to have two conscientious students on the team. The insights and contributions offered by the students on the design team was particularly valuable as they had completed the course within the previous year and were enthusiastic about implementing numerous design ideas learned in subsequent courses in the IDPT program. Working on the redesign provided the student team members the opportunity to participate in the design process and provided insights into the creativity, com-

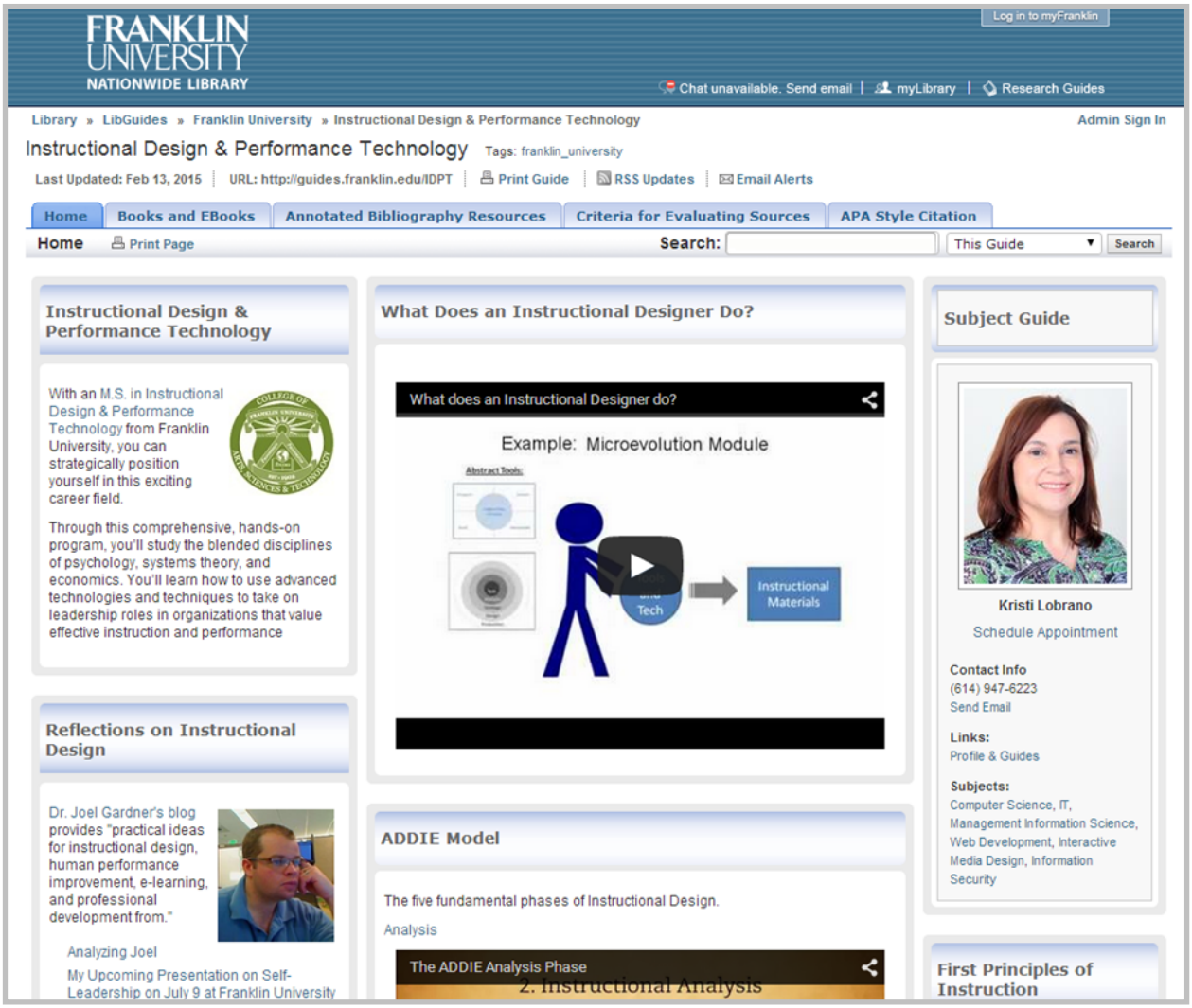

Figure 8. The Library Guide for the IDPT Program.

promise, flexibility, and energy that goes into the design process from start to finish. The students suggested creating a library guide for IDPT students to help guide them to available resources. See Figure 8. The students developed PowerPoint manuscripts used as the basis for two of the three theory videos created for the course. They also made recommendations related to specific assignments and provided their insight on how long assignments take students to complete. Both students felt that they were able to make a solid contribution to the redesign of this introductory course, critically important for the success of the students in the IDPT program.

Working Toward the Ideal

As with all instructional design projects, we found ourselves working under constraints such as limited time and human resources for the development of the course. We realize that there is seldom an ideal set of resources or a perfect course design, and we determined to move toward the ideal as much as possible in this course redesign. We employed a disciplined, creative effort to develop the course into "something that more closely resembles the desired state" (McDonald, 2011, p. 54). The increase in student retention and apparent student satisfaction with the course seems to demonstrate that our efforts were fruitful. However, we realize that future enhancements to this course and the other courses in the IDPT program are inevitable, and that plan to continue to do the best work possible in all of our course redesigns.

The flexibility ot ADDIE. It is important to note that during this redesign process our team moved back and forth among the phases of the ADDIE process (Branson, et al., 1975). We found that we were often doing analysis, design, and development activities simultaneously and iteratively, reflecting the flexible nature of the ADDIE process. We agree with Reiser and Dempsey (2012) that the iterative and self-correcting nature of the instructional design process emerges as one of its greatest strengths.

Future activities. Overall, we are pleased with the redesign of IDPT 600. In the future, we plan to continue to revise and improve IDPT 600 based on formative feedback from students and faculty. Our hope is to conscientiously develop an introductory course that enables students to gain a foundation upon which they can build their expertise as learning and performance professionals.

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Appendix A: Graduate Skills for Success Self-evaluation

The following skills, abilities, and resources will help foster your progression in the IDPT program. Experience has shown that developing and using these skills and resources will lead you towards being successful in your graduate studies at Franklin University.

INSTRUCTIONS: Self-assess your skills and abilities for the following criteria (see pages 1 and 2) using the **3-point Likert Scale** below.

3-Point Likert Scale

Self-Assessment	Rating
Poor	1
Satisfactory	2
Excellent	3

You will use the results to identify your strengths and weaknesses, to formulate an action plan for improvement to bridge the weaknesses, to develop a PowerPoint Presentation (PPT), and to present your results to your classmates in the Module 4 online session, along with sharing strategies for success with your classmates to partially fulfill the requirements in the IDPT600 Principles of Learning Theory course.

Research Skills

Criteria	Self-Assessment	Rating
My ability to read and interpret academic articles is		
My ability to perform a literature review is		
My ability to use library resources is		

Writing Skills

Criteria	Self-Assessment	Rating
My ability to structure an academic paper is		
My ability to use proper grammar and sentence structure is		
My ability to use APA style effectively, including paper formatting, citations, and references is		
My ability to use technologies to facilitate use of APA (Library reference creator, Zotero, Mandalay) is		

Critical Thinking Skills

Critical thinking is defined as questioning one's own assumptions, being open to new perspectives and using evidence to make decision.

Criteria	Self-Assessment	Rating
My ability to think critically about the evidence and the information available is		

My ability to reflect on my experiences and adapt to new ways of thinking is		

Presenting Skills

Criteria	Self-Assessment	Rating
My ability to deliver effective, professional presentations in a face-to-face (f2f) environment is		
My ability to deliver effective, professional presentations in a virtual (web-based) environment is		

Technology Skills

Criteria	Self-Assessment	Rating
My ability to effectively use the Franklin University Learning Management System (LMS) course room technology is		
My ability to effectively use the online meet tool synchronous delivery platform is		

Abilities to Access Franklin Support Resources

Criteria	Self-Assessment	Rating
My ability to access the Student Learning Center (SLC) writing support is		
My ability to access HelpDesk technology support is		

Communication and Study Skills

Criteria	Self-Assessment	Rating
My ability to professionally interact with peers and faculty is		
My ability to practice effective time management is		
My ability to study effectively by submitting paper drafts into the SLC is		
My ability to study effectively by submitting assignments and discussions on time is		
My ability to consistently read (textbook, journal articles, etc.) before performing the course work is		

Chosen Skill

In the space below, write down which skills you would like to work on to improve.