JoSoTL

Journal of the Scholarship of Teaching and Learning

Volume 18, Number 1, January *2018* *josotl.indiana.edu*

JOSOTL
JOURNAL OF THE SCHOLARSHIP OF TEACHING AND LEARNING

Volume 18	Number 1	January 2018

Journal of the Scholarship of Teaching and Learning, Vol. 18, No. 1, January 2018, pp. 1-10.
doi: 10.14434/josotl.v18i1.22508

Reflections versus Extended Quizzes: Which is Better for Student Learning and Self-Regulation?

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Abstract: Both quizzes and reflections have been found to benefit student learning, but have been typically compared to passive or superficial controls. The purpose of this quasi-experiment is to test the relative effectiveness of brief quizzes followed by reflections compared to longer quizzes. Participants (N = 218) were introductory psychology students enrolled in two different courses, one in which students engaged in weekly brief quizzes and reflections and a second in which students engaged in longer quizzes. Results indicated that the two conditions were similar in effectiveness in terms of learning and self-reports of self-regulation.

Keywords: Quiz, reflection, instructional design, self-regulation

Introduction

Instructors who are committed to improving student learning often review the literature and find that many instructional methods may improve student study strategies and subsequent learning. For examples, writing reflections and quizzes have both been shown to be effective methods of increasing learning (e.g., McDaniel, Agarwal, Huelser, McDermott, & Roediger, 2011; Watkins, 2001). However, the benefits of these instructional methods are typically compared to passive controls (e.g., Angus & Watson, 2009; Bannert, 2006; Connor-Greene, 2000; Moos & Bonde, 2015; see Di Stefano, Gino, Pisano, & Staats, 2014 for an exception). Instructional time and student study time are limited, so it would be useful for instructors to know which technique is more effective in an authentic class environment. The purpose of this study is to compare the relative benefits of reflection versus extended practice in a college course.

Benefits of Quizzes

Incorporating quizzes, which are frequent, low stakes learning assessments, has been noted to benefit performance in a variety of disciplines (e.g., Angus & Watson, 2009; McDaniel, Wildman, & Anderson, 2012). Quizzes are thought to be helpful for several reasons under the framework of *desirable difficulties* (Bjork, Little, and Storm, 2014). Desirable difficulties are challenges that benefit students by improving encoding and processes that support learning (Bjork & Bjork, 2011). Quizzes provide an opportunity for students to practice retrieving and using information from memory (McDaniel et al., 2011). This practice retrieval is beneficial because it can strengthen long-term memory of the material (Roediger & Butler, 2011; Roediger & Karpicke, 2008). In addition, students often overestimate how well they understand content, a phenomenon known as the *illusion of competence* (Koriat & Bjork, 2005). One way to overcome the illusion of competence is to have students test themselves on the content (Kornell & Bjork, 2007). Unfortunately, students often choose to reread material than to quiz themselves (Karpicke, Butler, & Roediger, 2009) even though rereading material is considered an ineffective

learning strategy (see Dunlosky, Rawson, Marsh, Nathan, & Willingham, 2013). For these reasons, requiring quizzes may be helpful for students to improve the monitoring of their learning. Finally, if quizzes occurred frequently throughout a term, they encourage students to study and review the material regularly (i.e., spaced practice) instead of relying on last-minute exam preparation (i.e., massed practice; Connor-Greene, 2000; McDaniel, Roediger, & McDermott, 2007).

Benefits of Reflection

Reflection, the process of examining and contemplating one's knowledge and learning, has also been noted as beneficial for student learning (Dewey, 1933; Peltier, Hay, & Drago, 2005; Rogers, 2001). Reflection provides opportunities to think about performance, consider what strategies are effective, and contemplate how to improve in the future (Mann, Gordeon, & MacLeod, 2009). Reflection is a key process in effectively choosing and monitoring strategies to achieve one's goals, known as self-regulation (Dabbagh & Kitsantas, 2004; Ellis & Davidi, 2005). Specifically, reflection is critical to monitoring behaviors during a task and evaluating the effectiveness of these behaviors (Nussbaumer, Dahn, Kroop, Mikroyanndis, & Albert, 2015). Moreover, self-regulation can be taught with reflections (Paris & Paris, 2001). For these reasons, reflection can improve learning by making it intentional and purposeful (Di Stefano et al., 2015). This is likely why empirical evidence indicates learning benefits with reflections (see Zheng, 2016 for review). For examples, reflections on learning strategies used for mathematics assignments lead to improved course performance (Zimmerman, Moylan, Hudesman, White, & Flugman, 2011). In addition, reflecting on learning strategies improved students' skills to develop their own knowledge (Cacciamani, Cesareni, Martini, Ferrini, & Fujita, 2012). Moreover, prompts to reflect on one's learning process improve performance on transfer tasks (Bannet, 2006; Bannert & Reimann, 2012). In work contexts, individuals who engaged in reflection had lower error rates when learning work skills than their less reflective peers (Roessger, 2014). Finally, choosing to engage in reflective thinking practices is positively associated with academic performance (Phan, 2014).

The Current Study

The discussion on quizzes and reflections indicate that both may improve student learning. However, the amount of time students are willing to apply towards a course is finite. Given restraints, is it better to answer more quiz questions thereby covering more content related to exams or to have a shorter quiz followed by a reflection on learning? The current study addresses this question with a quasi-experiment using two large introductory psychology courses. One course had quizzes followed by a reflection on how they learned the material. The other course had a longer quiz, but no reflection. Because reflection is most effective when regular and ongoing throughout the semester (Bringle & Hatcher, 1999), quizzes and reflections were weekly.

The current study examined the relative effects of quizzes and reflections versus extended quizzing on two sets of dependent variables: performance on exams and self-reported self-regulation. Performance on exams was chosen because it is indicative of overall learning in the course and the variable of interest in class-based quiz studies (e.g., Rezaei, 2015). Self-regulation was of interest to allow for examination into possible changes during the semester as a result of

reflections. If the results of the current study indicate that reflection benefited performance compared to extended quizzing, it is likely because reflection improved self-regulation.

Typically, studies on quizzes compared conditions with quizzes to control conditions without a comparable learning activity (e.g., Angus & Watson, 2009; Bjork et al., 2014; Connor-Greene, 2000; although often conditions varying the types of quizzes were also compared; e.g., Bunce, VandenPlas, & Havanki, 2006; McDaniel et al., 2011) or quizzes were compared to an ineffective study strategy, such as rereading (McDaniel et al., 2012; McDermott et al., 2014). Moreover, reflection studies typically used passive controls in which students were not given reflection prompts (e.g., Bannert, 2006; Moos & Bonde, 2015; although there may be comparisons in the types of reflection activities as well; e.g., Michalsky & Kramarski, 2015; Roessger, 2014). In contrast, the relative benefits of brief practice followed by a reflection versus extended practice without reflection on mathematical tasks were compared in a lab experiment (Di Stefano et al., 2015). Findings from this work indicated that, although individuals indicated a preference for extended practice over reflection, performance improved with reflection compared to extended practice. Based on these findings, it is likely that reflection would lead to better study strategies and course performance in the current study than would extended quizzes. However, lab results do not necessarily transfer to class environments (see Hulleman & Cordray, 2009). This may be especially true when considering the work by Stefano and colleagues as they examined performance on a single mathematical skill whereas the current study examined performance on understanding a broad range of psychological concepts.

Methods

Participants

Participants were 218 introductory psychology students at a large Midwestern university. Only students who completed at least 75% of the quizzes and/or reflections (depending on condition) and completed both pre- and post- self-regulation measures (see Measures) were included in analyses. Approximately 60% of the students identified as female and 40% identified as male with an average age of 19.02 years (SD = 1.89 years). In terms of racial background, approximately 86% reported being Caucasian, 2% reported being African American, 4% reported being Asian, 1% reported being Hispanic, 3% reported being biracial or multiracial, and the remainder did not report racial background.

Procedure

Participants were in two different courses, both taught by the same instructor and both offered in the afternoon. The lectures and exams were the same in both courses. For the course in the quiz-and-reflection condition, students completed a 5-item, multiple-choice quiz weekly followed by a reflection of how they learned the material for the quiz. Following exams, students reflected on how they learned the material for the exam. For the course in the extended quizzing condition, students completed a 10-item (5 of the items were the same as in the quiz-and-reflection condition), multiple-choice quiz weekly. Information targeted by the quizzes was either on the exams or related to information on the exams. There were 104 participants in the extended quizzing condition and 114 in the quiz-and-reflection condition. All weekly assignments were completed online through the course learning management site. Students were given immediate

feedback on their quiz performance. Following best practices in teaching with reflections, reflections were given feedback as well (Aronson, 2011). Only students who completed at least 75% of the quizzes and/or reflections (depending on condition) were included in analyses.

At the beginning of the semester, students in both courses learned about effective and ineffective study strategies as part of the cognitive psychology unit. In addition, students were required to read and write a response to a systematic review of study strategies written by Dunlosky and colleagues (2013) at the beginning of the semester. Therefore, they had a background in study strategies upon which to reflect.

Measures

Three unit exams were the measures of course performance. Unit exams were not cumulative. There was also an optional final exam (students could choose to take the final exam to replace a previous, lower unit exam grade) that 112 students chose to take. The final exam was cumulative. Each exam consisted of 40 multiple-choice questions.

The Metacognitive Self-Regulation Scale (MLSQ; 12 items) from the Motivated Strategies for Learning Questionnaire was used to measure self-regulation (Pintrich, Smith, Garcia, & McKeachie, 1993). The MSLQ has been used in many research studies and is considered a useful, flexible tool for examining the differential effects of interventions (Duncan & McKeachie, 2005). It was administered to students in class during the second week of the semester and the second-to-last week of the semester.

Results

To compare the relative effectiveness of the quiz-and-reflection condition versus the extended-quiz condition on performance, the effects of condition on both the sum of the unit exams scores and the final exam score were examined. First, a one-way ANOVA was conducted with condition as the independent variable and the number of items answered correctly on the three unit exams as the dependent variable. There was no difference between conditions, $F(1, 217) = 1.07$, $p = .30$ (see Figure 1).

Figure 1: Unit exam scores by condition (means and +/- 1 standard error bars)

Then, a one-way ANCOVA was conducted with condition as the independent variable, the number of items answered correctly on the final exam as the dependent variable, and number of items answered correctly on the three previous unit exams as the dependent variable. Again, there was no difference between conditions on exam performance, $F(1, 110) = .20$, $p = .65$ (see Figure 2). Previous exam performance was a significant covariate, $F(1, 110) = 174.61$, $p < .001$.

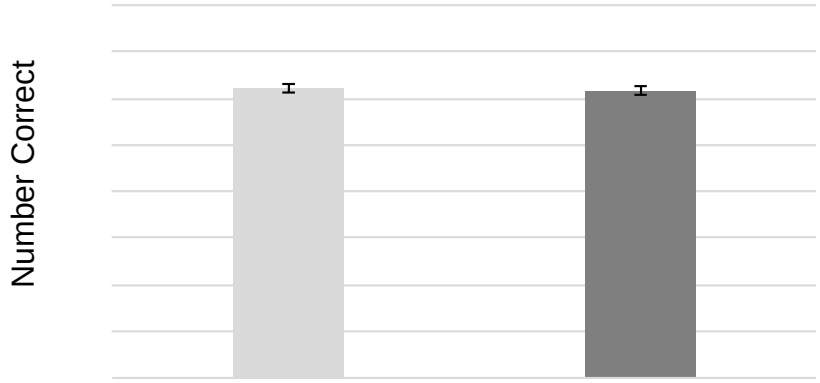

Figure 2: Final exam scores by condition (covariate adjusted means and +/- 1 standard error bars)

The relative effectiveness of the conditions on metacognitive self-regulation was also examined. A one-way ANCOVA was conducted with condition as the independent variable, scale score at the beginning of the semester as a covariate, and scale score at the end of the semester as the dependent variable. There was no difference between condition, $F(216) = .04$, $p = .84$ (see Figure 3). Scale score at the beginning of the semester was significant as a covariate, $F(1, 216) = 127.03$, $p < .001$.

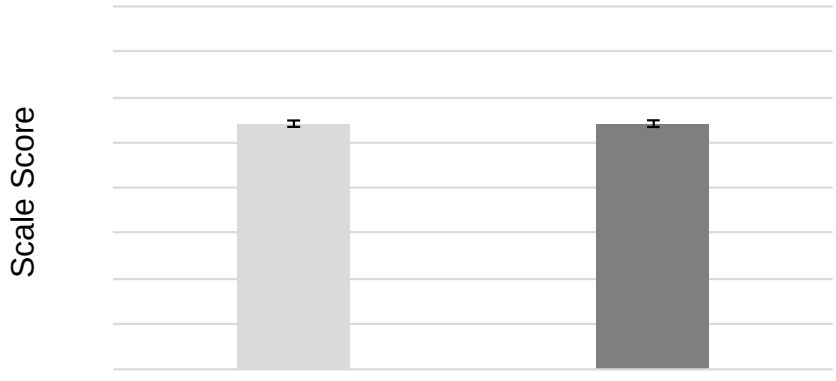

Figure 3: Metacognitive self-regulation scores by condition (covariate adjusted means and +/- 1 standard error bars)

Discussion

The purpose of this study was to compare the relative benefits of a brief quiz followed by a learning reflection versus an extended quiz. Based on the findings from this study, there was no difference in the two instructional methods on student learning or self-regulation.

These findings may be informative for instructional design. For example, an instructor who wishes to incorporate reflections, but is concerned that less content would be covered as a result, may find these findings reassuring that covering less content in quizzes may not lead to less learning in a course. Conversely, an instructor who teaches large enrollment courses with minimal assistance for grading may appreciate knowing that longer quizzes, which may be automatically graded with feedback through learning management systems, may be as useful as reflections, which may be labor intensive to grade.

Limitations and Future Directions

Given that both quizzes and reflections have been previously found to improve learning (e.g., McDaniel et al., 2012; Di Stefano et al., 2015), it was not surprising that there was no difference in exam performance between the two courses. However, it was anticipated that reflection would increase self-regulation given previous findings (Dabbagh & Kitsantas, 2004; Paris & Paris, 2001; De Steafno et al., 2015). One reason for the similar self-regulation scores between conditions could be that the extended quizzes prompted the students to self-regulate as they had to apply their learning strategies to more content than did students in the quiz-and-reflection condition. Another possibility is that reflection prompted enhanced self-regulation more than extended quizzing, but that the self-report measure was not sufficiently detailed to detect a difference. An interesting idea for future work would be a mixed methods approach and, in addition to the quantitative data from the self-reports, obtain qualitative data by interviewing a sample of students about how they regulate their learning and how quizzing and reflection contribute to self-regulation. The findings from such a study would provide information of both breadth and depth to illuminate the relationships between these instructional methods and self-regulation.

One important limitation of the design in this study is that a control condition without quizzes or reflections was not incorporated. However, such a condition was considered unnecessary. There did not appear to be a need to conduct another empirical study showing that quizzes and/or reflections yielded learning benefits over a passive control or a control with an ineffective study strategy (e.g., rereading). Moreover, it could be considered unfair to students in a control condition to deprive them of an instructional method shown to be effective in the literature. Overall, the design of this study, a quasi-experiment comparing two techniques previously found to be effective, afforded practical guidance for instructors to make decisions about their courses. Given the number of instructional methods found to have benefits over passive or superficial controls, it may be helpful for future studies to compare the relative effectiveness of instructional methods to help instructors determine which methods are most effective.

Conclusion

Instructors who wish to incorporate research-based practices into their courses may be overwhelmed by the number of methods noted as effective in the scholarship of teaching and learning literature. To help instructors make informed choices, this manuscript discusses a study in which the relative effectiveness of two instructional methods—quizzing and reflections—are assessed in a quasi-experiment. Although the results indicated similar scores on learning and self-regulation measures for the two methods, these findings provide guidance for instructors. Instructors can apply these findings to know that quizzes and reflections appear to be equally effective and base their decision on what would work best for their particular learning environments.

Acknowledgements

Courtney Duff, Alex Karie, and Alek Krumm are thanked for their assistance with data collection and entry.

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Journal of the Scholarship of Teaching and Learning, Vol. 18, No. 1, January 2018, pp. 11-24.
doi: 10.14434/josotl.v18i1.21027

Digital Video as a Personalized Learning Assignment: A Qualitative Study of Student Authored Video Using the ICSDR Model

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*Abstract: Students within this study followed the ICSDR (**I**dentify, **C**onceptualize/**C**onnect, **S**toryboard, **D**evelop, **R**eview/**R**eflect /**R**evise) development model to create digital video, as a personalized and active learning assignment. The participants, graduate students in education, indicated that following the ICSDR framework for student-authored video guided their video creation process, resulting in focus for their ideas, and increasing motivation to learn more about their content. Finally, the participants indicated that creating a digital video was an authentic and personalized learning experience that fostered personal choice and voice and peer collaboration. Evidence from the qualitative study supports students following a development framework for video creation.*

Key Words: Personalized Learning, student-authored video, ICSDR, active learning

The predominance of social media and the increased accessibility of mobile devices with cameras are known contributors to the consumption and development of digital video. The ubiquitous access and ease of use of video recorders on smartphones, tablets, and cameras and the convenience of video sharing sites have more adults than ever recording, capturing, and uploading video to Internet sharing sites. YouTube, the largest video social sharing website, boasts "over a billion users who watch millions of hours of video daily (YouTube, 2016). Digital video flourishes. Over 72% of adults, who use the Internet, also use online Internet video-sharing (Anderson, 2015). Over 400 hours of new videos are uploaded to YouTube in a one-minute period (Wojcicki, 2015).

Video sharing sites and their related tools enable viewers to move from being consumers of video to being producers of video. The simplicity of capturing and uploading video has facilitated the billions of hours of digital videos typically created for informational and entertainment purposes by individuals, business, government, and education. The exponential growth of video in the past 10 years has influenced pedagogical approaches in the classroom. For instance, in a recent study by Kaltura (2015), 24% of participants surveyed identified that over 50% of classes at their institution regularly used video in instruction while 83% of the educators

believed that students will be creating more video content in the future (*N*=948). However, educators agree that more experience and training is needed for authoring video. Providing a framework for digital video creation may scaffold the work flow of video creation.

It is known that having students create digital video can be an active and authentic learning assignment (Dumova, 2008; Kearney & Schuck, 2004); yet, it is unknown if digital video creation is a personalized learning activity. It is the authors' contention that learners creating and authoring a video are not only engaged in active, authentic learning but are also engaged in personalized learning. As a student generative activity, students' voice and choice are observed in well-crafted, edited digital video. Imploring the question, does the addition of a digital video development model support or hinder the creation of digital video as a personalized learning activity?

With the need for providing training in authoring video and the desire to engage higher education students in active, authentic and personalized learning experience, the aims of the study were to (a) identify the state of student created video among the current population; (b) describe the ICSDR model; (c) analyze students' perceptions of incorporating the ICSDR framework to make a student created video; and (d) identify the assess personalized learning aspects of video assignments. For the purpose of this paper, digital video refers to video captured with a personal device or camera that can be found on video hosting websites, like YouTube, Vimeo, TeacherTube, SchoolTube, or a local on file storage. "Digital video" referenced in this paper does not include professionally created video, video shorts, or full featured film.

Within this study, student created or student authored video denotes: video recorded in a natural or authentic setting, audio tracks (e.g. voiceovers, audio recorded in an authentic setting, and or curated original music). Student created or authored video signifies that the student edited the raw video and audio that they generated resulting in finished and complete video as an outcome. Student created or student authored video (used synonymously) does not refer to a multimedia slide presentations, animated video, or still images that have been animated and set to music.

Literature Review

Students as Consumers of Video in the Classroom

Video is often used in higher education for instructional and tutorial purposes (Campbell, 2012, Martin & Martin, 2015; Shipper, 2013, Yarning & Yit-Liang, 2015; Wen-Jung & Cigas, 2013). Teachers assign students to watch videos both in and out of the classroom for the purpose of introducing a topic, watching recorded lectures, encouraging discussions, learning a second language, explaining activities or assignments, and recording screencasts (step by step instructions to complete a procedure or process on a computer). In some cases, these uses bring a multimedia dimension to static instruction (Ljubojevic, Vaskovic, Stankovic & Vaskovic, 2014; Viteri, Clarebout, & Crauwels, 2013). Students indicate that video helps them acquire knowledge because they are able to stop, start, and replay a video until they feel they understand the material being presented.

Using video in the classroom has been recognized to motivate students at all age levels (Ballast, Stephens, & Radcliffe, 2008; Gunter, 2012; Ljubojevic, Vaskovic, Stankovic & Vaskovic, 2014; Spires, Hervey, Morris, & Stelpflug, 2012;). Students' motivation to watch video extends beyond watching teacher assigned videos for a grade to watching videos of their own choosing either to develop a deeper understanding of content, to complete a process or procedure,

or for their own enjoyment. However, the length of a video and the content makes a difference as to how much of the video is watched. Martin and Martin (2015) observed that students do not watch academic tutorial videos over 3 minutes in length. Others' research noted that students tend to watch some or parts of video skipping around to the parts they felt pertained to them the most (Bowles-Terry, Hensley, & Hinchliffe, 2010).

Students as Producers of Video in the Classroom

A digital video assignment moves students from being consumers to be producers of their own content. Incorporating digital video as a generative assignment in higher education affords the demonstration of acquired understanding of a body of knowledge (King & Cox, 2011). A range of other known student created digital video assignments consist of personal introductions, encompassing an aspect of their lives, telling a personal narrative (Hughes, & Robertson, 2010; Ballast, Stephens, & Radcliffe, 2008), recreating a historical event, (Debiase, 2008; Hofer & Swan, 2006) creating a book trailer (Gunter, 2012; Kenny & Gunter 2010; Gunter & Kenny, 2008). Typically, the guidelines and assessments of digital video assignments include a teacher-created checklist of required elements (both content and technical) and or a rubric to support assessment. Literature describing the genres of student created digital video assignments does not indicate that students were provided a framework or model to scaffold the digital video workflow and development processes. There is a paucity of literature describing models for video creation.

Student created video is only limited by the student's idea, creativity, and technical abilities. The cohesiveness and quality of a video of a student created video requires more than just capturing video and putting a title on it. Like writing an essay, often students do not know where to begin to create a video beyond the technical aspects of video creation. Further, students do not edit video often because they lack the skills or the self-efficacy to do so as the students in this study indicated in their pre-survey responses and discussions. Others feel it takes too much time to edit a video. Some student authored digital video may appear not to have a cohesive purpose, can be too long, or the converse may be the case videos may have great technical qualities with minimal substance. All of these reasons can contribute to the quality of student authored video. Just as students benefit from instruction and strategies on how to write a succinct paper, it is our hypothesis that a framework for creating and curating student authored video would be useful in academic video development.

ICSDR: A Framework for Student Authored Video

Knowing the need for guidance for student-authored video development (Hofer & Swan, 2006), a model was developed to aid teachers in implementing video assignments. ICSDR (pronounced ick-stir), an acronym for **I**dentify, **C**onceptualize and **C**onnect, **S**toryboard, **D**evelop, **R**eview, **R**eflect, **R**evise, is a model that provides a pathway and framework for students to follow when producing a video (See Figure 1). The model begins at development of concept, requires peer feedback, and includes opportunities for revision, and reflection before the student finalizes the video. Similar to the draft and revision process of writing an essay, student authored video benefits from drafting, editing, and reviewing its development prior to being completed. The ICSDR model has been implemented with elementary, middle school, undergraduate, and graduate students (Campbell, 2012).

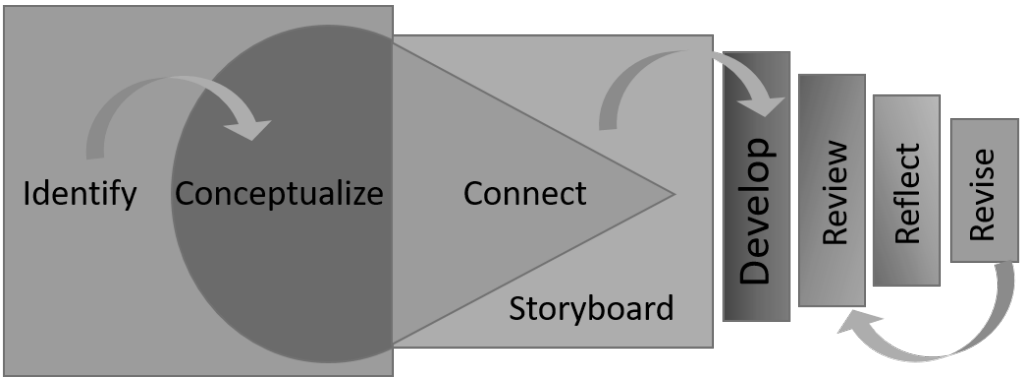

Figure 1. ICSDR Model for student-authored video

Using a grounded theory approach to development, the ICSDR model was developed with varying populations of students as a means to quantify a process for student authored video development. The model was meant to fill an observed need noted by faculty members from both K-12 and higher education. The ICSDR framework has been applied to student created original digital video as well as student curated digital video (Campbell, Planinz, & Miller, 2016). Each step in the model was refined over a period of time through student comment, faculty use, observations, and video development artifacts (brainstorming, storyboarding, peer review analysis, and the videos themselves).

Personalized Learning

Personalized learning considers students first. The *National Education Technology Plan's* (NETP) (Department of Education, 2010), definition of personalized learning incorporates the familiar terms of differentiation (Tomlinson, 2000), individualization, and personalization and emphasizes the facilitation of personalized learning occurring through the use of technology. Specifically, personalized learning includes teaching and learning governed by student's learning needs, preferences, interest, and pace.

The culture of a personalized learning environment values the learner's individual needs and abilities when meeting standards, benchmarks, and competencies. Assessments and feedback guide the learning path for students on an individualized basis, meaning activities and assignments may vary. Further, there is mindfulness towards independent learner agency, nurturing independent learning and thought, while still collaborating with peers. Personalized learning, as a pedagogical method or approach, practices individuality and varied methods, pacing, objectives, and content for student success. The learner is empowered and makes learning choices within assignments allowing for customized learning experience (Grant & Bayse, 2014) incorporating a wide variety of activities and assignments.

Assignments in a personalized learning environment, capitalize on the key principles of personalized learning. An assignment such as a student created video can share the hallmarks of personalized learning. Students choose the content, pursue relevant content, produce their representation of knowledge, participate in reflective personal and collaborative feedback and assessment and finally publish their work. It is within this context that the graduate students in this study created one-minute videos as a personalized learning activity.

Methodology

Research Design

A qualitative research design for the study was used from a phenomenological approach. Descriptive statistics were analyzed from the pre and post surveys of self-reported data. Other data collected included, online group discussions, notes from peer conversations, brainstorming records, storyboards, the videos themselves, and the students' reflections.

> ***Research Question 1:*** How does following the ICSDR model, for student authored video, influence or effect the outcome of the video?
>
> ***Research Question 2:*** What are graduate students' perceptions regarding the ICSDR model for student authored video?
>
> ***Research Question 3:*** Did the students consider the student created video a personalized learning experience and what did the students value in the assignment?

For question 1: Videos were analyzed for change from brainstorming to the final posted videos. The videos were coded to see if they aligned with the author's initial objective. Further, students wrote a reflection about the processes to complete the video. These were analyzed for indicators of influence. For questions 2 and 3: Using an open-ended questionnaire, an analysis of focus and peer group conversations, and online discussions, students perceptions were coded and emerging themes were documented.

Participants and Setting

The participants N=10 for the study were all female graduate students enrolled in an education program at a large Southeastern University attending the same class. Eighty percent of the students were state certified teachers working on a Master degree program in content area disciplines such as Science, Math, and Reading. The other 20% of the students were not currently in the K-12 classroom but in other educational training roles. Consent to participate in the study was obtained from all participants.

The technological skills of the students varied from novice to average proficiency as self-identified. Seventy percent of the students indicated that they had made at least one video prior to the class for personal reasons often using their smartphone or tablet. However, only 20% of the students indicated that they previously made a video as part of a class assignment (individually or collaboratively) and 40% of the students had assigned their own students to create a video for an assignment. Their students used PowerPoint or PowToon's video as part of an assignment. These graduate teachers K-12 students curated images and added sound. They did not capture live authentic video themselves nor were they required to provide a plan prior to the final product.

The format of the class was a hybrid instructional model. Classes were conducted either face to face on the campus of the University or through synchronously using Google Hangouts every other week or every three weeks. The class materials and management was conducted through Canvas, a Learning Management System (LMS). Some of the discussion for this study

was mediated through the LMS, while the rest was conducted live through Google Hangouts, or in the Face to face classroom.

Procedure

Prior to the introduction on a student created video unit of instruction, students knew they would be making a one-minute video that they would capture with a mobile device. Basic parameters, for the assignment were discussed. Elements and requirements for the video included telling a story, a time restriction of no longer than a minute, live action video that the students had personally captured, and the video was to be based on a measurable content objective. The objective would indicate a behavior or action that a student would perform as a result of watching the video. For instance, a student who taught marketing and business, objective was for students to be able to define the term return on investment. The students were not to make a screencast, a lesson, a presentation, or a tutorial. The purpose of the video could be an introduction to content that would be taught in a lesson, an explanation of an abstract word or concept, or a means to spark interest of content. Since the graduate students were all practicing teachers or trainers they chose to create a video that would help them in their current teaching assignment. Students were then asked to determine a measurable objective for their video.

Then students completed a Qualtrics survey indicating their experience with student authored video (either as a teacher or student), and recorded a potential idea and objective of their video. After the pre-survey, students were assigned to watch a presentation about the ICSDR framework. At the next class period and after watching the presentation students engaged in a face to face discussion related to how they had used student created video in their own teaching practice. During this discussion, students reviewed and discussed the model with each other and the instructor. Peer groups were established for feedback and review, and a collaborative student driven timeline was developed to provide structure to the assignment. At this point, students confirmed their topic and objective of their video.

Then students received a digital copy of the brainstorming collaboration document to complete over the next week. After conversing with peer groups and others (e.g. colleagues, friends, and even family members), the students finalized their topic and wrote a measurable objective for their video. Students were then given digital storyboards (See Figure 2) and the assignment deadlines were established based on collaboration between students and the instructor. Over the next week, students completed the storyboards for their video and consulted their peer groups through online discussions and phone conversations resulting in revisions to storyboards and scripts. Then, the students completed the technical aspect of the assignment which included shooting and editing the raw video, curating and editing sounds, and recording voiceovers. After completing the first draft of the video, students posted a link to the video for peer review within the peer group and within the class. Using a feedback checklist as a guideline of required elements, students self-reviewed and peer reviewed the student created video. Students reviewed the comments about their video from themselves and others and made modifications before posting a final version of the video. At the conclusion of the assignment after final edits were completed and videos were posted, students watched each other's final videos. They turned in a private open-ended reflection of the assignment (process and product) and completed a post assignment survey in Qualtrics.

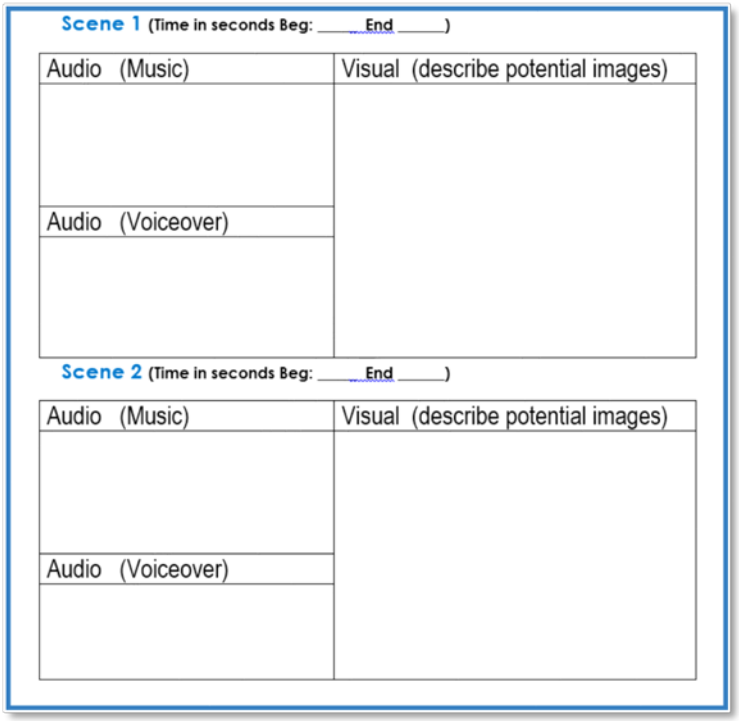

Figure 2. Digital Storyboard template.

Results

Research Question 1

How does following the ICSDR model, for student authored video, influence or effect the outcome of the video? After looking at the assignment artifacts (e.g. brainstorming record, storyboards, and feedback discussions, the students concluded that all completed student videos evidenced change from the previous step at many of the phases of the ICSDR model. Three themes emerged from this question include: objective importance, peer feedback related to editing and instruments.

Objective Importance. In 80% of the videos, the initial objective was clearly met as determined by the participants themselves and their peers. One student comments summed up the relevance of referring to the objective throughout video development. She indicated, "The objective kept me focused so I did not chase 'shiny distractions' or give my learners too much information at once." Of the 20% that did not meet the objectives, one student indicated that after the second round of peer evaluations, she felt that she needed a new concept and did not go through the initial stages for the second video she created. However, she did follow the later steps from storyboarding phase forward. In the other case, the student indicated she was aware that she did not stick to her initial objective. Even though her peers mentioned this to her and made suggestions in the storyboard review stage, she chose not to revise her storyboard or to consider their suggestions. In her final reflection, she noted that she wished she had either followed or revised her initial objective because she felt her video did not communicate her ideas and lacked the depth of her peers' videos.

Peer Feedback Related to Editing. Throughout the online discussions at each step in the framework that required peer feedback students often provided pragmatic advice to their peers.

One such comment exemplifies how the collaboration ultimately guided change within the video at the storyboard phase. The student said in a discussion, "I thought about the peer comments and then decided there would be value in reworking my video. The audio did not change too much, however the visual completely changed. If I did not make the edits based on my peers' suggestions at the storyboard stage, I am not sure I would have done the changes. I would not have the video I have today and I probably would not be as happy with the assignment. I can't wait to show my own students from the brainstorming sheet to the completed video.". Others students explained that peer feedback made them consider their ideas and work in a way that they would not have had they only self-reflected about that phase of their video.

Instruments: Brainstorming and Storyboards. Generally, students indicated that the storyboards were useful as a roadmap and even though they may have veered from them at times it still helped to provide cohesiveness during video production. The majority of the students indicated that they referenced their brainstorming sheets even while they were capturing video, others stated that they did not feel the brainstorming process was necessary since the brainstorming paper did not reflect their final video product but all indicated that the storyboards were important. Finally, one student stated, "The easiest part of the assignment was creating the storyboard. After creating the brainstorm document, I was able to go through the storyboard quite easily to produce a story line of my video."

Research Question 2

What are graduate students' perceptions regarding the ICSDR model for student authored video? Students' perceptions were collected through the post survey, personal reflections, and class discussions. Students were in favor of using a model for video development and would consider using the model with the K-12 learners that they teach (see Table 1). From their personal reflections students specifically indicated the model was beneficial. One student wrote, "The ICSDR model helped to make sure the story aspect of the video was apparent." Another student noted, "The ICSDR model helped me significantly because it created an outline for what was needed and required of the video as I followed through the steps, the storyboard and creation of the video came together much easier than expected. I feel like I made a video that others in my school could use."

Table 1.
Post Survey Perspectives after completing the student created video assignment

Questions	Yes	No	Maybe
Would you assign a one-minute video assignment for your K-12 or other students when you teach?	6		4
Would you use the ICSDR model for student created video for yourself?	10		
Would you use the ICSDR model for student created video with your K-12 or other students?	10		
Does your school have the technology for students to do a one-minute video project?	9		1
I learned something about making a one-minute video using the ICSDR model?	10		

Note: Students had the option of including additional comments for each question

Completion and Timing. Students initially indicated that they thought it might take 8 hours or less to complete the assignment from initial concept to final video and for the most part this estimation was accurate. Students reported that they completed the storyboard portion in 1 to 2 hours and they spent the rest of the time shooting the video, finding music or completing voiceovers, and editing the raw video and audio. Most students did not capture raw footage and edit the video on the same day. Instead, they organized their work over several days. Where initial edits may have taken hours, the final edits after the last round of peer reviews took from 15 minutes to an hour. Videos were required to be one minute or less. Some students felt that the one-minute restriction caused them more editing time then they initially anticipated. For 2 of the students they rationalized that if the video could have been any length (5-7 minutes) they would have less editing to do. All students indicated that they had a learning curve in regard to video editing so in the future it may take them less time to create a video.

Students' response varied as to whether they would assign creating a video to their own students, of the 20% of the 40% students that they might require a video assignment, indicated that the age and grade of their students would probably prohibit them from requiring a video assignment. However, if they had older peers to help they would consider it a viable assignment. While all would use the ICSDR model for their own creation of videos, most thought authoring a video took more time to do than they had in a day to devote to developing curriculum in their classroom.

Research Question 3

Did students consider the student created video a personalized learning experience and what did the students value in the assignment? All of the students indicated that student created video was a personalized learning experience as defined by The *National Education Technology Plan's* (NETP) (2010). The students indicated that student created video following the ICSDR model included key elements found in personalized learning such as autonomy in decisions, collaboration, student voice and choice, while incorporating various technologies for creation and feedback. Student choice, content and technical skills gained, and collaboration were the themes evidenced in the reflections and discussions related to personalized learning.

Student Choice. Pertaining to student choice, the students chose the content of the one-minute video, their audience. The content of their videos was designed for their own K-12 students or trainees. For instance, one teacher introduced Monet to her 4th grade students through a one-minute story while another student created video that introduced the math concept of greater than. She captured video at a local alligator farm so students could see the open mouths of the alligators. From the assignments inception, students chose the objective and the path to reach the objective. If students felt they needed more content or skills they chose the means to gain the knowledge they required. Students were not obligated to follow advice from their peers instead they could engage in a discussion and make their own choices. Collectively, the students chose deadlines for each stage of the model and how they were going to complete the assignment.

Academic Content and Technical Skills Gained. One surprising result of the study was that 40% of the students indicated that they learned more about the content as they were planning and developing the content for the video. Some attributed their new knowledge to researching more information to create a story that they told in the video. One person indicated that a peer reviewer asked her a question about her content that she did not know so in search of an answer she learned more about her topic. Twenty percent of those that did not learn new content stated that their lessons were at a basic level and they did not feel there was any room for them to learn new content.

Participants (80%), expressed that they learned a new technical skill as a result of editing the video and audio they recorded. Some indicated they watched a short screen captured type video to aid them in how to use the program. Two of the students noted that the videos they watched to learn a technical skill were over 6 and 9 minutes long respectively. Each learner expressed that they skipped through to the part they felt pertained to them. They concluded that shorter videos were better for their own learning. The videos they watched to learn the technical skills were not assigned; rather, they found the video on their own and even shared them with their classmates through an online shared space.

Collaboration. The students repeatedly valued the collaborative aspect of this model because they felt collaboration allowed them to create a better video than if they had been working alone. One student mentioned that initially she felt like her storyboards were detailed and were easy to follow. However, after the peer review she realized her storyboards would benefit from revision as they needed more detail to tell a complete story. Another student noted that she asked her junior high students to collaborate as she was developing her ideas since they were going to be the primary audience of the video. She felt that their collaboration made her video more relevant to their interests.

Discussion

Findings

The findings of the study include that these learners indicated that following the ICSDR model influenced the creation and production of their student authored video. Participants' responses revealed that ICSDR model was a useful framework for student created video. Students noted that the model fostered revision and collaboration that might not have happened if they did not follow the model. Students indicated that the instruments (e.g. brainstorming template and storyboards) within the model guided the digital video development process while still affording the creativity and developmental autonomy.

Students' perceptions regarding the ICSDR model related to beneficial collaboration, the actual timing to complete the assignment, and the pros and cons of following a model. Finally, the findings regarding student created video being a personalized learning assignment implied that student created video is a personalized learning activity. Students' noted because the activity was authentic, fostered student choice, provided outlets for collaboration and feedback that they were driven more to learn more to complete the video.

Limitations, and Implications of the Study. A potential limitation of the study was the sample size; meaning generalizability is limited. In light of this constraint, the study could be conducted again with a greater number of participants. Because the modality of the study happened in a hybrid setting the replicability of the study while possible may yield different results if conducted in a different type of classroom (e.g. hybrid, fully online, or fully face to face) (Blackmon, 2012). According to the students in this study, the creation of the video was aided by the ICSDR model but it is unknown if the viewers of the video would concur. A future study could include audience perceptions.

While this study did not specifically address the length of video students created, in the final reflections half of the students in this study felt that the required time limits (meaning the video they created were limited to one minute or less) hampered their ability to create the video they wanted to create. Their preferred video length would have been 5 to7 minutes even though

they noted that they themselves would probably not watch an assigned video that was that long. In follow up discussions, 80% of the students indicated that when assigned to watch a video over 5-7 minutes they tended to only watch parts of videos up to about 3 minutes in length which is similar to Martin and Martin (2015) findings. However, our participants stated that they do watch videos that are longer in length if they have a personal motivation to watch. Based on these unintended results, further investigation of ICSDR model relative to varying time constraints is warranted.

Conclusion

Based upon their own experiences as learners and their current role as teachers, the participants in the study, indicated that there is a need for framework or design model to scaffold student created video at every grade level through graduate school. In the students' opinion, based on their video creation experiences in this study, the ICSDR model facilitated the video creation processes to produce a concise video in comparison to other video development experiences of their own or when their students created videos. The participants attributed the quality of their video to their own quality control after review from their peers at several points through development of the video.

Germane to personalized learning and video creation, the student created or authored digital video assignment following the ICSDR model was perceived by the participants as a personalized learning activity. How the participants' created the video, the content of the video, the tools used for digital video creation reflected students' choices which motivated the students to produce a video that they would use again and again. Following the ICSDR video development model scaffolded the design process. The use of the ICSDR model in a personalized learning assignment was not considered a barrier or hindrance but was deemed a support to the digital video development process according to the participants. The reviews and discussions with peers after the storyboards were created, the pre and post editing of the plan prior to filming, and the peer review checkpoints throughout the creation of the digital videos were denoted as the most helpful aspects of the ICSDR model. The majority of the graduate teacher participants remarked that they would incorporate the ICSDR model in their own classrooms.

The study provides implications to the literature: (a) the importance of personalized learning assignments and (b) the usefulness of student authored or created digital video. Specifically, within the student authored or created digital video, research studies are limited especially related to their design and development. Student created video as a personalized learning activity merits more research with other populations and other context.

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Journal of the Scholarship of Teaching and Learning, Vol. 18, No. 1, January 2018, pp. 25-42.
doi: 10.14434/josotl.v18i1.21356

Embracing Service-learning Opportunities: Student Perceptions of Service-learning as an Aid to Effectively Learn Course Material

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Abstract: Educators are aware of the benefits of service-learning such as retention or application of course concepts. Students enrolled in courses with a service-learning assignment may not be aware of the benefits or may not view the assignment as beneficiary. This study examined student perceptions of service-learning to determine if students' perceptions matched educator perceptions in the literature. Overall, students make the connection between the assignment and course material. Results and themes are discussed.

Keywords: Service-learning, experiential learning, learning outcomes, communication

Service-learning provides students with a unique opportunity to learn outside of the traditional classroom by engaging with an organization or the community. Several studies have examined service-learning and discovered that service-learning enriches students' academic experience and learning (e.g. Conway, Amel, & Gerwien, 2009; Eppler, Ironsmith, Dingle, & Errickson, 2011; Flynn & Carter, 2016). For example, service-learning contributes to students meeting general education outcomes (Littlefield, Rick, & Currie-Mueller, 2016), applying and understanding course concepts to real world contexts (Britt, 2012; Whitney & Clayton, 2011), increasing students' multicultural skills (Blithe, 2016; Warren, 2012), and civic engagement (Ash & Carpenter, 2004; Brownell & Swaner, 2010), amongst other benefits. While researchers and educators are aware of the benefits of incorporating service-learning into the classroom, less is known whether students perceive service-learning as aiding in learning classroom material and course concepts.

Exploring student perceptions of service-learning provides educators and administrators with a holistic view of the benefits of service-learning. Each institution typically defines service-learning differently according to its needs (Brownell & Swaner, 2010); for the purposes of this study, Duncan and Kopperud's (2008) definition is used. Duncan and Kopperud defined service-learning as, "a learning method that upholds a commitment to appreciating the assets of and serving the needs of a community partner while enhancing student learning and academic rigor through the practice of intentional reflective thinking and responsible civic action" (p. 4).

The present study examined how students perceive service-learning, exploring whether students perceive service-learning to assist in the learning of course materials. The study explored student perceptions through self-reported reflections of undergraduates participating in an intercultural communication course at a mid-sized Midwestern university.

Service-learning

In its most basic definition, service-learning incorporates learning while an individual is serving others. Most scholars place John Dewey (1938) as the founder of the service-learning movement. His ideas and writings on learning via experience were influential in the development of service-learning and provide its theoretical foundation (Katula & Threnhauser, 1999; Meaney, Housman, Cavazos, and Wilcox, 2012).

Dewey's (1938) scholarship promoted experiential learning as imperative in a student's education and essential in contributing to democracy. For Dewey, the community served as an essential component of the education process because whatever a student learned in school should extend beyond the school walls to enrich the student's educational experience and improve the community (Waterman, 2013). Therefore in Dewey's view, learning by experience was indispensable to democratic society.

Dewey advocated for students to be active learners via experience. Because young students lacked the collection of experiences needed to understand the abstract ideas taught in the classroom, Dewey was concerned students were being taught without anything for the students to connect the ideas to (Caulfield & Woods, 2013; Katula & Threnhauser, 1999). Dewey (1938) feared students were moving through the education system as passive learners, where educators dictated information and knowledge to their students. Dewey (1938) argued for "cooperative enterprise, not dictation" (p. 72) and viewed the role of educator as facilitator where the educator helped shape a student's understanding of their experience while connecting it to learning. However, Dewey focused on younger students in elementary education and training citizens for American democracy, he was not concerned with other stages of the education system.

Kolb (1984) extended Dewey's work within higher education (Caulfield & Woods, 2013; Katula & Threnhauser, 1999). Credited with bringing experiential learning and service-learning to the forefront of education's attention (Caulfield & Woods, 2013; Meaney et al, 2012), Kolb's scholarship was rooted in his concern of the changing higher education landscape. For Kolb, the growing diversity of the population of higher education meant students were entering the higher education system without having the necessary experiences to prepare them for "traditional textbook approaches to learning" (Katula & Threnhauser, 1999, p. 242). Further, Kolb was troubled with the growing gap that existed between instruction and required job skills – a gap that could only be reduced by experience.

Whereas Dewey believed experience reinforced learning, Kolb (1984) argued learning begins with experience with knowledge being created via "transformation of experience" (p. 38). Kolb argued the combination of having the experience and transforming the experience is what contributes to learning. This transformation occurs via reflecting on the experience, conceptualizing it, and later testing the experience out by applying what was learned to similar experiences in the future (Katula & Threnhauser, 1999). For Kolb, service-learning allowed students to link experience to classroom concepts while enabling a community of knowledge to be developed.

Communication and Service-learning

Service-learning and communication courses are complementary to each other. Communication classes teach concepts that are applicable to students' lives outside of the classroom (Ahlfedt, 2009). Kahl (2010) argued in order for students to use communication effectively and to make a difference, service-learning must be included to provide students an opportunity to "engage in communication scholarship beyond the classroom" (p. 299). Communication courses that do incorporate service-learning provide students with a richer understanding of communication (Applegate & Morreale, 2006).

The benefits of incorporating service-learning into the communication classroom are plenty. Throughout the communication discipline, these benefits are well known and widely accepted (Oster-Aaland, Sellnow, Nelson, & Pearson, 2004); for example, students are able to link communication theory and concepts with practice (Ahlfedt, 2009; Soukup, 2006; Whitney & Clayton, 2011), become actively responsible for their learning (Brown, 2011; Hashemipour, 2006), or build community connections (Novek, 2009).

Studies reveal service-learning assists in students achieving the desired outcomes of a particular class (Ash & Carpenter, 2004; Lahman, 2012; Motely & Sturgill, 2013). For example, Littlefield et al. (2016) examined how service-learning contributed to students meeting general education outcomes in a communication general education course. The researchers discovered service-learning was related to increased student cognitive, behavioral, and communication competence – all components of general education outcomes – as put forth by the Liberal Education and America's Promise (LEAP) initiative.

Furthermore, meta-analyses reinforce the benefits of service-learning. In Novak, Markey, and Allen's (2007) meta-analysis of service-learning and cognitive outcomes, the findings across nine studies revealed service-learning maintained a positive relationship with student learning outcomes. Similarly, Warren (2012)'s conducted a follow up meta-analysis to Novak et al.'s study with twelve additional published and non-published studies. Warren's meta-analysis confirmed Novak et al's findings and revealed that service-learning did indeed contribute to a student's learning outcome.

The benefits of service-learning are not limited to the communication course. Service-learning benefits extend across disciplines and include benefits beyond the classroom, such as personal growth. For example, studies reveal that service-learning enhances a student's sense of social responsibility and civic engagement (Ash & Carpenter, 2004; Gleason & Violette, 2012; Oster-Aaland et al., 2004), learning (Brownell & Swaner, 2010; Hashemipour, 2006; Warren, 2012), and intercultural skills and multicultural awareness (Blithe, 2016; Einfeld & Collins, 2008; Simons & Cleary, 2006). In addition, Yorio and Ye (2012) determined service-learning to provide students with an increased positive understanding of social insights and more nuanced personal insights.

Service-learning has become a powerful tool for educators to promote student engagement in the classroom and in the community. While promoting this engagement, service-learning acts in a two-fold manner; in that, it can help students understand course materials more effectively by translating theoretical concepts into actual practice (Darby, Longmire-Avital, Chenault, & Haglund, 2013). Service-learning attempts to bridge the gap between the academic and non-academic world by encouraging students to use their knowledge and class concepts to solve real issues (Motley & Sturgill, 2013; Steimel, 2013; Quintanilla & Wahl, 2005). Though the benefits of service-learning are well known to educators and researchers, what remains

unknown is students' awareness of learning throughout a service-learning opportunity. Students may be unaware of their learning experience and may perceive their experience as contributing to or not contributing to their learning experience.

Diversity and Service-learning

Currently, the United States is experiencing an increase in diversity and a shift in cultural representation within the population. The education system is directly impacted by the growth of diversity with students experiencing different classroom climates and exposure to new cultural experiences. With this shift in population, service-learning grows even more salient in the college student's experience, as students interact with other individuals from cultures that are unlike their own during and after college. Furthermore, exposure to diverse scenarios aides in the learning and overall experiences of students (Loes, Pascarella, & Umbach, 2012). Students need to develop the skills that will allow them to navigate successfully across cultures (Blithe, 2016; Karakos et al., 2016). Service-learning encourages and provides an opportunity for students to develop needed skills, embrace diversity, and enhance their own personal development (Gullicks, 2006; Simons & Cleary, 2006; Simonds, Lippert, Hunt, Angell, & Moore, 2008).

Service-learning has been demonstrated to assist in multicultural awareness and enhancing a student's intercultural skills (Einfeld & Collins, 2008; Oster-Aaland et al., 2004; Warren, 2012). Utilizing service-learning in an intercultural communication course can be beneficial because students are able to apply service-learning intercultural course materials in real-world contexts involving people from diverse backgrounds. Service-learning provides a venue for students to practice and demonstrate skills that are taught via traditional classroom methods, such as lecture or textbook readings.

That service-learning helps in the retention of course material, achievement of learning outcomes, and the realization of multitudes of other benefits to students is unchallenged. However, further understanding of student perceptions of service-learning is warranted, therefore the following research question is proposed:

> RQ: Do students perceive through reflective observations that service-learning assists in their understanding of course content?

Method

Participants

Participants were drawn from an undergraduate intercultural communication class. Of the total population of 393 undergraduate students enrolled in three sections of the course, 382 participant responses were used for analysis, as 11 students did not complete the assignment. The same instructor taught all three sections of the course over a four-year period. Of the original 393 participants, 61% (241) were female and 39% (153) were male. The sample included 15.2% (60) freshman, 49.1% (193) sophomores, 23.6% (93) juniors, and 11.9% (48) seniors representing 46 academic majors. Majors included finance, animal range sciences, marketing, sociology, pre-

pharmacy, Spanish, natural resource management, electrical engineering, dietetics, communication majors and others. The research received IRB exempt status.

Service-learning Activity

Participants were assigned an experiential service-learning activity as a requirement of the course. The assignment required each student to provide 10 hours of service to a local community organization throughout the duration of the semester. Students were instructed to select organizations that they would be able to interact with other individuals from different cultural groups than their own. A cultural group in this assignment was defined broadly to include economic status, social status, ethnicity, education level, age, sex, sexual orientation or other identifying factors. Students having trouble in selecting an organization were given assistance in finding an organization.

The assignment required students to practice their intercultural communication skills while servicing the needs of their chosen community organization. To receive full credit for the assignment, students submitted a contract identifying a point person at the student's chosen organization and detailing scheduled hours that the student would work with the organization, a report during the middle of the semester, and a final service report once the assignment was completed. Students were required to schedule at least four sessions with their organization to establish a relationship with the organization.

Instrument

The instrument used in this study was developed as part of a larger project designed to measure student perceptions of a service-learning activity at a mid-sized university located in the Upper Plains. The instrument was a combination of a series of questions and student reflections. Students completed the instrument after finishing the service-learning assignment. The specific question used to provide data in the present study was: *"How did this service experience help you to better understand ideas or subjects we studied in class?"* The responses were usually one or more sentences in length.

Data Collection

Students turned in their final service report at the end of the semester for grading by the instructor. Prior to the beginning of the semester, students were informed that their responses would be retained as a part of ongoing assessment being completed for the institution. All names and identifiers were removed from the data and responses were numbered from 001 to 382. The authors identified the participants' numbers as the source of each sentence. A total of 1125 sentences were recorded in the data. Seven sentences were excluded from the data because of their illegibility or incongruity, bringing the total number of usable sentences to 1118. Similar to the broader project, respondents' sentence(s) were typed into a spreadsheet with one sentence per line entry. The participants' numbers (e.g., 001, 002 . . . 382) were used to identify each sentence, allowing participants to provide more than one sentence in the data set.

Coding

The authors created the initial codebook using an open-coding process (Saldaña, 2013) whereby the data were read several times to identify the nature of the responses provided. Four broad categories emerged: Perceptions about cognitive understanding; perceptions about behavior; perceptions about content matter and/or context for service-learning experience; and other perceptions. Within each of these categories, subcategories became identifiable: new perceptions about the general category topic, changed perceptions about the general category topic, and improved perceptions about the general category topic. A preliminary review of the data suggested to the researchers that these categories would provide for the coding of the data in such a way that the research question could be answered.

In consultation, the two authors determined the data could be coded initially to place the unit of analysis into one of the four general categories (e.g., 0 = no answer; 1 = cognitive understanding; 2 = behavioral understanding; 3 = content/context specific understanding; and 4 = other). Then, units of analysis would be coded for those who responded to determine the nature of the perception (e.g., 1 = new perception; 2 = changed perception; 3 = improved perception; 4 = other perception).

Two independent coders were trained using the codebook to conduct a preliminary coding of 38 randomly identified units of analysis, to establish inter-coder reliability. A Cohen's *kappa* was used as Cohen's *kappa* "prevents the inflation of reliability scores by correcting for chance agreement" (Hruschka et al., 2004). The initial coding produced results that were insufficient to establish inter-coder reliability, so authors and the coders reviewed the codebook and discussed areas where disagreement occurred. An additional 38 randomly identified units of analysis were isolated for a second round of testing. While the results improved, they were still insufficient to establish inter-coder reliability.

When inter-coder reliability is deemed unacceptable by the researchers, the codebook is discussed and modified. Coders then repeat the coding process with new data until acceptable inter-coder agreement is reached (MacQueen, McLelland, Kay, & Milstein, 1998; Miles, & Huberman, 1994). The authors reviewed and discussed the codebook, identifying two flaws: First, considering units of analysis separately (particularly when there may be more than one sentence from a participant) did not provide sufficient context to discern the meaning of the individual unit of analysis; and second, asking coders to determine levels of learning based upon the unit of analysis required too much interpretation. To address the first limitation, the unit of analysis changed from each individual sentence to all of the sentences provided by each individual participant. This enabled the coders to have a more complete understanding of the intent of the participant when responding to the question.

To address the second flaw, a new codebook was formulated. First, the unit of analysis was coded for content (e.g., 0 = no answer; 1 = cognitive outcome; 2 = behavioral outcome; 3 = both cognitive and behavioral outcomes; 4 = cannot determine outcome). If the content was coded as reflecting a cognitive outcome (1), the coders determined the valence of the comment (e.g., 0 = no answer; 1 = positive; 2 = negative; 3 = cannot determine valence). If the content was coded as reflecting a behavioral outcome (2), the coders determined the valence of the comment similarly to that which was described for coding the cognitive outcome. If the content was coded as reflecting both cognitive and behavioral outcomes (3), the coders determined the separate

valences of the comments for cognitive and behavioral outcomes (e.g., 0 = no answer; 1 = positive; 2 = negative; 3 = cannot determine valence of content). In addition, the authors added a category to determine if and where the "epiphany moment" of learning occurred for the participant (e.g., 0 = no answer, 1 = in the classroom; 2 = in the service-learning situation; 3 = cannot determine if or where epiphany moment occurred).

Using the revised codebook, the coders were given an additional 38 randomly identified units of analysis for a third round of testing. The authors used Landis and Koch's (1977) criteria and Neuendorf's (2002) criteria to judge for *kappa*. Landis and Koch note *kappa* above 0.70 is substantial and *kappa* above 0.81 is almost perfect. Similarly, Neuendorf notes *kappa* of 0.75 and above reflects excellent agreement beyond chance. The authors were satisfied with the results of Cohen's *kappa*, as provided in Table 1.

Table 1. New Code Book and Drift Test Cohen's Kappa

Category	New Code Book	Test for Drift
Identification of content	*k*=.72	*k*=.75
Valence of cognitive content	*k*=.88	*k*=.83
Valence of behavioral content	*k*=.74	*k*=.73
Context for epiphany moment	*k*=.88	*k*=.83

An additional 38 randomly identified units of analysis were isolated for a final comparison to test for drift. The complete data set was then divided between the two coders and all 374 revised units of analysis were coded. The test for drift produced satisfactory inter-coder reliability as noted in Table 1.

Data Analysis

Once the data were coded, each unit of analysis was grouped into one of the four categories (no answer, cognitive, behavioral, both cognitive and behavioral, cannot determine) and responses associated with each were analyzed. While the number of units of analysis was 382 participants, the authors removed an additional eight participant units of analysis who did not provide an answer for the question on the larger survey from which this study was a part, bringing the total participant units of analysis for this study to 374. The authors then reviewed the participants' responses and identified common themes to determine the nature of the perceptions identified.

Results

Descriptive Statistics

Table 2 provides the categorical breakdown of units of analysis into cognitive, behavioral, both cognitive and behavioral, and other. The results suggest that overwhelmingly, over 95% of the students recognized learning outcomes associated with the service-learning assignment. Table 2 also shows the valence associated with cognitive, behavioral, and both cognitive and behavioral

outcomes identified by the students. The data suggest students' recognition of cognitive outcomes is more positive than their recognition of behavioral outcomes.

Table 2. Categorical Placement and Valence of Data

Outcome	(+) Units	%	(-) Units	%	Valence Undeterminable	%	Total Units	%
Cognitive	210	.97	5	.02	.01	.01	216	.58
Both Cognitive and Behavioral							106	.28
Cognitive	102	.96	4	.04	-	-		
Behavioral	94	.89	6	.05	6	.05		
Behavioral	31	.86	4	.11	1	.03	36	.10
Undeterminable	-	-	-	-	-	-	16	.04
							N=374	100

Table 3 reports the location of the epiphany moment of learning. As expected, the service-learning context proved to be at the center of the service-learning experience for the vast majority of the participants.

Table 3. Context for Epiphany Moment of Learning (N=374)

Context	Units	%
Service-learning context	319	.85
Cannot determine location	41	.11
Classroom environment	14	.04

Emergent Themes

After the units of analysis were coded to identify the primary outcome, valence, and epiphany moment of learning, the data were sorted by groups of responses to gather exemplars to illustrate the nature of the comments provided by the participants. The following themes are grouped by primary outcome and valence. The original syntax of the respondents is used for authenticity and all participants have been given pseudonyms in this paper.

Positive Cognitive Themes

Participants provided comments suggesting what they learned and how they applied concepts presented in class to their service experiences. John referenced the overarching theoretical approach used in the course to familiarize students with different ways of studying and interacting with other cultures:

> *"I was able to look at my experience and learn from it through social science, interpretive, and critical perspectives."*

Peter identified specific terminology and concepts from class that helped to guide his communication at the service-learning site:

> *"I feel that it was a good way to apply the concepts that I learned in class and apply them to the way I was interacting with the people at [my site]. For example the men had low uncertainty avoidance... Their use of language was different than my usual situation... Facework was very important to the people at [my site]."*

Angela similarly recalled a specific topic from class that guided her role as a volunteer:

> *"Another concept that stuck out was the worldview concept. These residents within [my setting] had a completely different outlook on the world than I did. Here I am a privileged student trying to fit into this different type of culture."*

As these comments suggest, students identified positive cognitive outcomes serving as reference points that helped them navigate the service experience.

Positive Behavioral Themes

From a behavioral perspective, students provided examples of affected personal behaviors resulting from their service-learning experience. Alisha explained how she became more open to other people:

> *"Usually, I confine myself to campus. I do not adventure around very much and therefore do not meet any different people. Because of this class, I was able to meet a lot of interesting people from other countries. Also, I met with people of lower economic status than me. This gave me the perception of how different people from other countries and other status groups are. It also taught me that we are very similar as well."*

Tim found his particular communication with an elderly person helped him understand that his behavioral approach had an impact:

> *"I liked using the dialogical approach ideas. I worked a lot in the Alzheimer's unit and depending on the dialogue I used, the clients may or may not remember you. I worked with one gentleman who was an absolutely hilarious person to talk with and after spending an entire afternoon with him, I came back the next day and he remembered who I was. I felt like I had actually made an impact."*

These examples are reflective of the comments made by students who acknowledged behavioral outcomes stemming from the service-learning experience.

Negative Cognitive Themes

While the vast majority of the comments were positive, there were students who shared that the experience had not increased their level of understanding. Typically, comments indicating that little was learned were without warrants. For example, Tom remarked:

> *"[The service experience] didn't really help me better understand anything from class";*

and Emily added:

> *"I don't think [the service experience] helped in a specific way to understand a theoretical concept. But it did help me to understand about cultural communication."*

Negative Behavioral Themes

Similarly, the few comments suggesting a negative effect on behavioral outcomes were focused more on the experience itself. For example, one agency did not have the student volunteer working directly with clients, prompting Rob to remark:

> *"Since I did not have opportunities to communicate with people, I could not learn through experience which was disappointing since that is what I was hoping to do. I could imagine how they were going through minority development or how their words, actions, implications, and gestures may be different from mine but I never had a chance to test it."*

A few other students who were placed into experiences that were unfamiliar to them also experienced some discomfort, as Jill confessed:

> *"Well for me power was hard to adjust to. The people I was working with were all older than me. I never really had any grandparents so it was hard for me to talk with them. I had the power while volunteering and I never thought I would. It was a little uncomfortable at times."*

With regard to cognitive and behavioral outcomes, both positive and negative comments were identified. However, the vast majority (see Table 2) of the students acknowledged either cognitive or behavioral (or both) positive outcomes suggesting that the service experience enhanced their classroom learning. Jane explained:

> *"Since this class allowed us to get out and actually interact with other cultures instead of just learning about it from a book, it really gave light to what goes on. Because you can sit in a classroom all day and learn about power, the contact theory, marginalized people, and so forth. But if you don't get out there in the world and put yourself into these positions, you wouldn't be putting what you learned to use and wouldn't be helping other people realize that getting to know another culture really isn't as hard as it may seem."*

Tony echoed this positive assessment:

> *"This experience helped me better understand ideas in class because it actually put me in the shoes of what the concept pertains to. For instance, a person can just sit in class and listen to a lecture about communication topics, but if field experience is also added, professors are bringing the classroom to an actual setting and making their concepts come alive. Many concepts were understood better, especially the saying I have said before: 'Communication patterns and skills depend on the context.'"*

Context for Epiphany Moment

To further clarify the role of the service-learning experience, students revealed the context of their epiphany moment of learning. While some of the students acknowledged the classroom as the place where they best understood the course concepts, most of the students identified the service-learning context as the place where they actually learned the course material (see Table 3).

Classroom Setting

Just over 10% of the students pointed to the classroom as the place where their understanding of the course material occurred. For example, Janelle offered:

> *"I don't think I will ever forget the talk we had about certain people holding power for reasons that we really don't control. It's helpful and I will think back to that discussion many times in the future I believe."*

David noted what perhaps may have been an experiential classroom experience as the source of his understanding:

> *"I feel like the guest speaker recently who talked of his struggles in moving here to America as a refugee really gave me more insight to some of the situations the clients at the shelter have. He was a very powerful and wealthy man in Africa but when he came to America he just had a small apartment with little to fill it. It made me think about how some of the clients probably had higher degrees in school than I do and just fell upon hard times. This made me feel like I could relate to them better."*

Sally perhaps summarized those who acknowledged the classroom as the context for their epiphany moment:

> *"Most of the ideas became clear in class."*

Service-learning Setting

The greater percentage of students recognized how the context of their service experience was instrumental in helping them to understand. Judy was straightforward in her comment:

> *"This experience taught me how important it is to interact with people from other cultures. Obviously this is stressed in our text, but I still was not able to grasp the concept until I stepped out of my comfort zone and participated in this service-learning activity."*

Mark was specific about his application of course concepts in the service setting and how that helped him to understand:

> *"Working at [my site] helped me to take concepts that we were studying in class and use them in real-life setting. Being able to use things we learned in the classroom and apply them in a work-type of setting was very satisfying. For example, we talked a lot about the importance of non-verbal communication in class and how it can differ across cultural groups. I never realized the significance of this until I worked at [my site] because I tried to express friendly facial expressions towards other cultural groups, but these individuals came across as very rude to me at first. Eventually, I remembered that even though this type of behavior seemed rude to me, it is probably a very common cultural norm for people of that ethnicity and that they don't mean anything bad by it."*

Some students even recognized and applied the critical perspective gained in their service context, as Kelly revealed:

> *"If anything, I recognized my place in the dominant culture just by the fact that I was able to offer volunteer hours to an organization that offers its services to people who are, in some cases, desperately in need of help . . . . [T]his experience helped me to see my privileged position in our culture. In this sense I was more deeply able to appreciate the privilege-disadvantage dialectic that we studied throughout the text."*

Discussion

This study provided some insight into whether students perceive service-learning to be beneficial in understanding course content. Using both a descriptive and interpretive lens, this study identified that the vast majority of students in the sample recognize both cognitive and behavioral outcomes associated with positive evaluations of their experiences. These results are encouraging to educators and the findings provide further reinforcement in support of work suggesting that service-learning helps students apply course concepts to contexts (e.g. Britt, 2012; Darby et al., 2013; Whitney & Clayton, 2011).

However, perhaps most pertinent to the classroom environment was the role the service context played in the creation of the epiphany moments of learning. Student reflections provide support for where Kolb (1984) identified learning to begin. Based upon student reflections, it was in the service context where most students found that they experienced real learning. Phrases reflecting this attribution were repeated throughout the data. Students wrote that the service-

learning experience . . . "helped me learn," "reinforced everything that was learned in class," "helped me experience first-hand," "helped me realize," and "helped me better understand."

These reflections reveal when students are able to determine and recognize moments of learning, students are able to apply the concepts taught in a traditional setting via the service-learning experience. In a traditional setting, students may find it difficult to connect a topic or subject to a non-classroom scenario. Students that reflected epiphany moments, recognized exact moments of learning or acknowledged the context in which their learning occurred through applied knowledge. These students may be able to retain knowledge in the long-term because of application and identifying their epiphany moments.

While our hunch was strong that students do make connections between the service-learning experience and the course content, the data provided a more robust identification of the nature of those perceptions as being positive. The responses included in the data set provided insight to the value of experiential learning for students. Service-learning can be a powerful tool for communication educators to employ during a course when the experience aligns with course content, and objectives (see Ahlfedt, 2009; Britt, 2012). This study suggested students are on the same page with educators in recognizing the benefit of service-learning. However, the presence of a few comments suggesting that the setting was not conducive to positive interaction underscores the need for communication educators to make sure that the service-learning contexts will provide for meaningful communication between the student volunteer and the people who are served.

Conclusion

This study explored the intersection of service-learning in communication courses and student perceptions of experiential learning. While we know that service-learning enhances the overall university experience for many students, being able to identify more specifically how students reflect upon the experience adds insight into future academic planning and course development. Perhaps Patricia put it best when she reflected:

> *"The service experience helped me better comprehend ideas we studied in class because I actually got to practice what we learned. In most classes, students sit in lectures and are given exams on certain strategies, techniques, and more, but never get to practice what they have learned. By backing up the lectures and classroom activities with real life experiences, the lessons were brought to life."*

The limitations of the present study provide opportunity for future research. Initially, while the data revealed that students overwhelmingly agree that service-learning experiences help them to better understand the course materials, discerning their level of learning proved problematic. For example, did the experience teach something new to the student or did the experience reinforce something that the student already knew. Future research could reveal how the experience contributed to learning, providing useful information for future educators as they develop their course materials and exercises.

Another aspect of understanding course materials is the acquisition of vocabulary and terminology associated with the service-learning experience. This is especially the case in the

area of intercultural communication where students are presented with specific, cultural terms to help them understand and analyze their own cultural communication practices. One related aspect of the larger study was to determine the use of specific terminology from the course in the student responses to the questions on the survey. There was some indication that a large number of the students responded to the question probe using course-specific terminology. Future research could more specifically explore the acquisition and usage of course terminology as a demonstration of applied learning in the service context. This could be accomplished by first examining language and terminology used in the mid-semester reports versus the final reports. Our hypothesis would be that reports would reflect more specific terms following the introduction of specific terms following the formal introduction of vocabulary when presenting intercultural theories and principles.

Overall, this study provided further support for Littlefield et al.'s (2016) earlier work, suggesting that service-learning meets general education outcomes. As our findings suggest, students do perceive the service experience as an enhancement to their understanding of course material. Thus, incorporating service-learning into our communication courses should provide additional ways to reach students and contribute to their overall education.

Acknowledgements

The authors acknowledge the contributions of Amy Duchsherer and Jade Monroe, graduate students in the Department of Communication at North Dakota State University, who coded the data for this study.

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Journal of the Scholarship of Teaching and Learning, Vol. 18, No. 1, January 2018, pp. 43-57.
doi: 10.14434/josotl.v18i1.21427

A Culture of Extrinsically Motivated Students: Chemistry

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Recent research indicates that students are adopting a consumerist approach to education, while data shows that the best academic outcomes are associated with intrinsic motivation. The goal of the study was to explore student academic motivation in an undergraduate Principles of Chemistry I class. The study targeted 432 students enrolled in 9 sections of the class over two semesters at a mid-sized, public four year university. Student academic motivation was measured using the adapted Academic Motivation Scale (AMS). A total of 311 students returned the survey (response rate = 72 %). The results indicated that students enrolled in Chemistry I classes were extrinsically motivated more than intrinsically motivated. The types of extrinsic motivation identified by students were the least autonomous ones, such as external and introjected regulation.

Keywords: self-determination theory, academic motivation scale, chemistry course.

Introduction

A significant number of scholarly reports on student motivation comes from the college classroom environment and indicates that student motivation is vital for success at the university level (Astin, 1984; Howey, 1999; Pintrich, 1988a, 1988b; Ryan et al., 1985). Student motivation has been shown to be a determinant of academic performance and achievement (Pintrich, 2004) with motivated students having better class attendance (Moore et al., 2008) and course grades (Wilson and Wilson, 2007), including a higher first-year academic performance (Allen et al. 2007).

Historically, psychologists have viewed motivation as a unitary concept—one that differs in amount rather than type. In contrast, Self Determination Theory (SDT) (Deci and Ryan, 2008) considers motivation to be a differentiated concept that differs in type and exists along an underlying continuum of autonomy (Ryan & Deci, 2000): amotivation (AM), extrinsic motivation (EM) and intrinsic motivation (IM). The Academic Motivation Scale (AMS; Figure 1) (Vallerand et al., 1992), a well-tested metric for exploring academic motivation within the SDT perspective, further subdivides IM and EM into three subscales each.

With *amotivation*, the person perceives (1) a lack of contingency between behavior and the attainment of desired outcomes and/or (2) a lack of ability to perform the behavior that is necessary to attain desired outcomes. As a result, the person experiences passivity and an absence of autonomy.

With *extrinsic motivation*, the person does an activity, because it leads to a separable outcome or consequence, such as obtaining a reward or avoiding a punishment. SDT specifies three types of extrinsic motivation that vary in the degree to which they are internalized into the self and, therefore, autonomous. The least internalized type of extrinsic motivation is external regulation (EM-External Regulation; EM-ER), in which the person is motivated by the salience of external rewards or punishments. The next type of extrinsic motivation is introjected regulation (EM-Introjected Regulation; EM-IN), in which the person is motivated by the salience of internal rewards (e.g., pride) or punishments (e.g., guilt). Both external regulation and introjected regulation are experienced as relatively controlled forms of extrinsic motivation. As the process of internalization proceeds, the next type of extrinsic motivation is identified regulation (EM-Identified Regulation, EM-IN), in which the person is motivated by the value and/or importance of the activity. Identified regulation is the most internalized type of extrinsic motivation in the AMS.

With *intrinsic motivation*, the person does an activity because it is inherently satisfying and enjoyable. That is, there are no separable outcomes or contingencies that initiate and maintain the behavior; rather, intrinsically motivated behaviors occur spontaneously and are accompanied by experiences of interest, excitement, and enjoyment. Intrinsic motivation (along with well- internalized forms of extrinsic motivation; viz., identified regulation) is the prototype of autonomous, self-determined behavior. The three types of intrinsic motivation are intrinsic motivation to know (IM-To Know; IM-TK), intrinsic motivation toward accomplishments (IM- To Accomplish; IM-TA), and intrinsic motivation to experience stimulation (IM-Stimulation; IM- ST). IM-To Know is seen when an individual engages in a behavior for the satisfaction experienced while learning or trying to understand something new. IM-To Accomplish occurs when an individual engages in a behavior for the pleasure experienced while trying to accomplish a task or create something. IM-Stimulation transpires when an individual engages in a behavior in order to experience stimulating or exciting sensations.

More recently SDT studies have found that there is less distinction between intrinsic and extrinsic types of motivation and more of a sliding scale between behaviors that are more

autonomous and intrinsically motivated versus behaviors that are less autonomous and extrinsically motivated (Ryan & Deci, 2000).

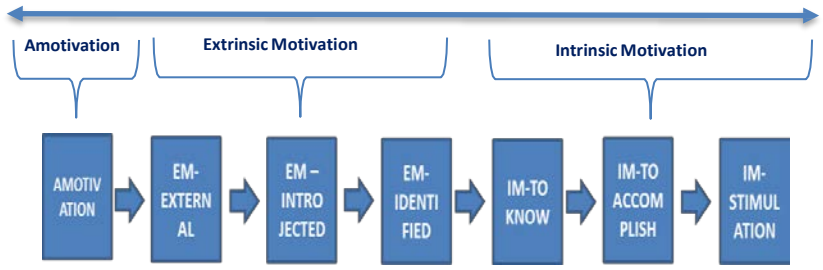

Figure 1: Academic Motivation Scale (AMS)

In the literature, the relationship between motivation type and academic achievement is inconsistent. Some researchers indicated intrinsic motivation is most important to academic success (Deci & Ryan 2000), while others supported the importance of extrinsic types of motivation (Eliot and Moller, 2004). Both intrinsic and the more autonomous extrinsic types of motivation were linked to positive academic outcomes (Pintrich and De Groot, 1990). IM and EM-Identified Regulation types corresponded positively with GPA, while AM corresponded negatively with GPA (Erten, 2014). Intrinsic motivation was also associated with lower dropout rates, withdrawal rates, rates of absenteeism, levels of anxiety about school, and higher levels of academic performance (Prospero and Vohra-Gupta, 2007). Self-regulation was linked to psychological well-being, while intrinsic motivation was also linked to psychological well-being that was dependent on academic performance (Burton et al., 2006) and higher perceived competence and lower anxiety about course material (Black and Deci, 2000). Studies in Sweden showed IM to be the only motivation type to be associated with positive academic success over a one year period (Taylor et al., 2014).

Gender differences are observed in student motivation, but the evidence seems contradictory. Arrogul, 2009 and Cockley et al., 2001 reported no significant differences between males and females; others indicated that females exhibited higher levels of IM and EM, while males exhibited higher levels of AM (Köseoğlu, 2013, Vallerand, 1992). Yet other studies showed that undergraduate male students exhibited higher levels of EM and IM than females, and females showed higher levels of AM (Hakan and Münire, 2014). In a sample of exercise physiology students in the US, higher levels of IM were related to higher levels of male class performance compared to females (Cortright, 2013). For college in general, females tended to have higher levels of both IM and EM. (Brouse et al., 2010).

The enjoyment of learning was shown to motivate students in some disciplines such as computer science, history, biology, and geology, but not necessarily in others (Breen and Lindsay, 2002). Several studies conducted at our institution used the SDT framework to examine student motivation in nutrition, physics, and human anatomy (HAP) classes (Maurer et al., 2012, 2013). In these three disciplines, both IM and EM were rated higher than amotivation. Differences between majors were observed; nutrition majors exhibited IM, while HAP and physics students exhibited EM (Maurer et al., 2012, 2013). In addition, students who have taken more courses in their chosen major were found to be more intrinsically motivated (Maurer et al., 2013). More recent studies showed that often students are attending college for future rewards, or out of expectation, or obligation. They are most interested in earning a high grade needed for accomplishing a career goal (Labaree, 1997; Pintrich and De Groot, 1990) indicating a more consumerist approach to education.

Student perceptions of science courses seem to play an important role in academic motivation. A study of nursing students demonstrated that courses deemed to be difficult contributed to low motivation in students (Nilsson and Stomberg, 2008). Other studies indicated that science, technology, engineering, or mathematics (STEM) courses have a high attrition rate in the first two years (Chang et al. 2008), and student performance in introductory courses influences whether they decide to stay with a STEM major (Seymour and Hewitt, 1997).

There are some studies on motivational shifts in chemistry students, but very few which address motivation types in chemistry students. Faculty expectations of students to be motivated to learn chemistry tended to be high at the beginning of the semester (Lammers and Smith, 2008), but student attitudes as measured in a Swedish study shifted toward less motivated behavior over the semester (Berg, 2005). This seems to mirror studies that reported a decline in student motivation over time (Brouse et al., 2011; Hakan and Münire 2014), including students enrolled in chemistry courses (Zusho et al., 2003).

High school chemistry students in Greece exhibited low motivation to learn chemistry (Salta and Koulougliotis, 2015), while organic chemistry students who came to class with self- regulation or who were guided in the process of developing self-regulation, performed better in the course (Black and Deci, 2000).

The emerging field of Discipline Based Education Research (DBER) is changing the approach of educational researchers to the topic of learning in the chemistry classroom. The National Research Council (NRC) cited the DBER report *(*2012) in which it noted that studies on students' dispositions and motivations towards science and engineering are sparse and that future development of this field of study is important. Our study on student academic motivation in chemistry will add needed data to this growing field.

Research Questions

The study targeted students at a mid-sized public university in Principles of Chemistry I, since it is the first chemistry course taken by science majors including chemistry, biology, geology, physics, and exercise science. While approximately 50%, students take the course in their freshman year of college the rest of the students are distributed at the sophomore, junior, and even senior levels (See Table 1). Typical rates of successful completion of the course, as evidenced by a grade of "C" or higher, are around 75 %.

Most students taking the two semester chemistry sequence start in the fall semester and are therefore considered to be on-sequence, while students who take the first course in the spring are considered off-sequence. There are many reasons students might be in an off-sequence course. Some have enrolled in the fall, but then withdraw from the course; some have completed it unsuccessfully in the fall; and some have taken time off between semesters for other reasons. Researchers noted a difference in student performance in classes considered off-sequence (Smith et al., 2015). Studies of curricular changes in physics at Colorado University Boulder systematically reported a 3.5 % fall-spring test score difference that was attributed to the differences between on- and off-sequence semesters (Pollock et al., 2007).

The research questions examined in this exploratory study are:

1) Is the adapted AMS a reliable instrument for measuring student motivation in chemistry?

2) What types of motivation do students exhibit in Principles of Chemistry I?

3) Are motivation types different between males and females and in underrepresented minority (URM) groups?
4) Are there differences in motivation types between on-sequence and off-sequence students?

Methods

The survey was administered at the beginning of the semester in both Fall 2013 on-sequence and Spring 2014 off-sequence to Principles of Chemistry I students (see Appendix 1). Institutional Review Board (IRB) approval was obtained before conducting the study. No identifying information was collected, and no incentives were given for participation.

Participants

The participants for the study were 77 undergraduate students enrolled in two sections of Principles of Chemistry I in Fall of 2013, and 234 undergraduate students enrolled in seven sections of Principles of Chemistry I in Spring of 2014. The majority of participants (89%, n = 209) noted that the course was required for their major. The demographic distribution of gender, ethnicity, class standing, major, GPA, attendance, time spent studying, and expectations from class are found in Table 1. Allied health majors include exercise science, athletic training, health education and promotion, nutrition and food science students.

Instrumentation

A non-manipulative, exploratory design with a convenience sample was employed. The participants used the first 15 minutes of class time to complete the paper survey. The 41-item survey consisted of 13 demographic questions which included gender, ethnicity, class standing, major (2 items), attendance (2 items), GPA, study habits, and expectations (4 items) along with 28 Likert-scale items adapted from the Academic Motivation Scale (AMS; Vallerand et al., 1992).

The internal consistency is a measure of how well items within a scale describe the same construct (Henson, 2001). Cronbach's alpha (α) is a measure of internal consistency, and literature supports that values greater than 0.70 indicate moderate internal consistency in the measure of classroom rating scales (Murphy and Davidshofer, 2005). The original AMS, constructed of seven subscales, demonstrated the following reliabilities: [AM (a = .85), EM-ER (a = .83), EM-IN (a = .84), EM-IR (a = .62), IM-ST (a = .86), IM-TA (a = .85), and IM-TK (a = .84)] of four items each (Vallerand et al, 1992). See the Results and Discussion section for the reliabilities of the adapted AMS.

Table 1: Participant Demographics Fall 2013 and Spring 2014

	Fall 2013 Participants N = 77	Spring 2014 Participants N = 234
Gender	Male (42%) , Female (58%)	Male (41%) , Female (59%)
Ethnicity	White (66%), African American (22%), Hispanic (5%), Asian (3%), Other (3%)	White (65 %), African American (29 %), Hispanic (2%), Asian (0.4%), Other (1.7%)
Class Standing	Freshman (57%), Sophomore (17%), Junior (14%), Senior (10%)	Freshman (50%), Sophomore (25%), Junior (18 %), Senior (5%)
Major	Biology (22 %), Allied Health (40 %), Chemistry (20 %), Engineering (4 %), Physics (0 %), Other (14 %)	Biology (37%), Allied Health (30%), Chemistry (9%), Engineering (2.6%), Physics (0.9%), Nursing (2%), Other (19%)
Self-reported GPA	<2.00 (1.3%), 2.00 – 2.49 (7.8%), 2.50 – 2.99 (14.3%), 3.00 – 3.49 (32.5%), 3.50 – 4.00 (41.6%)	<2.00 (7.3%), 2.00 – 2.49 (12.4%), 2.50 – 2.99 (23.6%), 3.00 – 3.49 (30%), 3.50 – 4.00 (26.6%)
Frequency of Attendance	Hardly ever (0%), Sometimes (1.3%), Most times (6.5%), Almost every time (15.6%), Every time (76.6%)	Hardly ever (0.4%), Sometimes (1.3%), Most times (7.7%), Almost every time (32.5%), Every time (58.1%)
Self-Reported Hours of Studying per Week	< 1 hour (10.4%), 1 – 3 hours (48.1%), 3 – 6 hours (32.5%), 6 – 9 hours (7.8%), > 9 hours (0%)	< 1 hour (11.1%), 1 – 3 hours (59.2%), 3 – 6 hours (21.5%), 6 – 9 hours (6.9%), > 9 hours (1.3%)
Expectations of Class Difficulty in Comparison to Other Classes	I expect it to be much less difficult (10.4%), I expect it to be somewhat less difficult (13.0%), I expect it to be of the same difficulty (24.7%), I expect it to be somewhat more difficult (36.4%), I expect it to be much more difficult (15.6%)	I expect it to be much less difficult (4.3%), I expect it to be somewhat less difficult (15.8%), I expect it to be of the same difficulty (22.2%), I expect it to be somewhat more difficult (40.2%), I expect it to be much more difficult (17.5%)

Results and Discussion

The adapted AMS was tested for reliability for use with undergraduate chemistry students. Predominant motivation types were determined and demographic information was collected. Analyses were conducted on the seven subscales of the AMS to determine adequate reliability for use with the current sample. Additionally, descriptive statistics and frequency of endorsement were used to evaluate the demographic characteristics and motivation trends

across the participants. Nonparametric statistics were used to determine the difference between off- sequence and on-sequence students. Finally, ANOVA statistics were used to determine differences in motivation patterns within demographic subgroups of the sample.

Adapted AMS a reliable instrument for measuring student motivation in chemistry

It was found that the adapted AMS subscales are all highly reliable for use with the current undergraduate chemistry sample. See Table 2 for means and standard deviations. The reliabilities of the subscales for Spring 2014 are as follows: (IM-TK; *a* = .93), (IM-TA; *a* = .86), (IM-ST; *a* = .91), (EM-ID, *a* = .82), (EM-IN; *a* = .85), (EM-ER; *a* = .85), AM (*a* = .84). These results are comparable to results from Fall 2013 reliability analyses [(IM-TK; *a* = .93), (IM-TA; *a* = .86), (IM-ST; *a* = .92), (EM-ID, *a* = .80), (EM-IN; *a* = .87), (EM-ER; *a* = .85), AM (*a* = .82)].

Table 2: Psychometric Properties by Semester.

	a	*M*	*SD*	*Ranked Frequency of Endorsement*
Fall 2013				
IM-TK	.93	3.67	1.85	5
IM-TA	.86	3.96	1.86	4
IM-ST	.92	3.26	1.60	6
EM-ID	.80	5.50	1.67	**2**
EM-IN	.87	4.94	1.93	**3**
EM-ER	.85	5.70	1.86	**1**
AM	.82	1.93	1.86	7
Spring 2014				
IM-TK	.93	3.69	1.92	5
IM-TA	.86	3.97	1.96	4
IM-ST	.91	2.92	1.75	6
EM-ID	.82	4.96	1.95	**3**
EM-IN	.85	5.51	1.78	**1**
EM-ER	.85	5.51	1.78	**1**
AM	.84	1.93	1.51	7

Types of motivation exhibited by students in Principles of Chemistry I

With regard to motivation characteristics across the participants, descriptive statistics revealed that undergraduate chemistry students are largely extrinsic in their academic motivation with 136 participants (58%) showing the highest endorsement for EM-ER. Only 11 (3.5 %) intrinsic motivation types were found out of all 311 participants. The lowest

frequency of endorsement was related to IM-ST with 1 participant (0.4%). Other categories included IM-TK (n = 7, 2.5%), IM-TA (n = 3, 1.1%), EM- ID (n = 36, 12.8%), EM-IN (n = 38, 13.5%), and AM (n = 11, 3.9%). See Table 3. With regard to gender differences across the sample, females (M = 5.05, SD = 1.61) are significantly more likely to identify with the introjected form of extrinsic motivation (EM-IN) than males (M = 4.28, SD = 1.74), $F(228) = 12.20$, $p = .001$. Additionally, it was demonstrated that African American students (M = 3.00, SD = 1.70) are significantly more likely to identify with the stimulation form of intrinsic motivation (IM-ST) than White students (M = 2.77, SD = 1.40), $F(223) = 2.78$, $p = .02$. Shapiro Wilks test demonstrated the normal distribution of data ($\alpha = .32$).

Several studies were conducted using the SDT framework to examine student motivation, adapted the AMS to specific courses such as nutrition, physics, and human anatomy and physiology (HAP, Maurer, Allen, Gatch, Shankar & Author, 2012, 2013). In these three disciplines, the AMS proved to have high reliabilities that were consistent with AMS reliabilities in higher education generally (Vallerand et al, 1992), which supports our findings for the adapted AMS for chemistry.

Different types of motivation exhibited between genders and in URM

Table 3: Important characteristics of motivation in females, males, and URM chemistry students from the Spring 2014 study based on descriptive statistics.

	Motivation trends in the Principles of Chemistry Students (Spring 2014)						
	Intrinsic Motivation			**Extrinsic Motivation**			**Amotivation**
Freq. of Highest Endorse-ment	IM-TK n/%	IM-TA n/%	IM-ST n/%	EM-ID n/%	EM-IN n/%	EM-ER n/%	n/ %
Females	5 3.68%	2 1.47%	0 0%	17 12.50%	30 22.06%	76 55.88%	6 4.40%
Males	1 1.04%	1 1.04%	2 2.08%	19 19.79%	9 9.38%	59 61.46%	5 5.21%
URM	4 5.13%	0 0%	1 1.28%	14 17.95%	19 24.36%	36 46.15%	4 5.13%

Table 3 offers a descriptive look at frequency of endorsement across gender and URM demographics. As with the overall sample, the data across these categories clearly indicate that the vast majority of students identified most closely with EM-ER, with greater than 50% of both genders and approximately 46% of URM rating these items the highest. Additionally, greater than 90% of females and males rated their own behaviors as aligning with the three types of extrinsic motivation (EM-ER, EM-IN and EM-ID). With regard to URM, over 93% of students self- reported identification with the aforementioned extrinsic

motivation types. Conversely, approximately 5% of females, 4% of males and 6% of all URM students reported intrinsic styles of motivation (IM-TK, IM-TA and IM-ST).

While African American students identified more often as IM-Stimulation than their White peers, the overall representation of African Americans in the sample was much lower. Therefore, it is not possible to determine if African American students are more intrinsically motivated or if those students who are intrinsically motivated are attracted to pursuing science majors more frequently than their white peers. There were slight gender differences, with women reporting more intrinsic motivation than men. The results were similar to what was reported in the literature (Salta and Koulougliotis, 2015) as IM was shown to predict academic success for women, while EM-ER tended to be a stronger predictor of success for men (Vecchione et al., 2014).

Differences in motivation types between on-sequence and off-sequence students

The larger cohort of participants was enrolled in Spring 2014 (234) as compared to Fall 2013 (77). As seen in Table 1, there are some differences in the two groups between self-reported GPA, frequency of attendance, and self-reported hours spent studying. It is possible that these demographic indicators reflect the differences between the on-sequence and off-sequence cohorts.[6] In order to determine the representativeness of the sample with regard to motivation characteristics, a sample of 77 participants from Spring 2014 were randomly selected for comparison to the sample of 77 chemistry students from Fall 2013. Nonparametric tests (Mann- Whitney U) determined that there was no significant difference across the groups in their endorsement of items on any subscale. The nonparametric test was chosen due to the large sample size differences between the Fall 2013 and Spring 2014 participants. The indication that there is no difference in motivation types between on-sequence and off-sequence students, contradicts some previous research findings (Smith et al., 2015; Pollock et al., 2007). Whether these differences may be population related or subject related may warrant additional studies.

Implications and Future Directions

The instrument used in the study was the adapted AMS for chemistry that evaluates academic motivation from within the SDT framework. The adapted AMS had high reliabilities and chemistry instructors at other institutions can use this instrument to determine student motivation types in their own classrooms and potentially adjust instructional practices to improve student learning.

This study added to the paucity of research on academic motivation in college chemistry students (Lammers and Smith, 2008; Berg, 2005) and revealed a predominantly extrinsic motivation type in chemistry classes. These findings support previous research that indicate a shift towards extrinsic motivation (Labaree, 1997; Pintrich and DeGroot, 1990) which seem to span across different subjects and populations. Future research should target chemistry students in advanced chemistry classes, as there seems to be a difference in academic motivation in students who are already taking classes in their major of choice (Maurer et al, 2013).

The findings of this study did not show significant differences in academic motivation between genders, in URM and on-and off-sequence students, adding to the contradictory nature of findings in these populations. Perhaps future studies should target larger samples of these populations (across multiple institutions and/or in longitudinal studies) to elicit differences, if any. In addition, the survey data set was collected at the

beginning of the semester and did not examine potential changes in motivation over the course of the semester.

Some research in the education domain (Niemiec & Ryan, 2009; Black and Deci, 2000; Niemiec et al., 2006) indicated that a shift towards more autonomous forms of motivation is possible if instructors provide support for their students' basic psychological needs, such as autonomy, which is the ability to take charge of one's own learning (Holec, 1981). Studies targeting student academic motivation showed that when students experienced autonomous supportive instructors, they demonstrated an increase in autonomous self-regulation, perceived competence, and interest/ enjoyment of the course (Black and Deci, 2000). This can be done by providing choices and meaningful rationales around learning activities to include peer-led supplemental instruction, one on one student interaction, extra office hours, academic success center led programs, and residential peer programs among others. Educators can also act as a mediator by acknowledging students' feelings and minimizing pressure and control around learning activities (Niemiec & Ryan, 2009). Given the largely extrinsic types of motivation in chemistry students, as evidenced by this study, instructors may want to consider utilizing teaching practices that can affect the shift towards more successful autonomous motivation.

Our future goal is to use the background data on motivation in chemistry students and incorporate need support training by peer leaders in our classrooms. Both correlational (Niemiec et al., 2006) and experimental (Deci et. al., 1994) studies have shown that autonomous motivation is facilitated by provision of need support (Deci et al, 1999). Strategies that are associated with need support include (1) relating from the student's perspective; (2) encouraging self-initiation and choice; (3) providing a clear rationale for requested behavior; (4) minimizing use of controlling language; (5) being positive that the student can succeed; (6) creating optimal challenges; (7) giving accurate, effectance-relevant feedback; and (8) developing a warm, empathic, non-judgmental relationship with the student (Williams et al., 2011). We plan to provide need support training of peer leaders based on SDT and incorporate peer led sessions into regular class time. This would allow students who are otherwise unable to attend sessions outside regular class time to benefit from peer leaders.

Moreover, the DBER report (2012) pointed out that few studies explore how learning and responses to different instructional strategies vary by student characteristics such as gender, socio- economic status, and ethnicity. Future studies should focus more on the effects of different teaching strategies in different populations.

Research findings are limited by the fact that the data set was collected at one institution in the southeast US. Since the major goal of the study was to examine the motivational types in chemistry students, no identifiable information was included on the survey. As such, we could not study the influence of motivational types on students' academic performance or teacher differences (in use of motivational tools or strategies) on motivation. Future studies could fill these gaps by surveying multiple institutions, linking students' grades to survey responses to examine causality between motivation type and academic performance; by expanding to longitudinal studies to examine whether motivational types change with progression in major or teacher differences, as well as by comparing student motivations as measured by SDT to mindset theory, which describes motivations in the form of mindsets and skills that can be fostered and developed by

[6] The initial data set was collected in the Fall and the opportunity to expand the study became available in the Spring, resulting in a larger data set.

educators (Dweck et al., 2014).

Conclusions

Our results clearly indicate that the adapted AMS is a reliable instrument to measure academic motivation types in chemistry classes. The data set also overwhelmingly supports recent research in that undergraduate students enrolled in chemistry classes at our institution highly endorse external motivation and in particular the least autonomous types. This holds true of both on- sequence and off-sequence students. It could be that the introductory and required nature of this class for many majors, not just chemistry, plays a role in such high endorsement. Future studies with students in more advanced chemistry classes may help determine if student motivation becomes more autonomous as chemistry majors progress in their course of studies. The differences in motivation among genders, as evidenced by our data, may suggest that a differential approach should be used to target males and females in chemistry classes, however future studies on gender differences in the population of chemistry students is warranted. Interventions provided by the instructor, peer leaders, the institution, etc. designed to boost more intrinsic forms of motivation should be encouraged to develop a learning environment conducive to more autonomous types of motivation to facilitate greater student success.

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Journal of the Scholarship of Teaching and Learning, Vol. 18, No. 1, January 2018, pp. 58-74.
doi: 10.14434/josotl.v18i1.22350

Student Perceptions of Plagiarism Avoidance Competencies: An Action Research Case Study

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Abstract: Student plagiarism in higher education is widespread and presents a growing concern for faculty and administrators who are intent on upholding academic integrity. However, a myopic view of plagiarism as a purely ethical issue is misguided. It is not always simply a deliberate attempt to deceive. Through the involvement of students in an introductory MBA course, this case study uses an action research approach to explore student perceptions of the challenges of avoiding plagiarism in academic writing, the appropriateness of plagiarism penalties, and the value of corrective feedback on penalty-free writing assignments. It also offers a practical example of how discipline-based faculty can incorporate plagiarism education into their curriculum.

Keywords: plagiarism, corrective feedback, academic writing, action research, CRASP model.

Introduction

Research points to the lack of student knowledge and skills as significant contributors to the overall problem of plagiarism in higher education (Newton, Wright, & Newton, 2014; Voelker, Love, & Pentina,, 2012; Blum, 2009; Brown, Dickson, Humphreys, McQuillan, & Smears, 2008). It appears that intentional offenders represent only a small portion of students guilty of plagiarism (Youmans, 2011; Brown et al., 2008). A larger portion of offenders appears to be the students who lack the academic writing competencies and information literacy (IL) skills necessary to avoid it (Iyer-O'Sullivan, 2013; Heckler, Forde, & Bryan, 2013; Holt, 2012). In fact, one university study indicated that more than 50% of the faculty had doubts about whether offenders are actually aware that they plagiarizing (Singh & Bennington, 2012). As a result, untrained students may find themselves as unwitting offenders and subject to the penalties designed to punish those guilty of unethical behavior.

Plagiarism is a dichotomous issue, dividing intentional and inadvertent offences. Consequently, the reliance on reactive measures alone cannot alleviate the issue as a whole. Instead, a comprehensive approach focused on instruction may serve to more adequately reduce plagiarism in the higher education classroom. In order to accomplish such a feat, faculty and administration across all disciplines should begin by evaluating existing practices.

Theoretical Framework

This research is guided by the CRASP model (see Table 1), a meta-theoretical model of teaching and learning, located in the non-positivist paradigm (Zuber-Skerritt, 1992). In contract to positivism, which is grounded in the use of empirical data to test the relationships among variables, the non-positivist perspective offers that valuable information regarding variables and the strength of their relationships can come from analysis of interviews or other qualitative techniques (Ashworth, 1997). The CRASP model integrates theory and practice through action research (Zuber-Skerritt, 1992; 1993). Zuber-Skerritt (1992) provided that:

> My research and that of others suggest that it is not a question of knowing the ideal state of good teaching practice (and of following prescriptions of good practice, but that the problem is one of changing and improving the current practice of teaching in particular areas (Zuber-Skerritt, 1992, p. 5).

Table 1

The Case in Relation to the CRASP Model

C	Critical attitude	Critique of the status quo in practice and context.
R	Research into teaching	Identifying and solving problems in the curriculum and student learning through a spiral of action research cycles (plan-act-observe-reflect).
A	Accountability	Intrinsic and extrinsic: Justify the academic value of practice and publishing the theories and practices of the work and situation.
S	Self-evaluation	Self-reflection and self-evaluation as part of the teachers' research into their own teaching, inviting students and others to provide critical comments.
P	Professionalism	Professional development through action research; professionalism encompassing the above four requirements.

Note: CRASP model reproduced from "Professional Development in Higher Education: A theoretical framework for Action Research," by O. Zuber-Skerritt, 1992, p. 21. Reprinted with permission.

Literature Review

The Frequency of Inadvertent Plagiarism

A great deal of the data regarding the frequency of plagiarism are derived from student self-reports (Saana., Ablordeppey, Mensah, & Karikari, 2016; He, Liu, Yang, Li, & Doss, 2016; International Center for Academic Integrity, 2015; Eret & Ok, 2014; Fish & Hura, 2013; Sentleg & King, 2012). Donald McCabe's survey of more than 65,700 undergraduate and 9,250 graduate students spanning from 2001 to 2005 (as cited in Plagiarism.org, 2014), provided the following self-report statistics:

- 36% of undergraduate and 24% of graduate students reported "paraphrasing/copying few sentences from Internet source without footnoting it."
- 38% of undergraduate and 25% of graduate students reported "paraphrasing/copying few sentences from written source without footnoting it."
- 14% of undergraduate and 4% of graduate students reported copying materials "almost word for word from a written source without citation."

While those numbers are alarming, the true extent of the problem of inadvertent plagiarism is difficult to discern. Some faculty may neither address nor report instances of plagiarism by their students (Bennington & Singh, 2012; Singh & Bennington, 2013). In addition, a recent study indicated that a majority of faculty considered it important to handle student plagiarism without the involvement of university administration (Bennington & Singh, 2012).

Plagiarism Prevention through Pedagogy

There is evidence that faculty may expect students to develop academic writing and information literacy skills on their own, without the aid of any systematic instruction (Weiner, 2014; McGuiness, 2006). However, findings suggest that a successful plagiarism reduction strategy should include a move toward prevention through educational instruction (Newton, Wright, & Newton, 2014; Brown et al., 2008; Lampert, 2004; Hurlbert, Savidge, & Laudenslager, 2003). "There is an apparent gap between the IL skills that faculty want their students to have and those that they actively support and develop" (DaCosta, 2010, p. 218).

Research has shown that incorporating writing and referencing instruction and feedback into higher education curriculum can result in a dramatic improvement in students' referencing and citation skills (Purcell & Barrell, 2014; Fallahi et al., 2006). Newton, Wright, and Newton's (2014) research showed that a even a 30-minute, single-session training program that targeted plagiarism, patch-writing, and paraphrasing resulted

in increased confidence and referencing skills in a group of first year undergraduate students.

An additional study on the efficacy of multimedia referencing and anti-plagiarism lectures, which were designed to help undergraduate students' performance in written assessments, was shown to produce no statistically significant improvement in students' knowledge of plagiarism (Brown et al., 2008). More than 88% of the students participating in this study indicated a need for referencing skills. However, 36% of them indicated a perceived lack of ability to learn the skills without in-person classroom instruction.

Feedback as Instruction

Effective feedback has been shown to improve the overall quality of student writing (Gulley, 2012). However, research on the influence of feedback on plagiarism is scant. The majority of students in a recent study agreed that anti-plagiarism instruction was important in preparing them for assignments, but some of the students suggested that reflecting on feedback might be more valuable for their learning.

Icy (2014) called for the need of innovative feedback approaches to improve student writing skills and provided a collection of current best practices:
1) Balanced feedback on content, organization, language, mechanics, style and genre.
2) Provide feedback at different stages of the writing process.
3) Direct feedback at selected patterns of errors rather than pointing out each.
4) Indirect feedback (resist the temptation to provide all of the answers).
5) Individualized feedback based on students' needs.
6) Use a variety of feedback sources
7) Peer feedback
8) Clear, specific and constructive written commentary.
9) Teacher-student conferencing. Baleghizadeh & Gordani (2012) found that verbal corrective feedback through student-teacher conference provided better results when compared the written feedback in college writing assignments.
10) Feedback without scores.

Research Questions

• What are student’s perceptions of their greatest challenges to avoiding plagiarism?
• What is students’ perceived value of written feedback in penalty-free assignments in increasing their understanding of plagiarism?
• Do students feel they are receiving adequate plagiarism instruction?
• What do students think about the existing penalties for plagiarism?

Method

Because the overarching goal of the study is to drive pedagogy in an effort to increase the student competencies necessary to avoid inadvertent plagiarism, the action research approach was determined to be appropriate. The Institute for the Study of Inquiry in Education defined the method as "a disciplined process of inquiry conducted by and for

those taking the action" (Sagor, 2000, p. 3). Sagor (2000) described the approach as a method used to help educators become more effective in the development of their students through their "actions."

The sample consisted of 11 (7 male, 4 female) students in an introductory MBA course at a private southeastern university. Participation in the research was voluntary with no promise of compensation in any form. All of the students in the class agreed to participate. Each was provided with an informed consent to participate in the research.

The students completed the Plagiarism Attitude Scale (PAS) survey in class. The PAS is an open-source tool available on the Purdue University Online Writing Lab (OWL) website. It is a 12-item survey designed to explore students' understanding and perceptions of plagiarism.

Following the survey, and prior to the first assignment, students were provided with classroom instruction. The 2-hour instruction included a discussion about what constitutes plagiarism, basic referencing and citation guidelines, and information synthesis supported through the use of specific examples. In addition, students were instructed how to access online library and writing resources.

Following the instruction, students were told that no penalties for plagiarism would be assessed on the first primary writing assignment and that extensive written feedback would be provided along with the opportunity for a faculty-student conference. The students were then provided the opportunity to revise their work based on the feedback received and resubmit for full credit.

After the feedback was provided and the corrections were submitted, the students were contacted by phone outside of class in order to complete the semi- structured interview. A total of 11 interviews were conducted, each lasting approximately 30 minutes. The interview questions focused on student challenges in academic writing, previous plagiarism instruction, perceptions of the fairness of penalties for plagiarism, and the perceptions of the value of feedback in penalty-free assignments. Students were assured anonymity and encouraged to provide honest responses. The researcher took notes during the interview.

In an attempt to glean a depth of knowledge from a small purposive sample, the data analysis in this case study used a qualitative approach. Responses to the interview and survey questions were compared and contrasted in order to explore student perceptions of plagiarism and the value of penalty-free feedback. Denzin and Lincoln (2008) provided that in qualitative action research, the evaluator becomes the conduit for the voices of the students.

Results

Student Challenges in Avoiding Plagiarism

In the pre-instruction survey, 10 of the 11 students indicated that they had a good understanding of what constituted plagiarism and what did not. Interestingly, the class discussion and the findings from the interviews indicated that was not the case for many. There were misconceptions about what constituted originality and when citations were required and among the students. From the interviews, several common challenges to avoiding plagiarism emerged.

Understanding When to Cite. With regard to plagiarism, students indicated that understanding when to cite information was their major challenge in academic writing. They struggled with the concept of citing ideas, theories and concepts, as opposed to direct quotes. Many students were unaware that thoughts and concepts taken from another required a citation, even when paraphrased. One student indicated that "It's not the subject matter - we go to other places to get it. The problem comes with citing and not knowing about citations." Adding support to this idea, another student said, "I try to use original thoughts, but how many words do I have to change before it's considered to be my own work?"

Several students discussed the idea that a lack of uniform faculty standards added to their confusion about the appropriate use of citations. One student indicated that the a challenge came from "Understanding what needs to be cited because standards are different for every professor. There's a grey area."

Information Synthesis. Students also found information synthesis to be their major challenge. Several of the students said that undertaking an analysis of unfamiliar topics was difficult and several mentioned that the literature review process in particular was particularly challenging. One student said "identifying what parts are important and narrowing them down" presented the most difficulty; another cited "going through so much information and putting it in your own words" as a challenge.

Formatting Citations and References. The mechanics of the American Psychological Association (APA) style of formatting was also reported to be a major challenge for many of the students. In addition to expressing a lack of understanding regarding the proper formatting of citations and references, several expressed a desire to uphold ethical values, but indicated that they did not have a firm grasp of how to cite information correctly. When asked about plagiarism in general, one of the students provided that "For me, it's never intentional, it's just understanding the correct way to cite." Another student said "I always have a fear of [unintentional plagiarism] even though I think I'm doing the right thing. I don't really think any of us go into it with the intention of cheating."

Previous Instruction

Overall, these graduate-level students indicated a lack of previous formal plagiarism instruction. When asked to discuss any previous plagiarism or academic writing instruction, most indicated that previous instruction had been brief. One student shared that "[Previous Instruction] has been very limited and boilerplate-plagiarism is bad, but your class is the first time we discussed it in depth."

Many students indicated that they were informed about the existence of the honor code and instructed to avoid plagiarism, but reported that previous academic writing instruction had been inadequate or non-existent. One student responded that "Everyone assumes we know this and I'm not sure where it falls short." Another student added "[Avoiding plagiarism] was stressed, but I had to figure it out on my own."

Students' Perceptions of Existing Plagiarism Penalties

Based on the PAS survey responses, the majority of students did not agree that the penalties for plagiarism in college should be light for those "just learning the ropes." Surprisingly, all of the students indicated a need for strict penalties for those guilty of intentional plagiarism. However, based on the interview responses, the students were divided with regard to their perceptions of the appropriateness of existing plagiarism penalties.

While all of the students indicated a need for penalties and most thought that existing penalties were fair, many of them expressed the need for leniency in cases of inadvertent plagiarism. One student said "It's a pretty serious offense, but they should look at it case by case. Sometimes penalties can be too high. A lot of times, it is not intentional." In support of this view, another student added "Penalties are too extreme. Like me - I don't always know the right way. I would investigate before punishing and give everyone a fair chance. Sometimes it seems like a witch hunt."

Perceived Value of Penalty-Free Written Feedback

Although, student outcomes were not measured for the study, the students overwhelmingly indicated that receiving detailed written feedback on a penalty-free assignment was valuable in helping them to understand and avoid future instances of plagiarism. "Not too many instructors give such detailed feedback" said one student, who indicated that she had been out of school for many years. Another student added that "[It] was completely helpful. Being be able to learn from your mistakes before you're penalized is important. The feedback was pretty positive and you made sure I understood the format of citations." Adding to the idea that students may mistakenly think they have a good knowledge of plagiarism, one student said "The feedback was helpful. I found out I was doing it wrong all along."

Perceptions of Instructional Need

When asked if there were specific areas of academic writing in which they felt they needed additional instruction, the answer was unanimous - yes. Students indicated that learning when and how to use citations and references was their greatest need. "If I don't know how to cite it, I just don't use it - referencing and citing is still fuzzy" said one student. Several of the students indicated that they believed the feedback would help them to avoid plagiarism in future assignments.

A close second was the perceived need for information synthesis instruction. Students admitted that they still did not have a firm grasp on how to provide an analysis of academic journal articles. One student said "I have difficulty reading full journal articles and finding the things I'm looking for." Another student added "A literature review is different. Reading scholarly journals is not as easy as putting in a Google search and finding what you need."

Limitations and Suggestions for Future Research

A limitation of the study is that with such a small sample, major generalizations from the findings cannot be made. In addition, participants represented only one class within one

university. Future research might employ a quantitative methodology using a larger and more diverse sample.

Another limitation is that the study is based on students' perceptions and does not provide any evidence of student learning performance. "While students' attitudes and opinions are important, other forms of evidence need to be presented in order to conclude whether learning has actually improved" (Kirkwood & Price, 2013). Future research measuring students' learning outcomes in response to written feedback would be beneficial.

Finally, the teacher as a researcher may have influenced students' responses regarding the value of written feedback. Future research might employ alternative data collection methods. Research focused on plagiarism reduction outcomes based on the type of feedback provided (i.e. written vs. verbal) or the timing of the feedback could also be valuable.

Implications for Teaching

The research presented indicated that overall, the students in this study viewed academic writing, citing/referencing, information synthesis, APA formatting, and grammar as areas that presented the greatest challenges. Although the students indicated that extensive written feedback on written assignments was helpful, students also overwhelmingly indicated a need for further academic writing instruction.

The need for increased student writing and referencing competencies is apparent. Integrating both plagiarism and academic writing instruction, into every class, regardless of the discipline or level, presents a viable pedagogical strategy. Faculty should be encouraged to utilize a variety of approaches in order to develop these competencies.

In addition, utilizing feedback specifically targeting the challenging areas appears to be useful in helping students to develop academic writing competencies and avoid inadvertent plagiarism. Teachers should be encouraged to experimenting with a variety of feedback strategies. By developing a greater awareness of the specific challenges faced by students, faculty can more effectively address them.

Appendices

Appendix A: Plagiarism Attitude Scale

Appendix B: Interview Questions

Appendix A: Plagiarism Attitude Scale

Directions

This is an attitude scale, which measures how you feel about plagiarism. It is *not* a test with right and wrong answers. Please consider your honest opinions regarding the items and record your responses. Do *not* place your name on this scale. Your instructor may give you further instructions.

1. Sometimes I feel tempted to plagiarize because so many other students are doing it.

- o Strongly Agree
- o Agree
- o Neutral
- o Disagree
- o Strongly Disagree

2. I believe I know accurately what constitutes plagiarism and what does not.

- o Strongly Agree
- o Agree
- o Neutral

- Disagree
- Strongly Disagree

3. Plagiarism is as bad as stealing the final exam ahead of time and memorizing the answers.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

4. If my roommate gives me permission to use his or her paper for one of my classes, I don't think there is anything wrong with doing that.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

5. Plagiarism is justified if the professor assigns too much work in the course.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

6. The punishment for plagiarism in college should be light because we are young people just learning the ropes.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

7. If a student buys or downloads free a whole research paper and turns it in unchanged with his or her name as the author, the student should be expelled from the university.

- Strongly Agree
- Agree
- Neutral
- Disagree

- Strongly Disagree

8. Plagiarism is against my ethical values.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

9. Because plagiarism involves taking another person's words and not his or her materials goods, plagiarism is no big deal.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

10. It's okay to use something you have written in the past to fulfill a new assignment because you can't plagiarize yourself.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

11. If I lend a paper to another student to look at, and then that student turns it in as his or her own and is caught, I should not be punished also.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

12. If students caught plagiarizing received a special grade for cheating (such as XF) on their permanent transcript, that policy would deter many from plagiarizing.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

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Available on the Purdue.edu OWL website as open access instruments available for public use from https://owl.english.purdue.edu/owl/owlprint/929/

Appendix B: Interview Questions

1) Think about plagiarism in particular and tell me what you think are your greatest challenges when it comes to academic writing?
2) Tell me about any previous instruction you've had on plagiarism, referencing, academic writing and information synthesis?
3) How do you feel about the penalties for plagiarism? What would you recommend?

4) Did you find that the ability to turn in specific writing assignments without fear of penalty was beneficial? Why?
5) Tell me about the feedback you received.
6) Did the feedback help increase your understanding of plagiarism, referencing, and information synthesis? How?
7) In what areas of academic writing do you feel you need additional instruction?

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Journal of the Scholarship of Teaching and Learning, Vol. 18, No. 1, January 2018, pp. 75-95.
doi: 10.14434/josotl.v18i1.22371

College Connectedness: The Student Perspective

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Abstract: Connectedness and integration are essential elements of student satisfaction, academic success, and retention. Despite its importance in the lives of college students, research on connectedness has approached the concept from definitional perspectives other than those of students. This multi-study explores connectedness from the student perspective while drawing from social identity theory and student involvement theory. In Study 1, students described their experiences and perceptions of connectedness in focus groups. Study 2 built on the qualitative findings of Study 1 and empirically tested connectedness as defined by the students. Results of the study indicate the need for a student definition of connectedness and provide practical suggestions for institutions of higher education.

Keywords: Connectedness, social identity theory, student involvement theory, instrument design, higher education

College students' connection to campus life can sometimes be a mystery, but it is a vital relationship that helps with their healthy and successful college experience. Dozens of studies have explored this relationship from different angles. Some of the primary considerations include student satisfaction (Krumrei-Mancuso, Newton, Kim, & Wilcox, 2013), student engagement (Kahu, 2013), academic integration (Tinto, 1993), early integration (D'Amico, Dika, Elling, Algozzine & Ginn (2013) student self-efficacy (Davidson & Beck, 2007), student-institution fit (Denson & Bowman, 2015), the teacher-student relationship (Hagenauer & Volet, 2014), social integration (Brooman & Darwent, 2014), student engagement (Flynn, 2014), student assimilation (Sollitto, Johnson & Myers, 2013), student attachment (Wilson & Gore, 2013), expectancy and goal setting (Friedman & Mandel, 2011, 2012), and complexity thinking (Forsman, Linder, Moll, Fraser, & Andersson, 2014). All these explorations on student connectedness stem from the conceptual perspective of the researcher or an institutional framework.

The mystery of the students' concept of connectedness is in need of more investigation. Rovai (2002) offers a broad and holistic definition of connectedness; the feeling of belonging and the creation of bonding relationships. This definition offers what can be considered an all-encompassing idea of connectedness, specifically, one that includes the students' perspective. Working within this idea of connectedness, learning and building on connectedness from the students' perspective provides academics with the ability to further cultivate healthy and successful students. By using social identity theory and student involvement theory, it becomes possible to explore the processes, sites, and values used by students to develop their sense of

connectedness. This provides valuable insight into how institutions of higher education might facilitate interactions that lead to successful undergraduate experiences.

Literature Review

Effective learning in higher education requires successful student interaction as well as positive attitudes and perceptions regarding the setting (Aitken, 1982). Students interact in both social and academic systems of a college campus (Mannan, 2007), but interaction does not ensure integration, as individual student perceptions define relationships and memberships with the campus community (Tinto, 1987). A divide currently exists between the social and academic aspects of student life (Boyer, 1987), which is also reflected in connectedness literature (Sollitto, Johnson, & Myers, 2013) and the lack of agreement regarding the meaning of academic integration (Braxton & Lien, 2000). Hanover (2011) noted that institutional approaches geared toward improving retention rates, a direct signifier of student success, need to consider a holistic approach that includes both academic and non-academic factors of student happiness and success. Tinto (2011), a prominent researcher of student success and retention, addresses the topic in a more holistic manner, but emphasizes classroom interactions more than other sites of student interaction. Increased access to higher education in recent years has shifted the educational emphasis toward technical classroom skills (Philpott & Strange, 2003), resulting in a social-academic learning divide. To bridge this divide, the campus experience needs to encompass elements of teaching and learning within the context of a social setting, which can address student development in and outside the classroom (Borden & Gentemann, 1993; Braxton, Doyle, Hartley, Hirschy, Jones, & McLendon, 2014; Brown, Brown, & Littleton, 2002).

Connectedness is an overarching construct that encompasses students' sense of belongingness, integration, and satisfaction with their relationship to their institution, and may play a role in student commitment toward the institution (Rovai, 2002). Connectedness may be divided into two types. Students may feel connectedness through satisfaction with interpersonal relationships and various social groups (Cutrona, 1982; Rovai, 2002), which this study identifies as social connectedness. Students also develop connectedness to the institution through feelings of belonging and acceptance with organizations, programs, and faculty (Sidelinger & Booth-Butterfield, 2010), or institutional connectedness. The existing literature on the role of student connectedness in college success emphasizes either social connectedness or academic connectedness; both bodies of research rely on researcher-defined criteria for connectedness, neglecting to ask students to express connectedness for themselves (Clark, 2005; Smith & Zhang, 2009).

High degrees of social connectedness are associated with a legion of positive outcomes including higher levels of emotional well-being (Cutrona, 1982; Russell, Peplau, & Cutrona, 1980), less substance abuse and better health (Blum, McNeely, & Rinehart, 2002; McNeely & Falci, 2004), decreased depressive symptoms (Jacobson & Rowe, 1999), less loneliness (Cutrona, 1982; Russell et al., 1980) and decreased risk of violent or deviant behavior (Blum et al., 2002; McNeely & Falci, 2004). A perceived lack of social connectedness can produce depression, social anxiety and jealousy (Leary, 1990), and a perception of one's surroundings as threatening and unfriendly (Swann, 1990). Undergraduates' perceived depth and quality of connectedness appears to be more meaningful than the number of people with whom a student is connected (Cutrona, 1982; Jones, 1981). A multitude of factors can affect a student's feelings of institutional connectedness. A feeling of loneliness influences the sense of community, while feeling cared

about, valued and accepted accentuates a sense of belonging. A high-quality social life and the perception of high degrees of support, involvement, and achievement also enhance a student's sense of institutional connectedness (Cheng, 2004; Cutrona, 1982).

Many institutions recognize that gradual change and guidance into the campus community improves students' adjustment to college (Boyer, 1990). First-year college students face practical and social choices including behavioral changes (Fromme, Corbin, & Kruse, 2008; White & Jackson, 2004/2005), academic performance (Perry, Hladkyj, Pekrun, Clifton, & Chipperfield, 2005), and relationship patterns (Oswald & Clark, 2003). This transition has been associated with declining satisfaction with the feelings of social connectedness established in high school (Oswald & Clark, 2003), as well as decreased perceptions of social connectedness and heightened feelings of loneliness and anxiety among first-year college students who no longer live with their parents (Larose & Boivin, 1998). In a vein similar to Smith (2015) exploring an alternate conceptualization of academic integration, this study seeks a new perspective on student connectedness. This study allows students to define connectedness, both social and institutional, while exploring the theoretical salience of both social identity theory and student involvement theory.

Social Identity Theory

Social identity theory approaches connectedness from a small group perspective. Group identification, or self-categorization, often leads to a feeling of connectedness with specific groups (Hogg & Abrams, 1988). Social identity theory explains how people develop personal identities and their perceptions of others (Abrams, O'Connor, & Giles, 2002; Hogg & Abrams, 1988; Tajfel & Turner, 1979). When identifying with a group, people are prone to differentiate and compare themselves as much as possible to other groups (Hogg & Abrams, 1988). These social comparisons allow for the development of group identifications. Group identification may be based on factors such as religion, race, sports, clubs, personal traits, or physical appearances (Hogg & Abrams, 1988). When an identity with a specific group is created, people who do not fit into the group are considered the out-group (Tajfel & Turner, 1979) and experience a lack of connectedness. Identification of in-groups and out-groups allows individuals to pursue participation in a particular group (Brewer, 1999), fostering greater levels of connectedness.

Group identification influences personal values and behaviors (Tajfel & Turner, 1979). An individual may adopt group behaviors to strengthen the belief that they belong to the group (Hogg & Abrams, 1988). Group identification differs slightly from connectedness in that identification is based on self-perceptions and self-categorizations from personal attributes and stereotypes (Hogg & Abrams, 1988; Turner, 1991). Another difference between connectedness and group identity is that personal behaviors are influenced by group norms, and connectedness is associated with feelings of belonging and bonding (Hogg & Abrams, 1988; Rovai, 2002; Turner, 1991). However, social identity theory fosters an understanding of connectedness through the relationship between personal identities and perceptions of belonging.

Student Involvement Theory

Student involvement theory places the student at the center of student success and claims that external factors such as campus facilities and course content have less influence in determining a student's ability to succeed than student involvement (Astin, 1984). This emphasis on the student experience provides a theoretical grounding that emphasizes the student perspective in the

development of this study. Student involvement theory presents a direct link between student involvement and students' level of institutional connectedness, indicating higher levels of involvement will develop higher levels of institutional connectedness.

Student involvement theory states that the more involved students are in their college education, the more likely they are to succeed (Astin, 1984). Astin (1984) defines involvement as the amount of physical and psychological energy a student commits to the academic experience and notes that an "involved student is one who…devotes considerable energy to studying, spends much time on campus, participates actively in student organizations, and interacts frequently with faculty members and other students" (p. 297). A large degree of student success is attributed to the students' proximity to campus, as students living on campus have more convenient access to peer socialization events, campus activities, and services (Astin, 1973, 1977, 1982; McCluskey-Titus et al., 2002; Terenizi, Parcarella, & Blimling, 1996).

Rationale

The goal of this research is to more clearly understand how college students perceive connectedness and how those perceptions relate to existing connectedness and student satisfaction literature. An applied approach to investigating student perceptions of connectedness is ideal for addressing the assumptions of relevant research (see Creswell & Plano Clark, 2007). This research uses a mixed-method approach to clarify the divide between social and institutional connectedness in previous literature. Study 1 explores connectedness using focus groups in order to discover the student-defined themes and perspectives. Study 2 uses the findings of Study 1 to develop a survey and create a measure of connectedness. An exploratory factor analysis reveals the underlying factor structure of connectedness from the student perspective; variations in students' level of connectedness are explored across key demographic variables; finally, the relationships among the dimensions of connectedness are examined.

Study 1

Focus groups with traditional-age (18-25) first-year undergraduate students were conducted to discover how undergraduate students develop connections to their peers and the university, two elements of connectedness. The focus groups were guided by the following research question.

RQ1: How do first-year students perceive, describe, and experience connectedness?

Participants

Thirty first-year undergraduate students from a midsized, Midwestern, land-grant university participated in four focus groups, 19 females and 11 males. Focus groups ranged from 5-10 participants. Participants were aged 18-25 (M = 19.1, SD = 1.647). Approximately 80% (n = 24) of the participants were white; 20% (n = 6) identified as Hispanic/Latino, Asian, African American, Native American, or other. The majority of participants lived on campus (n = 25), while other participants indicated they lived off campus (n = 5).

Procedures

Participants were recruited through email. The focus groups were conducted using a semi-structured protocol. Focus group questions thematically related to how and where students meet others and the different types of relationships developed as first-year students. For example, students were asked, "How have you met people here?" and "What are examples of relationships you have developed with teachers or other people who work on campus?" The focus group moderator did not use the term "connectedness," but the questions were developed to describe situations that involved social and institutional connectedness.

Data Analysis

Focus group transcript analysis used a combination of open and axial coding. Data analysis began by reading the focus group transcripts to develop a comprehensive sense of the data. Open coding and an inductive approach were used to develop codes and themes. First, descriptive themes were identified from the text. Following suggestions from Strauss and Corbin (1990), descriptive codes were used to create theoretical and analytic themes that captured a more general perspective. The research team developed descriptive codes and code definitions, which lead to the development of theoretical codes. Research team members individually coded the transcripts to identify theoretical codes and reach inter-coder reliability (92%).

Results

The results of Study 1 yielded three analytical themes: (1) social expectations versus social actions, (2) relationships with instructors, and (3) overlap of social and institutional connectedness. *Social expectations versus social actions* highlighted the tension between what students wanted from their college experience and what they have done since beginning their college careers. This analytical theme provided an understanding of the range of positive and negative experiences first-year students had when attempting to develop friendships. The second analytical theme, *relationships with instructors*, compared the different experiences students had with instructors and other university employees. Codes within this theme revealed the types of interactions students had with instructors and university employees. Interactions that focused only on academic topics were distinguished from those that included elements that demonstrated personal care for the student as an individual. Finally, students did not distinguish between social connectedness and institutional connectedness, even though previous research identifies the two as independent concepts. This observation resulted in the development of a third analytical theme, *overlap of social and institutional connectedness*.

Social Expectations Versus Social Actions. First among these was a disjunction between student expectations before coming to college and their actions once on campus. Students indicated they intended to establish many new kinds of social connections, but their actual tendency was to gravitate toward previously established connections or toward students with similar backgrounds. Students described either not establishing many new social connections, or establishing connections that do not meet their stated expectation of new kinds of relationships or relationships with new kinds of people.

A comprehensive listing of participant comments on this theme would be replete with the phrase "meet new people" when students described their expectations before coming to college. These comments suggested students expected their social connections to be different (e.g., more varied, more numerous, or more central to their lives), than their previous experiences. Many

comments indicated the variety of activities and relationships students expected to join in college. Bonnie's mention of the absence of "cliquey" groups drew agreement from other participants and was a commonly repeated idea. Several participants also pointed out they expected college to be a time in which important decisions about their social connections would be made independently. When students described their actual social-connection behavior upon coming to college, their descriptions and stories depicted patterns of prioritizing pre-existing connections or seeking new connections with people with similar experiences and worldviews.

When students sought new relationships, they often restricted themselves to connections that extended their social experiences before college. This pattern appeared amplified among students whose previous friends came to college with them. As Paul said, "Yeah, I had friends that carried over from high school too, so I didn't try too hard to make new friends." Paul's comment was particularly striking, because it indicated his expectation to "make new friends" persisted even as he described having prioritized his pre-college relationships in his actions. These two discordant ideas in the same statement illustrate how deeply the disjunction between "meeting new people" and prioritizing continuity or familiarity was embedded in students' experiences. Michael echoed other participants saying, "coming from a small town, it's easier for me to relate with people who were from small towns because we had, I don't know, we just knew what each other was talking about..." In context, the idea of knowing "what each other was talking about" was shorthand for similar life experiences, values, and assumptions about the world. Prioritizing relationships with similar people highlighted the disjunction between expectations and action.

Relationships with Instructors. The second overarching theme was the inextricable interweaving of students' personal and academic relationships with their instructors. Students saw their instructors not merely as educational providers, but as figures with whom personal relationships could be forged. Students' descriptions of instructors with whom they most felt connected did not reflect classroom teaching style or pedagogical competence, but rather the degree to which students perceived the instructor cared about them as people. As Casey described one such instructor, "... [W]hen you go talk to them during office hours you can talk about the stuff they do in classes and also he's interested in ... what do you want to be when you grow up, kind of stuff like that."

Owen described a connection with an instructor that began in a classroom context. However, this instructor showed enough personal interest in the student (he "was really nice") that Owen began to "stop in for a couple minutes," asocial act that had nothing to do with the academic element of Owen's education. Owen's choice to describe the instructor as "really nice" rather than professional or scholarly quality spoke to the relational element the student valued. Owen also described a positive outcome stemming from his perception that this "really nice" instructor cared about him: it led Owen to return to the instructor for other additional academic help.

As might be expected, a personal connection with an instructor can be negative, and can also influences a student's academic interaction with that instructor, as Becky recounted:

> ... [O]ne of my professors last semester was so intimidating, and I had a question on a test that I had taken, and I was just, like, dreading going there, I was, like, sweating and shaking and then I, like, go there and it's just like, you don't want it to be like that.

The crucial adjective "intimidating" that Becky applied to the professor is noteworthy. She did not use a term associated with his knowledge of his field, the clarity of his instruction, or the fairness of his grading. An academic interaction, a question about a test, was again refracted in the student's mind through the prism of personal connection.

Overlap of Social and Institutional Connectedness. Social connections and the students' sense of connection to their university as an institution overlap and interweave, contrary to the assumptions of much existing literature. This theme was illustrated by the dual nature of students' personal and academic relationships with instructors and other university employees including advisors, financial aid staff, and custodial workers. This theme emerged when participants discussed the role of non-academic staff. Kathy's observation demonstrated this theme: "I don't really know them, but the people in our dining centers are just so friendly… they'll just ask the question, you know, be nice about it and they'll just, I don't know, it just makes me feel seen..." Kathy noted the importance to her was not the service provided but rather that she felt "seen." The significance of these employees was not confined to their formal institutional roles.

This overlap of personal and institutional connectedness occurred negatively as well: employees who failed to establish a personal connection were judged as performing poorly in their professional and institutional capacities. Abby described such a relationship when her advisor essentially told her to quit the program if she didn't like the major. Abby characterized her relationship with her advisor by the perceived degree to which the advisor did not care about her as a person. In context, this demonstrated the negative aspect of how students respond to not being "seen" by campus employees. It demonstrated a different way of how students viewed personal connection as inseparable from their experience of connection with the university as an institution (embodied in the people who carry out its functions).

Discussion

Key findings from Study 1 established overlapping relationships across social and institutional connectedness, suggesting from the students' perspective, the frameworks of social identity theory and student involvement theory merge. Combining the assumptions of social identity theory and student involvement theory, the relationship between new student friendships and feeling connected to a larger student body helps elucidate that belonging to groups and being active in campus life are positive indicators of student success. Previously, student involvement theory only focused on students who are institutionally involved on campus, excluding social elements. Social identity theory explains that a portion of student involvement emerges as a result of developing new friendship groups. Social and institutional aspects of connectedness appear to be interlinked, influencing one another in creating an overall feeling of connectedness.

Study 2

The themes that emerged from the results of Study 1 suggest first-year students' conception of connectedness is not fully explained independently by either social identity theory or student involvement theory. Drawing upon previous connectedness literature and qualitative findings of Study 1, Study 2 served as a platform to empirically tease apart the complex and multidimensional nature of connectedness from the students' perspective. The following research questions were posed:

RQ2: From the students' perspective, what dimensions encompass connectedness?

RQ3: How do the dimensions of connectedness differ as a function of key demographic characteristics?

RQ4: How do the dimensions of connectedness relate?

Study 2 employed an online survey method to capture dimensions of connectedness from the students' perspective, identify the situations and relationships in which students experience connectedness, and investigate the relationship among the dimensions of connectedness, with the underlying purpose of refining the qualitative overlap between social and institutional connectedness seen in Study 1.

Procedures

The procedures for Study 2 involved a series of steps. First, scale items measuring various aspects of connectedness were developed. Second, the items were examined for content and face validity. Third, an online survey was administered to first-year students. Fourth, an exploratory factor analysis was used to examine the factor structure of connectedness from the students' perspective. Each of these steps is outlined below.

Development of scale items. Scale items were generated based on the qualitative findings of Study 1 and previous literature, with the intent of capturing students' perceptions of expectations and actions of their new and old friends (20 items), as well as relationships with faculty and other students (18 items). These items were placed on scales ranging from (1) "not at all true" to (9) "very true;" therefore high scores indicated high levels of connectedness in a variety of ways. These items were examined for content validity. The items created were determined representative of both the findings from Study 1 and connectedness literature. In order to assess face validity, survey items were given to a group of first-year students who participated in Study 1 to evaluate whether the items captured aspects of social and institutional connectedness; the students confirmed the face validity of the items.

Sampling. First-year traditional-age undergraduate students were recruited from a university-wide required course, using a purposive sampling technique (Kerlinger & Lee, 2000). The course provided access to the target population of first-year traditional-age undergraduates. A recruitment email was sent via the course listserv. Students who qualified to participate in the study accessed the online survey through a link embedded in the recruitment email. Students who agreed to the online consent form were redirected to the online survey. Participants responded to questions about their expectations and actions of old and new friends, as well as their relationships with faculty and other students. Demographic information was also collected.

Participants. A total of 256 participants were recruited. There were 115 (44.9%) males and 136 (53.1%) females with five (2%) students not identifying their sex. A total of 230 (89.8%) students reported their age as 18-20, 21(8.2%) as age 21-25, and five (2%) who did not report age. Participants included 228 (89.1%) white students, 19 (7.4%) non-white students, and nine (3.5%) who did not identify ethnicity. A total of 194 (75.8%) students reported living on-campus with 57 (22.3%) off-campus students, and five students not reporting residence. The study included 48 (18.8%) students whose hometown was 0-60 miles away, and 204 (79.7%) students whose hometown was 61 or more miles away, with four students not reporting distance from hometown. The study included 77 (30.1%) students who reported visiting their hometown a few times a month or more, and 161 (62.9%) students reported visiting their hometown once a month or less, with 18 (7%) students not reporting frequency of hometown visits.

In order to determine how well the sample (N = 256) represented the entire student population of 11, 987 students, at the university where this research was conducted, chi-square tests were used to compare distributions of biological sex, age, ethnicity, and residence. The results indicated that the sample proportions of students' biological sex [χ^2 (df = 1) = .148, p = .70], age

[χ^2 (df = 1) = .04, p = .84], ethnicity [χ^2 (df = 1) = .281, p = .60], and residence [χ^2 (df = 1) = .08, p = .78], were similar to the student population proportions, therefore allowing the results of this study to be generalizable to the university's undergraduate student population. This research took place at a Midwestern, land grant institution at which a majority of classes offered have 40 or fewer students (NDSU, 2011).

Measures of connectedness. An exploratory factor analysis using principal components extraction and varimax rotation was used to identify the underlying factor structure of connectedness. The initial analysis (including 37 items) revealed several items with low communalities, items that cross-loaded onto multiple factors, and items that failed to load onto any factor (at an adequate level of .60 or higher). Following recommendations of Conway and Huffcutt (2003), these items were dropped. The final subsequent analysis revealed five factors with eigenvalues greater than 1 that accounted for 70.16% of the variance. Table 1 reports the connectedness variables and factor loadings for each of the five factors.

Table 1. Factor Loadings Using Principal Components and Varimax Rotation

	1	2	3	4	5
1. I can rely on other students for personal support.	**0.868**	0.100	0.097	0.160	0.098
2. I can trust other students for academic advice	**0.861**	0.170	0.090	0.102	0.123
3. I can trust other students for personal advice.	**0.853**	0.099	0.124	0.172	0.089
4. I can rely on other students for academic support.	**0.839**	0.207	0.058	0.133	0.120
5. I can easily talk to other students about personal topics.	**0.815**	0.171	0.124	0.212	0.060
6. I talk regularly with other students about school topics.	**0.808**	0.063	0.076	0.239	0.144
7. I can easily talk to other students about academic topics.	**0.771**	0.059	0.114	0.235	0.245
8. I receive personal support from instructors.	0.027	**0.889**	0.030	-0.044	0.021
9. I can trust and rely on instructors for personal advice.	0.005	**0.835**	0.132	0.013	0.114
10. The personal responses I receive from instructors are valuable.	0.115	**0.813**	0.031	0.120	0.181
11. I talk to instructors about personal interests.	0.113	**0.785**	-0.101	-0.065	-0.009
12. I talk to instructors about classes on a regular basis.	0.202	**0.735**	-0.153	-0.031	0.000
13. I receive academic support from instructors.	0.346	**0.659**	-0.115	0.155	0.039
14. Since coming to college I have remained close to my high school friends.	-0.051	0.023	**0.800**	-0.198	0.047
15. Since coming to college I see my high school friends a lot.	0.227	-0.062	**0.794**	0.177	0.022
16. Since coming to college I have remained close with my friends from high school.	0.226	-0.074	**0.773**	0.180	0.005
17. Before I came to college I expected to see my high school friends a lot.	-0.020	0.064	**0.744**	-0.177	0.164
18. Before I came to college I expected to maintain my friendships from high school.	0.125	-0.034	**0.722**	0.309	0.045
19. Before I came to college I expected to meet people I didn't know before.	0.211	0.024	0.077	**0.873**	0.117
20. Before I came to college I expected to stay close with my friends from high school.	0.270	0.044	0.059	**0.810**	0.115
21. Before I came to college I expected to meet different people.	0.211	0.018	0.123	**0.774**	0.239
22. Since coming to college I have met people I didn't know before.	0.321	-0.048	0.124	**0.602**	0.299
23. Since coming to college I have met a lot of new people.	0.477	0.060	-0.021	**0.600**	0.269
24. Before I came to college I expected to meet people who have different hobbies than me.	0.179	0.095	0.119	0.214	**0.788**
25. My new friends at college came from a different size hometown than me.	0.110	0.039	0.080	0.451	**0.746**
26. Before I came to college I expected to meet people who came from a different size hometown than me.	0.162	0.049	0.083	0.453	**0.699**
27. My new friends at college have different hobbies than me.	0.224	0.129	0.057	-0.010	**0.679**

Note. Factor 1 = Student Connectedness; Factor 2 = Faculty Connectedness; Factor 3 = Connectedness with Old Friends; Factor 4 = Connectedness with New Friends; Factor 5 = Connectedness to Diverse Friends

Results

The results of Study 2 elucidated current knowledge about connectedness. In response to RQ2, connectedness is comprised of five dimensions: Student Connectedness, Faculty Connectedness, Connectedness with Old Friends, Connectedness with New Friends, and Connectedness to Diverse Friends. The first factor was labeled "Student Connectedness," and includes 7 items that account for 32.32% of the overall variance ($\alpha = .95$; $M = 6.05$, $SD = 1.90$). The second factor was labeled "Faculty Connectedness," and includes 6 items that account for 14.55% of the overall variance ($\alpha = .90$; $M = 4.35$, $SD = 1.89$). The third factor was labeled "Connectedness with Old Friends," and includes 5 items that account for 10.51% of the overall variance ($\alpha = .87$; $M = 5.45$, $SD = 1.78$). The fourth factor was labeled "Connectedness with New Friends," and includes 5 items that account for 8.3% of the overall variance ($\alpha = .88$; $M = 7.47$, $SD = 1.51$). The fifth factor was labeled "Connectedness to Diverse Friends," and includes 5 items that account for 4.5% of the overall variance ($\alpha = .82$; $M = 7.01$, $SD = 1.55$). These measures of connectedness were used to shed light on RQ3 and RQ4.

The results of Study 2 also provide insight about how various forms of connectedness may differ as a function of key demographic variables. In response to RQ3, logistic regressions were used to examine how students' perceptions of connectedness varied in terms of biological sex (male, female), age (18-20, 21-25), ethnicity (white, non-white), residence (on-campus, off-campus), first generation student (first generation, non-first generation), distance from hometown (0-60 miles, 61 or more miles), and frequency of hometown visits (a few times a month or more, once a month or less). It is important to note that discriminant analysis is another statistical approach that could have answered the same questions as logistic regression; however, the latter was more appropriate for the current study because the data did not satisfy the assumptions of discriminant analysis (see Mendenhall & Sincich, 2012). The analysis revealed a significant overall model for age [$\chi^2 = 31.10$, $p < .001$, Nagelkerke $R^2 = .27$], ethnicity [$\chi^2 = 14.18$, $p < .05$, Nagelkerke $R^2 = .13$], residence [$\chi^2 = 23.37$, $p < .001$, Nagelkerke $R^2 = .14$], first generation student [$\chi^2 = 14.08$, $p < .05$, Nagelkerke $R^2 = .12$], and frequency of hometown visits [$\chi^2 = 11.26$, $p < .05$, Nagelkerke $R^2 = .07$].

In order to determine the usefulness of these logistic models, classification accuracy was examined. Two of the logistic regression models (age and frequency of hometown visits) were considered useful; these obtained a 25% improvement over the rate of accuracy achievable by chance alone. Classification accuracy of age was 92.4% (which is greater than the proportional by chance accuracy criteria of: 72% x 1.25 = 90%) and frequency of going home was 70.8% (which is greater than the proportional by chance accuracy criteria of: 56% x 1.25 = 70%).

The results revealed that for every one-unit increase in students' connectedness with their classmates, they are 44% *less* likely to be age 21-25, when compared to students age 18-20. Similarly, for every one-unit increase in students' connectedness with new friends, they are 25% *less* likely to be age 21-25. Interestingly, for every one-unit increase in students' connectedness toward faculty, they are 74% *more* likely to be age 21-25 (see Table 2).

Table 2. Age as a Predictor of Connectedness

	Regression 1: Age 18-21 vs. 21+ 0 = 18-21 (*n* = 230) 1 = 21+ (*n* = 21)		
	Maximum Likelihood Parameter Estimate		
		95% CI for Exp(*B*)	
Connectedness Variables	Exp(*B*)	LL	UL
Student Connectedness	0.56**	0.38	0.83
Faculty Connectedness	1.74**	1.24	2.45
Connectedness with New Friends	0.75*	0.56	1.00
Connectedness with Old Friends	0.94	0.65	1.37
Connectedness with Diverse Friends	1.22	0.84	1.77

Note. Exp(*B*) is the odds ratio; Exp(*B*) – 1 = % that the odds increase (+) or decrease (-) change in the independent variable; CI = confidence interval; LL = lower limit; UL = upper limit; ** $p < .01$ * $p < .05$

In regard to frequency of hometown visits, for every one-unit increase in students' connectedness with other students, they are 23% *more* likely to go home infrequently. However, for every one-unit increase in students' connectedness to new friends, they are 19% *less* likely to go home infrequently (see Table 3).

Table 3. Frequency of Going Home as a Predictor of Connectedness

	Regression 1: Frequent vs. Infrequent 0 = 18-21 (*n* = 161) 1 = 21+ (*n* = 18)		
	Maximum Likelihood Parameter Estimate		
		95% CI for Exp(*B*)	
Connectedness Variables	Exp(*B*)	LL	UL
Student Connectedness	1.23*	1.02	1.49
Faculty Connectedness	1.01	0.86	1.18
Connectedness with New Friends	0.81**	0.68	0.97
Connectedness with Old Friends	1.06	0.84	1.33
Connectedness with Diverse Friends	0.97	0.78	1.21

Note. Exp(*B*) is the odds ratio; Exp(*B*) – 1 = % that the odds increase (+) or decrease (-) change in the independent variable; CI = confidence interval; LL = lower limit; UL = upper limit; ** $p < .01$ * $p < .05$

Study 2 illuminated RQ4 by clarifying the relationships among the dimensions of connectedness from the students' perspective. The results revealed a statistically significant, positive relationship between each of the dimensions of connectedness, except connectedness with old friends and faculty connectedness, and connectedness with new friends and faculty connectedness (see Table 4).

Table 4. Pearson Correlation Matrix: Students' Perceived Level of Connectedness

	SC	FC	COF	CNF	CDF
SC	1	0.326**	0.255**	0.472**	.425**
FC		1	-0.003	0.037	.193**
COF			1	0.242**	.199**
CNF				1	.489**
CDF					1

Note. SC = Student Connectedness; FC = Faculty Connectedness; COF = Connectedness with Old Friends; CNF = Connectedness with New Friends; CDF = Connectedness with Diverse Friends; ** $p < .01$

Discussion

The purpose of Study 2 was to refine current understanding of connectedness from the students' perspective. The exploratory factor analysis yielded five factors of connectedness that extended from the qualitative themes of Study 1 (i.e., social expectations versus social actions, relationships with instructors, overlap of social and institutional connectedness). The findings of Study 2 suggest that while there are qualitative differences between expectations and actions of students' connectedness to new and old friends, the statistical distinctions lie among connectedness with old friends, new friends, and unique qualities of friends (i.e., diversity among friends). The qualitative importance of connectedness to instructors found in Study 1 was expanded in Study 2 to highlight connectedness to faculty *and* other students. The students' perception of the distinction between connectedness to students and connectedness to friends is an important concept when considering the blur between "social" and "institutional" connectedness. The findings of Study 2 call to question previous connectedness literature, suggesting the need for a more nuanced conceptualization of connectedness, namely, from the students' perspective.

Rovai (2002) defined connectedness as the feeling of belonging and the creation of bonding relationships. This study acknowledges the complexity of connectedness based on this definition, and explores how connectedness is experienced and realized by students. The current study brings Rovai's definition of connectedness closer to verisimilitude, suggesting that connectedness is multidimensional and can vary based on key demographic factors of students. Connectedness, from the students' perspective, consists of an overlapping network of connectedness with old, new, and different friends, as well as with other students and faculty. The formation of connectedness is not a linear process, but a function of relational development that occurs through a series of interrelated dynamic stages. Connectedness is achieved when students are able to fulfill task roles and simultaneously meet their interpersonal needs.

Study 2 explored variations in connectedness across key demographic characteristics (e.g., biological sex, age, ethnicity, residence, first generation student, distance from hometown, and frequency of hometown visits). Findings suggest the dimensions of connectedness vary based on student age and the frequency of trips home. The variation within these factors provides a more nuanced understanding of connectedness and confirms some of the literature on college student experiences.

Connectedness manifests in two distinctly different ways based on age. Students who are 18-20 are more likely to have a high degree of connectedness with their classmates and with new friends, when compared to those aged 21-25. Alternatively, students age 21-25 are more likely to have a high degree of connectedness with faculty than are students age 18-20. While both age

groups experience connectedness, it happens in different ways. Turman and Schrodt (2006) note, "teachers and students work together to fulfill a variety of individual and educational goals" (p. 265). While teachers and students must work together to achieve connectedness, students' age appears to have an impact on the development of connectedness to faculty.

Research indicates nontraditional students actively participate more often in the classroom, and instructors expect this increased level of participation (Fritschner, 2000). Younger students perceive classroom roles differently; they remain passive and quiet allowing instructors to impart their knowledge (Fritschner, 2000). These differences coincide with the manifestations of connectedness among younger students and are informed by social identity theory, which explains how people develop personal identities and perceptions of others and relate to those who are similar (Hogg & Abrams, 1988; Tajfel & Turner, 1979). Younger students may feel connected to each other based on their classroom expectations. Connectedness between instructors and nontraditional students may develop as a result of their shared expectations as well.

Study 2 also revealed students' connectedness may be contingent on the frequency of trips home. Students with a high degree of connectedness with *other students* appear to be more likely to go home frequently, whereas students with a high degree of connectedness to *new friends* are less likely to go home frequently. Student involvement theory provides a rationale for these behaviors. Students connect to their new friends through campus activities and events (Astin, 1984). As these relationships develop and connectedness increases, students are more likely to spend more time on campus with these new friends rather than return home. Student involvement fosters new relationships and connectedness among students. In turn, the increased connectedness with new friends results in the desire to become more involved. The reciprocal nature of these factors highlights the importance of connectedness and student involvement.

The absence of significant variations between first generation students and others sets this study apart from previous research. Other studies have found first generation students expect to spend less time socializing with friends in college (Murphy & Hicks, 2006), are less engaged with their college community (Mehta, Newbold, & O'Rourke, 2011), and are less likely to develop connections with faculty members through classes, research, or conversation (Kim & Sax, 2009). Further research is needed to determine whether this contrary finding is unique to this study, or if the first generation factor is less salient when considering connectedness from the students' perspective.

Finally, study 2 explored how the dimensions of connectedness relate to one another. Social identity theory and social involvement theory treat social connectedness and institutional connectedness as independent constructs. Study 1 revealed that the student perspective of connectedness does not clearly distinguish between the two. Rather than mutually exclusive concepts, students identify and experience connectedness as a blended or overlapping concept. Study 1 suggested students develop feelings of connectedness through relationships with different groups. Students indicated they can feel both socially and institutionally connected based on their relationships with other students or faculty, old friends, new friends, and with diverse friends. Exploring these relationships separately, Study 2 revealed students connect both socially and institutionally through personal relationships. Furthermore, the dimensions of connectedness are predominantly positively related, with the exception of connectedness with old friends and faculty connectedness, and connectedness with new friends and faculty connectedness.

The positive relationships found in Study 2 are informed by elements of social identity theory and student involvement theory. Social identity theory explains that these positive relationships are the result of group identification and membership (Hogg & Abrams, 1988). This

coincides with the results of Study 2; students recognize the presence of different groups and their membership in multiple groups. When connectedness increases in one specific facet, the increase is also present across group memberships. Student involvement theory notes that connectedness results from interacting frequently with both faculty members and other students (Astin, 1984) rather than with just one or the other. Dimensions of connectedness are interrelated, and increases in connectedness generally appear to be experienced in tandem.

It is important to note the lack of relationship between faculty connectedness and connectedness with old friends, and connectedness with new friends, respectively. This finding suggests faculty can positively facilitate connectedness among students, a specifically academic relationship, but their influence may not extend to students' social connectedness with old and new friends. Friendship is a personal and often intimate relationship (Parks & Floyd, 1996). Social identity theory (Hogg & Abrams, 1988) explains that certain aspects of group identification, such as faculty connectedness, may not extend to students' personal relationships with others. In a similar manner, student involvement theory emphasizes interactions with students and instructors (Astin, 1984), rather than friends.

Practical Implications

This study reaffirms previous findings that a sense of connectedness grows from *students' perceptions* (Cutrona, 1982; Tinto, 1987), which can then be developed into objective measures. The results of Study 1 and 2 have a number of practical implications for those who work in and with student affairs. Students who feel connected are more likely to have better social and academic experiences during college, but from the students' perspective, these experiences are blurred. Perceived college connectedness is associated with a host of positive student outcomes, including higher emotional wellbeing, less likelihood of substance and alcohol abuse, and better health (Blum et al., 2002; Cutrona, 1982; Jacobson & Rowe, 1999; McNeely & Falci, 2004; Russell et al., 1980).

In general, colleges and universities should note that any interaction between a student and *any* campus employee plays a role in connectedness. Employees in settings where students are also forming social connectedness, such as food service or residence life staff, are well positioned to facilitate a sense of institutional connectedness. Students' perception that social connectedness is not necessarily distinct from connectedness in their academic programs provides further support for collaborations between departments of academic affairs and student affairs to provide a coherent, unified student education experience (Whitt, Nesheim, Guentzel, & Kellogg, 2008). Examples of this include formal faculty-student mentoring programs and informal activities such as shared meals in campus dining centers. More specifically, interactions between instructors and students aged 21-25 can be encouraged and prioritized in a number of ways, as this relationship has been found to foster student connectedness when relationships with other students are not as effective.

Limitations and Future Considerations

While the primary goal of this research was to generate theory-based applicable knowledge about college connectedness from the students' perspective, future research should test the five factors of connectedness among a variety of cultural and contextual academic settings in order to refine the measures. The exploratory nature of this research provides a stepping-stone for better

understanding connectedness; future research should use confirmatory factor analysis to test whether connectedness is a single construct comprised of five dimensions, or whether a two-factor structure may actually map onto social connectedness and institutional connectedness distinctly.

This study was also limited in that only two of the five significant overall models identified in the logistic regression analyses were useful. Future research should continue to explore how key demographic characteristics such as these, and others, may relate to students' connectedness. Research should also continue to explore connectedness from the perception of nontraditional, returning, or transfer students. Scholars may consider personal characteristics of faculty and university staff in further understanding connectedness from the students' perspective. For example, what qualities of faculty are most likely to foster connectedness (e.g., biological sex, age, personality)? What types of university staff are more influential in fostering connectedness (e.g., residence life, dining hall, janitors, academic services, financial services)?

Another limitation of the study was the sample; the generalizability of findings is limited to the university where this research took place. The findings may not be generalizable to students at other institutions due to unique campus cultures; university culture may have played a role in how the students experienced connectedness. It is important to note that while these findings may not be extended beyond the university where this research took place, the findings call into question how connectedness has been perceived in higher education. The findings of the present research may be salient at other institutions; further research should examine these concepts to see if certain patterns ring true.

Conclusion

Students perceive social and institutional connectedness as overlapping constructs, a significant consideration that can shape future studies on student connectedness and satisfaction. Connectedness is developed through relationships with friends, other students, instructors, and campus personnel. The present study provides a nuanced understanding of how connectedness emerges, how demographic variables affect its development, and how various elements of connectedness relate. From here it is important to consider how students' relationships with friends and other students may influence their ability to form connections with faculty and staff. This knowledge suggests university employees can increase students' level of connectedness through both formal and informal means. A holistic approach focused on student connectedness and satisfaction should incorporate the student perspective rather than relying predominantly on institutional conceptualizations of structure and outreach. The student experience and perception of the institution does not necessarily align with the formal structure of the organization. Adapting to this divide could be a pivotal step in the effort to better serve student needs and wants, ultimately contributing to increased student connectedness and success.

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Journal of the Scholarship of Teaching and Learning, Vol. 18, No. 1, January 2018, pp. 96-114.
doi: 10.14434/josotl.v18i1.20722

The Effects of Children's Literature on Preservice Early Childhood Mathematics Teachers' Thinking

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Abstract: In this article, the author shares an intervention of using children's literature as a pedagogical frame for an undergraduate mathematics content course with early childhood education majors to influence their thinking about mathematics teaching and learning. With this case study of 29 preservice teachers, the author found that literature increased preservice elementary teachers' excitement about mathematics, heightened their self-efficacy in mathematics, and motivated them to design innovative mathematics lessons. Results highlight the continued need for mathematically competent teachers in elementary classroom spaces, and the author advocates for the incorporation of literature as a means to do this work. Finally, the author provides implications for future research and practice with other Scholarship of Teaching and Learning (SoTL)-related projects involving children's literature.

Keywords: children's literature, mathematics education, early childhood education

Introduction

The mathematics taught at the early childhood level is intellectually robust, and prospective elementary teachers must recognize the richness of mathematics at that level (Mathematical Association of America [MAA] & American Mathematical Society [AMS], 2001). In this manuscript, the terms prospective teachers, early childhood majors, elementary preservice teachers, and students are used interchangeably; these constructs all refer to undergraduate students who are seeking their teaching certification in early childhood education (PreK–5). Notwithstanding, there are prospective teachers who have some deficiencies in mathematics, suffer from mathematics anxiety, or possess low self-confidence in mathematics, and hence should seek to break the cycle of being defeated by mathematics for improved mathematics teaching and learning at the early childhood level.

On the other hand, preservice elementary teachers generally have an affinity toward children's literature (Purdum-Cassidy et al., 2015). In line with this, the National Council of Teachers of Mathematics (NCTM) encourages the use of literature in mathematics as a medium to address mathematics standards in an ingenious fashion (NCTM, 2000). These ideas are echoed in the Common Core State Standards for Mathematics (CCSSM) (National Governors Association Center for Best Practices, Council of Chief State School Officers, 2010). To this end, integrating literature with mathematics is in sync with national efforts to improve mathematics education. Thus, it seems prudent to capitalize on prospective elementary teachers' ties to literature as a mechanism to influence their thinking about mathematics teaching and learning.

The focus of this case study is to share results of a scholarship of teaching and learning (SoTL) mini-grant project—a pedagogical intervention of using children's literature as a didactical framework to influence early childhood education majors' thinking about

mathematics. In doing so, there are some questions for critical consideration. What sorts of mathematical experiences are needed for early childhood prospective teachers to obtain certification and be deemed capable of delivering effective mathematics instruction in schools? Why do so many prospective elementary teachers have ill feelings, negative experiences, and shallow beliefs concerning mathematics while maintaining an affinity for children's literature? Why, despite many of the current efforts to promote Science, Technology, Engineering, and Mathematics (STEM) education, do certifying bodies continue to license teachers who have disdains for and obvious gaps in their mathematical knowledge systems? And how do teacher educators convince preservice teachers that their future roles as early childhood educators will provide the foundation upon which students' later mathematics trajectories are built?

These questions, among others, have provided the impetus for this SoTL study. Moreover, these questions provide opportunities to reflect more deeply and critically about ways to improve early childhood teacher education in general and engage preservice teachers in the mathematics teaching and learning dynamic in particular. To address these issues, children's literature was used to influence preservice teachers' ideas about mathematics pedagogy through this pedagogical intervention. The following research question was used to drive this study: How might the incorporation of children's literature in a mathematics content course influence preservice early childhood teachers' thinking about mathematics teaching and learning?

This article begins with a discussion of analogous SoTL research studies integrating mathematics and literature with preservice teachers followed by descriptions of the program and this case study's participants. Then, the pedagogical intervention is discussed. After that, the methods and results sections chart with specificity the methodological practices for data collection and the results obtained from collected data. Next, implications for future research and scholarship as well as practice are emphasized as it relates to early childhood education. The author concludes this article by summarizing ideas and posing questions for critical reflection, dialogue, and action among teacher educators who might engage in similar SoTL-related projects.

Related Literature

There is a growing body of contemporary literature that explores using children's literature in different contexts (see, e.g., Edelman, 2017; Flevares & Schiff, 2014; LeSage, 2013; Massey, 2015). In this section, some post-secondary research studies with preservice elementary teachers that directly parallel this work are highlighted.

Hillman's (2000) study with 51 preservice teachers in two sections of an elementary mathematics methods course was intended for preservice teachers to design and implement meaningful mathematics instruction with literature connections. Qualitative data sources included copies of lesson plans, field notes from observations, and written reflections from class activities and lessons taught. The findings revealed lessons were designed and then were categorized based on the following three groups: strong link, weak link, or no link. A strong link meant solid connections were made between the mathematical ideas in the literature and the accompanying mathematical activities. A weak link occurred when mathematical connections were minimal or not emphasized when preservice teachers finished reading a book. Lastly, no link represented a mismatch between the mathematics lesson and the mathematics embedded within the literature. Hillman suggested that preservice teachers should be allowed opportunities

to design mathematics lessons around literature, execute these lessons in real classrooms, and reflect on these experiences to augment the learning process.

In another study, Wilburne and Napoli (2008) examined the beliefs of eight preservice elementary teachers about teaching mathematics through a novel. Data sources included the following: interviews, written responses from focus group questions, reader response notebooks (whereby preservice teachers recorded interdisciplinary connections and made notes for mini-lessons surrounding the novel), mathematical autobiographies, field notes of the dramatization of the novel, and mathematics lesson plans. Preservice teachers discussed the novel within literature circle groups to share ideas of how to translate theory to practice. Results from the study's data yielded three overarching themes: (1) literature helps motivate preservice teachers to learn mathematics; (2) constructing mathematics lessons around literature helps preservice teachers make sense of mathematics more meaningfully; and (3) teachers need to be more proactive with respect to making mathematical connections to literature. Additionally, the study revealed a significant shift in the preservice teachers' beliefs about, interests in, and benefits of teaching mathematics through literature.

As it relates to pedagogy, Ward (2005) inspired 30 K–8 preservice teachers' future mathematics pedagogy by presenting activities and ideas in an elementary mathematics methods course. She did this by showcasing the unique ways in which mathematics and language skills can develop simultaneously. More specifically, she connected mathematics, social studies, and science as well as mathematics, geography, and mapmaking through children's literature. She also integrated mathematics and poetry. Finally, she required her preservice teachers to author a piece of children's literature to demonstrate their literary ingenuity. Ward advised mathematics teacher educators to equip K–8 preservice teachers with tools, resources, and strategies to effectively integrate literature into mathematics classrooms.

As it stands, the works of Hillman (2000), Wilburne and Napoli (2008), and Ward (2005) provide the backdrop for this SoTL study and can be replicated in teacher education programs across the nation. This SoTL study parallels Hillman's work in that students designed mathematics lessons, implemented them, and reflected on this practice. With regard to Wilburne and Napoli's work, this SoTL study utilizes literature circle teams to explore mathematical ideas. Further, Ward sought to establish connections to other academic disciplines. Ward also advised mathematics teacher educators to provide preservice teachers with resources to teach mathematics through children's literature effectively, and this current SoTL study seeks to achieve these aims. Collectively, their research findings informed this case study, and this SoTL project extends this body of research.

There are other studies that use multicultural children's literature as a context for teaching mathematics (Leonard, Moore, & Brooks, 2014; Strutchens, 2002) and connect science and mathematics with children's literature (Jewett et al., 2015). In the literature, there are also useful resources for teacher educators who have a desire to infuse mathematics-themed literature in their instructional practices (e.g., Casey, Kersh, & Young, 2004; Schiro, 1997; Thompson et al., 2008; Ward, 2009; Whitin & Whitin, 2004) as well as national standards to guide teacher educators regarding the preparation of PreK–12 mathematics teachers (see, Association of Mathematics Teacher Educators, 2017). These works underscore how the study included herein extends existing SoTL in early childhood teacher education, and these works provide worthwhile resources for scholar-practitioners. In what follows, a description of this study is provided.

The SoTL Study

As mentioned previously, the research question to guide this research study was as follows: How might the incorporation of children's literature in a mathematics content course influence preservice early childhood teachers' thinking about mathematics teaching and learning? Below the program and the participants involved in this study are described to further contextualize this case study. Then, specific information about the intervention is provided in light of the mathematics content course.

Program Description and Participants

The participants for this project consisted of a cohort of 29 early childhood education majors in a traditional teacher preparation program at a university in the southeastern United States: four males and 25 females. These early childhood education majors were seeking an undergraduate degree in Early Childhood Education as well as initial teacher certification (PreK–5). Students' major courses were arranged into four blocks during their junior and senior years. In Blocks I–III, students took a mathematics content course along with other education related courses in addition to completing required practicum hours in elementary schools two days per week. The mathematics course that was used for this study was taken during Block I (i.e., algebraic concepts). This content course was designed to build on students' knowledge bases in the numbers and operations domain and broaden their algebraic conceptualizations and understandings. There are mathematics courses in Block II (i.e., geometric concepts) and Block III (i.e., probability and statistics), and students complete their student teaching internship during Block IV.

Pedagogical Intervention

Children's literature was employed during this project to influence preservice teachers' thinking about mathematics. As mentioned beforehand, literature (e.g., Adler, 2012; Lichtman, 2008a; Scieszka, 1995; Tang, 2005) was infused in the course design to demonstrate the promise, potential, and impact of this SoTL project (Hutchings, Huber, & Ciccone, 2011). The entire class community read Lichtman's (2008a) *Do the Math #1: Secrets, Lies, and Algebra.* The author facilitated the class discussion for this mathematics-themed literature text and provided learning activities to scaffold and deepen students' understandings in this domain (see Jett, 2015 for an extensive discussion of this work).

In addition, students were placed into literature circle teams and worked on a collaborative book presentation (Daniels, 2002). The students read, extrapolated, and presented several texts including: *The Joy of Pi* (Blatner, 1999), *Do the Math #2: The Writing on the Wall* (Lichtman, 2008b), *The Toothpaste Millionaire* (Merrill, 2006), *Mathematicians Are People, Too: Stories from the Lives of Great Mathematicians* (vol. 2) (Reimer & Reimer, 1995), and selected chapters from *The Man Who Counted* (Tahan, 1993). Other literature circle texts that have been used in subsequent semesters are included in Table 1; the table also includes recommended mathematics ideas to teach in conjunction with these texts.

Table 1. Mathematics-Themed Children's Literature

Author	Text	Mathematics Idea(s)
Adler	*Fractions, Decimals, & Percents*	Fractions, decimals, and percents
Calvert	*Multiplying Menace: The Revenge of Rumpelstiltskin*	Multiplication
Degross	*Donovan's Double Trouble*	Mathematics anxiety
Dobbs	*The Great Divide*	Division
Duffey	*The Math Whiz*	Mathematics confidence
Franco	*Math Poetry: Linking Math and Literature in a Fresh Way*	Various mathematics concepts through poetry
Holub	*Zero the Hero*	Zero and its properties
Hutchins	*The Doorbell Rang*	Division
Kroll	*Equal Shmequal*	Equal and estimation
Leedy	*The Great Graph Contest*	Graphs
Mills	*Fractions = Trouble!*	Fractions
Mills	*7 x 9 = Trouble!*	Multiplication
Murphy	*Divide and Ride*	Division
Murphy	*Less Than Zero*	Negative numbers
Neuschwander	*Sir Cumference and the Off-the-Chart Desserts*	Graphs
Princzes	*100 Hungry Ants*	Factors
Rockwell	*100 School Days*	Counting principles
Shaskan	*If You Were a Fraction*	Fractions
Souders	*Whole-y Cow!: Fractions Are Fun*	Fractions
Wing	*The Night Before the 100th Day of School*	Counting principles

All of these texts were selected so preservice elementary teachers could present them through multiple modalities. Further, these texts served as interdisciplinary tools to deepen students' conceptual knowledge base regarding mathematics, engage students in mathematical sense making and reasoning, and build interconnected bridges across different content areas (Ward, 2005; Wilburne & Napoli, 2008). Moreover, students established connections to the mathematics and shared pedagogical lessons, insights, and ideas for use in their future mathematics teaching (Hillman, 2000).

Anticipation guides and other graphic organizers such as the Know, Want to Learn, Learned (KWL) chart, the Frayer Model, and web diagrams were used in tandem with the literature texts to synthesize mathematical ideas and bolster connections to language and literacy. Mathematical concepts from the literature texts reappeared in the mathematics problem sets, algebraic tasks, and other in-class as well as out of class activities and assessments throughout the semester designed for students to engage in and with the Standards for Mathematical Practice (SMPs) as outlined in the CCSSM (National Governors Association Center for Best Practices, Council of Chief State School Officers, 2010).

All of the learning designs were tied to literature to allow early childhood education majors to explore mathematical ideas via in-depth analysis and propel their mathematics achievement outcomes. Students also completed various activities to improve their precision of mathematical vocabulary and increase the usage of accurate mathematical vocabulary. For

example, students kept a Word-A-Day Calendar; students completed vocabulary activities; and students were expected to define and write about mathematics on various assessment tools. The pedagogical goal was not only for preservice teachers to link literature to mathematics but also for them to deeply understand the SMPs, synergistically unpack the standards, and critically address how to implement them in their respective classroom spaces. By designing mathematics learning activities, preservice teachers were provided opportunities to research ideas, pose problems, and author high-level mathematics tasks aligned to their literature texts. These evidence-based SoTL pedagogical aspects foster long-lasting leaning for students as espoused by Hutchings, Huber, and Ciccone (2011). Next, a discussion of the research methods for this project is provided.

Methods

Case study research "is an empirical inquiry that investigates a contemporary phenomenon (the "case") in depth and within its real-world context, especially when the boundaries between phenomenon and context may not be clearly evident" (Yin, 2013, p. 16). Case study researchers investigate cases for the purpose of explaining, understanding, and making the public aware about the cases (Hays, 2004). Fundamentally, case studies provide solutions and offer analyses of various solutions so that others can adapt these solutions in their own settings. Using the case study research approach, the author engaged in this SoTL project with this specific case—a cohort of 29 early childhood education majors. With this case study, both quantitative and qualitative data collection research methods were employed to understand how the incorporation of literature influenced students' thinking about mathematics teaching and learning.

Data Collection and Analysis

To collect quantitative data, the author requested for preservice elementary teachers to complete a pre- and post-Likert scale survey consisting of 20 items with the following response codes: 1 = Strongly Disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; and 5 = Strongly Agree. To respect confidentiality, preservice teachers were asked not to include their names on the surveys and were promoted to include a student identification number on it. The survey was adapted from the Attitudes Toward Mathematics Inventory (ATMI) (Tapia & Marsh, 2004). This attitude survey evaluates engagement with mathematics, and it was employed in this project to examine how literature influences students' thinking about mathematics teaching and learning. Notably, the ATMI has a .97 reliability with college students, and the content validity has been established.

The modified ATMI solicited information about their beliefs and feelings concerning mathematics. In particular, students were questioned about the value of mathematics in everyday life, the satisfaction out of solving a mathematics problem, and having self-confidence in mathematics. Statements were tailored to the specific goals of this research project. Examples included statements pertaining to enjoying reading a storybook about mathematics, infusing literature into the mathematics classroom, and designing mathematics lesson ideas around literature. To view the complete survey administered to students, please see Table 2.

Qualitatively, students submitted a narrative reflection at the end of the semester as reflections make students self-aware of their learning progress and simultaneously provide data for SoTL projects (Hutchings, Huber, & Ciccone, 2011). In this reflective paper, preservice teachers chronicled their experiences as a mathematics student from early childhood until now,

discussed how their own mathematical experiences might influence their future mathematics teaching, elaborated on how the incorporation of children's literature assisted with their own mathematics learning, and explained how this mathematics content course has been different from previous mathematics content courses taken. To view the complete assignment details, please see Table 3. After examining the students' reflective narratives, the author coded the qualitative data and placed them in various categories based upon themes (Bogdan & Biklen, 2007). Samples of students' narratives along with survey results are included in the subsequent results section to substantiate the findings, and pseudonyms are used to maintain anonymity.

Table 2. Survey Instrument for Quantitative Data

No	STATEMENT	RESPONSE
1.	Mathematics is a very worthwhile and necessary subject.	
2.	I want to develop my mathematical skills so that I can become an effective teacher.	
3.	I get a great deal of satisfaction out of solving a mathematics problem.	
4.	I get a great deal of satisfaction out of reading a storybook about mathematics.	
5.	Mathematics is important in everyday life.	
6.	Mathematics is one of the most important subjects for people to study.	
7.	I can think of many ways to teach mathematics in a classroom setting.	
8.	I can think of many ways that I use mathematics outside a classroom setting.	
9.	Mathematics is one of my most dreaded subjects.	
10.	Studying mathematics makes me feel nervous.	
11.	I expect to do fairly well in any mathematics class I take.	
12.	I am always confused in a mathematics class.	
13.	I am happier in math than in any other class.	
14.	Mathematics is dull and boring.	
15.	I feel a sense of insecurity when attempting mathematics.	
16.	I have a lot of self-confidence when it comes to mathematics.	
17.	I really enjoy mathematics.	
18.	I really enjoy reading.	
19.	I can infuse literature into a mathematics classroom effectively.	
20.	Designing mathematics lessons around literature helps make mathematics more meaningful.	

Table 3. Narrative Reflection Assignment for Qualitative Data

DIRECTIONS: Please provide honest, critical assessments concerning the questions that you choose to answer. Please answer some of the following prompts:
How has this mathematics course been different from other mathematics courses you have taken?
How have your own experiences as a mathematics student influenced how you will teach mathematics in elementary spaces?
How did the incorporation of literature assist with your mathematics learning and/or algebraic thinking?
How did the cooperative learning activities linked with literature enhance your individual mathematics learning?
What was the most valuable thing you learned in this course (this is not relegated to math)? Explain its significance to you.

Results

For the quantitative data, the mean pre-score and the mean post-score were calculated for each survey statement. Also, the mean difference between the pre- and post-scores and the standard deviation were calculated. Please see Table 4 to view the survey data's calculations in a systematic fashion. Pre- and post-survey data were analyzed to ascertain whether or not gains were noted regarding preservice teachers' ideas about mathematics teaching and learning with respect to literature and their experiences learning mathematics in this fashion. As mentioned earlier, Table 4 includes results pre- and post-means as well as pre- and post-standard deviations (SD) for all pre- and post-items. Addedly, a two-tailed t-test was conducted to determine the statistical significance of the differences between the pre-post mean scores. The significance test yielded a p-value of 0.011522. Therefore, it was determined that the increases were significant regarding the pedagogical goals of this SoTL intervention.

Conversely, some statements from the survey data yielded a negative response. In particular, Statement 11 had the largest adverse effect. The statement read: "I expect to do fairly well in any mathematics class I take." Perhaps preservice teachers thought they would perform exceptionally well in this mathematics content course given the focus on the pedagogical intervention. Some students were frustrated, however, that they did not perform well on various mathematics assessment items.

As a whole, preservice teachers' ideas about mathematics and literature were greatly influenced through their enrollment in the mathematics content course in general and their engagement with the SoTL intervention in particular. Coupling this survey data with the qualitative data yielded three overarching themes that emerged from the analysis of the data. These themes included: (1) increased excitement about mathematics because of literature, (2) heightened self-efficacy in mathematics, and (3) motivated early childhood education majors to be innovative regarding teaching mathematics. These themes are discussed taking into account supporting data.

Table 4. Survey Data

Statement	Pre-Mean	Post-Mean	Difference	Pre-SD	Post-SD
Statement #1	4.36	4.32	-0.04	0.70	0.79
Statement #2	4.72	4.80	0.08	0.45	0.40
Statement #3	3.48	3.88	0.40	1.36	1.11
Statement #4	2.76	3.48	0.72	0.91	1.06
Statement #5	4.32	4.40	0.08	0.79	0.69
Statement #6	4.20	4.36	0.16	0.75	0.79
Statement #7	3.44	3.96	0.52	1.06	0.87
Statement #8	4.08	4.32	0.24	0.89	0.68
Statement #9	3.28	3.48	0.20	1.56	1.60
Statement #10	3.52	3.40	-0.12	1.55	1.47
Statement #11	4.04	3.56	-0.48	0.77	1.10
Statement #12	2.56	2.68	0.12	1.20	1.32
Statement #13	2.48	2.60	0.12	1.24	1.26
Statement #14	2.20	2.32	0.12	1.06	1.19
Statement #15	3.04	2.96	-0.08	1.46	1.40
Statement #16	2.56	3.04	0.48	1.30	1.46
Statement #17	3.16	3.16	0.00	1.25	1.32
Statement #18	3.80	4.00	0.20	1.13	1.02
Statement #19	3.24	4.04	0.80	0.91	0.87
Statement #20	3.76	4.36	0.60	0.99	0.74

Theme 1: Increased Mathematics Excitement because of Literature

Preservice teachers expressed the mathematics-themed literature caused them to exhibit more enthusiasm about mathematics. Their comments echoed the findings in Wilburne and Napoli's (2008) study. The gains in response to statement two from the survey data also support these ideas (Statement 2: I want to develop my mathematical skills so that I can become an effective teacher). In this respect, the integration of mathematics and literature yielded a unique excitement about the mathematics teaching and learning process. One preservice teacher declared:

> I hate math, luckily this Algebra for Teachers course is not your typical math class. This course takes differentiation to a new level, through the use of not only math, but literature, articles, and if we're lucky pizza. In my past math classes going all the way back to elementary school, I always dreaded them…by using literature and hands-on examples, students like me can begin to enjoy and comprehend math. (Preservice Teacher Amy)

Amy had some struggles with mathematics during her earlier schooling experiences. She paid particular attention to the intervention as well as differentiation. Along with other students who mentioned they were learning about differentiation in their education courses, she cited this course as one whereby she could recognize differentiated instruction. She also mentioned pizza in her reflection paper referring to a lesson in which one literature circle group brought in real pizzas to assist with teaching and understanding fraction concepts. One of the literature circle group members worked as an assistant manager of a nearby pizzeria. The pizza overshadowed

the mathematics lesson because the preservice teachers were more excited about the free lunch. However, the teachable moment provided an opportunity to learn about mathematics as well as staying focused and taking care to stress the mathematics connections with such an exciting learning activity.

Overall, the preservice teachers were excited about mathematics because of literature. They also expressed presenting their literature circle text to the class was exhilarating. One literature circle team dressed up as prisoners and guards to bring to life how Beremiz solved the problem of halving the years Sanadik was to spend in the great prison of Baghdad (see, Tahan, 1993). Another literature circle group wrote a Pi Day rap and made a mathematics video of their rap to accompany their presentation of Blatner's (1999) text. As such, their literature circle presentations corroborated their excitement about this SoTL project.

Theme 2: Heightened Self-Efficacy in Mathematics

Students expressed heightened levels of self-efficacy in mathematics. In other words, the learning experience allowed them to see themselves more as mathematically capable thinkers. As the results from the third statement in Table 4 indicate, gains were made concerning students' self-confidence about mathematics (Statement 3: I get a great deal of satisfaction out of solving a mathematics problem). This self-efficacy paradigm was generated/shifted despite several difficulties with mathematics during many of their previous schooling experiences as shared in their reflective narratives.

Having challenges with mathematics prior to this course was a persistent theme throughout the reflective narratives. Narratives from two students who professed they struggled with mathematics for many years are shared. One student disclosed:

> Before beginning this course, I was not as confident about my math abilities and feared math as an obstacle that I never thought I could overcome. Through great teaching and a willingness to learn more about a subject that I have in the past struggled with, I feel as though I am confident to introduce math as an adventure that should never be seen as complicated or fearful. (Preservice Teacher Becky)

It is important to note that Becky communicated her fear of mathematics at the beginning of the semester after one of our initial class meetings. Through this SoTL intervention, however, she exhibited heightened self-efficacy concerning her mathematical abilities. This student not only shared thoughts about her self-efficacy in mathematics, but she also transferred these skills to her ability to perform this work as a future classroom teacher.

Another student who struggled in mathematics conveyed:

> I really don't remember when I started hating math. I guess it was ingrained in me from the start. I realize now at the age of 31 that not liking math was all from my past teachers. I never once had a teacher encourage me or tell me that I was good at math until I had [the author]…. With [the author] encouraging me, telling me I could do the problem, and making me go to the board to work out a problem with the help of others, I started to develop confidence in math. (Preservice Teacher Christina)

Christina had many struggles with mathematics and shared she enrolled in College Algebra five times before successfully completing the course. Actually, her struggles with College Algebra coupled with her remedial mathematics course pattern taking at the community college prior to her enrollment at the university and other responsibilities resulted in her being a non-traditional undergraduate student. Her persistence in the subject is remarkable, and she noted this SoTL

intervention helped her self-confidence in mathematics. Moreover, she credited the pedagogical style of the course as being instrumental in her development of mathematical confidence. Her comments also touch on some of the elements in theme three, which is presented below.

Theme 3: Motivated Early Childhood Education Majors to Design Innovative Mathematics Lessons

In this mathematics content course, literature was used as a differentiation tool that spanned across multiple intelligences while keeping mathematical ideas at the forefront. The MAA in conjunction with the AMS (MAA & AMS, 2001) declare that: "In order to support children's learning in this realm, teachers first must do this work for themselves" (p. 20). More precisely, preservice teachers must first experience the effects of mathematics-themed children's literature as an empowering intervention if they will later do this innovative work in their own classroom spaces. Consequently, my instructional practices modeled literature integration via novel strategies, tools, and techniques for the students. As they observed my instructional practices through the lenses of student and prospective teacher, the preservice teachers extended their efforts to be innovative in their own teaching. One preservice teacher shared:

> This [the incorporation of literature] could honestly be the missing piece of the puzzle when it comes to children's lack of excitement about mathematics. Integrating these two subjects is something I plan to do on a daily basis within my classroom. Through the integration of literature and mathematics, I hope to rid children of their fears about mathematical concepts. (Preservice Teacher Demetria)

Demetria articulated her viewpoints in this domain. She championed literature as "the missing piece of the puzzle" that represents elementary students' mathematical experiences. Her narrative relies on an assumption that children lack excitement about mathematics or have fears about mathematical concepts. This assertion could be because of her own perceptions of learning mathematics as a child. Such statements and ideological orientations about mathematics must be challenged in early childhood teacher education given that young children are generally excited about mathematics learning. On the contrary, her narrative supports the theme of making improved efforts to be innovative in her mathematics instruction through children's literature.

Through the analysis of preservice teachers' surveys and reflections, data revealed students exhibited increased excitement about mathematics, heightened self-efficacy in mathematics, and improved efforts to be innovative practitioners. As already mentioned, Table 4 portrays the quantitative changes that occurred in students' thinking related to each of the three themes that emerged from the analysis of the qualitative data. These findings answered the research question: How might the incorporation of children's literature in a mathematics content course influence preservice early childhood teachers' thinking about mathematics teaching and learning? With regard to the research question, the data suggest literature increased their excitement about mathematics, heightened their self-efficacy in mathematics, and motivated them to design innovative mathematics lessons. In the next section, implications for future work are shared.

Implications

Research and Scholarship

Based on the findings from this case study, this SoTL project lends itself to several implications for future research and scholarship. Through this study, it was found that prospective teachers' intellectual and creative schemas were magnified through children's literature. Therefore, more SoTL projects are needed to measure students' self-efficacy as they explore and design pedagogical innovations. Future inquiries should also investigate how early childhood preservice teachers' mathematics dispositions are influenced as a result of a pedagogical intervention such as this one, especially given the mathematically deficient labels often ascribed to prospective elementary teachers.

Additionally, future studies are needed to more fully understand how mathematics pedagogical and content knowledge are developed with respect to children's literature. This work goes beyond incorporating reading into the content areas; instead, this intervention should foster rigorous mathematics instruction anchored in students' experiences (Gay, 2010). Literature can make mathematics teaching and learning more meaningful (Jett, 2014; Thompson et al., 2008; Ward; 2009; Zambo, 2005). Consequently, future studies should be conducted with preservice teachers to explicate how mathematical ideas are solidified through children's literature and even extend these ideas through problem writing (Barlow & Drake, 2008). Researchers could utilize the *Mathematics and Children's Literature Brief Inventory* to explore how teachers' ideological orientations inform their use of children's literature during the mathematics teaching and learning process (Cotti & Schiro, 2004). These studies should be replicated or modified in teacher preparation programs across the nation to provide scholars with a more comprehensive understanding of this work. For example, a replication study could be done with preservice teachers at Historically Black Colleges and Universities (HBCUs) and other Minority Serving Institutions (MSIs) given their unique mission to provide equitable mathematics learning opportunities for culturally diverse students to ascertain how findings would be similar or dissimilar.

Finally, future research should explore the use of children's literature to expose students to STEM education in early childhood classroom spaces (see, Vasquez, Sneider, & Comer, 2013). Because of the unique role of mathematics in STEM, children's literature could provide more access to teaching and learning about STEM possibilities. In this vein, a longitudinal research study whereby early childhood students' STEM trajectories are charted throughout their schooling experiences using different SoTL interventions such as the literature one to propel students in this realm would be beneficial for the field. The goal should not necessarily be to produce more STEM graduates. Rather, the goal should be to produce STEM literate citizens who can use mathematical and literature principles for the empowerment of self, community, and the world. Essentially, future research studies such as the aforementioned ones could offer much to advance the SoTL canon.

Practice

In conducting this study, the author educed that infusing children's literature in the mathematics classroom has many implications for practice. The dominant discourse suggests some prospective elementary teachers have mathematical deficiencies, and national documents in

mathematics education state teachers' mathematics content knowledge is related to students' mathematical performance (AMS & MAA, 2012; MAA & AMS, 2001; NCTM, 2000). With this case study, many of the preservice teachers initially had a sense of disillusionment and a lack of enthusiasm for mathematics. As a result, one implication from this study's findings is that it is important for early childhood teacher education scholars to model excitement and heightened self-efficacy in mathematics with preservice teachers.

Next, a practical implication is for teacher educators to use children's literature as a vehicle to engage preservice and in-service teachers alike in the mathematics teaching and learning dynamic. As the research suggests, exposing them to literature alone in teacher education programs or professional development sessions is not sufficient—teachers must extend the work embedded within literature texts to author mathematics tasks and learning activities, create reform-oriented questions (Purdum-Cassidy et al., 2015), infuse advocacy letter writing in concert with the text's learning goals (Massengale, Childers-McKee, & Benavides, 2014), and develop mathematics writing prompts responsive to the needs of their students. With this case study, children's literature prompted the early childhood education majors to be creative and innovative in their mathematics lesson designs, so teacher educators should capitalize off of literature's creative schemas to extend this work in unique ways.

Teacher educators should also devise support mechanisms for preservice teachers to learn various ways to incorporate children's literature into mathematics lessons (Rogers et al., 2015). As Hillman (2000) recommends, solid connections must be made between the mathematical concepts and the accompanying mathematics learning designs to promote mathematics achievement outcomes among students. These connections should be extended to other academic disciplines to show the utility of children's literature to other content areas (see, e.g., Maples & Taylor, 2013; Vasquez, Sneider, & Comer, 2013). All in all, early childhood teacher educators should systematically utilize children's literature to positively influence students' pedagogical thinking and buttress their mathematics learning outcomes.

Conclusion

As the data from this case study revealed, children's literature increased preservice teachers' excitement about mathematics, heightened their self-efficacy in mathematics, and motivated them to be innovative with their mathematics lesson designs. Wu (2011) argues: "Because teachers also have to answer questions from students, some of which can be quite profound, their knowledge of what they teach must go beyond the minimal level" (pp. xv–xvi). Relatedly, preservice teachers' knowledge base must deepen if we expect them to deliver effective instruction that will weave academic disciplines such as mathematics and literature together in innovative ways. Considering that early childhood educators' roles lend themselves to integrating academic disciplines and establishing a culture where students are positioned as thinkers, doers, and contributors to the academic enterprise, this work is critically important at this developmental juncture in children's lives.

Also, this SoTL project is significant because reform efforts in both early childhood and mathematics education encourage the incorporation of evidence-based instructional practices such as teaching mathematics through literature (National Association for the Education of Young Children [NAEYC] & NCTM, 2010). Previous research supports that teachers' beliefs about early childhood mathematics instruction influence their pedagogical practices (Brown,

2005). Therefore, SoTL efforts and studies to influence prospective early childhood educators' thinking and belief systems regarding mathematics pedagogy must be employed.

To challenge readers' epistemological ideas surrounding mathematically competent teachers at the early childhood level, the following questions could serve as discussion prompts for the teacher education community writ large: What are the present teacher education goals for early childhood education majors? How might existing SoTL studies help to achieve these goals? How might children's literature inform these goals? What types of curricula, pedagogical approaches, and theoretical orientations are effective in helping prospective elementary school teachers gain mathematics conceptual, pedagogical, and cultural knowledge needed for effective mathematics teaching and learning? And how might innovative SoTL practices work in line with these ideas?

In closing, the research literature indicates there is a need for skilled, effective teachers not only for the sustainment of the mathematical enterprise, but also to make certain that our children are provided with the high-quality teachers, rigorous and equitable mathematics instruction, and culturally responsive curricula and evaluative tools needed for this time (Delpit, 2012; Gay, 2010; White et al., 2016). Children's literature is a vehicle to achieve this goal. Literature helps to foster positive dispositions about mathematical activity as found through this case study and previous SoTL work (Hillman, 2000; Ward, 2005; Wilburne & Napoli, 2008). The author beseeches teacher education pedagogues to act and jointly engage in SoTL projects with preservice teachers for the sake of the classrooms, families, and communities they will serve.

Acknowledgements

This research project was supported by an intramural University of West Georgia Institutional STEM Excellence (UWise) faculty mini-grant, and the author would like to thank the Georgia Board of Regents STEM Initiative for their support of this project. The author would also like to thank Dr. Erika C. Bullock for her feedback on an earlier draft of this manuscript.

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Journal of the Scholarship of Teaching and Learning, Vol. 18, No. 1, January 2018, pp 115-135 .
doi: 10.14434/josotl.v18i1.22097

A Simple Classroom Experiment on Money Demand

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Abstract: This simple classroom experiment is designed to help students to better understand the concept and the theory of money demand. By simulating what households face in real life, the experiment allows students to reflect on the cost and benefit of holding money and understand how money demand is affected by various factors. The experiment is suitable for an undergraduate macroeconomics course at the introductory or intermediate level. The paper also presents evidence of effectiveness of the experiment on student learning, controlling for student characteristics. Stronger effects are found for lower-year students, native English speakers, students with better attendance, and those with lower GPAs.

Key words: money demand, macroeconomic experiment, classroom experiment effect, economic education

Introduction

Money demand is a key concept in introductory and intermediate macroeconomics. It is at the core of models based on the money market, such as the short-run models (including the conventional IS-LM model and the more recent IS-MP model) and the open economy macroeconomic models adopted in international economics textbooks (for example, the Mundell-Fleming model and Dornbusch's overshooting model). However, students often confuse it with other concepts, such as money supply, saving, income, and wealth, causing difficulties in understanding subsequent theories.

The purpose of this paper is twofold. First, it introduces a classroom experiment to illustrate the concept of money demand. By simulating what households face in real life, the experiment gives students an opportunity to reflect on the cost and benefit of holding money and better understand how money demand is affected by expenditure, interest rate, and the cost of transferring financial assets to money. The expanded version of the model can also incorporate factors such as interest rate and exchange rate risks. Suggested issues for follow-up discussion and questions for a homework assignment based on the experiment data are included to further reinforce students' learning experience. The second purpose of the paper is to examine the resulting student learning outcome so that instructors are aware how successful the experiment is during trial. Using data collected from multiple sections of macroeconomics courses at the principles and intermediate levels, the paper finds a strong, positive effect of the experiment, controlling for student characteristics.

In general, existing literature on classroom experiments is either a description of a new classroom experiment (for example, Hodgson, 2014; Ewing, Kruse, & Thompson, 2004) or a study of the effectiveness of existing experiments (for example, Emerson & Taylor, 2004; Eisenkopf &

Sulser, 2013), but not both.[1] This paper introduces a new classroom experiment concerning a macroeconomic concept and adds to the pool of classroom experiments in macroeconomics that is still relatively small. In addition, by studying the resulting student learning outcome, this paper takes it to the next level to present evidence of efficacy of the experiment so that instructors are better informed before adopting it. The study will also contribute to the general understanding of the effectiveness of classroom experiments in association with student characteristics.

Although the growing popularity of adopting classroom experiments as a teaching strategy indicates favorable opinions among instructors, the results of existing formal studies vary widely on the effectiveness of classroom experiments. A closer look at these studies reveals that the existing studies differ in the experiments used, the measures of student learning, and the approaches to draw conclusions. As a result, their results may not be entirely comparable. First, the experiments used in the studies are different, rendering cross-study comparison and generalization of results from individual studies problematic, particularly for those based on a single experiment. The size and characteristics of students involved also vary greatly. For example, Gremmen and Potters (1997) used a simulation of international economic relations in three college-level classes with 47 students in total. Without controlling for student characteristics, they found the effect of the game was positive immediately after it was conducted, but it dissipated over time. Eisenkopf and Sulser (2013) studied a fishing game with 42 classes of 720 high school students, and found the effect of the game strongly depended on student capabilities. Other studies also confirmed that the gains from classroom experiments may be affected by classroom size, preferences of learning styles (Durham, McKinnon, & Schulman, 2007), whether incentives are provided (Dickie, 2006), whether a follow-up report is required (Cartwright & Stepanova, 2012), and so on. Thus, in addition to the quality of individual experiments, the effectiveness of experiments may also depend on student attributes and how they are conducted.

The measure of student learning outcome used in the studies includes test results, student opinions, student attitude, retention of knowledge, etc. Although related, these measures have different emphases and are not perfectly substitutable. When measured by test results, most studies find that classroom experiments yield positive effects on student learning (Eisenkopf & Sulser, 2013; Emerson & Taylor, 2004; Frank, 1997; Gremmen & Potters, 1997), but some studies detected little evidence of test improvement with certain experiments (Durham *et al.*, 2007) or as a general strategy in comparison with the conventional approach (Mitchell, 2008; Yandell, 2004), perhaps due to the aforementioned differences in the research design. Using non-test based measures, Durham, McKinnon, and Schulman (2007) conclude that classroom experiments significantly improve students' attitude toward economics and retention of knowledge, but Emerson and Taylor (2004) find no effect on student evaluations and class attrition rates. For ease of measurement and the benefit of objectivity, this paper uses test performance as a measure of student learning.

The experiment presented in this paper is related to but differs from two existing experiments designed by Beckman (1987) and Ewing *et al.* (2004). Beckman (1987) describes a SAS computer program based on Baumol (1952) and Tobin (1956), in which participants decide their money demand by buying and selling bonds in a 12-month period, and one such transaction is allowed each month. It takes little time to run with computers, but otherwise it would be too complex and time consuming to run. In Ewing *et al.* (2004), an interesting experiment is presented focusing on the portfolio theory and stresses the risk factor of assets. However, it does not address

[1] The *Journal of Economic Education* suggests that manuscripts on classroom experiments are divided into these two *separate* categories (Emerson, 2014).

other fundamental factors, such as interest rates and expenditure, which serve as the foundation of macroeconomic models in macroeconomics and international economics textbooks.

The experiment is based on a model by Baumol and Tobin (1989), which is incorporated in some macroeconomics textbooks (see, for example, Mankiw, 2010; Rossana, 2011). The model serves as a microeconomic foundation for the theory of money demand. It illustrates the transactional motive of holding money and the trade-off with holding non-money assets. It also addresses the more recent understanding of the impact of banking deregulation and technological development by considering the cost of transferring non-money assets to money. However, like its alternatives, the model has its limitations. For example, it does not explain the roles of uncertainty and expectation as in some portfolio theories. Of course, it can be impractical to combine different models into a single classroom experiment and attempt to address too many factors. Nevertheless, an expanded version of the experiment accommodating interest rate and exchange rate risks is described later.

The experiment is suitable for an undergraduate macroeconomics course at the introductory or intermediate level. It has a much simpler setting than Beckman's (1987) and only requires paper and pencil to run. The set-up also allows multiple money transactions within a month without a limit, and thus it is more flexible and realistic. It is simple to conduct and flexible enough to allow the instructor to allocate as short as 25 minutes or as long as 50 minutes to finish, with some time left for discussion. Depending on how much time the instructor is willing to spend and how large the class size is, the experiment can be conducted by groups or by individuals. If the class size is large, students can be divided into groups so that entering data will not consume too much time, particularly if the instructor chooses to analyze the results in class immediately after the experiment. Another advantage of having students work in groups is to allow discussions during the experiment before the instructor-led discussion after the experiment.

The experiment does not require computers. However, it will be advantageous if the instructor has a computer and a data projector, since the results can be recorded in a spreadsheet[2] and aggregate data can be shown and analyzed immediately after the experiment. This will facilitate discussion while students' memories are still fresh. Alternatively, data can be processed by hand with the help of an assistant. The aggregate data can then be shown on the blackboard for discussion.

The remainder of the paper is structured as follows. The first two sections describe the experiment, discuss the experiment results based on my experience, and offer suggestions on in-class discussion and homework assignment. The third section contains suggestions on how the experiment can be run in alternative ways, incorporating additional factors such as interest rate and exchange rate risks. The next section presents a formal analysis of student learning outcomes resulting from the experiment. The last section includes final remarks. Instructions, decision recording forms, and sample results from running this experiment are in the Appendices.

Description of the Experiment

Structure of the Experiment

[2] An Excel file containing the formulas is available on request.

In the experiment, each student (or group of students) represents a household and makes decisions regarding how much money (cash and checkable deposits, assuming for simplicity that savings deposits are non-money assets) to hold by withdrawing from their savings accounts during a month. Students are given the information regarding: (i) the initial savings deposits at the beginning of the month; (ii) spending level during the month; (iii) interest rate level; and (iv) the cost of making a withdrawal. Savings deposits yield interest, which is calculated based on average balances. Checkable deposits do not bear interest and are treated as cash. Students make withdrawals to pay for spending, which spreads evenly through the month. Each withdrawal incurs a fixed cost regardless of the amount withdrawn and for simplicity's sake it must be in the same amount. Thus, the key decision is how many withdrawals to make during a month and in what amount.

Observed from past results of running this experiment, students can easily see that they should hold just enough money to pay for the spending and not carry a money balance at the end of the month. Thus, for simplicity, I will focus on the experiment in which the number of withdrawals is the only decision to make, and the amount of each withdrawal is the spending level divided by the number of withdrawals.[3]

Payoffs are calculated by subtracting total withdrawing cost from interest earned. The experiment is repeated with different interest rate levels, withdrawing costs, or spending levels. The concept of money demand is illustrated when students consider how they allocate their assets between savings deposits and money (cash and checkable deposits) by weighing the cost (forgone interest earnings) and benefit (convenience, reflected by lower total withdrawing cost) of holding money.

The experiment is repeated 9 times (3 quarters with 3 months in each quarter) in total. For simplicity, each month is independent of each other, and an earlier decision does not affect the later months. In the first quarter, the interest rate is different in each month, while the initial savings deposit, spending level, and withdrawing cost are all the same. Thus, students' response in the first quarter will show how their money demand responds to interest rate changes. In the second quarter, the withdrawing cost is lower than in the first quarter (but the same across the three months); everything else follows the first quarter. By comparing the first and second quarters, we can see how money demand changes when the cost of withdrawing money (or converting non-money assets to money) drops. In the third quarter, the spending level is higher than in the first two quarters (but again, it is the same for all the three months in the third quarter). Other conditions are the same as in the second quarter. The change of money demand between these two quarters shows how it is affected by expenditure.

Preparations for and Running the Experiment

Before the experiment, it is useful to briefly review the concept of money in class: for example, the functions of money and the meaning of each function; the connections between the functions of money and money demand; the measure of money (what is considered as money); and misunderstandings about this concept (perhaps asking students to make a sentence containing the word money and diagnose if the concept in the sentence is the same as defined in macroeconomics). For a principles course, this experiment can be run after finishing the introduction of the money

[3] Of course, if there is enough time, this setting can be easily modified to allow the amount withdrawn as part of the decision. See Appendix II for a modified decision recording table.

concept. For an intermediate level course, spending 10 minutes reviewing the concept should be sufficient.

As in the general case of classroom experiments, it is necessary for the instructor to prepare a handout of detailed instructions and carefully go through them before the experiment. It is essential for the instructions to contain a numerical example to show how payoffs are calculated (see Appendix I). Before the experiment starts, the instructor should ensure that students fully understand what decisions they are expected to make and how their payoffs are calculated. When going through the instructions, it is also beneficial for the instructor to verbally stress some of the information that might be confusing to them: for example, the purpose of the experiment is to illustrate what affects money demand and how each month is independent of each other; savings deposits always start at the same level regardless of previous decisions; their key decision is the number of withdrawals and in which column of the decision table it is recorded; and they can use intuition to make decisions without doing the calculations, and so on.

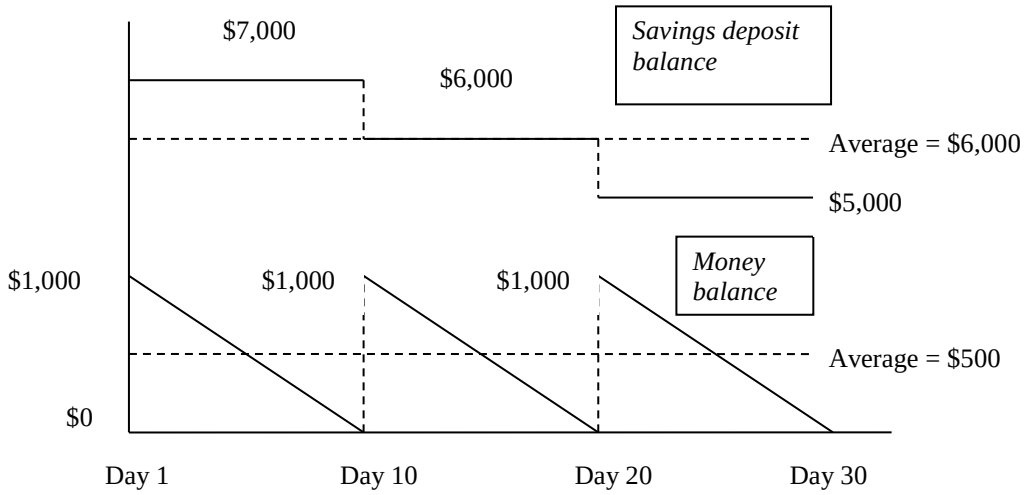


Figure 1. Calculating average balances.

To help students understand how withdrawing decisions affect money balances and payoffs, a graph can be used to illustrate how average money balance and average savings deposits are calculated (Figure 1). This graph is similar to Baumol and Tobin (1989) and Mankiw (2010). Using the example (as in the instructions) of $8,000 initial savings deposits, $3,000 monthly spending, and withdrawing 3 times during the month with $1,000 per withdrawal, the graph illustrates how money balance and savings deposits change over time during the month. As can be seen, the average money balance in this month is the average of the amount of each withdrawal and $0 (here it is ($1,000)/2 = $500). Likewise, the average balance of savings deposits is the average of the beginning balance and the ending balance ($7,000+$5,000)/2 = $6,000 here). Of course, this chart can also be included in the instruction sheet.

After reviewing the instructions, the instructor can assign a household id to each student for follow-up analysis. The instructor will also point out that students with top total payoffs are awarded extra credit points or small gifts as an incentive. If the monetary value of the maximum payoff in the experiment is small, the instructor can directly use cash as the award. In the past, I have used chocolate bars, candies, small stationery items, such as white-out tapes and post-it notes.

Even if the values of those items are small, it seems they are more effective in drawing interests from the students than extra credit points.

The instructor may choose to provide the information month by month or simply announce the start and the end of each month to synchronize the pace. However, in my experience, it is preferable to give the information of the 9 months to students all at once, and leave the students to determine the pace by themselves. Providing the information all at once allows the students to more easily compare the differences in the conditions they need to consider and to vary their decisions accordingly. Moreover, even if the calculations are simple and the formulas are included in the table, the pace at which the students complete the first several decisions varies greatly. However, the instructor does need to stress how much time in total they have before the experiment and to frequently remind them about how much remaining time there is during the experiment. The instructor needs to remind the students towards the end of the experiment that if they have not finished making decisions, they must do so using their intuitions without doing the calculations. This will ensure that the experiment is finished on time.

My time allocation of the experiment is usually as follows: 10 minutes for the instructions, 15 minutes for the experiment, and 5-8 minutes for in-class results recording (with 30 students or less). The total time of running the experiment is about 30 minutes.

It is helpful for the instructor to calculate the best number of withdrawals before the experiment in order to choose the appropriate levels of interest rates, expenditure, and withdrawing cost for each case, so that the optimum numbers of withdrawals differ in each case. Using Y to represent spending, r monthly interest rate, c withdrawing cost, and n number of withdrawals, the payoff $\pi = (savings\ deposits - (Y/n + Y)/2) * r - nC$. Maximizing π yields the optimum n to be the square root of $(Yr/2C)$. However, note that the purpose of the experiment is not to mathematically formulate the maximization problem and find the solution, but to train students to better understand the concepts and the factors determining money demand in an intuitive way.

Decision Recording

Students record their decisions and calculate money demand and payoffs for each month in a table. Students can make withdrawing decisions intuitively and calculations of payoffs by themselves are not necessary. In this case, the instructor can act as the bank for the households and calculate payoffs for the students. However, it would still be better to include the full version of the decision recording table, while specifying in the instructions that the instructor will perform the final calculations and students should focus on making withdrawing decisions (see experiment instructions in Appendix I). In this case, most students will still choose to perform the calculations for at least their first several decisions since doing the calculations obviously helps their decision making. However, the correctness of their calculations is no longer a concern, and those who struggle can choose to rely on their intuition.

Not requiring calculating payoffs by the students has a number of benefits. First, it ensures that students' effort is focused on making withdrawing decisions, not to calculate the payoffs correctly. Second, students are more likely to try to think intuitively, without having to finish all the calculations. Third, it saves time and removes frustrations students may have due to their fear of mathematics. I have run the experiment with and without requiring payoff calculations, the results (how total money demand of all households change with the factors considered) have not differed greatly. But when it was not specified that calculating the payoffs was not required, there were always a few students who spent too much time in getting the math right and could not focus

on or finish making decisions. The experiment was also run a few times without including payoffs in the decision recording table and students had to make their decisions based on intuition only. The experiment results still coincided with the theory well.

At the end of the experiment, students report their decisions to the instructor. With a smaller class size, the results can be recorded immediately in class. With a larger class size, the results can be collected and recorded after class. I usually record the results in an Excel table in class (it takes about 5-8 minutes with 20-30 students). The Excel table is pre-designed with all necessary formulas included so that when the number of withdrawals is entered, all corresponding values (monthly average money balance, monthly average balance of savings deposits, interest earnings, total withdrawing cost, and total profit) will be shown. A data projector can be used to display the table while each student reports his or her decision. Students are usually excited to watch and compare each other's payoffs. When there is more time left, the instructor can then proceed to discuss the results of the experiment.

Experiment Results and Follow-up Discussion and Assignments

I have run the experiment with the number of students ranging between 9 and 38. Individual responses have differed, and the average number of withdrawals and average money demand level may not always turn out to be optimal, especially with a small class. However, most students followed a correct strategy in making their withdrawing decisions, and the aggregate results have always been consistent with the theory, especially in terms of the directions in which money demand changes in response to changes in the factors considered in the experiment. As noted earlier, the purpose of the experiment is not to find the optimal money holding level, but to see what factors affect money demand and how. From my experience, this experiment has served the purpose well. The result of a sample experiment is reported in Appendix III.

As Hazlett (2005) points out, experiments are more effective if students are actively involved in the follow-up analysis. If the data is recorded and processed in class, a preliminary analysis of the data can be done immediately following the experiment. The instructor can randomly ask students why they change their withdrawing decisions in different months, such as why they make more withdrawals in month two, and why they have a lower money balance when the interest rate is higher. In addition, the data can be ordered according to payoffs. The instructor can ask students to compare the strategies of the households with higher and lower payoffs. Specifically, students can analyze why a particular household receives a higher payoff than another household, and recommend strategies for households with lower payoffs.

The following questions can also be discussed in class as an extension:

1) Suppose households can pay for their spending with credit cards. In this case, they write a check and pay the credit card company at the end of the month. How would your decision of withdrawing from your savings deposits be affected?
2) Why does money demand (average money holding) decrease when you withdraw more often? (This question is worth spending time on since students are often confused.)
3) In the real world situation, what are the likely sources of the withdrawing cost? Does your bank charge you when you make a withdrawal from your savings account? How long would it take to make a withdrawal if you have to go to your bank in person and wait in line? How do we measure the value of the time spent on making a withdrawal? What has happened to the withdrawing cost with the use of ATM machines, telephone banking, and internet banking?

4) Suppose you have a higher initial savings account balance, but your spending level, the withdrawing cost, and interest rates are the same. Would you respond differently?

A homework assignment can follow the experiment. The purpose is to guide students to further summarize the results generalized from the experiment and derive the money demand curve based on the results. The following are some sample questions:

1) What advice would you give to households 2 and 3? How would their money holding change if they follow your advice?
2) Imagine that the households participating in the experiment form a mini-economy.
   a. Calculate the aggregate money holding (money demand) for this economy by month.
   b. Using the aggregate data for the first quarter, draw a money demand curve with interest rate at the vertical axis and money demand at the horizontal axis. How does money demand change with interest rates? Explain why.
   c. In the same graph, repeat part b for the second quarter. How does the position of the money demand curve change? What caused the shift?
   d. In the same graph, repeat part c for the third quarter.
   e. With monthly income as the sum of total spending for all households, calculate the money demand parameter k and income velocity V (as in the quantity equation) for each month. How have they changed with interest rate, withdrawing cost, and spending level?

Modifications and Expansion of the Experiment

The experiment uses the narrow definition of money (M1, or cash and checkable deposits). Savings deposits are treated as non-money assets. The experiment can be modified to treat savings deposits as part of a broader definition of money. In this case, non-money assets can be represented by bonds, stocks, or fixed term deposits.

Spending levels can be the same or different across households. If the class size is relatively large, several tiers of spending levels can be assigned to different households. In this case, the experiment does not have to be repeated as many times and the ones illustrating how spending level affects money demand (the third quarter) can be eliminated. The transactional demand for money can be addressed by charting the money demand curve for different spending levels as part of a homework assignment.

Instructors who wish to focus only on the interest rate factor can save time and just use the first 3 months of the experiment. Likewise, to focus on the withdrawing cost only, the experiment can also be reduced to 2 to 3 months, with varying withdrawing costs but the same interest rates and spending levels. An alternative version of the experiment is to divide each month into several periods (for example, 4 weeks). Students decide whether to make a withdrawal in each period, and in what amount if they do. This setting is similar to Beckman (1987) and limits the maximum number of withdrawals each month. The corresponding recording table is in Appendix II.

The experiment can be set up differently to allow for interactions and collaboration between students. Students can be paired with one representing a household, the other a bank. For a visual effect, hand out printouts of hypothetical money totaling the amount of the initial savings deposits to each bank (for example, eight printouts of $1,000). These initial assets can also be designated as bonds, if instructors so choose, and banks as brokers. For simplicity, each month is divided into 4 weeks with the same conditions. A change in interest rate, withdrawing cost, or spending level is introduced at the beginning of a new month. At the beginning of each week,

households consult with their banks and make the decision whether to withdraw or not and in what amount. When they make a withdrawal, they receive money from their banks. At the end of the week, households remove an amount equivalent to their weekly spending from their cash holding. Households and banks are each primarily responsible for keeping records of money and savings account balances, respectively. They calculate the profit for the household at the end of the month separately and compare the results with each other to ensure accuracy. The instruction and recording sheet is included in Appendix IV. They are also allowed time to discuss observations after each month. In this setup, it is best to spend more time (about 10 minutes) on the first month to ensure students follow the instructions correctly. The rest of the months take less time to run.

The experiment can also be expanded to incorporate risks of returns on non-money assets. An additional month can be added when the interest rate is uncertain. Following Ewing *et al.* (2004), the uncertainty can be introduced by flipping a coin, with one side associated with high interest rate and the other side with low interest rate (ideally, a negative interest rate), and the mean the same as the interest rate in the previous month. As an illustration, during the last month in the alternative setup in Appendix IV, interest rate is determined by flipping a coin as either 8% or -6% with the mean 1%. In the baseline experiment, a pair of multipliers can be used to multiply the interest rates in a previous quarter while keeping the means the same, for example, 8 (heads) and -6 (tails). Although simple, this setting also implies that higher returns are associated with higher risks. Thus, comparisons within the 3-month quarter and with a previous quarter when no risk is involved are both worth attention as part of the follow-up discussion.

The effect of exchange rate risk on money demand is more complex. As reviewed by Arize, Malindretos, & Shwiff (1999), on one hand, the desire to reduce holdings of risky assets may cause demand for domestic money to increase with increased foreign exchange risk (Zilberfarb, 1988); on the other hand, money demand can also decrease due to a greater incentive to diversify assets and offset the higher transaction cost of international trade associated with more uncertain exchange rates (Akhtar & Putnam, 1980). If instructors wish to illustrate the former, the exchange rate risk can be combined with interest rate risk, specified as uncertainty in returns on interest earning assets. To illustrate the latter, additional periods of the experiment may be introduced (more conveniently to the alternative setup as in Appendix III), in which households spend on both domestic and foreign goods, paid by domestic and foreign currencies, respectively. The conversion from the domestic currency to the foreign currency may be at a fixed rate (without exchange rate risk) or at a variable rate determined by flipping a coin (with exchange rate risk).

Assessment of the Experiment

To collect evidence that the experiment fosters student learning, I made a few attempts to evaluate the effect when using this experiment in my courses. After reviewing the concept of money and the money demand theory in an abstract way, students were asked to answer four questions on money demand before the experiment. After the experiment, they answered the same questions, and the number of correct answers was compared. Based on the results of two sections of intermediate macroeconomics with 29 students each, on average, students answered 2.0 questions correctly before the experiment and 2.3 questions correctly after the experiment but before any discussion of the results. The mean improvement was 0.34 (17%) with a significance level of 13%. However, the result improved more significantly after the follow-up discussion and homework assignment (but before the homework was graded). The average number of correct answers increased from 1.9 to 3.4 with a significance level of 7% in a study with 15 students. This result

indicates that it is important to use follow-up analysis in order to take full advantage of classroom experiments.

Two short student surveys indicated students' favorable attitude towards the experiment. An anonymous survey was first conducted after the class discussion but before the homework assignment in two classes of intermediate macroeconomics with 58 students in total. The result indicated that 86% of the students agreed or strongly agreed that the experiment helped them better understand money demand; 71% agreed or strongly agreed that they had a better understanding of the concept of money; and 84% would recommend using this experiment for this course in the future. A second anonymous survey was conducted after the follow-up discussion and the homework assignment (but before the homework was graded) in an intermediate macroeconomics class of 15 students; the corresponding proportions of the students who agreed or strongly agreed to the above three statements were 100%, 90%, and 90%, respectively.

To further understand if the gains from the experiment differ depending on student characteristics, a more careful assessment was carried out later with students from principles of macroeconomics and intermediate macroeconomics courses. After the usual coverage of the contents on money and money demand, students were randomly divided into an experimental group and a control group, and a test of nine questions on money demand was given to all students. A bonus credit equivalent to 0.6%-1.5% of the total grade was given to participating students. To isolate the effect of the experiment without mixing it with that of homework assignments, the post-experiment test was given without completing a related homework assignment. A survey of student characteristics was also collected. The sample includes 132 students from four sections of Intermediation Macroeconomics and one section of Principles of Macroeconomics across several semesters. Most of the students were majoring in business, only a few were economics majors and minors. As shown in Table 1, the distributions of student characteristics in the two groups are generally similar. The mean improvement in the number of correct questions was about 8% with a significance level of 1.5%.

Regressions are run with the logarized test score as the dependent variable, while the experiment dummy (which equals 1 if in the experiment group) and student characteristics in Table 1 as explanatory variables. In considering the relatively small sample size, model selection is conducted using several criteria. With the Schwarz Bayesian (BIC) or Akaike information criterion (AIC), only the experiment dummy, GPA, and college year remain as explanatory variables; with the adjusted R-squared criterion, two additional variables, interest in economics and the female dummy are also kept. The regression results of these two models are reported in columns (1) and (2) in Table 2. Interactions between the experiment dummy and other variables are also considered, including those excluded as a result of the model selection process, two of which, the number of classes missed and the dummy for non-native English speaker, are added back due to their significant interaction terms with the experiment dummy. The results including these variables but without the interaction terms are in column (3) and those with the significant interaction terms are in column (4). Finally, column (5) includes an additional interaction term between GPA and the experiment dummy since it is often considered by the literature, even though it is not significant when it is included alone.

Diagnostic tests indicate that the specifications of the models are sound. Take model 3 as an example. The *p*-value is 0.933 for Ramsey's RESET test for functional form and 0.196 for White's test for heteroscedasticity, and there is no sign for collinearity with the variance inflation factors all below 1.3.

Table 1. Descriptive Statistics

	Without experiment		With experiment	
	Mean	St. dev.	Mean	St. dev.
Number of students	61		71	
Principles of Macroeconomics	11		9	
Intermediate Macroeconomics	50		62	
Female	34		34	
Non-native English speaker	23		17	
Test score (0-9)	4.77	1.68	5.52	1.80
GPA	3.31	0.43	3.28	0.49
Interest in economics (0=none; 3=much)	1.52	0.87	1.51	0.72
Number of economics courses taken	3.62	1.79	3.54	1.16
Number of classes missed for the course	0.98	1.82	1.44	2.63
Hours spent studying for the course	4.30	3.28	4.20	2.70
College year (1-4)	2.79	0.78	2.70	0.92

Estimation of the effect of the experiment dummy is stable and highly significant across all regressions. Similar to the regressions without interaction terms, the average marginal effect of the experiment dummy is 0.19 in the regressions with the interaction terms (models 4 and 5). These results indicate an 18-20% marginal improvement in test scores after the experiment. Among other variables, GPA, an indicator of aptitude, is consistently highly significant, as in the literature (for example, Durham *et al.*, 2007).

The results for the interaction terms suggest that the benefit of the experiment is substantially more for lower-year students, native English speakers, those who do not tend to miss classes, and those who have lower GPAs. Perhaps classroom experiments are particularly helpful for those who are less academically mature, indicated by their lower GPAs or shorter attendance in college. On the other hand, those who have missed many classes may lack the preparations or the desire to learn from the experiment. Different life experiences and the challenge of the English language may also create a hurdle for non-native English speakers to absorb the implications of the experiment in a short time.

The interaction terms of the experiment dummy with all other variables are insignificant (not shown in the table), and there is no compelling evidence that other student characteristics, such as interest, previous exposure to economics, and gender, play a role in test scores or gains from the experiment. As an example, unlike in Durham *et al.* (2007) and Emerson & Taylor (2004), neither the main effect of the female dummy, nor its interaction with the experiment dummy, which has a *p*-value of 0.664 when added to model 5, indicates any gender difference on test performance or the effect of the experiment.

Table 2. Regression Results (p-values in parentheses)

	(1)	(2)	(3)	(4)	(5)
Experiment	0.184***	0.204***	0.201***	0.973***	2.206***
	(0.002)	(0.001)	(0.001)	(0.000)	(0.000)
GPA	0.320***	0.281***	0.287***	0.365***	0.590***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
College year	0.111***	0.112***	0.111***	0.248***	0.297***
	(0.002)	(0.002)	(0.003)	(0.000)	(0.000)
Interest in economics	-	0.058	0.059	0.045	0.047
		(0.154)	(0.153)	(0.252)	(0.223)
Female	-	0.080	0.084	0.078	0.072
		(0.218)	(0.211)	(0.215)	(0.243)
Non-native English speaker	-	-	-0.004	0.121	0.156*
			(0.952)	(0.160)	(0.073)
Number of classes missed	-	-	0.0048	0.052**	0.074***
			(0.729)	(0.032)	(0.005)
Experiment * college year	-	-	-	-0.228***	-0.279***
				(0.001)	(0.000)
Experiment * non-native English speaker	-	-	-	-0.304**	-0.343***
				(0.019)	(0.008)
Experiment * Number of classes missed	-	-	-	-0.0549*	-0.081***
				(0.051)	(0.008)
Experiment * GPA	-	-	-	-	-0.318**
					(0.034)
Constant	0.12	0.115	0.092	-0.620*	-1.534***
	(0.650)	(0.669)	(0.750)	(0.055)	(0.004)

***p* < 0.1, ***p* < 0.05, ****p* < *0.01*

Final Remarks

As Ewing *et al.* (2004) note, existing experiments are mainly designed for teaching microeconomics and few are for macroeconomics. However, macroeconomics probably requires more abstract thinking since it may be more difficult for students to relate to their personal experience when studying macroeconomics. The theory of money demand is the key to understand a host of macroeconomic theories currently taught at the college level. Although a difficult and

confusing topic, it has a well-established microeconomic foundation, making it a perfect candidate for classroom experiments.[4]

One benefit of using classroom experiments is the promotion of knowledge retention (Parker, 1995). The decision-making process in this experiment enables students to better remember the material, particularly if the instructor guides the students to derive the intended theoretical results through follow-up analyses. Using the experiment in principles of macroeconomics and intermediate macroeconomics courses, I found that students had a more thorough understanding of money demand when they were subsequently introduced to related theories. However, such observations may be subjective and difficult to measure, as pointed out by Holt and McDaniel (1998). Studies may be designed to test whether experiments improve knowledge retention and aid learning of related theories.

The formal analysis of the effect of the experiment presented in this paper shows strong evidence that the experiment has a positive effect on student learning, and the effect is stronger for lower-year students, native English speakers, students with better attendance, and those with lower GPAs. However, there is no evidence that other student characteristics, including gender, affect test performance or the gains from the experiment.

The positive effect of the experiment in this paper is measured without a follow-up assignment, and the evidence that student learning can further improve after completing an assignment is preliminary. Further assessment may be carried out to compare the outcome after an assignment is complete. As in the literature, indicators other than test scores, such as improvement in student interest and attitudes towards economics, may also be used to measure student learning outcome.

[4] See Hazlett (2006) and Parker (1995) for suggestions on choosing experiments.

Appendices

Appendix I. Instructions and Decision Recording Table

Instructions

1. In this activity, each of you represents a household. You will determine your money demand level for each of the nine months considered. Your purpose is to keep enough money (including cash and checkable deposits) for your household's spending needs by withdrawing from your savings account and earn as much profit as possible. Your profit is your interest earnings less your total withdrawing cost.

2. You have $8,000 initial deposit in your savings account at the beginning of each month. You earn interests on your savings deposits. Your interest earning is calculated based on the average balance of your savings account.

3. Your monthly spending is distributed evenly through the month. You pay for your spending with money (in cash or checkable deposits) by withdrawing from your savings account. There is no initial money balance. For simplicity, each withdrawal is in the same amount and just enough for your spending. For example, if your spending is $2,000, and you make 2 withdrawals, each withdrawal is $1,000. The first withdrawal always occurs at the beginning of the month, and the rest spreads evenly through the month. Each withdrawal incurs a cost, which will be specified later. Money does not bear interest.

4. The following is an example of how your profit is calculated.

Month	Monthly spending	Monthly interest rate	Cost per withdrawal	Number of withdrawals *(key decision)*	Amount per withdrawal	Average cash/checking account balance (*money demand)*	Average savings account balance	Interest earned	Total withdrawing cost	Profit
	y	*i*	*F*	(1)	(2) = y / (1)	(3) = (2) / 2	(4) = $\frac{(8000-(2))+(8000-y}{2}$	(5) = (4) * *i*	(6) = *F* * (1)	(7) = (5) - (6)
Month x	$3,000	0.4%	$3	3	$3,000/3 = $1,000	$1,000/2 = $500	= ($7,000 + $5,000)/2 = $6,000	$6,000 * 0.4% = $24	$3 * 3 = $9	$24 - $9 = $15

5. Next, you will determine your money demand level through your withdrawing decisions in each of the nine months considered. Each month is independent of each other so your decision does not affect the conditions of the later months. In the first three months, your monthly spending and the cost of each withdrawal are the same, but interest rate differs. In the second quarter, the cost of each

withdrawal is lower; everything else is the same as in the first quarter. In the third quarter, your spending level is higher; everything else follows the 2nd quarter. Note that your key decision is how many times you withdraw each month, recorded in column (1). You may use your intuition to make the decisions and do not have to fill out columns (2)-(7). At the end of the activity, you will report this decision (column (1)) to me, and I will act as your bank and calculate your average balances and profit (again assuming you do not keep more money than necessary). The household with the highest total profit will receive a reward from me.

Decision Recording Table

You start with $8,000 savings deposits and no money balance at the beginning of each month.

Month	Monthly spending	Monthly interest rate	Cost per withdrawal	Number of withdrawals *(key decision)*	Amount per withdrawal	Average cash/checking account balance (*money demand)*	Average savings account balance	Interest earned	Total withdrawing cost	Profit
	y	*i*	*F*	(1)	(2) = y / (1)	(3) = (2) / 2	(4) = $\frac{(8000-(2))+(8000-y)}{2}$	(5) = (4) * *i*	(6) = *F* * (1)	(7) = (5) - (6)
1st quarter										
Month 1	$4,000	0.1%	$2							
2	$4,000	0.6%	$2							
3	$4,000	1.2%	$2							
2nd quarter										
Month 4	$4,000	0.1%	$0.2							
5	$4,000	0.6%	$0.2							
6	$4,000	1.2%	$0.2							
3rd quarter										
Month 7	$7,500	0.1%	$0.2							
8	$7,500	0.6%	$0.2							
9	$7,500	1.2%	$0.2							

Appendix II. Alternative Decision Recording Tables

a. Decision recording table with amount of each withdrawal as part of the decision

Month	Monthly spending	Monthly interest rate	Cost per withdrawal	Number of withdrawals *(key decision)*	Amount of each withdrawal	Average cash/checking account balance (*money demand)*	Average savings account balance	Interest earned	Total withdraw-ing cost	Profit
	y	*i*	*F*	(1)	(2)	(3) = $\frac{(2) + (1) * (2) - \$4{,}000}{2}$	(4) = $\frac{(8000 - (2)) + (8000 - (1) * (2))}{2}$	(5) = (4) * *i*	(6) = *F* * (1)	(7) = (5) - (6)
1st quarter										
Month 1	$4,000	0.1%	$2							
2	$4,000	0.6%	$2							
3	$4,000	1.2%	$2							

b. Decision recording table for an example month when each month is divided to 4 periods.

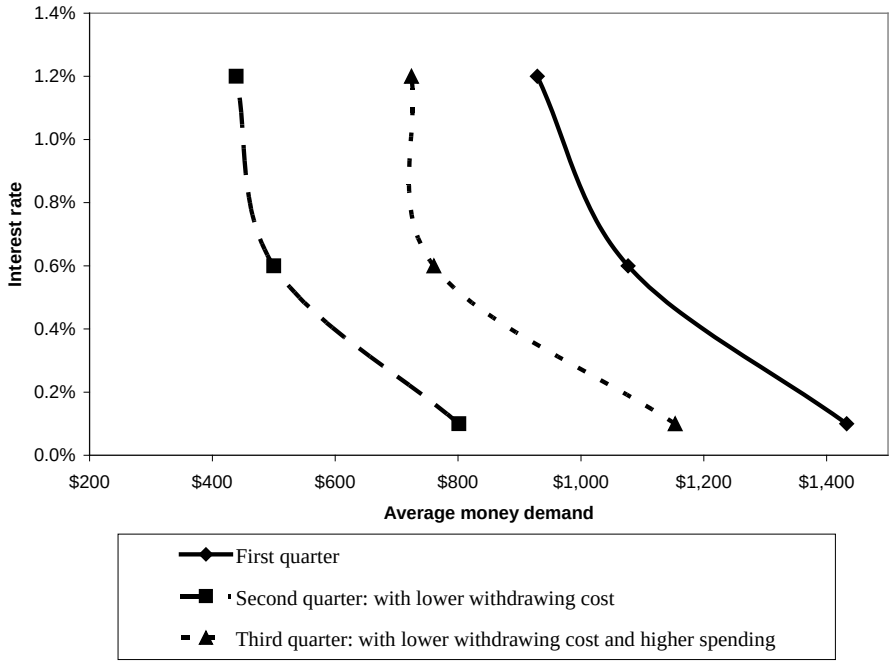
	Amount withdrawn	Withdrawing cost ($0 if no withdrawal)	Savings account balance	Money holding		Average money holding	Interest earned	Profit	Total profit for all periods	Money demand (Average money holding for both periods)
				Beginning balance	Ending balance					
	(1)	(2)	(3) = previous bal. - (1)	(4) = previous bal. + (1)	(5) = (4) –1,000	(6) = $\frac{(4) + (5)}{2}$	(7) = (3)* i	(8)= (7)-(2)	(9) = sum of (8) for all periods	(10) = avg. of (6) for all periods
Week 1			$8,000 – (1) =	$0 + (1) =						
Week 2										
Week 3										
Week 4										

Appendix III. Sample Results

Sample Experiment Results
(51 students in total from two sections of intermediate macroeconomics)

	Interest rates	Optimum number of withdrawals in theory	Average number of withdrawals in the experiment	Average money demand in the experiment
First quarter: Spending = $4,000 Withdrawing cost = $2	0.1%	1.0	1.8	$1,433
	0.6%	2.4	2.6	$1,077
	1.2%	3.5	3.8	$929
Second quarter: Spending = $4,000 Withdrawing cost = $0.2	0.1%	3.2	5.0	$801
	0.6%	7.7	7.8	$500
	1.2%	11.0	12.1	$439
Third quarter: Spending = $7,500 Withdrawing cost = $0.2	0.1%	4.3	6.0	$1,153
	0.6%	10.6	9.9	$760
	1.2%	15.0	15.4	$724

Sample Experiment Results: Average Household Money Demand



Appendix IV. Alternative setup and expansion of the experiment

1. In this activity, you will pair with another student, one of you representing a household, the other a bank. Households will determine money demand by withdrawing from their savings accounts. The purpose is to keep enough cash for their spending needs and earn as much profit as possible, which equals interest earnings less total withdrawing cost, calculated at the end of the month. The household and the bank are each primarily responsible for keeping records of the household's cash and savings account balances, respectively.

2. Household's spending level, the cost of each withdrawal, and the interest rate for savings deposits will be given at the beginning of each month. Each month consists of 4 weeks. At the beginning of each week, households will decide whether to withdraw, and how much to withdraw from the bank (in $1,000 increments). Note that the initial cash balance should be no less than your weekly spending level, or else your monthly profit will be set to zero. At the end of the week, households will remove an amount equivalent to their weekly spending from their cash holding (due to spending). The remaining cash can be spent in later weeks of the same month, but not in later months. I will announce when each week begins and when it ends. Households can consult with their banks and make joint decisions. You may not revise your decision after the end of each week.

Month 1.

Initial savings account balance: $8,000 — Spending level = $8,000
Interest rate = 0.1% (that is, every $1,000 pays $1 interest) — Cost per withdrawal = $4

Household's recording table:

				Cash (money) balance		
	Spending level	Withdraw?	If withdraw, how much?	Beginning balance	Ending balance	Average (of beginning & ending bal.)
week 1	$2,000					
week 2	$2,000					
week 3	$2,000					
week 4	$2,000					

Your monthly average money holding (money demand) (average of the last column): _____
Total number of withdrawals: _____
Total cost of withdrawals = number of withdrawals * $4 = $_____
Your average savings account balance (acquire from your bank): _____
Your interest earnings = average savings account balance * 0.001 = $_____
Profit = interest earnings - total withdrawing costs = $ _____
Now compare your profit calculation with your bank.

Bank's recording table (in a separate sheet):

Spending level	Withdraw?	If withdraw, how much?	Savings account remaining balance

week 1	$2,000
week 2	$2,000
week 3	$2,000
week 4	$2,000

Total number of withdrawals: _____
Total cost of withdrawals = number of withdrawals * $4 = $_____
Household's average savings account balance (average of the last column) = $_____
Household's interest earnings = average savings account balance * 0.001 = $_____
Profit = interest earnings - total withdrawing cost = $ _____
Household's average money holding (money demand) (acquire from household): $ _____

Month 2.

Initial savings account balance: $8,000 **Spending level = $4,000**
Interest rate = 0.1% (that is, every $1,000 pays $1) Cost per withdrawal = $4
Repeat recording tables.
Discuss 1) if there is any change in the frequency of withdrawals; 2) what the considerations are behind the change; 3) how the change in the frequency of withdrawals affects money holding.

Month 3.

Initial savings account balance: $8,000 Spending level = $4,000
Interest rate = 1% (that is, every $1,000 pays $10 interest) **Cost per withdrawal = $1**
Repeat recording tables.
Discuss the causes of any change in average money holding.

Month 4.

Initial savings account balance: $8,000
Interest rate is determined by flipping a coin: 8% (heads); -6% (tails). That is, for every $1,000, you may earn $80 or lose $60.
Spending level = $4,000
Cost per withdrawal = $1
Repeat recording tables.
Discuss the causes of any change in average money holding.

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Journal of the Scholarship of Teaching and Learning, Vol. 18, No. 1, January 2018, pp. 136-149.
doi: 10.14434/josotl.v18i1.22348

Examining Perspectives of Faculty and Students Engaging in Undergraduate Research

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Abstract: This case study analyzes one research collaboration between faculty and undergraduates at a teaching-intensive university within a teacher education program working to expand opportunities for undergraduates to engage in meaningful research. It examines how researchers perceive the opportunities and obstacles associated with such research. Data included written and oral reflections and field notes of the project participants, members of the research group. The study offers insight into how one group of teacher educators embedded undergraduate research into an existing research project and the opportunities and obstacles that the faculty and students encountered. Faculty involved in this study perceived opportunities for technology support, honest conversations and thoughtful collaboration, authentic interpretation, debunking misconceptions, and for taking time. Undergraduates perceived opportunities to experience and understand the research process, to make new relationships, and to learn from others. Faculty perceived obstacles included the paperwork, the lack of basic methodological training, and the lack of academic writing experience on the part of the undergraduates. Obstacles that were perceived by the undergraduates included logistical issues such as transportation and lack of background information about their role in the project prior to the project start, project pacing, and their confidence in their own contributions to the group. Opportunities outweighed obstacles in this research endeavor. This collaboration became an exercise in reflective practice and continual learning and has implications for the undergraduates involved to see themselves as researchers as they continue their professional careers as teachers.

Keywords: undergraduate research, teacher education, preservice teachers

Introduction

As teacher educators, we often struggle to integrate research and teaching, sometimes leaving these tasks compartmentalized. As a result, our students do not see the connections between our research and teaching, nor do they understand what we do when we are not teaching (Slobodzian, 2014). This realization led to a desire to include undergraduate researchers (URs) in a summer data analysis workshop. During our week together, five faculty members and three URs worked to analyze data related to a study examining preservice teacher lesson plan inspirations. The focus of

this paper is to examine the faculty and URs' perceptions of the opportunities and obstacles associated with engaging in undergraduate research.

Literature Review

Studies show that offering research opportunities to undergraduate students in all disciplines yields benefits for growth and intellectual development (Craney, McKay, Mazzeo, Prigodich, & Groot, 2011; Osborn & Karukstis, 2009). Undergraduate research also encourages leadership, collaboration, and enhances students' written and oral communication skills (Ishiyama, 2002; Kuh, 2008). According to Mabrouk and Peters (2000), 98% of the 320 past and present URs they surveyed would recommend undergraduate research to their peers. Undergraduate research has also been shown to support student retention (Burns & Goldin, 2017; Eagen et al., 2013; Webber, Nelson Laird, & BrekaLorenz, 2013).

Some students see their lack of knowledge about research as an obstacle to engaging in undergraduate research. To best maximize their experience, Scheel (2002) and Toepfer (2009) suggest offering these students an introductory research class. Often these classes are only offered in the final year of programs, but are needed earlier if students plan to work with professors. Others argue supporting undergraduate students' understanding of research can best be facilitated by conducting research with them (Bauer & Bennett, 2003). The relationship between faculty members and undergraduate researchers is an important component of the undergraduate research experience (Craney et al., 2011), and for those that have an opportunity to conduct research with a faculty member it can be "a life changing experience" (Kuh, Kinzie, Cruce, Shoup, & Gonyea, 2007, p. 38).

Undergraduate research also offers opportunities for professors. Gentile (2000) summarized this point when he stated, "research with undergraduate students is in itself the purest form of teaching" (p. 80). Faculty who support URs often report an increase in the quality of their work life (Webber et al., 2013). Other researchers have found that engaging in undergraduate research with students combats faculty turnover and increases creative synergy (Allen, 2007; Lunsford, Baker, Griffin, & Johnson, 2013).

Faculty mentoring of students, particularly partnering in research, can present obstacles such as lack of time. With demands for grant-writing, publication, university service, and teaching, mentorship of undergraduate researchers may be challenging (Dolan & Johnson, 2009). Some universities, such as Purdue, are planning to link, at least in part, academic promotion and tenure decisions to whether faculty can show evidence that they are active mentors to undergraduates (Jaschik, 2015). This trend is concerning to some faculty who already feel time crunched. The time required to mentor URs, which is often not computed in faculty teaching loads, can be a drawback for faculty who participate. Zydney, Bennett, Shahid, and Bauer (2002) found that 50% of faculty surveyed noted that they were spending at least three to five hours per week supervising URs. However, if faculty find ways to link the work they do with URs to manuscripts they write, they may be able to reduce the typical teaching-research tug-of-war (Toepfer, 2009). When research is already part of faculty's agenda, it is just a matter of finding a research topic that interests both the faculty and the students.

Slobodzian (2014) argues that the ultimate goal of research at the undergraduate level in schools of education is to develop future teachers who not only appreciate the value of research, but who also will become actively involved in research efforts themselves in their teaching career. "In doing so, the teachers act as agents of change and promote progress in the field of education"

(Slobodzian, 2014, p. 47). Furthermore, undergraduate research provides opportunities for preservice teachers to enhance their understanding of the relationship between educational theory and practice (Levy, Thomas, Drago, & Rex, 2013). In addition, it has the potential to lay the foundation for successful pursuit of a graduate degree by providing a taste of what it means to engage in research.

Studies show that in comparison to the natural sciences, there are fewer opportunities for undergraduate research in the social sciences and humanities (Seymour, Hunter, Laursen, & DeAntoni, 2004). Although it is beneficial for teacher preparation programs to engage students in research, it is not standard practice. In fact, students majoring in education are notably underrepresented in undergraduate research programs (Manak & Young, 2014). It is essential for teacher education programs to find ways to incorporate this practice into the curriculum as they to prepare future teachers. Thus, the purpose of this study was to specifically understand how faculty and students in a teacher education program perceive the opportunities and obstacles associated with engaging in undergraduate research.

Methods

To investigate the perceptions of faculty and URs as they engaged in a summer data analysis workshop, we utilized a case study design (Stake, 1995). We chose case study as the methodology because it best assisted us in answering the research question by focusing first on the experiences of the URs and their perceptions of the opportunities and obstacles associated with engaging in undergraduate research. Then we shifted our focus to the faculty and their perceptions. The bounded system was the summer data analysis workshop. Our data sources included observations, surveys, and self-reflections.

Participants

The selection of the undergraduate researchers was done in three parts. First, we met and determined what characteristics we wished the undergraduate researchers to exhibit. After determining the characteristics, such as being interested in technology, we created a survey on Google Forms as a way for the undergraduates to apply to be part of the research project. Participants were asked to identify their year of college, program of study, and dates they would be available for the research, and to write a short essay explaining why they would like to conduct research with us.

We distributed this survey to members of our own classes as well as a university undergraduate organization. After reading the seven responses to the essay, as well as knowing some of the students personally after having them in our courses, we selected three students that we believed would be the best candidates from the group. Because we were using advanced qualitative data analysis software Nvivo, we needed the participants to be comfortable using technology. Since the workshop was only three days, the participants also needed to be motivated and efficient workers. The students who were accepted are given the pseudonyms, Eileen, John, and Vivian. Table 1 highlights characteristics of each participant.

Once the participants were selected, we contacted all applicants to inform them of either their acceptance or to thank them for their application. The participants we accepted were required to take the Collaborative Instructional Training Institution (CITI) Social/Behavioral Research training required by our university.

Table 1. Participant characteristics

UG researcher	Program of study	Outstanding qualities	Personal description
Eileen (Junior)	Special Education	Had high scores in one of the instructor's classes. When she did not understand the material, she sought out assistance either from her instructor or her classmates. Self-motivated student	Eileen strives to curate immense resources to best enrich her teaching and build a strong teacher identity.
John (Senior)	Middle Education	Although not the top student, consistently showed an eagerness to incorporate technology into the classroom. Expressed interest in becoming an information technology support specialist in public schools Works for Apple part-time job, so he was familiar with Macintosh computers	John has experience with incorporating technology effectively into classroom instruction by ensuring that it is value added and not diminishing student engagement. He plans on pursuing a career as an Instructional Technology Resource Teacher post his graduate level career.
Vivian (Senior)	Inclusive Early Childhood Education	Works well with others Respected the ideas of her peers even if she disagreed with them Strong writer	Vivian has experience with students with special needs, as well as typically developing children and plans to be an educator of both in one classroom.

Once the participants were selected, we contacted all applicants to inform them of either their acceptance or to thank them for their application. The participants we accepted were required to take the Collaborative Instructional Training Institution (CITI) Social/Behavioral Research training required by our university.

Five faculty researchers made up the other part of the research team. The faculty, four female and one male, ranged from two to fifteen years of college teaching experience. Of the five faculty members working on the study, two of them had worked with URs before, but not at this university.

Context of the Workshop

During our summer workshop, we followed a traditional, short-term and task specific model of undergraduate-faculty research (Multhaup et al., 2010). In this model, the student supports a professor's current research agenda and the faculty member serves as a mentor to the student, demonstrating proper research techniques and guiding the student as he or she completes a series of tasks that supports the bigger research endeavor.

The major research task for the URs was to work with faculty to analyze the data. They met with us for three consecutive days. On the first day of the summer workshop, the five researchers and three URs focused on getting to know each other, learning how to use the qualitative analysis software, and reflecting on coding strategies. The faculty first modeled how to determine codes in the data. The URs watched this process and as they became more comfortable, they shared their coding ideas. The second day we focused on looking across the data, encoding everything consistently using the classification nodes constructed by the URs. During the last day of the workshop, we concentrated on what we learned from this investigation. To ensure that everyone's ideas were valued, the first ten minutes of each session focused on everyone reading through the data and coming up with their own conclusions. Next, everyone in the group shared what they found and we compiled central themes used to describe the lesson plans we were examining.

Data Collection and Analysis

The data sources for examining the experience of faculty and undergraduates conducting research together included written reflections from the URs before beginning the three-day workshop, observational field notes from faculty, and a final reflection from the URs and faculty members. The first reflection prompt asked the URs to reflect on what they knew about research, describe any previous experience with research, explain their knowledge of specific research methodologies, and share any concerns they had as well as what they hoped to gain from the experience. The field notes captured conversations and interactions between faculty members and URs. The final reflection asked the URs to share what they now know about research, if they would want to continue to work with professors on research, their thoughts about the connections between teaching and research, the most challenging and rewarding aspects of the project, and advice for future undergraduate research endeavors. The faculty were asked to reflect and share their thoughts about the experience.

The case study analysis was inductive and occurred in two phases. In phase one, we read and open-coded the field notes and the students' and faculty's reflections (Stake, 1995). The process of analyzing the first set of data was complex, given the variety of contexts in which the observations took place, such as during formal whole group discussions and during spontaneous informal interactions between individual faculty and undergraduates. In stage two we specifically focused on how each UR perceived the opportunities and obstacles associated with engaging in

research. The researchers collaborated to validate the findings through joint coding and reliability tests among the reflective responses.

Findings

This section highlights the findings related to our present research question: How do faculty and students in a teacher education program perceive the opportunities and obstacles associated with engaging in undergraduate research?

Faculty Perceptions

Prior to beginning this project, the faculty felt excited for this new endeavor but they knew that a few things needed to be in place so that it would be successful. These strategies included providing a daily agenda, scheduling an expert to train the team on how to use the data analysis software (NVivo), and planning who was bringing in snacks each day. At the end of the three days, faculty reflections revealed several opportunities and obstacles when incorporating URs into their current research endeavors.

Opportunities for technology support. We knew that John enjoyed technology, however, we did not expect the level of technology support that he and the URs offered. For example, during a conversation he told Joy and Katie that the night before he had watched forty-four minutes of YouTube videos on how to code using Nvivo so he would be prepared to support our efforts. Joy, who had not used the software before either, had not even thought about watching tutorials ahead of time. Thanks to the extra effort on John's part, he was able to support several of the faculty members when we began coding with the software. Reece shared, "I was amazed at how quickly Eileen became proficient in using the coding software. She added the coding information efficiently and accurately as faculty working alongside her shared thoughts regarding project data." The URs became so familiar with the software that the faculty started going to them for assistance as to how to change a code or to collapse one into a parent node.

Anticipating that we would have more questions about the software, we had planned on having a faculty Nvivo expert visit us again on day three of our work. However, by the time she arrived, John had taken the keywords we had created and used them to code the remaining data. This was quickly transformed into a document that allowed everyone to observe the codes and construct their own ideas about the findings and implications of this project. The technology support offered by the URs was an unexpected opportunity for faculty to sit in the seat as learners rather than instructors.

Opportunities for honest conversations and thoughtful collaboration. Several of the faculty reflected positively about the opportunity to have open conversation with the URs. Susan shared, "I appreciate their honesty and the level of comfort that they are exhibiting after just this short period of time." She credited this openness to the intentional language we used starting on the first day, our attempts to include the URs in our conversations, and invitations to share their thoughts.

Typically, we work with preservice teachers who have a clear career path in mind, unlike freshmen who are undeclared majors or undecided in a pre-professional program of study. Several faculty remarked about enjoying the opportunity to talk to John who was still exploring career options that combine his interest in technology and education. Engaging in conversations with John and the other URs reminded us that students are open and receptive to our ideas about ways

to combine their talents and interests into something that would be professionally challenging and enjoyable.

Working with the URs also provided the faculty an opportunity to collaborate, some for the first time, with students. Reece shared, "The URs were deep thinkers and offered substantive ideas as we developed codes." Susan added that she truly enjoyed the wonderfully rich discussions with the URs about how data can fit into more than one category.

Opportunities for more authentic interpretations. Katie shared that she liked working and talking with the undergraduates because it kept everything authentic. She reflected, "The undergraduate students were able to connect how we constructed thematic codes with elements from their own lives. They compared coding to tagging on Facebook which made the learning process meaningful and easier to understand." Susan talked with Eileen about how challenging it is to join the data together without losing the richness of the individual remarks made by others. "I enjoyed hearing the ways she described the commonalities that emerged from the data in the authentic language of the generation of people we were studying."

Collaborating with the URs offered a fresh way of looking at the data since we were examining the selection of resources by their peers, preservice teachers. Their insights helped us to understand the participants in the research project better. Vivian, John, and Eileen all shared personal examples of how and why they used some of the internet resources the preservice teachers in our study used. The UR's thoughtful explanation of why some preservice teachers rely heavily on internet resources (the research question we were examining) furthered the faculty's understanding and since the URs had an equal place at the discussion table, our interpretations of the data evolved further because we considered their perspectives as well.

Opportunities to debunk misconceptions. The faculty also remarked that conducting research with the undergraduates allowed them to rethink previous impressions held about students. Sadly, some of us who have worked with undergraduates for a long time have come to expect these students to have little initiative. However, the opportunity to work with the URs during the three-day workshop taught us that when undergraduates are motivated, more can be expected from their performance. The URs came in wanting to learn more about research, and they were the driving force for much of the coding process. Amanda shared, "The URs demonstrated to me that even though they might not know something, such as the computer program, they were willing to learn and demonstrate that learning in short period [of] time." On the last day, Amanda was excited about our progress and wanted to stay later. John volunteered to join her saying, "I have nothing else to do today." This is just another example of how the URs constantly discredited some preconceived notions of undergraduate students.

The faculty also appreciated the opportunity to share with students the other aspects of being a professor. As Katie explained, "We are showing them what we are doing in addition to teaching and making the connection between research and practice explicit. We are pulling back the curtain."

Opportunities to take time. All of the opportunities the faculty experienced were in part a result of the three consecutive days we spent with the URs. "Thoughtful collaboration takes time and I really thought that the opportunity to have an intensive work environment made for a productive think tank," shared Katie. During a typical semester, with teaching several courses, supervising practicum experiences and/or student teachers, and providing professional development to local schools, faculty typically have little time. The summer workshop gave us time to be more relaxed and the URs seemed to follow this approach. As we worked together, we found that repeating and explaining for the benefit of the URs benefitted us as well because we

were able to calibrate our expectations and clarify our definitions. Because the data were already collected, we were able to use the three days to fully explore data analysis with the URs. In addition, the time spent together convinced some faculty to consider inviting students to collaborate on future research. Susan said that working with URs, "will no doubt bring a more authentic voice to my discussions about what my undergraduate students are teaching and learning in my classroom and in their own future classrooms."

Obstacles. One of the largest obstacles, according to one faculty member, was the actual preparation process. Although the URs all signed up prior to knowing they would be compensated for their time, Joy felt that being paid for their work also made them feel like a valued and equal member of the team. However, to get paid the URs had to complete five different forms. In addition, they had to conduct the human subjects research training on CITI. Thus, before we even met with the students, they were given tasks to complete that were time-consuming and tedious.

We quickly realized that data analysis is hard to do without some fundamental understanding of the methodology. Reflecting on our three days together, we now know that it would have been helpful to have the URs do some reading on the chosen methodology before the workshop. That being said, the students picked up quickly on coding and at times we had to ask them to slow down their thinking/coding so the faculty could catch up.

In addition to being new to coding, the URs were also new to academic writing. On the third day, we all chose a section of the paper to begin drafting. Vivian especially felt vulnerable and shared that she did not identify as a strong writer and worried that she was going to be very slow. Susan reassured her by saying that she too was a slow writer. The faculty believed that these were only minor obstacles compared to all of the opportunities they experienced working with the URs.

Student Perceptions

During the three-day workshop, we co-created a space with the URs that was safe for everyone to share their thoughts. The benefit of this safe space was made clear to the faculty after we read the UR's honest final reflections. In the next section, we share their thoughts on the opportunities and obstacles associated with engaging in undergraduate research.

Opportunities to experience and understand research. The URs explained that from this experience they developed an unexpected passion for research and the research process. For example, Eileen explained, "I learned countless things from this experience but the one I will treasure most is the spark to pursue more research opportunities." The URs demonstrated their dedication to the research on the first day of the workshop by working through lunch time to calibrate the codes across computers. This example shows how their enthusiasm about the research process even trumped their need to take a break for food.

In addition, the URs developed an appreciation for teacher research and the possible use of it in their future careers. John generated the following equation: Teaching + research = better education and shared how he felt strongly about actively participating in the construction of new knowledge. Eileen shared:

> I am a firm believer in research playing a huge role in teaching. I understood the need for the day to day research of tests and questions but now I see the importance of looking at large picture items and applying them to myself as a teacher. It is research that allows teachers to be curators and find what works for them and find their teaching philosophies

> and so I think without research we are limiting the field of education to the ways of the past.

The URs enjoyed the opportunity to understand and experiencing research during our three days together. In addition, John felt a sense of urgency for the need to, "unpack the research to better teaching." Eileen made the connection between research and herself when she stated:

> I believe the knowledge gained from the research not only benefits the public but it benefits me as well. I have learned so much about myself as a learner, preservice teacher, and as a researcher that I will carry with me into the future.

Opportunities for new relationships. The URs also constructed new relationships during the three days. This benefit was evident as they became more comfortable with the faculty and with each other, joking, laughing and talking. Vivian explained, "I really liked feeling like my ideas were valued and that I added to the importance of the findings in the study." Eileen stated that, "having 5 professors value my opinion was very rewarding." By openly expressing a want and need to involve the URs and the faculty in the development and construction of ideas, we built relationships, demonstrating a respect for each other. John explained, "It was rewarding to be able to bring in a different perspective. They valued what I had to say. I feel like working with my professor on a different level allowed me to become a more reflective thinker for the future." Overall the URs felt that a new type of relationship was built with professors as a result of working alongside them rather than doing work for them as part of a class.

On the last day, Eileen suggested that we end our time together by playing the game we played on the first day, Two Truths and a Lie, since it had been so fun learning details that way about each other. This example shows that even though our time together was coming to an end, the URs felt vested in the relationships we had begun to build and wanted to learn more about us and each other.

Opportunities to learn from others. The URs noted in their reflections an appreciation for the many opportunities to learn from others during the workshop. Some students, such as Eileen, actually gained knowledge from analyzing the data. The URs also expressed how much they learned from working with faculty and their peers. John shared that he plans to take an important understanding he gained from the experience with him as he explained that he learned that by "engaging with different opinions, we can improve group understanding which leads to a better end product."

Learning from others is not always easy and the URs saw the faculty and themselves engage in several productive struggles. For example, during the break following one of our discussions, John and Eileen created a hierarchy of nodes on a piece of notebook paper to clarify their understanding. Taking the initiative to create a concrete model of our discussion reminded all of us that research is messy and complicated. Eileen said it best, "I found it interesting that we all understood the research questions yesterday but half way through today we had to stop and refocus and after talking we had a different mindset."

In the end, John admitted that he put more effort into this, the data analysis, than into anything last semester. Although Amanda disagreed (as John had been in her course), Katie countered that perhaps this experience is more meaningful because of its authenticity. John agreed by saying this (working with teachers and technology) is what he really wants to do in the future.

The opportunity to learn from others over the three days shaped how the URs felt about themselves, each other and the faculty.

Obstacles. The URs experienced several obstacles including transportation and miscommunication. First, because we chose to meet with the URs the week before summer school officially started, there were no busses running. For Vivian, who lives off campus and does not have a car, this was an issue. The first day Joy gave her a ride and then the next two days Eileen gave her a ride. Transportation issues may have impacted how many students applied to the summer workshop because they may have known there were no busses to campus the days we planned to meet.

The URs also identified that they had limited knowledge of exactly what they would be doing during the three-day workshop. Eileen shared, "More information prior to the first day would be beneficial. The extra knowledge may spark extra confidence therefore removing some of the learning curve." Vivian added that not knowing what they would be doing made her feel, "like I had a lot to catch up during the first meeting in order to be a helpful component to the process." John admitted that he did not even remember the overarching question being introduced.

In addition to more information needed prior to beginning the workshop, the URs shared that during the three days there were moments of confusion. Vivian remembers, "Sometimes discussions were too fast paced. It takes some time for me to digest the ideas of others and then add my own ideas." Eileen echoed these feelings when she shared, "I felt as though I censored a lot of what I said. I waited for someone to say something similar to my idea and then piggyback off that rather than always saying what came to mind from the start." The URs reflected that they became more comfortable as the experience progressed, but there were certainly moments of insecurity during the three-day workshop.

Discussion

Our findings clearly demonstrate the opportunities of working with URs outweighed the obstacles. One of the unforeseen opportunities that resulted from this partnership was dismantling the misconceptions we had of each other. We did this through building relationships with each other, thus lessening the academic divide between our traditional roles of professor and student. Second, since the URs were similar in age to the individuals' whose data we were examining, they were able to give fresh perspectives that were otherwise unseen. Although money was used as a way to express our appreciation of the URs time, that little incentive was not the driving force for their hard work. The URs were genuinely interested and excited about the learning process. Despite some minor obstacles with transportation and logistics, the experience was positive and enlightening to all involved.

For our first attempt at incorporating undergraduate research into our teacher education program, we followed the traditional model of students joining a project that supports professors' current and ongoing research agendas. However, with the success of this endeavor and as we think about next steps, we are open to undergraduates seeking support from professors for research projects that they themselves initiate. Currently, this option is only available to Honors Program students in our program.

Implications

Typically, most undergraduate research takes place outside of the time professors and students spend together in class (Multhaup et al., 2010). Students and faculty are busy people and with only so much time during the typical university calendar, working together in the summer

might be one way to create space for engaging in undergraduate research within teacher education programs or other programs of study. Next, we highlight ideas for future research and thoughts to consider before incorporating undergraduate research into your program.

We recognize that one of the limitations of this study is the small sample size and do not suggest that our findings are generalizable. Examining what a larger number of students know about undergraduate research would guide faculty in addressing students' misconceptions about research. Manak and Young (2014) suggest that faculty must draw students' attention to the inquiry-based scholarly experience already present in many courses that require students to create a case study, collect or analyze data, and share their findings with peers. Helping students recognize they are already doing or have done pieces of research may help make the idea of undergraduate research less overwhelming for some students. In addition, faculty need to share their conceptions and methodologies of undergraduate research with colleagues (Manak & Young, 2014; Levy et al., 2013). By doing this we can foster best practices and promote successful models of undergraduate research in programs across the country. Reflecting on our three days together, we should have taken more time on the first day to explain inquiry and the role it plays in teaching. In addition, having the students read a short piece on methodology prior to beginning our week together would have been helpful.

We strongly encourage all faculty who want to engage in undergraduate research with a group of students to take time to build community. We found it essential during our summer workshop with the URs to share the agenda each day, use icebreakers such as Two Truths and a Lie to get to know each other, develop group norms, and provide snacks in a comfortable environment. Doing these things helped to create a space where everyone felt comfortable and thus our time together was productive.

In addition to building community, we recommend that faculty and URs engage in reflection each day. On the first and third day, we asked the URs to write individual reflections. However, everyone reflected verbally several times each day and then at the end of each day we took turns sharing big takeaways. This sharing time allowed each member of the team to be an active and accountable participant.

If possible, we recommend offering URs opportunities to continue to work on the project and/or with the professors. For example, on the last day of the summer workshop the faculty offered the URs an opportunity to be co-authors of the manuscript based on the data they helped analyze. John was the only student who chose to do this, but we made it clear that we respected the others' decision not to continue working with us.

Conclusion

As teacher educators, we see that this joint endeavor with the URs was a step toward understanding for all those involved. The faculty had an opportunity to learn alongside students and listen to their thoughtful perceptions. The students not only gained research experience, but they expanded their thinking of the role of research in their careers as future teachers. We hope that by going beyond merely exposing the students to research, and actually getting them involved in the process, they may be more likely to engage in educational action research once they have their own classrooms. Reflecting on practices and engaging in inquiry about those practices not only will inform their teaching, but it also will help them better meet the needs of their students by bridging the gap between research and practice in the field of education (Frager, 2010; Price & Valli, 2005). Although our time together was short, it is clear that this model has the potential to develop

preservice teachers who approach classrooms with a researcher's mindset making instructional decisions based on empirical data. Examining perceptions of the opportunities and obstacles experienced by faculty and URs is one way those in higher education can further support these practices in their particular programs.

Acknowledgements

We would like to thank the College of Education at James Madison University for supporting this initiative with time and funding. We would also like to acknowledge the helpful reviewers for their guidance.

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ISSN: 1527-9316