InSight

A Journal of Scholarly Teaching

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"SoTL invites us to consider new ways of being leaders, and that this invitation extends even to those of us who have not yet identified ourselves as leaders."
~ Janice E. Miller-Young, Catherine Anderson, Deborah Kicenjuk, Julie Mooney, Jessica Riddell, and Alice Schmidt Hanbidge, "Leading Up in the Scholarship of Teaching and Learning," *The Canadian Journal for the Scholarship of Teaching and Learning*

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"We need to be thoughtful about how to bring the weird joy we find in our weird fields to students so that they too can find pleasure in the beautiful problems that fascinate us."

~ Paul Handstedt, *Creating Wicked Students: Designing Courses for a Complex World*

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"It is one thing to have evidence that a strategy works, but it is another thing entirely to know *why* students learn more when certain techniques are used over others."
~ Joshua R. Eyler, *How Humans Learn: The Science and Stories behind Effective College Teaching*

About Park University…

Park University (originally Park College) was co-founded by George S. Park, Dr. John A. McAfee, and Rev. Elisha B. Sherwood in 1875. An independent, private institution, accredited by the Higher Learning Commission of the North Central Association, Park University currently enjoys a distinguished position in higher education as a growing institution with 42 campus centers in 22 states including an extensive online degree program. In 2005, Park University created The Faculty Center for Innovation (originally the Center for Excellence in Teaching and Learning) to promote the practice and profession of teaching, including scholarly inquiry into teaching across the disciplines. *InSight: A Journal of Scholarly Teaching*, an outreach of the Center's programming, is a refereed academic journal published annually. The editorial staff invites submissions of research and scholarship that support faculty in improving teaching and learning. Open to submissions from all disciplines and institution types, *InSight* articles showcases diverse methods for scholarly inquiry and reflection on classroom teaching.

From the Editor…

As a scholar who studies writing across the disciplines, I am excited to finish my first year editing this volume *of InSight*. One thing I found especially interesting about editing my first volume was discovering unexpected connections between articles as we prepared this volume for print. The scholars represented in this journal may come from many different disciplinary backgrounds, but it is heartening and invigorating to discover how many concerns, ideas, and themes we share in common.

In our opening editorial, SoTL expert Jana Hunzicker stresses the transformative power of SOTL research for teachers in many disciplines in both secondary and higher education. In this volume, you will read several articles that develop that theme, for example, by focusing on developing signature pedagogy in field education in social work or by transforming teaching through school principal preparation programs.

Collaboration was another emerging theme from this volume, whether that is students collaborating to construct mind maps to develop interdisciplinary thinking or an international collaboration between American education students and Kenyan educators to design new schools. This last article also represents another theme in this volume, the exploration of differing cultural contexts for teaching and learning, a theme further developed by an article examining American and British Universities' differing stances on innovation and teaching constraints.

Finally, you will read several articles that combine or cut across fields of teaching and learning, for example by including the arts to transform STEM education. You will also read about how faculty across disciplines can be proactive in assessing and using learning analytics in higher education and how faculty benefit from SoTL workshops by developing strong teaching goals. The result of these shared themes and common concerns is this volume of *InSight* which represents all the advantages of a cross-disciplinary, collaborative, global effort to transform teaching and learning.

I am grateful to the many talented and experienced people who collaborate to make *InSight* a success. Many thanks to assistant editor Jamie Els for her infinite patience and prodigious knowledge about the journal's workings. I also would like to thank Stacey Kikendall, who not only encouraged me to take on the editorship, but who shared her experience and advice as a prior editor of *InSight*. Thank you also for the excellent and speedy work done by our copyeditor, Lauren Lovvorn. Finally, I would like to thank our wonderful team of peer reviewers and Amber Dailey-Hebert, director of the Faculty Center for Innovation at Park University, as well as FCI who make this journal possible.

--Amy Mecklenburg-Faenger, PhD

More Acknowledgements…

InSight's editorial staff would like to thank the board and executive staff of Park University; their leadership and support in providing faculty resources makes this publication possible. A special thank you is given to Dr. Greg Gunderson, President, Dr. Michelle Myers, Provost, Dr. Emily D. Sallee, Associate Provost, Brian Shawver, Associate Provost, and Dr. Katie Ervin, Associate Vice President for Academic Operations.

"What if inside every teacher was a scholarship of teaching and learning (SoTL) project waiting to be brought to life?"
~ Gary Poole, "Using Intuition, Anecdote, and Observation: Rich Sources of SoTL Projects," In N. Chick (Ed.) *SoTL in Action: Illuminating Critical Moments*

Scholarship of Teaching and Learning (SoTL): Transformative Professional Development for Teachers

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February is lambing season in Central Illinois. I know this because my dad is a sheep farmer. On a cold Sunday afternoon several weeks ago, while visiting Dad at our family farm, I walked with him to the barn to feed two bottle lambs. Right away, he noticed a ewe going into labor. He watched her closely as she paced in a circle, the other ewes backing away. She stood, then kneeled, then bellowed. Soon, we could see the hooves of the lamb about to be born. After a time, it became clear that she was struggling, so Dad entered the pen and waited nearby. Twenty minutes later, the newborn lamb lay steaming on the straw. Skillfully, Dad grasped it by its hind legs and carried it to a smaller pen that he had readied with fresh straw, the mother following closely behind. Settled into their own cozy space, the newborn lamb was soon clean, dry, and standing, ready to nurse. Its twin was born within the hour.

As I observed my dad, I was reminded of how different his work is from my own. Like most of you, my work as a teacher involves reading and writing, inquiring and collaborating, and discussing and presenting. I was prepared for my work by earning academic degrees and professional endorsements in college and university settings. My dad has a high school diploma, but he didn't learn how to breed and deliver sheep in school. He honed his craft through experience, first by working alongside more experienced farmers, and later with a great deal of practice, trial-and-error, and support.

Learning to be good at raising sheep is a lot like learning to be an effective teacher. Granted, a teacher's focus is on students instead of sheep, a classroom instead of a barn, and scholarly practice instead of casual reading and conversation, but the underlying motivation to try and the ongoing drive to succeed are the same. Sheep farmers and teachers alike spend their careers – and sometimes their entire lives – striving to improve their craft.

What inspires sheep farmers, teachers, and others to strive toward improvement in their life's work? Part of the answer lies in understanding how adults learn. Malcolm Knowles (1970) asserted that adult learning is distinguished by four assumptions:

1) Adult learning is self-directed.
2) Adults learn by building on their life experiences.
3) Adults are motivated to learn when learning is relevant to their lives.
4) Adults are motivated to learn when they can immediately apply their learning.

My dad started raising sheep in 1954 as part of a grade school 4-H project. By high school his sheep had won a few blue ribbons, and he was hooked. Dad became a

carpenter by trade but maintained a flock of sheep as a second source of income, refining his practice with each year of experience. Everything he learned about sheep interested him because he was committed to his flock, and most of what he learned could be applied immediately because it addressed actual problems.

Although critiqued by some as too anecdotal (Merriam, 2001), the four assumptions of adult learning are supported by neuroscience (Hagen & Park, 2016). Because adults' brains are equipped with well-developed neurological frameworks, or schemata, adults are better prepared than school-aged learners to make cognizant choices about what they need to learn. In addition, adults can more readily assimilate and accommodate new information because they have more prior knowledge and experiences to connect with. Moreover, because humans are created and conditioned to be successful in their adult roles and responsibilities, adults are more likely than school-aged learners to see the relevancies and applications of their learning, especially when it is self-directed.

Merriam (2001) defines self-directed learning as "learning that is widespread, that occurs as part of adults' everyday life, and that is systematic yet does not depend on an instructor or a classroom" (p. 8). Self-directed learning is an ongoing process that involves setting goals for the purpose of intentionally developing knowledge or skills in a particular area. Because adult learning is self-directed, it is naturally grounded in past experiences and usually occurs within authentic contexts (Rohlwing & Spelman, 2014). Self-directed learning also incorporates personal reflection and dialogue with others as means of cognitive processing, which can lead to lasting changes in thinking and decision-making over time (Drago-Severson, 2009; Rohlwing & Spelman, 2014). Jack Mezirow (1990) called such lasting changes transformative learning.

I am licensed and experienced as a middle school teacher and elementary school principal, but when I entered higher education halfway through my career, I quickly realized that I had much to learn about effective college teaching. After a few embarrassingly tiresome class periods, I began adapting activities I had used with eighth graders to enliven my college-level classes. I also started attending teaching workshops at my university, and as I collected new teaching strategies, I tried them in my classroom. In order to succeed as a college teacher, I built on my experiences, sought useful information, and applied what I was learning at the first opportunity. I reflected and readjusted after almost every class period, and slowly my teaching improved. In the process, I experienced firsthand that professional development becomes meaningful when teachers decide for themselves what they want to learn; develop and implement their own learning plan; and frequently reflect, discuss, and apply their learning.

I experienced firsthand that professional development becomes meaningful when teachers decide for themselves what they want to learn; develop and implement their own learning plan; and frequently reflect, discuss, and apply their learning.

Without a doubt, meaningful professional development is good, but Scholarship of Teaching and Learning (SoTL) (known as action research in PK-12 education) is what makes professional development transformative. Closely aligned with the four assumptions of adult learning, SoTL is self-directed, allows us to build on prior experiences, relates directly to our teaching lives, and can be applied to our

teaching practice immediately. But SoTL is more than self-directed adult learning. It is a systematic process of inquiry, focused on concerns related to the instructional practices and outcomes about which the investigating teacher cares deeply. Because SoTL projects are customized to the teacher, classroom, and students who will benefit most from the investigation, SoTL work is personal. The reflection and dialogue that occur through SoTL are authentic, prompting teachers to take ownership of both the SoTL research process and subsequent findings.

McKinney (2007) defines SoTL as "the systematic reflection/study of teaching and learning made public" (p. 8). Unlike discipline-specific research, SoTL focuses first on reflection and second on reporting. As Fanghanel (2013) explains, "The aim of SoTL is not to publish but to uncover the complexity of academic practice through reflection and engagement with relevant partners (colleagues, students) and to draw lessons that are subjected to debate and contradictions" (p. 63). In this way, engaging in SoTL work equips us to inspire better teaching and learning in others. Whether we share our SoTL efforts through a scholarly manuscript, during a concurrent session, or with a colleague over coffee, we positively influence the teaching profession by delineating a research process, revealing our findings, and modeling scholarly teaching.

My early attempts to succeed as a college teacher quickly morphed into SoTL work. My first SoTL project, in collaboration with a colleague, involved observing each other's classes to collect data on student engagement in learning, which we used to make improvements to our teaching practice. Later, I used similar data to compare an outdated teaching methods course with its newly-designed replacement, chronicling the teaching challenges I experienced during the transition. My third SoTL project involved a student survey exploring the written and verbal reflection of pre-service teachers, which I used to analyze the effectiveness of my class activities and assignments. With each SoTL project, my teaching knowledge increased; I honed my research skills, and I built a record of scholarship by presenting and publishing my findings. Currently, I am working on a SoTL project with four colleagues in another discipline, investigating how factors such as classroom space, furniture, and room arrangement impact teaching and learning in the health professions. Now in my twelfth year of college teaching, SoTL has transformed my own and others' teaching practice from mundane to memorable.

Regardless of the type of work we do, when we are passionate about it, we work hard and keep going until we get it right. For my dad, it was learning how to raise healthy and profitable flocks of sheep. For teachers, it's figuring out how to be the best teachers we can be. If you're a teacher who longs for transformative professional development, I encourage you to give SoTL a try. *Engaging in the Scholarship of Teaching and Learning: A Guide to the Process, and How to Develop a Project from Start to Finish* by Cathy Bishop-Clark and Beth Dietz-Uhler is an excellent place to begin. Through SoTL, we can become better teachers and positively influence our students and our colleagues, not just for an hour or for a semester, but for an entire career.

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Overcoming Gender Bias in STEM: The Effect of Adding the Arts (STEAM)

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This study investigated female students who attended a STEM course with the Arts (STEAM) in comparison to a traditional STEM course and the impact it had on desire to pursue a STEM degree. An independent-samples t-test was conducted to compare female to male students' interest in pursuing STEM degrees. In addition, follow up data for registration in STEM subjects was calculated. The participants (N = 58) consisted of college students (35 female students and 23 male students) attending a postsecondary institution in the northeastern United States. The study found significant differences ($p < .05$) between the groups and a larger percentage of female students from the STEAM course than from the traditional STEM course enrolled in another STEM course at follow up. These results support the positive relationship between female students attending a STEAM course and desire to pursue a STEM degree. The implications and results of adding interdisciplinary elements to traditional STEM courses for female students are discussed.

Science. Technology. Engineering. Mathematics. Commonly known as "STEM," these are the fields that have substantial influence on global progress, innovation, and economic success, as well as the potential to ameliorate many of the world's most urgent problems, such as poverty, environmental damage, clean water, food insecurity, renewable energy, and more (Clynes, 2016). In recent years, it has become painfully clear that America is not producing enough experts in STEM fields (McClarty, 2015). Furthermore, within the pool of STEM workers, there is a marked gender disparity; with a few exceptions, women are significantly underrepresented in most areas of STEM (U.S. Bureau of Labor Statistics [BLS], 2015).

One strategy that has been proposed to attract more women to STEM fields is a more interdisciplinary approach to STEM education. STEAM (STEM + the Arts) is an educational approach to learning that uses Science, Technology, Engineering, the Arts and Mathematics as access points for guiding student inquiry, dialogue, and critical thinking. It is also used to broaden interest in STEM fields (Sochacka, Guyotte, & Walther, 2016). Adding the Arts to the traditional STEM curriculum (thus creating "STEAM") allows for a more multi-faceted and engaging approach to STEM (Boy, 2013) and may catch the interest of students previously uninterested in STEM.

Since men outnumber women by 3 to 1 overall in STEM fields (U.S. Bureau of Labor Statistics [BLS], 2015) and only 35.2% of chemists are women (The National Girls Collaborative Project, 2016), it is important to concentrate on increasing women in these particular subject areas. Chemistry is a fundamental discipline that accounts for life at the molecular level. We use chemicals daily without even realizing it. All matter is made of chemicals, so the significance of chemistry is that it's the study of everything (Helmenstine, 2018). Therefore, the current study evaluated the impact of a "Chemistry with the Arts" course (which incorporated the application and utilization

of relationships between chemistry with everyday life and the arts) on female students' later pursuit of additional STEM courses in a community college compared to female students who attended a traditional Chemistry course.

Background

Need for Women in STEM

In addition to the simple fact that the United States needs to nurture and empower people of all genders to pursue STEM in order to literally make the world a better place, women who pursue STEM bring unique talents, skills, and perspectives to their fields. A lack of female input in critical STEM areas at best slows innovation and global progress; at worst it can have life-threatening implications. According to Hill, Corbett, and St. Rose (2010), "Engineers design many of the things we use daily—buildings, bridges, computers, cars, wheelchairs, and X-ray machines. When women are not involved in the design of these products, needs and desires unique to women may be overlooked" (p. 3). For example, the original automobile airbags were designed by men for the adult male body, and some deaths of women and children resulted from the deployment of these airbags, which might have been avoided had there been women engineers involved in the design (Margolis & Fisher, 2003, pp. 2–3).

STEM not only benefits global society and American economic competitiveness but can also have tangible economic benefits for women. It has been well documented that on average, women earn less than men in all career areas in the United States. In non-STEM careers, the overall wage gap is 21% (Beede et al., 2011). However, in STEM careers the wage gap is one-third lower: 14% (Beede et al., 2011). In addition to the smaller gender wage gap, there is a larger STEM earnings premium for women because women in STEM careers earn 33% more than comparable women in non-STEM careers, while the STEM premium for men is only 25% (Beede et al., 2011). Despite these statistics, the majority of women continue to major in female-dominated subjects, such as education, health, and psychology, even though they tend to earn less than they would in male-dominated majors such as engineering, mathematics and physical sciences (Goldberg Dey & Hill, 2007). If women with a natural inclination and desire toward STEM are encouraged to pursue those career areas rather than non-STEM careers, they will be better compensated financially over the course of their professional life. For men and women, STEM-related positions are expected to grow by 17% over the course of 10 years while non-STEM jobs have been increasing only by 9.8%; furthermore, workers in STEM careers earn an average of 26% more than those in non-STEM fields (Langdon, McKittrick, Beede, Khan & Doms, 2011).

Women in the Workforce and Academia

According to the 12th US Census, in 1900 women made up about 18% of the "gainfully employed" labor force (Abbott & Breckinridge, 1906, p. 18). This increased to around 30% in 1950 (U.S. President's Commission on the Status of Women [PCSW], 1963, p.28). As of 2015, nearly 47% of the American workforce was female, and women made up 52% of management and professional occupations (O'Farrell, 2015).

Women have made substantial gains in their participation in law, medicine and business. The American Bar Association (ABA) has documented that female law

students now make up almost half of law students attending accredited law schools (ABA, 2017). According to the Association of American Medical Colleges (AAMC), more women than in the past choose occupations in medicine, and in 2016 there were more female applicants to medical schools than males (Bergen, 2016). The Graduate Management Admission Council (GMAC) reports growing numbers of applications of full-time two-year MBA programs for women in 2016 (GMAC, 2015). Women now make up about 40% of students at full time MBA programs (Moran, 2015).

In recent decades, improvements have been made in the numbers of women in STEM professions; however, they are still underrepresented in many STEM fields. Men outnumber women by 3 to 1 overall in STEM fields, particularly engineering and physics (U.S. Bureau of Labor Statistics [BLS], 2015). Although women comprise nearly half (47%) of the total U.S. college-educated workforce, they make up only 24% of the science and engineering workforce (Beede et al., 2011). The National Girls Collaborative Project (2016) reports that female scientists and engineers tend to concentrate in different occupations than men, with fairly large proportions of women in the social sciences (62%) and biological, agricultural, and environmental life sciences (48%) and relatively low proportions in engineering (15%) and computer and mathematical sciences (25%). The engineering, computer, and math statistics can be further broken down to a selection of specific STEM careers to show that women comprise 35% of chemists; 11% of physicists and astronomers; 34% of environmental engineers; 23% of chemical engineers; 18% of civil, architectural and sanitary engineers; 17% of industrial engineers; 11% of electrical and computer hardware engineers; and 8% of mechanical engineers (NGCP, 2016).

In many academic fields, women today earn the majority of college degrees in America. They outnumber men in obtaining associates, bachelors, masters, and doctoral degrees (National Center for Education Statistics [NCES], 2017). In 2013 women earned 57.3% of bachelor's degrees in all fields and 50.3% of science and engineering bachelor's degrees. However, women's participation in science and engineering at the undergraduate level significantly differs by specific field of study. While women receive over half of bachelor's degrees awarded in the biological sciences, they receive far fewer in the computer sciences (17.9%), engineering (19.3%), physical sciences (39%) and mathematics (43.1%) (NGCP, 2016). At the PhD level, the proportion of women in the biosciences and social sciences has increased (to 40% female), and women are now overrepresented in psychology (78% female). However, men still vastly outnumber women in computer science (75% male) and engineering (77% male) (Noonan, 2017; National Science Foundation [NSF], 2016).

In the population as a whole, women hold almost as many undergraduate degrees as men; however, women make up a much lower number of STEM degree holders (about 30%). Women are disproportionately underrepresented among degree holders in all STEM fields, especially engineering (Noonan, 2017). Furthermore, women who have a STEM degree are more likely to work in education or healthcare than pursue a STEM career, unlike men with STEM degrees (Noonan, 2017). Despite a number of initiatives intended to increase the number of women in STEM, from 2000 to 2011 the number of science and engineering bachelor's degrees awarded to women remained level or even declined in computer sciences, mathematics, physics, engineering, and economics (National Science Board [NSB], 2016).

Overall, while significant increases have been made in women's choices to pursue STEM majors in post-secondary schooling and women's participation in the STEM workforce, the nature of women's progress in STEM is complex. Unpacking the statistics shows that the increases are very unevenly distributed across different STEM fields, possibly indicating that more barriers have been removed or overcome in some fields, but not in others.

Barriers to Women's Pursuit of STEM

Stereotyped school subjects. Historically, women have been encouraged to pursue English, reading and the arts, and at times have even been actively dissuaded from pursuing sciences and mathematics (Huston, 1983). This was at least partly because of stereotypes about females not having naturally "mathematical" or "scientific" minds. Subject stereotyping negatively affects women's performance (Marx, Brown, & Steele, 1999). The idea that men innately possess more aptitude than women in mathematically dominant fields, whereas women naturally excel in subjects using language skills, is damaging to women because it shortchanges the true diversity of their abilities (Hill et al., 2010). Lingering gender stereotypes remain in school subjects to this day. There are many forms of bias in subject choices, and schools often tend to follow traditional views of certain subjects being "feminine" and others being "masculine." When high school subjects were examined, physics, math and economics indicated a male bias; while biology, English and psychology indicated a female bias (Institute of Physics [IOP], 2013). Unfortunately, subject bias affects women's choices in college when deciding on a major (Marx & Roman, 2002). Women are less likely to pursue STEM fields. In addition, female students who start their bachelor's program with the intention of pursuing a STEM degree are more likely to switch to a non-STEM major than their male peers (Chen, 2013).

Helping fields. Morgan, Isaac, and Sansone (2001) found that students viewed STEM careers as less connected to humanitarian ideals and interpersonal goals than non-STEM careers. When choosing a career, women tend to gravitate toward "helping" professions and interpersonal goals (Lackland & De Lisi, 2001); therefore, the perception that STEM fields are not associated with these goals may be one reason that women tend to steer away from STEM subjects.

Most career fields in the United States are male dominated, other than education and healthcare (Goldberg Dey & Hill, 2007, p.22). Even though only 37% of physicians and surgeons are women, about 74% of all technical (i.e., STEM-focused) healthcare practitioners are women. Similarly, about 74% of all workers in educational roles are women. Education and healthcare careers are considered "helping" fields. Not surprisingly, these helping fields encompass a larger proportion of full-time working women than men. Furthermore, twice as many women than men (22% of women vs. 11% of men) pursue jobs in nonprofit companies (Goldberg Dey & Hill, 2007, p.23). This indicates that more women focus their talents and ambitions towards careers that directly help others, either from natural inclination or cultural socialization and expectations of females.

Lack of female role models in STEM. Research has shown that women's pursuit of a STEM major is influenced by female role models and mentors (Goodman &

Damour, 2011). When female students have female professors, some studies have discovered that "their stereotypes can be not only reduced, but inverted" (Young, Rudman, Buettner & McLean, 2013, p. 289). Increasing the number of female faculty members teaching STEM courses can have a strong encouraging effect on the pursuit of STEM careers by women, while also decreasing biases and negative stereotypes in the STEM fields (Frost, 2017).

Connecting secondary school students to STEM activities and role models is important to the development of STEM interest and career expectations. Girls are rarely exposed to female role models in STEM fields, which adds to the stereotype that the STEM professions are typically male (Marra, Peterson, & Britsch, 2008).

For all students, perhaps an inability to identify with STEM concepts is related to a lack of personal relationships with other STEM students or STEM professionals in the classroom. However, studies demonstrate that STEM initiatives for females can strengthen girls' identification with STEM by developing positive attitudes, interest and self-efficacy in STEM fields (Marra et al., 2008).

Educational outreach initiatives show that female students from diverse groups, including those of low socioeconomic status, need STEM role models who are inspirational and who can relate to their experience (Marra et al., 2008). Since recent research shows that women rely on and benefit from same-sex role models more than men do, an increased presence of female faculty and staff can have a positive impact on the educational attainment of female students (Frost, 2017). Therefore, female role models and mentors in college can help female students persevere in STEM majors (Goodman & Damour, 2011).

STEM pipeline. It would be a mistake to underestimate the influence of elementary and secondary education on a student's interest in pursuing STEM in post-secondary schooling and beyond. Each step is necessary, leading to the next stage and impacting the success of the final accomplishment of pursuing a career in STEM.

The STEM pipeline is the phrase used to describe STEM education throughout schooling levels and eventually culminating in the labor force. The development of a new scientist begins quite early and can only be accomplished through a series of steps. It starts with primary and secondary school, where students have to acquire both the skills and the interest in STEM fields to be successful in postsecondary studies. It continues grade by grade as students continue to acquire the skills and interests that might shape their decision as to whether or not to study STEM fields after secondary school (Bettinger, 2010, p. 72).

Exposure to STEM has to begin in kindergarten (Duncan et al., 2007), especially for girls, before they internalize gender stereotypes and cultural beliefs about their ability and competence to achieve in STEM. The United States currently has a leaky pipeline where STEM is introduced too late, so that women are not pursuing STEM fields in similar proportions to men.

Interdisciplinary Subjects and STEAM

STEM is essential, but equally important are the arts. STEM and the arts are not mutually exclusive. Scientific culture and technology have nurtured artistic innovations in many areas (and engendered new artistic fields such as digital design);

similarly, the arts have influenced STEM developments and discoveries (Herrmann et al., 2016). Many of the most innovative thinkers in STEM fields are highly creative people with an interdisciplinary approach to life; they are polymaths who are intensely influenced by music, the arts and other creative pursuits (Caper, 1996; Dail, 2013; Eger, 2013; Root-Bernstein, 2003). Research has found that Nobel prize winners are significantly more likely to pursue artistic hobbies, engage in a craft, or play a musical instrument than the general public (Root-Bernstein et al., 2008). For centuries, STEM and the arts have fed off one another in a mutualistic fashion. As demonstrated during the Renaissance Era, Leonardo da Vinci, who is best known as an artist, was also a scientist and inventor.

According to Catterall (2002), innovative thought in STEM fields is coming to depend more and more on eliminating the traditional separation between artistic disciplines, which are seen as "creative," and STEM disciplines, which are seen as more rigid, logical, or mathematical. Innovation will be hindered if schools continue to teach isolated disciplines based on simple reductionism; the arts should be incorporated into STEM to promote creativity together with reason and logic (Boy, 2013). This incorporation (STEAM) will help produce a multi-literate citizenry and workforce as the 21st century marches on (Taylor, 2016). Students who are exposed to the integration of arts and sciences develop a unique skill set (Land, 2013). STEM traditionally focuses on convergent skills whereas art traditionally focuses on divergent skills; having a workforce with exposure and capabilities in both types of skills is beneficial for America's competitiveness and global progress (Land, 2013). This means, Ball (2004) explains, "It will seem perhaps to be a strange notion, to non-chemists, that chemistry has an aesthetic. But it does. Chemists often make molecules that are admired not for their utility or ingenuity but for their artistry. These molecules are perceived to be beautiful. That is, sometimes, the sole reason for their creation" (Ball, 2004, p.185). Ball (2004) believes that chemistry itself can be artistic and beautiful.

STEM traditionally focuses on convergent skills whereas art traditionally focuses on divergent skills; having a workforce with exposure and capabilities in both types of skills is beneficial for America's competitiveness and global progress.

As a result there is a movement to include art and design in STEM education that builds on existing models of the interdisciplinary curriculum (Costantino, 2017). The interdisciplinary curriculum is based on an approach that integrates two or more subject areas, like the Arts and Sciences into a more meaningful association that enhances and enriches learning within a particular subject, in this case the Sciences (You, 2017). It is thought that an effective way to learn about phenomena in the real world could use an interdisciplinary approach (You, 2017), by employing concepts that use STEAM learning. In this way, interdisciplinary learning facilitates the thinking process in the sciences by incorporating the arts through the processes of critical thinking, deductive reasoning and reasoning by analogy. This interdisciplinary learning approach for Science learning or the STEAM approach will provide a rationale for understanding the big picture of the science concept applied to the real world. Moreover the interdisciplinary STEAM approach for learning STEM subjects involves collaborative learning amongst students because such learning further creates a natural

awareness of applying a STEM concept to the real world by using concepts in art or design. So when the original rigor of learning STEM subjects is connected to real world applications by adding artistic and design concepts, the STEM subject takes on a life of its own–called STEAM learning–helping students to better understand the STEM subject. Some universities have developed a multidisciplinary curriculum, which is a model intended to foster creative thinking by combining STEM fields with the arts and humanities (Madden et al., 2013).

The next generation of creative STEM professionals will need a polymathic blend of interests and skills in creative fields and multiple STEM fields.

Furthermore, as technology and global issues become more complex, many STEM fields are crossing boundaries and becoming more interdisciplinary with each other, which requires graduates who are capable of thinking about and working in multiple fields (Kezar & Elrod, 2012). The next generation of creative STEM professionals will need a polymathic blend of interests and skills in creative fields and multiple STEM fields (Shneiderman, 2003). Based on the prior research regarding the benefits of having a female role model in STEM subjects and adding the arts to STEM in order to increase interdisciplinary practitioners in the STEM field, the following hypotheses were formulated.

Hypotheses

H_1: A STEM class with an arts component (STEAM), when compared to a traditional STEM class without the arts, will positively affect female students' intentions to pursue STEM when compared to male students at the beginning of the semester.

H_2: Having a female STEM instructor will positively influence more women to pursue STEM subjects among students who attend a STEM with the arts class than women who attend STEM without the arts, compared to male students in the same classes.

H_3: More female students from the STEAM class will register for another STEM class over the next two semesters compared to female students from the traditional STEM (without the arts) class.

Method

Participants

The sample pool was drawn from 4 classes at a community college in the Northeastern United States, taught in the Fall 2016 and Spring 2017 semesters. Two classes were chemistry with the arts, and two were chemistry without the arts. The same female STEM instructor taught all 4 classes and was a fixed variable in order to rule out differences in teacher's personality and teaching styles.

Table 1
Chemistry with the Arts (STEAM)

	Total Fall 2016 & Spring 2017
Pre-test	(n=30)
Male	=15
Female	=15
Post-test	(n=18)
Male	=9
Female	=9

Table 2
Chemistry without the Arts (Traditional STEM)

	Total Fall 2016 & Spring 2017
Pre-test	(n=28)
Male	=8
Female	=20
Post-test	(n=16)
Male	=6
Female	=10

Explanation of Terms

STEM with the Arts (STEAM). The "Chemistry and the Arts" course offered a general background in the connections between chemistry and the arts. Topics include light absorption and reflection; the nature of color; additive and subtractive color mixing; separation of mixtures; chemical properties, synthesis and use of dyes, paints and pigments; the chemistry of art preservation and authentication of art objects; the hazards of chemicals used by artists; the principles of photography. The laboratory component applied chemical theory and techniques to practices involved in creating works of art such as photography, painting, and textiles. Students use modern laboratory instrumentation, such as Ultraviolet-Visible (UV-Vis) Spectroscopy and chromatography to examine materials used in art. For example, the blueprint reaction method of photography (also called cyanotype, which is a photographic printing process that produces a cyan-blue print) dates back to the 1840's. The photosensitive chemicals used include some iron salts discovered by Sir John Herschel. The process of light exposure and development is similar to black and white photography, where silver halides are used as photosensitive chemicals (Karimi, Hemraj-Benny, & Bojin, 2015, p. 71). The objective is to make chemistry vivid and easy to understand by employing concepts and methods of the physical sciences to understand the world around us.

STEM without the Arts (traditional STEM). The "Chemistry Fundamentals" course provided students with basic knowledge of modern theory of general chemistry. The course covers topics of general chemistry, including classification and properties of matter, elements and compounds, atomic theory, the periodic table, chemical composition, chemical equations, acids and bases, and chemical bonding. The laboratory experiments gave hands-on experience using principles of chemistry theory to the students. The objective was to use analytical methods to identify issues and evaluate evidence.

Research Design

This research used a quasi-experimental design. Participants were not randomly assigned because the classes used were already intact. The pre-test/post-test design was used to detect if the STEAM course taught by a female instructor had a significant effect on interest in pursuing a STEM degree among female students compared to a traditional STEM course, as measured with the pre-test/post-test survey responses.

Independent samples t-tests were used to compare pre- and post-test survey responses from the STEAM course and the traditional STEM course in order to see if there was a significant difference in male and female interest in pursuing a STEM degree at the beginning of the semester compared to the end of the semester.

Registration data was gathered for students who participated in the STEAM course and the traditional STEM course to determine whether female students from the STEAM class registered for another STEM course. Percentages were calculated for the entire STEAM course and the traditional STEM course as well as specifically looking at gender differences.

Procedure

Four classes were used as the sample: two STEAM, (one in Fall 2016 and one in Spring 2017) and two STEM without the arts classes (one in Fall 2016 and one in Spring 2017). The participants attended a community college in the northeastern United States. All participants signed consent forms, and then completed the same survey at the beginning of the course and again at the end of the course. The survey included a Likert scaled question regarding personal interest in pursuing a STEM degree: "Strongly Agree," "Agree," "Not Sure," "Disagree," or "Strongly Disagree." As follow-up to the survey, registration data were gathered for students who attended the STEAM class and the traditional STEM class for the two semesters following the course.

Data Analysis

An independent-samples t-test was conducted to compare male and female students on the pre-test and post-test scores for the survey question about desire to pursue a STEM degree in both the STEAM class and the traditional STEM class. An example of the question on the survey administered pre and post chemistry courses were "I am likely to pursue a STEM degree." The survey questions were scored on a Likert scale, which consisted of descriptive terms including "Strongly Disagree," "Disagree," "Neutral," "Agree," and "Strongly Agree."

In order to triangulate the data with more sources of evidence, registration data was evaluated for all students taking a STEM course two semesters following the courses studied.

Results

Independent-Samples T-Tests

STEAM course pre-test. There was a significant difference in the survey scores for women's interest in pursuing a STEM degree in the beginning of semester (M=2.8, SD=1.5) compared to men at the beginning of semester (M=2.2, SD=.67) conditions; t(16)=-1.194, p=0.028. These results suggest that female students in the STEAM course were significantly more willing to pursue a STEM degree at the beginning of the semester than male students.

Traditional STEM pre-test. There was no significant difference in the traditional STEM course in the pre-test scores on desire to pursue a STEM degree between females (M=3.2, SD=1.2) and males (M=2.8, SD=1.5) conditions; t(14)=-.537, p=.599. These results suggest that males and females were not significantly different in their desire to pursue a STEM course when they started the traditional STEM course.

STEAM course post-test. There was a significant difference in the survey scores for women's interest in pursuing a STEM degree at the end of the semester (M=2.56, SD=1.67) compared to men at the end of semester (M=1.78, SD=.83) conditions; t(16)=-1.252, p=0.032. These results suggest that despite the scores minimally decreasing from the beginning of the semester, upon comparison of the pre-test versus post-test scores, female students in the STEAM course still wished to pursue STEM degrees significantly more than male students at the end of the semester.

Traditional STEM post-test. There was a significant difference in the post-test scores on desire to pursue a STEM degree in the traditional STEM course for females (M=3.6, SD=.97) compared to males (M=2.3, SD=1.37) conditions; t(14)=-2.179, p=.047. These results suggest that women were significantly more likely than men to be interested in taking another STEM course when they finished the traditional STEM course.

Follow up, registration data found that 16.7% of the students (n=30) who attended the STEAM course attended another STEM course within the next two semesters, while 32.1% of the students (n=28) who attended the traditional STEM course attended another STEM course within the next two semesters. Students from the traditional STEM course were nearly twice as likely to pursue another STEM course at follow up when compared to the students from the STEAM course. However, when comparing percentages at follow up by gender, more female students (10%) from the STEAM course pursued STEM at follow-up than male students (6.7%), while more male students (17.9%) from the traditional STEM course pursued another STEM course than female students (14.3%).

Discussion

Research shows that only five percent of associate degrees in community colleges across the country each year are earned in STEM fields (Packard, Gagnon, LaBelle, Jeffers, & Lynn, 2011). This statistic is very significant as more than half of students today use community college as their initial introduction to higher education (Packard et al, 2011; St. Rose & Hill, 2013). We researched the effect of introducing the arts into a STEM course in order to encourage more women to take STEM courses at a community college. The research purpose was to explore whether offering a STEAM class in a community college would encourage more women to pursue STEM subjects and whether having a female instructor as a role model would influence more women to consider pursuing STEM subjects.

H_1 Hypothesis

The H_1 hypothesis was satisfied: in the STEAM course, at the pre-test level, women were more interested than men in pursuing STEM. Perhaps the title of the course, "Chemistry with the Arts," piqued the interest of women taking the course. As explained earlier, women interested in STEM may have been drawn to the arts component in this STEM course description more so than men.

H_2 Hypothesis

The H_2 hypothesis was also satisfied: at the post-test level, in the STEAM course, while the overall mean for women and men decreased, female students tended

to stay interested in the subject; they remained significantly more interested in the pursuit of STEM at the end than men in the same course.

The STEM course without the arts was a traditional chemistry class taught by the same female instructor. At the baseline pre-test there were no significant differences between male and female responses, but after the course, post-test responses showed that women in the traditional STEM course were more interested in the pursuit of STEM than men in the same course. This result was perhaps due to the female instructor who served as a role model for her female students.

H3 Hypothesis

In the follow up study using registration data for participants who attended the STEAM course in our study, a higher percentage of female students in comparison to male students took STEM courses over the next two semesters. This would indicate that STEM with the arts has a positive effect on female students pursuing STEM courses.

On the other hand, in the traditional STEM (without the arts) class, more men tended to take STEM courses in the next two semesters than women, possibly because this course was taught in the traditional manner, despite having a female instructor. Therefore, these results were in line with previous research (see Figure 1).

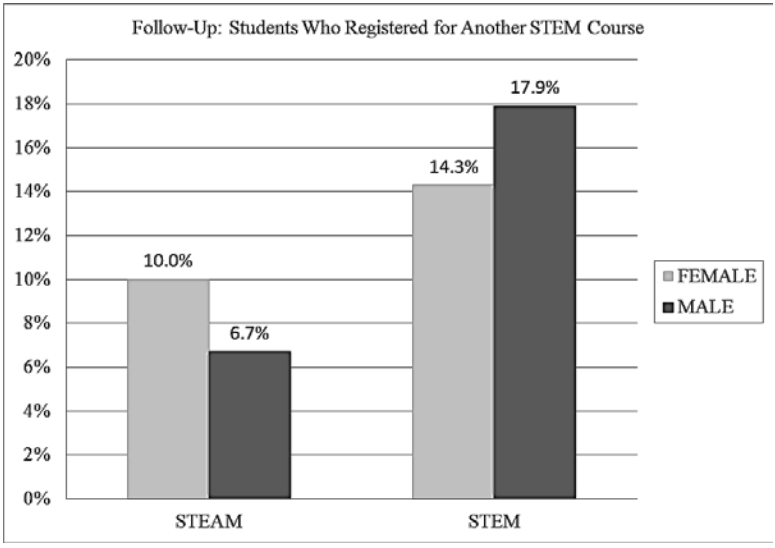

Figure 1. A larger percentage of female students from the STEAM course than from the traditional STEM course enrolled in another STEM course after the study ended.

Limitations

Since this research was conducted as a pilot study, there were a relatively small number of participants who were all students at one urban community college located in the northeastern U.S. They were not from a diverse set of two- and four-year colleges and universities. Additionally, for reasons unknown to the researchers, some

subjects did not show up to class on the days that the post-test survey was distributed; participants dropping out can result in biased conclusions. However, the researchers believe that had there been a greater number of participants and lower participant mortality, there might have been even stronger positive results. In order to increase validity and reliability of the results, qualitative data such as interviews and open-ended questions collected from the students would have been more beneficial. Since a female professor was used in both conditions of the study, the researchers could not compare the results with data from students who had male professors. All of these factors should be considered when evaluating the results.

Implications for Practice

Based on our research results, revamping the curriculum starting from grades K through 12, continuing in undergraduate schools, and eventually in graduate schools, is necessary to really make changes in perception of one's ability and success in STEM, specifically for women. It is central to include the arts in STEM education and to encourage female students in the early grades. However, even changes at the 2-year and 4-year collegiate level can have an impact!

If educators start teaching female students about STEM/STEAM subjects at earlier ages and expose female students to more supportive female role models, it may be possible to increase STEM/STEAM-educated faculty in post-secondary institutions so that more female students enter STEM careers.

Implications for Future Research

This study needs to be expanded with a larger sample size and replicated at other community and four-year colleges and universities in different regions of the United States. Comparing the effects of pedagogical approaches of female STEAM professors to those of male STEAM professors on students' pursuit of STEM subjects at community and four-year colleges and universities should be studied. Various interdisciplinary courses that compare STEM learning with the arts (STEAM) to STEM learning without the arts should also be explored to see their effect on attrition rates and impact on women pursuing a STEM degree.

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Collaborative Pedagogy in a Design Thinking Education Course

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This article describes a co-taught course that mobilized a Design Thinking approach in the service of creating a prototype for an actual girls' boarding school in Kenya. The goal of the class was to allow students to engage collaboratively with faculty, with their peers, and with experts "on the ground" to develop the various parts of the school, from the mission to the curriculum to the building design. The article describes the rewards and complexities of this kind of hands-on pedagogy in a higher education context.

"Learning occurs when teachers exercise control indirectly through work done as a social enterprise in which all individuals have an opportunity to contribute to something about which all feel a responsibility" (Dewey, 1997).

At Smith College in Northampton, MA, as in many other colleges and universities around the United States, "collaboration" has become a popular and commonplace term. In evaluating faculty for tenure, we have come to value and reward collaborative work within and across the disciplines. In designing our courses, we see student collaboration as a critical "soft skill," crucial to the learning process. We value co-teaching as a useful (if expensive) tool for modeling critical discourse, and we encourage both faculty and students to collaborate in their research with scholars around the world. Indeed, global collaboration has emerged as one of the most robust and burgeoning forms of intellectual sharing, as technology facilitates communication in ways that would have been impossibly cumbersome even a decade ago.

Collaboration, however, is often complicated: student group work is hard to monitor and evaluate, co-teaching is time-consuming, and personalities get in the way of easy interactions. Time differences and technological difficulties complicate online global collaborations. And yet, the collaborative sharing of knowledge and expertise can be rewarding in unprecedented ways, as the walls defining knowledge grow porous, and the possibilities for critical discourse multiply (Allan, 2016; Leavitt, 2006; Plank, 2011, 2013).

These rewards and complexities characterized the course described in this article. The class, entitled "The Making of a School," joined together the professors and their students with experts in Kenya to create the blueprints for a new girls' boarding school to be built outside the capital in Nairobi. The process of collaboration that we experienced in this class brought into bold relief the

…the collaborative sharing of knowledge and expertise can be rewarding in unprecedented ways, as the walls defining knowledge grow porous, and the possibilities for critical discourse multiply.

value of co-teaching and also underscored for us the ways in which emerging technologies and other new forms of pedagogy can enrich student learning. The course engaged with collaborative work on many levels: first, in its being taught by two faculty with complementary areas of expertise, one American and one born and educated in Kenya; second, in that the students worked in collaborative groups around specific areas of school design; and third, in that both faculty and students together consulted with experts "on the ground" in Kenya to formulate all aspects of the school, from mission to budget, curriculum, and site planning. Both the professors and their students came out of this experience with concrete skills for moving forward with the creation of this school, but we also gained a deeper and more nuanced understanding of design thinking, cross-cultural collaboration and the politics of school making. In short, this exercise in school making emerged for us as an object lesson in collaborative work, an experience in which all parties learned a great deal not only about the content at hand, but about new pedagogies, interpersonal relationships, and, perhaps most pointedly, about ourselves.

The Nexus of Collaborative Pedagogy and Design Thinking

Brufee (1999) writes that literature on knowledge construction, drawn from collaborative interactions, is grounded in three distinct domains. The first focuses on collaboration among members of a single knowledgeable community: peers in the same field. This kind of collaboration occurs when experts read and critique one another's research or co-author scholarship, drawing on like areas of expertise. It is also the domain of the most frequent form of team-teaching. Much of the literature on team-teaching points to its capacity to enliven pedagogy and even spark "joy" (Leavitt, 2006; Rinn & Weir, 1984). Team-teaching with colleagues in one's department or field can "build deep professional and intellectual bonds" (Jessen-Marshall & Lescinsky, 2011, p. 34) and can also serve as a model for students for how thoughtful people engage with one another over complex ideas.

The second domain of collaboration occurs when we work at the boundaries between knowledgeable peers (Brufee, 1999), where faculty and students across subjects or fields merge their expertise around a common problem. Recent thinking in the academy, especially in the areas of expanding global understanding, has encouraged these kinds of collaboration as a way to break down the barriers between disciplines and model for students the porous nature of knowledge itself. Arne Koch, dean of Global Engagement at Colby College, for example, describes programming at his institution where faculty in separate divisions travel together to study a common topic or problem, like sustainable farming or barriers to female literacy; afterwards, they develop new courses that attack the issue from diverse perspectives: economic, political, and even literary or artistic (Koch, 2018). Again, this kind of collaboration has its rewards and challenges. Translating ideas across intellectual boundaries requires patience and openness (Plank, 2011).

The third and most challenging form of collaboration occurs between knowledge communities (experts) and outsiders who want to join them. It is a form of sharing that problematizes the very notion of expertise and requires practitioners to rethink traditional models of authority and power. This approach to knowledge

construction drives the literature on design thinking. Design thinking has been characterized as both a "mindset" and "educational model" (Goldman & Kabayadondo, 2017; Rauth, Köppen, Jobst, & Meinel 2010; Renard, 2014). It is a mindset in that it privileges a focus on human values and requires collaborating individuals with varying experiences to value the work of others as crucial to their own success. As an educational model or pedagogy, it requires hands-on work—the conceptualizing and creation of "prototypes" or physical artifacts that are transformed and improved through continuous feedback and testing (Goldman & Kabayadondo, 2017; Miller, 2015; Sweet, Blythe, & Carpenter, 2017). As Renard (2014) notes, the design thinking approach can increase students' capacity to recognize opportunities, engage in divergent thinking, and revisit and revise ideas through iteration (p. 414). With roots in the ideas of knowledge construction put forward by educators such as John Dewey and Donald Schön, this approach is increasingly becoming popular in liberal arts college classrooms in the United States (Goldman & Kabayadondo, 2017; Renard, 2014). Its popularity seems to increase as higher education institutions recognize its potential for addressing the goal of deepening students' critical understandings of and engagement with the "real world" towards positive social change (Miller, 2015, Sweet et al., 2017). Design thinking has emerged as a valuable tool for students to produce works in a real-world context while at the same time allowing for the evaluation of those works to build knowledge in an iterative way (Renard, 2014).

Design thinking serves to challenge the traditional "banking" models of knowledge transmission (Freire, 2015) by positioning students as active constructors of knowledge, helping them reconceptualize the teacher-learner relationship. In adopting the principles of design thinking, faculty must be willing to negotiate the traditional power and authority they typically have over curriculum, teaching, and learning and instead serve as facilitators of learning, as coaches. They must seek to expose students to the cross-disciplinary knowledge and skill sets they need to undertake their team projects. Above all, they must embrace uncertainty engendered by their role. As Johnson (2017) notes, "Those who facilitate design learning must steadfastly negotiate their own fears as they lead others into disequilibrium, uncertainty and radical reframing that reliably occur when designing" (p. 129). As we note in a later section, this negotiation can open up important learning opportunities for students and facilitate a paradigm shift in instructors' views about collaborative pedagogy. Finally, design thinking encourages learners to seek input from outside experts and practitioners in the field. As knowledge becomes democratized through the design thinking process, sources of information, feedback, critique, and support grow wider, as experts and outsiders (Brufee, 1999) work together, pooling experience.

The Making of a School: A Collaborative Course Model

All these forms of collaboration were mobilized in ED222, "The Making of a School," a course whose explicit mission was to consider the ways alternative forms of education can address fundamental social problems within cultures. The goal of our work together was a concrete one: to design a prototype for an actual girls' boarding school in Kenya, to be built within the next few years, fulfilling the long-time dream of

one of the faculty teaching the class. That goal required students to address a series of complex questions. Since, in Kenya, quality girls' education remains a challenge (Chege & Sifuna, 2006; Mugo, Nderitu, & Ruto, 2016; Mule, 2008; Oruko et al., 2015), how could an alternative model for girls' education resolve some of the cultural and structural forces that thwart girls' success? How can past efforts to address educational injustice inform the present and transfer from one context to another? How might we reconcile a hands-on project like this, given the vast distances and cultural differences that separated designers and users of the school?

The course began with the familiar: a series of readings that outlined historical models for alternative schools created to address perceived inequities. The class looked at early 20th-century U.S. settlement schools for immigrants and at "liberationist" schools founded in American urban centers in the 1960s. Finally, we turned to the highly contested rise of charter schools as sites for educating disenfranchised groups. At this point, we visited a local suburban Chinese immersion charter school in the community and invited the principal of a local Latinx-majority urban charter school, inspired by the principles of Paulo Freire, to speak to the class. With this background, both theoretical and practical, the class then turned to Kenya and the arguments for creating alternative schools in that country. Readings and presentations on Kenya were carefully selected with a mix of history, educational policy and reform, challenges of girls' education, and models of alternative schools. This background laid the groundwork for the final, active work of the term: prototyping the school.

The class of 22 students was then broken into teams of students, each team charged with addressing a different aspect of the school-making process. Based on the readings and visits we had undertaken, students and faculty isolated six areas of focus for the project: school mission and web presence, budget and fundraising, curriculum, building plan, governance and personnel, and student life. The teams met regularly both in and out of class, and we, the instructors, moved from group to group, providing readings, facilitating discussions with Kenyan contacts, and generally collaborating on the groups' emerging plans. At the end of the term, students presented their plans to a public audience through the college's Global Studies Center.

Forms of Collaboration

Faculty-to-Faculty

As a co-created and co-taught course, our collaboration began with the preliminary design of the class. That design was necessarily grounded in our own areas of expertise. One of us was a historian of education with a background in curriculum and school reform; the other was an expert on social justice and comparative education, with a particular focus on Africa and the African diaspora. Both of us felt strongly that contemporary policies, whether local or global, needed to be grounded in an understanding of the past and an empathic connection to the present.

All readings were compiled collaboratively and posted on an online shared team drive accessible to all. Student work was evaluated collaboratively, and the scope and content of each individual class was discussed and negotiated in advance of the

session. As co-teachers, we also participated in monthly "teaching circle" discussions with other faculty members in the college who were using the design thinking approach in their courses. These sessions allowed us to problem-solve alongside faculty who were also grappling with course designs. Staff at the Design Thinking Center provided concrete tools for collaborative brainstorming (markers and multi-colored post-it notes; flipchart paper and sample readings, as well as a guest lecture, early-on in the course, to explain the principles of Design Thinking to the students). Professors in math and architecture made themselves available for consultation, as did the GIS Mapping staff, whose contributions to the course will be discussed below.

Faculty-Student Collaboration

Before students could begin their individual team work, certain shared understandings about the proposed school needed to be negotiated across faculty and students. Though certain "givens" existed a priori (the actual site of the school; the fact of the Kenyan national curriculum), all other decisions were negotiable. Together, faculty and students decided that the school would be themed, that the theme would be "leadership," and that the school would be an all-girls school and a boarding school. The group collaborated, too, in naming the school, voting for a tentative name from among a range of group-generated possibilities. Faculty and students also negotiated the team evaluation rubric for the project portion of the course. Students suggested, and faculty agreed, that they add to the faculty-made team drive both a master document developed by each team (that was regularly updated and shared with other teams) and a spreadsheet developed by one student in which teams reported their weekly progress and posted questions for other teams. Finally, faculty continued to move from group to group until the end of the term, checking in, critiquing, offering new readings or recommendations, and serving, generally, as cheerleaders as the emerging deliverables came into focus.

Faculty collaboration served to change the nature of the faculty-student exchanges. Students witnessed, in almost every class, the dynamics of faculty-to-faculty negotiation, as we debated ideas between ourselves in front of the classroom, disagreed about interpretations of readings, and found common ground through these debates. Modelling this kind of intellectual negotiation seemed to break down barriers between faculty and students, who became increasingly open with us throughout the semester, critiquing readings and suggesting alternative formats for class activities and assignments.

Student-to-Student Collaboration

Student teams were each composed of three or four students who together needed to negotiate not only what their final deliverables should be composed of but also what form those materials should take. For example, the group assigned to research the physical site of the school presented aerial maps of the area, graphs documenting soil composition, sites for septic and well construction, and rough architectural plans for the school itself. Students charged with budget construction presented an outline of budget categories, examples of budgets from comparable

schools in the area, and a list of potential funding and grant sources. Students were encouraged to utilize the design thinking process as a way to gain consensus on ideas and work through conflict.

Several teams worked in other areas of the college. The site team worked collaboratively with the school's GIS staff in the Mapping Lab; the curriculum and mission groups worked in the college's Knowledge Lab—an open space with white boards, beanbag chairs, and other materials that encouraged hands-on, iterative work. Teams consulted with other teams as needed, and groups reassembled at the end of each class to share their thinking and ask questions. Design thinking collaboration among students necessitated that each group revisit individual assumptions, consult resources, and rethink their conclusions in an ongoing and iterative way.

Collaboration with Experts on the Ground

The fourth level of collaboration in the course was the work done with experts on the ground in Kenya or with Kenyan visitors to the college. In the pre-planning stage, one of the instructors spent a summer in Kenya visiting with school founders and touring alternative schools. Some of the contacts established during the visit would later speak with our students via Zoom (a video conferencing tool). Zoomed sessions, in which the entire class participated with Kenyan experts, deepened the collaboration across geographical borders. The collaboration with experts, whether online or in-person, addressed a range of topics. A director of students from an independent school outside Nairobi spoke about student life, parental involvement, and the centrality of wellness programs for students in Kenyan boarding schools. A visiting senator from Kenya, who served on the board of a boarding secondary school, spoke to students about school board composition, funding, and marketing. A visiting Kenyan journalist talked about her personal struggle to access quality education growing up. She also spoke about the development of "soft skills" and the critical importance of out-of-classroom work, clubs, and sports teams for Kenyan girls. Two Kenyans living locally in Massachusetts spoke about ways of funding schools and explained the key role of the African diaspora in supporting educational efforts back home. Students also heard via Zoom from a former curriculum developer at a new and innovative university in Mauritius about the need and strategies for decolonizing the curriculum in African schools, and a Smith student who had interned in the school also shared her experiences with curriculum reform. In all, seven individuals familiar with the Kenyan education context served to encourage and support the work of the students, a crucial piece of the collaborative puzzle and one that helped to offset the students' sense of themselves as privileged outsiders, unequipped to make recommendations across cultures and continents.

In short, all these varied forms of collaboration served to create a complex, innovative, and challenging experience for both faculty and students. Stepping back from the class at the end of the term, we have sought to clarify the experience practically, philosophically, and ethically. The following section enumerates those understandings that have emerged from the class itself and from our ongoing analysis of our work.

What was the impact of this multi-tiered collaboration on student attitudes and student learning? In their final assessments of the course, students identified collaboration as a major skill gained during the semester. When asked to respond anonymously to the question, "What would you say are the top two or three things you personally gained from this course?" 9 of the 16 students who responded identified collaboration with others. It was frequently mentioned second only to content (knowledge about alternative schools and their contexts), which was mentioned by 10 students. Other gains identified included a new appreciation for the design thinking process (mentioned by 4 students) and effective communication (mentioned by 4 students). We also asked students to let us know what worked or did not work for them with regard to the collaborative teaching/learning model we had adopted for the course. Half of the class responded to this question and conveyed their appreciation of the approach, ranging from collaboration modeled by the instructors to teamwork. One student noted, "Love-team teaching as a soon-to-be teacher myself, and really think partnership we saw in class echoes the true nature of education."

However, there was criticism as well. Many students said they wished they had more time for cross-team collaboration and discussion, a feeling captured by one student who noted, "I loved this model for learning! Everything worked for me except I would have appreciated a different structure to allow for more/deeper check ins with various teams…" The need for more cross-team discussions increased especially toward the end of the semester as the teams prepared for the public presentation of their work. Clearly, the four weeks dedicated to the team project was not enough. Nor was the online team drive used as effectively as we had anticipated, and most students said they simply needed more time to work as a full class, reporting back on the progress they were making in their smaller, interest-based subgroups.

To gauge the students' attitudes about the use of the design thinking process for this course, we asked them, "How useful was the design thinking approach to your team? Would you recommend the same amount, or more or less instruction in this kind of group work strategy?" All the 15 students who responded anonymously to this question found the strategy to be useful—some more than others. One enthusiastic student noted, "A great way of teaching!" Most, however, sought more explicit instruction about the strategy, as well as a more seamless integration throughout the course. Three of the six teams reported that they extensively used the process in their team project.

Although we did not explicitly ask students about their views regarding collaboration with Kenyan partners, their unsolicited comments throughout the semester consistently conveyed the value they derived from this aspect of the course. Evidence of collaboration and iterative thinking was evident as students worked toward team deliverables. For example, the team in charge of developing budget and funding plans conveyed in their team report the importance of multiple layers of collaboration in their team:

> Like most other findings in this report, the process of forming the budget was influenced by design thinking. Throughout the semester, the Budget and Funding group reached out to other groups in order to empathize with and

> define their funding needs. We used that information to ideate, prototype, and test different models of presenting these needs in light of no definite costs being available. As our team and others realized new potential costs, our team cycled through those steps until we arrived at [the final] list…Non-classmates were also essential to our process and will be much more important in the future as plans for the school continue to grow. We had the opportunity to talk with [Kenyan collaborators] and meet with a few potential [Kenyan diaspora] donors. In producing this report, we strived to keep in mind the knowledge, concerns, and advice offered by our outside resources.

For this team, it was clear to us that there was a marked shift from their original North-to-South ideas about funding development to a realization that a funding plan that included Kenyan donors is feasible and ultimately more sustainable. What was instructional for us as instructors is that the varied levels of collaboration in the course allowed for this kind of organic learning.

While we were glad that students did not exhibit the aversion to group work often cited in literature (Allan, 2016), important questions emerged that will guide our future project-based courses. How early in the semester should the team projects begin? What constitutes "sufficient" levels of cross-team collaboration in a project like this? What collaboration tools would be appropriate for maximizing cross-team communication for a project like this? What level of depth on design thinking—theories, method, philosophies—should students be taught prior to engaging in their team projects? How can collaboration with global partners be deepened in every step of the projects?

Rewards and Difficulties of Collaborative Pedagogy from the Instructors' Perspective
Professional Development

For the two faculty who engaged in the design and teaching of this course, the rewards were profound. Our weekly planning sessions afforded us time to "teach" the readings to one another, to debate issues that arose in the material, and to parse together the dynamics of the class. Indeed, one could argue that collaborative course design and team teaching are among the most effective forms of professional development, providing as they do an opportunity for metacognition and self-scrutiny.

There were a myriad of instances throughout the term when our co-planning yielded deeper understandings that would never have emerged in casual conversations. For example, a conversation about "what the Kenyan young women *needed*" in their co-curricular experiences revealed the limitations of western liberal assumptions on the part of the American faculty member, whose skepticism about the value of "class trips to Europe" was rebuked by her Kenyan collaborator. Differences of opinion about standards for grading and attendance made for fascinating discussions about pedagogy and the cultural norms that undergird our teaching. These regular debates were highly instructive, especially since they took place within the safe space of our offices between colleagues whose trust grew deeper over the course of the term.

The college's willingness to support the team-taught class, allowing us to count it as a full course-equivalent for each faculty member, communicated their

understanding that this kind of collaborative work was not only worthwhile but crucial. If teachers are to implement new technologies and extend their work across fields, they may well need the support that comes from teaching in teams. Experimentation and risk-taking felt so much easier with a friendly partner.

Time and Logistics

Despite these positive outcomes for our professional development, multi-level collaboration of the kind we describe here also necessarily carries with it certain stubborn challenges and hurdles (Benjamin, 2000; Hinton & Downing, 1998; Letterman -& Dugan, 2004; Plank, 2011; 2013). The first and most obvious are the logistical ones. Planning a course like ours required a formidable time commitment. Before the course even began, we, the teachers, needed long stretches of time together for planning, communicating with Kenyan advisors, setting up schedules for school visits, and Zoomed interviews with experts. Given our own deep commitment to the project—the making of a real school—this commitment felt less burdensome than it would be if the course was simply an abstract exercise. Still, institutions that seek to support this kind of hands-on, collaborative, and interdisciplinary work should recognize (and compensate) the exceptional time commitment required for such work.

Another logistical complexity was balancing the various factors involved in supporting the student teams. Student teams worked at different campus sites (the locations team worked in the GIS Center; the budget team worked in the Knowledge Lab; etc.), and faculty moved from place to place, consulting and supporting student work, movement that was cumbersome and created an occasional sense of dislocation and could potentially lead to contradictory advice. Technology, too, created logistical challenges; time differences made working with Kenyan colleagues unwieldy, and technology was sometimes unpredictable, as internet connections were imperfect or failed altogether.

The Problem of "Privilege"

One unpredicted challenge we faced emerged less from the practical aspects of collaboration than it did from the more abstract and ethical issues associated with this kind of collaborative school making. Almost from the start of the class, some students voiced their concerns about their own ethical stance with regard to the project. How, they questioned, could privileged first-world women make recommendations for best practice for teachers and students they had never met in a country in which they had never lived? That sense of privilege, and the uneasy paralysis that emerges from it in the face of doing good, became a recurring theme in our work. Indeed, though students moved forward with their team deliverables, their unease with the process of that work increasingly emerged. Despite our preliminary efforts to situate our school-building project in the context of historical understandings about other liberationist work, and despite our work to integrate the expertise of Kenyan nationals (including one of the two faculty teaching the class), students expressed repeatedly their sense of themselves as western interlopers imposing their dominance and their privilege on a community they would never know profoundly. Collaborative

conversations about these concerns became increasingly commonplace as the work advanced and sparked for the two faculty collaborators a rethinking of the meaning of these student-initiated discussions. Clearly, the conversations were important and useful on a number of levels, serving, ironically, to reinforce the very strategy of design thinking that drove the entire exercise. The way in which these complaints were voiced and analyzed, with increasing candor and eloquence, also seemed a natural outgrowth of the collaborative nature of the course.

Whenever this unease was shared with the Kenyan collaborators, students' perspectives shifted somewhat. In two instances, for example, students shared their "interloper" fears and in each case received affirming responses from the Kenyan partners. The Kenyan journalist assured students that Kenyans are global-minded and used to partnering with other countries toward sustainable development. Another consultant, the Kenyan senator, expressed his regret that the proposed school would not be built in his county. Collaboration at the highest level, we reasoned, is always iterative (Letterman & Dugan, 2004), and the recurring desire to parse the nature of our collaboration (the values that informed it; the authority of the players in the process) was as deeply educative as the school product that was created by the group. Indeed, discussions about privilege, authority, and power—discussions that often take place at Smith College—gained new urgency and complexity as a result of their context here. What does it mean to make something like a school for someone who one knows only through second-hand readings and accounts? What constitutes "sufficient" levels of collaboration to legitimize a project like this? What right do privileged white students have in making recommendations of best practice to disadvantaged or disenfranchised groups? The discussions we had about these issues were surprisingly complex. The final written assessment of one student summarizes well the nuanced understandings produced by this collaborative discourse:

> The most important thing I learned about myself in this project was simply how much more I have to learn. This class took everything that I knew or understood about privilege and turned it all upside down…I went into this class with the idea that establishing schools and teaching in developing countries was how I wanted to spend my life, and I couldn't see anything other than the positives of that. I had all of these preconceived ideas about the benefits of education as a driver for social change, and while I still believe in those ideas for the most part, this class really made me rethink the limitations of my own privilege.

In a school where political discussions tend to highlight a single point of view—often the most politically correct and progressive—students here worked their way through a range of viewpoints, made more candid and comfortable because of the collaborative work that preceded those discussions. This was true not only between students, but between students and ourselves.

Perhaps the most rewarding aspect of collaborative pedagogy enacted in this course was that it enabled us to teach the design thinking technique to students who might never otherwise have had the opportunity to engage with this kind of alternative form of learning. In addition to the students' perceptions about the approach discussed above, we observed throughout the semester how the language of design thinking became commonplace in class discussions and in their various written assignments,

including the process paper each group submitted at the end of the semester. The deliverables they submitted were faithful to the process of creating "artifacts" or "prototypes" that were improved through consultation and feedback. At the final public presentation of their work, students' ease with the language and process of design thinking was evident throughout. Students spoke explicitly about their processes for negotiating controversy and their newfound understanding of how complex tasks can be simplified and clarified when divided among team partners who are equally invested in the outcomes of those tasks. These seemed to us like important life lessons that can be carried into other classes and ultimately into the workplace.

Conclusion

The semester was a first for us in two important ways. We were finally able to co-teach a course after many years of wanting to do so, and we used the design thinking approach for the first time to organize our course. Design thinking energized us and afforded us the rare opportunity to collaboratively reflect in and on our practice. We became comfortable opening up to each other and to our students about our passion for and vulnerabilities with regard to course content. Despite its less than flawless application in our course, the pedagogy provided our students with rich opportunities, not only to engage deeply with content around the policy, politics, and practice of school making at home and abroad, but also to do this in collaboration with others. It offered us (the course instructors) an opportunity to transform a shared interest in comparative education into a complex and multilayered course that would leverage human and material resources across the campus, in the local community, and beyond our national borders.

If we get an opportunity to teach this course again in the future, we would continue to model collaboration as co-teachers. As noted earlier, many students acknowledged and appreciated this modeling. We would create more opportunities for large-group conversations—perhaps "flipping" the classroom as a way to better facilitate these conversations (EDUCAUSE Learning Initiative, 2012). We found that once students realized we were transparent about our passion, fears, and uncertainties with the project, they mirrored the same transparency and engaged in deep conversations about content, process, and skills. Finally, a study abroad component may be a useful addition to a future iteration of the course. Short-term faculty-led study abroad opportunities, linked to specific courses, have become a popular option for students and faculty at Smith College. Even brief engagement "on the ground," might allow students to begin to negotiate the North-South power dynamics that confounded them throughout the term. Face-to-face meetings with experts onsite would certainly deepen the various forms of collaboration that served as the basis for this challenging and satisfying class.

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Appendix

The following questions informed the observations made in this article regarding student experiences of and learning in the course. We designed the first two questions in response to an invitation that went to all faculty in the College, asking them to submit optional custom questions for the usual end-of-semester course feedback questionnaire. We sent the two questions as we wanted to gather student views on our use of collaboration and design thinking approaches in our course:

1. This is the first time we have taught a course built so wholly around a collaborative project. Can you comment on what worked and did not work for you with regards to this collaborative teaching/learning model?

2. How useful was the Design Thinking approach to your team? Would you recommend the same amount, more or less instruction in this kind group work strategy?

Student responses to the following three questions contained in the College's feedback questionnaire that relate to learning strategies provided us with quantitative and qualitative data that confirmed our observations about the usefulness on collaboration and hand-on learning activities used in the course:

3. Please indicate how helpful [our] teaching methods were in furthering your own learning in this course:

a) Facilitation of activities and discussions, and b) responsiveness to questions.

4. Please indicate how helpful the following structural aspects of the course were in furthering your learning:

a) In-class activities and discussions, and b) out-of-class activities

5. What general learning strategies or study methods did you find most useful in this course?

a) Engaging actively in class discussions and activities

b) Doing class assignments (reading, etc.)

c) Other

The following two questions contained in the College's feedback questionnaire provided us with quantitative and qualitative data that confirmed our observations about student learning in the course:

6. What would you say are the top two or three things (ideas, skills, perspectives, etc.) you personally gained from this course?

7. Please indicate how helpful the following structural aspects of the course were in furthering your learning:

a) The instructor created an effective learning environment.

b) The course contributed significantly to my education.

Learning Analytics in Higher Education: A Reflection

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The idea of learning analytics has become popularized within higher education, yet many educators are uncertain about what is entailed when implementing these technologies into practice. The following article serves as an overview to the field of learning analytics for faculty, educators for whom the expectations to use these technologies continues to increase. We additionally argue that those who work directly with students need a functional understanding of the learning analytics landscape in order to exercise their own expertise.

What are Learning Analytics?

From IBM commercials to conversations over coffee, the term *analytics* has become pronounced within our culture. This trending topic is often found within higher education and can be used to describe the measurement of business and (the focus of this manuscript) student learning. Perhaps the authoritative definition of learning analytics is offered by the premier scholarly community studying the subject, the Society for Learning Analytics Research (SoLAR): "Learning analytics is the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs" (as cited in Shum & Ferguson, 2012, p. 4). The purpose of this article is to reflect on the what, who, and how of Learning Analytics (LA) so that readers are more informed regarding how these technologies may support student learning.

In their conceptual framework of analytics in higher education, Van Barneveld, Arnold, and Campbell (2012, p. 6) relate the broad term analytics, which they define as "an overarching concept described as data-driven decision making," to differentiated types of business/academic analytics, learning analytics, and predictive analytics. In this framework, business and academic analytics are used to manage an institution, whereas learning analytics is focused on the learner and uses data to improve student success. Predictive analytics can be used at all levels within higher education and draws upon historical data to predict future changes, therefore guiding action. As the relatively new field has grown, researchers have reminded scholars that the work is about *Learning* and *Analytics*. Suthers and Verbert (2013) describe the field as a middle space between these two concepts; an intersection between broad understandings of learning and the development and the explanation of analytic processes.

Recently, Learning Tools Interoperability (LTI) technology has expanded possibilities for building in LA components into learning management systems (LMS). As a protocol which allows systems to "talk" to one another, LTI enables third-party

vendors to build blocks that can be easily inserted in LMS architecture (IMS Global, 2018). In the past few years, a cottage industry of sorts has arisen where small programming companies build custom or one-off systems to integrate into schools' homegrown or licensed LMS systems. Within the larger LMS systems, primarily Blackboard's Learn, Instructure's Canvas, and D2L's Brightspace, a host of tools have been developed with ambient student data, with dashboards as the primary mode of data consumption. Blackboard has an analytics suite which can help schools with such tasks as "predictive analytics" or help with "assessment and accreditation" (Blackboard, 2018). Instructure's Canvas Dropout Detective is designed for faculty use to identify student performance issues which may put them at-risk for unsuccessful outcomes (Canvas, 2018). D2L's Brightspace Insights similarly uses data for "actionable opportunities" (D2L Brightspace, 2018). Common amongst these systems is the use of extant data in order to provide visual indicators of student behavior which may be problematic for successful outcomes. However, what remains ongoing is taking seemingly disparate data, combining them in compelling ways, understanding the myriad of performance data, and providing actual interventions which might have a positive effect on student outcomes.

Conceptually, LA overlaps with other academic fields such as Educational Data Mining (EDM) and the learning sciences (Rosé, Dawson, & Drachsler, 2017). According to the *Handbook of Educational Data Mining*, EDM is focused on the development of methods to analyze the vast and differential data within education (Romero, Ventura, Pechenizkiy, & Baker 2010). Despite the stronger emphasis on methodology and analysis compared to LA, the results of these methods can be used to satisfy some of the aims of learning analytics such as modeling student learning progress and improving course teaching. Siemens and Baker (2012) further distinguish between EDM and LA by arguing that the former emphasizes automated discovery, whereas the latter relies on human judgment. In their argument for collaboration between the two camps, these authors write, "Both communities have the goal of improving the quality of analysis of large-scale educational data, to support both basic research and practice in education" (p. 253). Meanwhile, learning sciences (a broad, interdisciplinary field measuring learning) can serve as a conduit between computer science and learning analytic projects, informing their design and implementation (Piety, Hickey, & Bishop, 2014). However, the field of learning analytics is currently wrestling with the extent to which learning theory is incorporated in LA projects. Shum and Crick (2012) observe that the complexities of student learning as measured in the learning sciences have yet to be extensively captured within LA processes. Some researchers have argued that analytics developed without connection to research in the learning sciences are vulnerable to validity issues, which influence their acceptance among stakeholders (Ochoa & Worsley, 2016).

How is Learning Measured in LA?

Many researchers have used a pass/fail binary outcome in predictive modeling to measure student success. However, actually measuring student learning in an analytic project can be difficult because defining (and thusly predicting) student learning is more complex than student success (Shum & Crick, 2016). Furthermore,

learning outcomes differ between courses; therefore, scaling projects derived from specific theories of learning may not work for multiple courses compared with interventions designed to improve the universal goal of student success. Despite the difficulty, scholars in the LA field have called for developers to use learning theory to guide the analysis of education data (Wise & Shaffer, 2015).

Both researchers and the LA community have actively sought to rectify the divergence between technology and theory. For example, an entire issue of the *Journal of Learning Analytics* focused on the application of theory to inform the development of LA projects (Dawson, Mirriahi, & Gašević, 2015). The issue generated some interesting studies, some of which are highlighted here. In one study, researchers used learning theory on spacing (i.e., the distribution of study times vs. the consolidation of long study sessions) to evaluate the behaviors of initiating online sessions related to Massive Open Online Course (MOOC) certification (Miyamoto, Coleman, Williams, Whitehill, Nesterko, & Reich, 2015). Findings from this research validate their theoretical underpinnings: students who spread out their study sessions were more successful. In an application of group cognition theory, researchers created a tool that graphed group dynamics by focusing on terms repeated between members, which could be used by instructors to design future group activities (Kelly, Thompson, & Yeoman, 2015). New methods, such as discourse-centric learning analytics, can be employed to measure complex aspects of learning and educator discourse such as meaning making and language typology (e.g., specific to discipline or emotional constructs) (Knight & Littleton, 2015).

The absence of theory in LA presents an important opportunity for faculty, who are experts on student learning, to inform the design and implementation of these projects.

Although this research exemplifies how learning theory can be used to guide the work of analytics, studies like this are rare. Because many LA projects are guided by computer scientists, these efforts can be agnostic regarding learning theory, as Wise and Shaffer (2015) warn their colleagues in the field, "there is a danger in falling into the trap of thinking that with sufficient data, the numbers speak for themselves. In fact, the opposite is true: with larger amounts of data, theory plays an ever-more critical role in analysis" (p. 5). In their framing of the field, Knight, Shum, and Littleton (2014) describe several pedagogical approaches found within LA, including transactional, pragmatic, and constructivist approaches. In his commentary on the afore mentioned issues of the *Journal of Learning Analytics,* Chen (2015) argues the relationships between theory and LA is not a "one-way bridge" in that these technologies are not only guided by theory, but they themselves can contribute to generating new theories of student learning theory and educational psychology. The absence of theory in LA presents an important opportunity for faculty, who are experts on student learning, to inform the design and implementation of these projects.

What Types of Data are Used?

The instillation of data collecting and management systems has stimulated the development of learning analytic projects by allowing for the timely analysis of data from multiple sources (Ostrow, Wang, & Heffernan, 2017). The introduction of

these technologies provides unprecedented depth of understanding on student behavior. For example, the data collected by LMSs such as click stream data have revolutionized the type of information collected about student academic behavior (Siemens & Long, 2011). However, learning analytic projects are not limited to the analysis of data collected via a LMS. Researchers can now draw multiple types of data from numerous systems such as admissions (demography, orientation participation, high school GPA), financial aid (household income, aid amount, Pell eligibility, total student loans taken), academic history (prior credits earned and total credits attempted), and learning management (attendance, discussion post count, late assignments, non-substantive post count, and count of messages to instructor) (Barber & Sharkey, 2012). These data extend beyond student information to the behavior of staff and faculty interacting with students; for example, to evaluate the use of LA software to advise students, researchers can use software log, calendar application, and survey data to measure the behaviors of academic advisors (Aguilar, Lonn, & Teasley, 2014). Certainly, there are no shortages of data points for researchers to use when implementing LA projects; however, there are continual efforts to bridge the gap between digital behavior and the physical world.

In many ways, data collected by online behavior and informational records cast a more permanent "digital footprint" compared with traditional understandings of physical behavior (e.g., listening to lectures, talking with peers, or reading a textbook) (Siemens & Long, 2011). However, researchers in LA recognize that digital data cannot represent the whole student and differentiate between *front stage online* (digital behavior recorded by a LMS), *backstage online* (digital behavior not captured by the institution), and *backstage offline* (physical behavior not recorded by the institution) (Gilmore, 2014). In response to this gap in measurement of student behavior, researchers incorporate additional tools that measure various aspects related to learning (such as dispositions not recorded online) providing further guidance in modeling student behavior (Shum & Crick, 2012). In an effort to bridge behavior observation and analytic method, researchers have used hand-coded video data of the ways engineer students solve design problems. Machine learning is then applied to the data to discover relevant patterns of behavior and improve instruction (Worsley & Blikstein, 2014). Advances in technology have allowed researchers to measure multimodal interaction, which includes data regarding the students' physical reactions such as heartbeat, gestures, and eye movement (Blikstein, 2013). LA project designers take advantage of the proliferation of these sources of data to design comprehensive models to measure and, in some cases, predict future student behavior.

How are LA Models Refined, then Scaled?

For any LA initiative, transitioning a working model into an analytic tool is a crucial step in scaling (i.e., the process of converting quantitative trends into actionable resources for educators working with a large student body). Updating a model can address a range of issues such as recall time, access to data, or presentation of the outcome of interest (Barber & Sharkey, 2012). Researchers also must choose what data they decide to draw from, preferring to use sources that are historical, interpretable, and authentic (Renzel & Klamma, 2013). When working with such large data sets,

researchers often develop tools to categorize data via a metric of understanding. For example, data that is dense (like text data) would require extensive time to process from scratch were it to be used in modeling. However, researchers can assess and categorize dense data prior to modeling, using smaller categories as proximities (Dowell, Graesser, & Cai, 2016). Beyond developing predictive models that are accurate or visualizations that are accessible, analytic tools need to be scrutinized and evaluated in terms of capabilities and feasibility to achieve stakeholders' goals (Arnold et al., 2014). Once a learning analytic tool has been developed, the tool must be transformed so that it can be accessible for parties associated with scaling the project: affordable for administrators, accessible for support staff, usable for faculty, and reliable (and safe) for students (Ferguson et al., 2014).

Once data sets have been identified and tools have been created, LA implementers face a new set of challenges when they try to design systems that can handle hundreds of students in real time, bringing them to scale. In a description of the learning analytics cycle, Clow (2012) described four steps of analytic processes: (1) generate data from learners, (2) analyze data from established metrics, (3) intervene to enhance learning based on metric results, and (4) evaluate the changed behavior of learners. In this conceptualization of LA, Clow argues that this feedback loop relies on increasing the audience size (scaling up) to enhance model stability while also increasing the impact of LA initiatives. Often scaling will include the use of automation and require reconceptualization of course functionality with the goal of creating systems that provide real-time feedback for faculty and students (Hickey, Kelley, & Shen, 2014). Suggestions from scaling a 30-student to a 500-student course include an incremental approach, incorporation of design-based methodology (i.e., creating learning opportunities that explore a particular type of learning), use of formal and informal assessment of student learning, and the creation of interactive features that not only measure contextual knowledge but also conceptual and procedural components of understanding. This process leads to new sets of barriers found within institutional organization that can prevent scaling.

There are numerous challenges that project teams must meet to successfully scale LA beyond an initial research exploration. Issues can stem from disagreements between organizing units, incongruence between software, growing pains associated with automation, and data accessibility for project partners (Lonn, Aguilar, & Teasley, 2013). Often, organizational processes can slow down the process of scaling analytic models. Planning and resources allocation often impede the implementation of learning analytics (Siemens & Long, 2011). Lack of staff can also impede the scaling process of analytics projects. In the implementation of an academic analytic initiative, Buerk (2014) described the lack of expertise among personnel in automation, analysis, and report generation as major barriers to the project's success.

Who Is Involved in LA to Support the Institutional Mission?

Numerous types of stakeholders must be included to nurture a successful LA project (Ganley & Hart, 2017). There are a few aspects of any project to consider when including these stakeholders, such as demands, scope, and implementation. Campbell, deBlois, and Oblinger (2007) describe aspects of a successful implementation of an

analytic project by listing campus leaders who use data to inform their decision-making, staff who have expertise in analyzing data, and sufficient technology to receive and process data. In another perspective of LA program design, Clow (2012) identifies four stakeholder groups associated with LA: learners, teachers, managers, and policy makers. The author uses the dimensions of speed and scale to describe how these roles relate to project demands. For example, learners and teachers prefer real-time feedback, while managers and policy makers have the resources to expand scale. Because of the wide-range of LA projects, there is a sense of scope that can be applied to different types of analytic projects that can be found on campus. Applying the conceptual framework of analytics developed by Van Barneveld et al., (2012), the authors identify a proposed level of focus for the types of analytics: academic analytics (institution), learning analytics (department/learner), and predicative analytics (all levels). In Buerk's (2014) narrative study of implementing an academics analytic initiative, the author describes using a "top-down approach" beginning with higher-level and department-level administrators, then evolving to include stakeholders (e.g., departments chairs, instructors, advising staff, and students). These aspects of a project, demands, scope, and implementation are dependent on institutional culture (Sharkey, 2011). Often, projects will rely heavily on those who are on the *front line* interacting with students: faculty and advisors.

Faculty, who observe student performance either in physical classrooms or in digital environments, are often seen as key partners for analytic projects and can be tasked with intervention when analytics predict student failure (Campbell et al., 2007). Similarly, academic advisors can be asked to incorporate analytic results into their work with students. Barber and Sharkey (2012) put the results of their model in the hands of academic advisors in their use of University of Phoenix data to predict student course completion with two goals: (a) to validate the accuracy of the predicted model and (b) to, "provide actionable information to front-line advisors in a form that can increase student success" (p. 262). In another study, Aguilar et al. (2014) measured academic advisors use of a student warning system and found surprising behavior. For example, the researchers intended for the tool to be used prior to meeting with students, but advisors often used it during their meetings, which influenced the results of the intervention. When studying the unanticipated outcomes from advisors, it is important to account for departmental culture and the training needed to implement these technologies; otherwise, academic advisors may misinterpret predictions, create stereotypes based on output from a tool, or can miscommunicate learning analytic information to students. Examples such as these articulate some of the challenges of implementing analytic projects as staff may use technology in their own unforeseen way.

A last (or perhaps first) stakeholder to consider is the student, since they can provide valuable feedback on the individual interpretation and resulting behaviors in the development of LA projects. For example, in a study using data from Cognitive Tutor software, Baker (2007) was able to identify students as on or off-task in their online behavior and recommended informing students of their classification to evoke self-monitoring among off-task students. In this case, students were directly involved in the feedback loop without interpretation from faculty or advisors. LA researchers, who are often provided with large amounts of institutional data on students without

IRB review, frequently overlook the communal and even ethical duties of including student voices in the development of these projects (Willis, Slade, & Prinsloo, 2016). Often, researchers will develop LA projects with a focus on creating tools with high predictability rates without consideration for how they will influence student behaviors; instead, students should be seen as valuable partners when trying to design tools that can be integrated into their experience.

From government and institutional policy makers, campus administrators, faculty, advisors, and students, LA projects challenge organizational bodies to collaborate. Researchers who work to implement LA projects have also considered the broader contribution of these projects to support the mission of an institution. In their case for the value of analytics for higher education, Siemens and Long (2014) describe the ways these technologies can enhance the decision-making of institutional leaders. Specifically, the authors identify the power of analytics to transform pedagogy by improving understanding of student learning, enhance sense-making of complex topics (e.g., social networks), and relate faculty productivity with institutional outcomes. Furthermore, learning analytics as a system offers feedback that can enhance the decision-making of stakeholders at multiple levels (e.g., faculty designing pedagogy, administrators resourcing learning initiatives, policymakers setting a learning and outcome agenda) (Shum & Crick 2016). From a fiscal standpoint, the implementation of LA presents benefits that are within higher education interests, such as business advantages for successfully educating students and meeting customer expectations of personalized digital services (Kay, Korn, & Oppenheim, 2012).

Although the ways in which analytics can enhance institutional decision making is clearly noted, successful LA projects require careful consideration and alignment with institutional values. As with any academic initiative, LA projects must comport with institutional history, students served, organizational structure, and overall needs (Sharkey, 2011). As reflected in the section regarding the barriers to scaling, LA projects require financial resources, socio-cultural support, and pedagogical anchoring (Arnold et. al, 2014). Therefore, LA project team members need to make a clear case on the ways LA can be used to further campus goals, which includes a careful consideration of issues related to the ethics surrounding this type of work along with an understanding of the criticisms of this field.

What are the Larger Implications for LA Projects?

Reflecting on LA would be incomplete without the promotion of caution when designing these projects. One of the criticisms of the current work in LA is that it is too technologically deterministic or, to put it another way, LA implementation is established in such a way that technology dictates educational practice (Knight, Buckingham Shum, & Littleton, 2014). Although the benefits of LA for higher education institutions have been described in this manuscript, the use of this tool presents ethical obligations for managers of these projects, particularly in the areas of data interpretation, student privacy, and storage of data (Slade & Prinsloo, 2013). In addition, there are several ethical concerns that institutional stakeholders need to consider when implementing analytics related to distribution of resources and the profiling and tracking of students (Willis, Campbell, & Pistilli, 2013). Furthermore,

specific issues of ethical consideration surrounding LA projects lend themselves to principles within the academy that affect all levels of participation (administration, faculty, students) such as transparency, accountability, and assessment (Pardo & Siemens, 2014). Though ethical approaches to learning analytics tend to offer frameworks for considering the pertinent issues, what is important from the project level is the possibility of considering how consequences, intended and unintended, affect all stakeholders.

Opportunities Ahead

As described in this essay, bringing learning analytics into practice requires collaboration among stakeholders who arrive at these projects with their own expertise and values. There are several camps responsible for bringing these projects from ideas to realities: computer scientists, institutional research staff, end users (such as academic advisors or faculty), and campus administrators (Zilvinskis & Borden, 2017). These partnerships can present opportunities for collaboration across camps represented by distinct domains, such as the *academic* domain (experimentation and software development), the *business* domain (assessing costs associated with supporting students who struggle), and the *practitioner* domain (skeptical toward various processes involved in LA). When these partnerships get together, it can be the case that the voice of the practitioner is muted over the promise proposed within the academic domain and the urgency vocalized by the business domain (Buyarski, Murray, & Torstrick, 2017).

However, it is important to remind the readership of this publication that educators play an important role in the development of these technologies. Faculty, academic advisors, and student affairs educators are experts in student learning and are uniquely qualified to inform the implementation of learning analytics into interventions that work, reminding developers and administrators the original goals of these projects. Student success, then, is dependent on those who work directly with students exercising their own expertise in the ever-changing environment of LA. Because of this, educators are not limited to the role of informing or educating developers and administrators, instead they should be the partners demanding better tools to support student learning, asking for LA that can conform to their teaching style and philosophy of learning.

There is an opportunity ahead for educators to invite developers and administrators into educational spaces to improve student outcomes. The implications of these technologies include the ability to predict student success and learning in a course so that educators may create more developmental and inclusive environments, enhancing the opportunity of success. LA can also be used beyond the course to enhance understanding of student learning within the curriculum. Furthermore, the use of LA presents several funding and research opportunities for educators to gain the resources needed to make these tools work. Although learning analytics is

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a burgeoning field, there has been some research performed on the design of these tools; however, what is needed are more studies of academic cultures that have successfully implemented these technologies and research on how to best collaborate with faculty, who have the motivation to improve student learning but may struggle with the time or expertise to implement learning analytics. Faculty can set the pace by insisting on LA and showcasing the possibility of these tools to enhance the experience of the students served.

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Strengthening Field Education: An Integrated Model for Signature Pedagogy in Social Work

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Disciplines that incorporate field education into their curriculum face similar challenges around fidelity and tracking of the integration of course work, field learning, and attainment of educational competencies. In social work curriculum, field education is identified as its signature pedagogy (CSWE, 2015), underscoring the importance of in-vivo learning. In this paper, the author's explore challenges associated with integration and assessment of competencies reflective of signature pedagogical principles through a social work lens. The authors propose a model for upholding field education as signature pedagogy through a combination of utilizing a faculty field liaison, housing field education within a course, and by instituting a comprehensive field education learning plan. While specific to social work, the model may generalize to other disciplines struggling to uphold quality in clinical and field education experiences.

The integration of classroom learning and field education proves paramount to developing a professional self and arguably is the goal of signature pedagogy in any curriculum. The circular merging of class concepts into students' demonstration of professional competencies through behaviors in the field, followed by the processing of behaviors in the classroom environment demonstrate the bi-directional learning conducive to professional growth. This bi-directional integration of learning also supports the development of critical thinking and identity in the field (Shulman, 2005a; 2005b).

Several professions identify students' practical field learning as their signature pedagogy. Gurung, Haynie, and Chick (2009) identify nursing, occupational therapy, and teacher education as a few professions centered on competencies gained in field experience. Other professions, such as medicine and physical therapy, emphasize the importance of clinical experience (Arena et al., 2017; Rider & Nawotniak, 2010). Challenges across these disciplines prove similar, such as maintaining fidelity in the field experience, tracking attainment of necessary professional competencies and skills, and integrating requirements set forth by professional accrediting bodies (Greenberg, Pomerance & Walsh, 2011; Gurung et al, 2009; Polglase & Treseder, 2012; Schott et al., 2015). While field experiences remain paramount to the student educational experience, competing priorities for faculty to devote time to scholarship, service and

teaching, combined with budgetary constraints faced by many universities, little attention is given to solutions around how to create higher quality field education experiences (Bogo, 2010).

In 2008, The Council on Social Work Education (CSWE) defined field education as the signature pedagogy in social work education (CSWE, 2008). The updated 2015 Educational Policy and Accreditation standards (EPAS; CSWE, 2015) underscore the centrality of field education in the social work curriculum:

> Signature pedagogies are elements of instruction and of socialization that teach future practitioners the fundamental dimensions of professional work in their discipline-to think, to perform, and to act ethically and with integrity. Field education is the signature pedagogy for social work. The intent of field education is to integrate the theoretical and conceptual contribution of the classroom with the practical world of practice setting. It is a basic precept of the social work education that the two interrelated components of the curriculum-classroom and field—are of equal importance within the curriculum, and each contributes to the development of the requisite competencies of professional practice. (p.12)

In this paper, the authors provide a model for an integrative model of field education intended to strengthen conceptual linkage to signature pedagogy. While the paper focuses on a deep investigation of challenges pertaining to social work field education and offers solutions for such challenges, the authors suggest the information proves useful in the study of a SoTL approach to assess what students are learning in field as it relates to signature pedagogy principles across disciplines (Cornell-Swanson, 2012). The authors offer suggestions for overcoming challenges with implementation of the model while also charging institutions to prioritize excellence in the field education experience.

While field experiences remain paramount to the student educational experience, competing priorities for faculty to devote time to scholarship, service and teaching, combined with budgetary constraints faced by many universities, little attention is given to solutions around how to create higher quality field education experiences.

Signature Pedagogy and Social Work

Signature pedagogy is defined as "the types of teaching that organize the fundamental ways in which future practitioners are educated for their new professions" (Shulman, 2005a, p. 52), and incorporates three essential components: surface structure, deep structure, and implicit structure. Surface structure comprises the classroom component, where the instructors impart knowledge and education about social work to the student. Deep structure refers to the beliefs and assumptions around how the important components of the education are being taught. Finally, implicit structure encompasses the morals and values of the profession. In social work, the surface structure counts as classroom learning, or the teaching by field supervisors to students about specific practicum duties and obligations. Deep structure is the belief that field and classroom learning function best when one informs the other within the curriculum. In the field, deep structure is the learned behavior in action. Implicit

structure in social work is encapsulated in our code of ethics and may also be inherently found in social work's nine competencies. As such, the student is expected to behaviorally demonstrate learned acquisition of social work theories, competencies, and ethics. Beyond that, Shulman states that signature pedagogy moves the student into a state of "habits of the mind, habits of the heart, and habits of the hand" (2005a, p.59), an inevitability of learning the basics by rote and then moving beyond them to a place where making informed and critical professional choices are always guided by the backdrop of the structures (Shulman, 2005a; 2005b). Thus, the student becomes deeply engaged, is visible within, and accountable to the profession.

Social work field education strives to meet Schulman's criteria through integration of the core competencies into the surface structure (knowledge learned in the classroom), implicit structure encapsulating integration of social work values and beliefs, and deep structure integrating knowledge and values, as demonstrated in cognitive and affective processes (CSWE, 2015). Much has been written about the theory of signature pedagogy and its application to social work education (Bogo, 2005; Boital & Fromm, 2014; Cornell-Swanson, 2012; Earls Larrison & Korr, 2013; Wayne, Bogo, & Raskin, 2010). The literature provides thoughtful conceptualization on the application of signature pedagogy in developing competent and ethical social work practitioners. Earls Larrison and Korr (2013) argue that signature pedagogy, as defined by Shulman, should focus on "skills fundamental to practitioner competence: to think, to perform and to act with integrity" (p.195). The authors highlight an important aspect of pedagogy, the professional use of self, they believe is currently neglected in CSWE standards. They recommend improved conceptualization of how social work can explicitly define and embrace development of a social worker's ability to integrate education into practice, to develop critical thinking skills, and self-identify as thinking and acting like a social worker (Earls Larrison, & Korr, 2013; Lee & Fortune, 2013). Others endorse the view that CSWE does little to support specification or support social work programs in actual design, implementation, and assessment of signature pedagogical principles, resulting in programs falling short of true integration of coursework and field (Wayne et al., 2010; Holosko & Skinner, 2015). This, in part, may be due to the lack of research on the effectiveness of field education programming (Holden, Barker, Rosenberg, Kuppens, & Ferrell, 2011) and variability in implementation of field education (Bogo, 2010; Boital & Fromm, 2014; Holden et al., 2011).

Beyond Social Work: Issues Central to Field Education

Social work is unique in its use of the term "field education" to describe the signature pedagogy. However, many cross disciplines use experiences in the field to promote learning and engagement within the profession. Student teaching in education curriculum seems most akin to the social work field experience. In a comprehensive report published by The National Council of Teacher Quality (NCTQ; Greeberg, Pomerance, & Walsh, 2011), student teaching is the semester long final clinical experience where student teachers "synthesize everything they have learned about planning instruction" (p.1). While the report did not name the student teaching experience as the signature pedagogy, it is important to acknowledge the conceptual

linkages between the student teaching experience and social work students' field practicum. However, in social work field placement is viewed not as a culmination project but as an integral aspect of the learning process in graduate social work education.

In reviewing literature from other disciplines, healthcare sciences, such as physical therapy, occupational therapy, and nursing utilize clinical practices and simulations to assess students' application of applied learning. Further, counseling, psychology and other mental health care disciplines use clinical practice to develop skills for their prospective professions. Yet, the authors failed to locate field education as a signature pedagogy for these professions, and therefore more studies and papers may need to explore the implications of a theoretical framework for field education experiences in these disciplines.

While beyond the scope of this paper, it is important to note that the common challenges across field experiences in nursing, occupational therapy and education are related to assessment, lack of quality placements, lack of qualified supervisors, and lack of a comprehensive framework to support consistency across implementation of learning goals and assessment across field education placements (Cuenca, 2012; Greenberg et al., 2011; Mannix, Faga, Beale, & Jackson, 2006; Polglase, 2012; Schott et al., 2015). Field education is extensively studied in social work, and therefore provides a solid lens from which to articulate the importance of field education as signature pedagogy, and the challenges of measuring outcomes and assessing fidelity in the field learning environment.

Field Education, Signature Pedagogy and Social Work Educational Policies and Procedures

The Social Work EPAS stress the importance of behavior assessment of social work competencies, meaning the student should behave in a manner that illustrates and upholds defining social work principles (CSWE, 2015). Arguably, field education provides the environment where students demonstrate behavioral competence of the nine competencies through the integration of course content and field activities. Further, the dimensional component added to the CSWE 2015 Education Policies (knowledge, values, skills, cognitive and affective processes) attempts to capture the totality of processes involved in the acquisition of social work behaviors. Ideally, in social work education, the student transfers classroom learning into an experiential environment where they are required to synthesize learning and reflect on personal and professional issues that arise because of in vivo social work experiences (Boitel & Fromm, 2014). Lager and Cooke Robbins (2004) sum up the value of the field education experience:

> In the field students have the opportunity to test what they learn in the classroom; integrate theory with practice; evaluate the effectiveness of interventions; contend with the realities of social, political and economic injustice; strive for cultural sensitivity and competence; deliberate on the choices posed by ethical dilemmas; develop a sense of self in practice; and build a connection to and identity with the profession. (p. 56)

Beyond integration of course work into field experience, students also must learn how to navigate in a real-world environment while working within the framework of the nine social work competencies. In 2008, CSWE revised the EPAS to emphasize social work as competency-based education measured by student learning outcomes (CSWE, 2008). The 2015 EPAS continues to promote such standards (CSWE, 2015). In the 2015 EPAS, competencies are identified by "the knowledge, skills, cognitive and affective process and behaviors associated with the competence." (CSWE, 2015, p. 11). CSWE defines the purpose of competency-based education as follows: "Social work competence is the ability to integrate and apply social work knowledge, values, and skills to practice situations in a purposeful, professional matter to promote human and community well-being" (2015, p. 6).

CSWE highlights the importance of embracing an outcome-oriented approach rooted in behavioral manifestation of competence: "The goal of an outcomes approach is to ensure that students are able to demonstrate the integration and application of the competencies in practice" (p. 6). Outcomes-based education must, therefore, identify procedures to assess the competencies in a holistic fashion. Student's manifestation of competencies occurs both in and out of the classroom and often demonstrate behaviors related to more than one competency at a time (Poulin & Matis, 2015). In field education, it is recommended that ongoing and formalized procedures exist to systematically track growth in each competency area. Further, assessment should move beyond simple rating forms where the information provided does little to support how the competency was met (Poulin & Matis, 2015).

In field education, students must demonstrate knowledge, application, and integration of classroom learning while also explicitly enacting the competencies within practice. Yet, how do monitoring and assessment procedures within social work programs capture such integration? CSWE provides few guidelines on how to assess outcomes in field learning (2015). This may be, in part, because CSWE's policies concerning field education largely focus on the application of the field experience rather than standard procedures for assessing outcomes. However, CSWE does state "field education is systematically designed, supervised, coordinated, and evaluated based on criteria by which students demonstrate the social work competencies" (2015, p. 12).

The lack of guidelines on how to monitor the holistic integration of social work competencies and course learning leads to inconsistencies across schools and departments in monitoring and evaluating practicum learning (Boital & Fromm, 2014; Earls Larrison & Korr, 2013; Martin & Ciarfella, 2015). Further, minimal literature explores the act of "doing" the integration. Different components have been identified as important to field education implementation and assessment, such as a field learning contract (Poulin & Matis, 2015; Boitel & Fromm, 2014), use of field liaison (Ligon & Ward, 2005), and a field seminar class with required

In field education, students must demonstrate knowledge, application, and integration of classroom learning while also explicitly enacting the competencies within practice. Yet, how do monitoring and assessment procedures within social work programs capture such integration?

reflective practice (Boitel & Fromm, 2014). Yet, no literature was found that provides a thorough and realistic plan for holistic, bi-directional integration. Thus, institutions are left to their discretion as to how they monitor and assess competency and integration. This lack of plan can be problematic when assessing fidelity of implementation and outcomes of the signature pedagogy (Boital & Fromm, 2014).

Martin and Ciarfella (2015), in their content analysis study examining field education manuals of twenty undergraduate social work programs, identified several discrepancies around the implementation of field education. They found that while some consistencies exist around defining field personnel roles such as training, educational requirements (director, supervisor, and liaison) and gatekeeping procedures, inconsistencies exist in other areas of field education. In particular, the authors found only four of the twenty field education manuals they examined in their study mentioned the social work competencies. Concerning the role of the field liaison, the study found consensus between the manuals in articulating that the faculty liaison serves as the "bridge" between the agency and the educational institution and that the liaison is responsible for assigning grading. The manuals, however, did not specifically address how liaisons assessed and assigned final grades. Of note, Martin and Ciarfella did not research how field education manuals assessed the integration of course and field work, possibly indicating that integration was not a theme in the manuals themselves, or that this concept lacked importance in their investigation.

In preparation for the writing of this manuscript, the authors conducted an exploratory pilot study aiming to elucidate how Master of Social Work programs implement and assess integration of course work into field education and how they monitor the application of the competencies (Olson-Morrison, Dickey, & Radohl, 2016). The results, while tentative and not generalizable, indicated no clear consistencies or standards for how universities assess outcomes in field education. Learning plans were minimally endorsed, and some institutions assigned grades based on presentations, dialogue, and papers. Some institutions assessed field education learning through seminar classes, while others had no such formal environment for supporting and monitoring student practicum experiences. Further, the data indicated that the monitoring of students in field education was done by a variety of personnel, including part-time non-social work staff, adjunct faculty, and tenured faculty. The report showed a varied picture of how institutions operationalize field education. The findings of this pilot study indicate little cohesion and formality on how departments assess social work's integration of classroom and field or the application of signature pedagogy.

In summary, while an abundance of literature discusses the importance of bi-directional integration of field and classroom and integration of competencies across both (Bogo, 2010; Fortune, et al. 2001; Vayda & Bogo, 1991; Walden & Brown, 1985), minimal literature exists on how to monitor and assess the integration of field and course work and the application of the EPAS competencies (Boitel & Fromm, 2014; Gursansky & Le Sueur, 2012; Poulin & Matis, 2015). In failing to specifically focus on integration, the students may dissociate conceptual learning from merely an apprenticeship where skills are learned through imitation and not through developing critical thinking and sense of self (Vayda & Bogo, 1991), thus failing to meet the standards of a signature pedagogy.

Three primary areas for field education emerge from the literature to support the function of an integrated field education as social work's signature pedagogy: the field learning contract, the faculty field liaison, and the seminar course. While not inclusive, these three elements support the application of signature pedagogy in social work curriculum. The first component, the field education learning contract, facilitates the comprehensive assessment of the integration course and field learning, monitors acquisition of competencies, and provides the necessary structure to guide and assess field learning (Boital & Fromm, 2014; Lee & Fortune, 2013). The second component centers on the use of a faculty member serving as the field liaison. Currently no guidelines exist in CSWE EPAS (2015) stating who should serve in this capacity, and little guidance or structure is provided in the literature on how programs are to fulfill this role (Ligon & Ward, 2005; Wayne et al, 2008). However, the field liaison serves as the bridge necessary to facilitate maximum learning and integration of a field education curriculum indicative of a signature pedagogy. Lastly, a field education seminar course provides a space for dialogue and structured learning where the student can be assessed in a classroom environment. While seminar classes have been discussed in the literature specifically related to baccalaureate programming (Poe & Hunter, 2009), a field education course that functions as a hybrid between a seminar course and no formal course, particularly in master's programs, has yet to be explored.

Therefore, drawing from the literature, in support of the 2015 CSWE EPAS on outcomes and competency-based education and application of signature pedagogy, the authors propose an integrative model of field education that contains the aforementioned three core elements: (1) a formal Field Learning and Education Plan (FLEP); (2) a formal, fully-credited field education course; and (3) a faculty member serving as field liaison (see Figure 1).

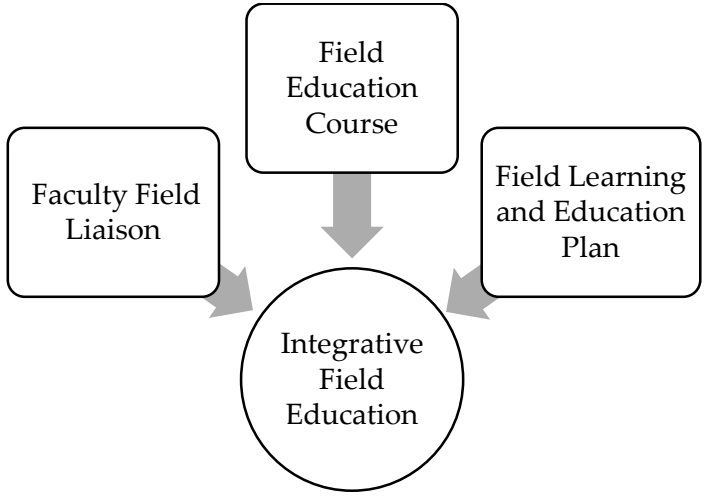

Figure 1. Components of Integrative Field Education as Signature Pedagogy

The Field Learning and Education Plan

The field learning contract assesses student performance in field education. It serves as a link between conceptual and experiential learning to provide a structured document that reflects field learning content, objectives, competencies and student goals (Lee & Fortune, 2013). The contract reinforces and highlights the parallel process occurring between coursework and field and embraces a strengths approach to adult learning in that the student is required to create their own goals based on their perceived learning needs and interests and those of the agency itself (Lee & Fortune). A field learning contract guides the learning process and supports the outcome-based acquisition of social work competencies. "The learning contract…represents a central element of the signature pedagogy of social work" (Boital & Fromm, 2014, p. 616). Some studies suggest which elements should be incorporated into a learning contract, but relatively little literature discusses this element of field education (see Boital & Fromm for review). While master's levels programs may incorporate various types of learning contracts, the literature suggests many schools fail to require a learning plan, or they prove of limited usefulness because they fail to assess the integration of field and coursework (Boital & Fromm, 2014).

Two recent manuscripts delineate conceptualization of a learning contract. Cleak, Hawkins, Laughton, and Williams (2015) developed a Common Assessment Tool (CAT) that assessed seven key learning areas pertaining to social work competencies. The CAT was designed to be completed by students, field liaisons, and field instructors. In their evaluation of its usefulness, the authors found that the consistency and structure when assessing student outcomes based on social work competencies proved highly useful for adopting pedagogical standards. The CAT was so successful that universities across Victoria Australia adopted this tool as a formalized assessment protocol for field education in social work (Cleak, Hawkins, & Williams, 2015).

Boital and Fromm (2014) discuss the viability of an integrated learning contract, which utilized theory to enhance the contract's usefulness in developing new learning in student competency behaviors. They suggest that an integrated contract utilize course syllabi to inform the development of goals and objectives for field education. Evaluations of competencies are assessed through observed *and* written work, and the contract enables the instructor to assess student work across competencies that often are not addressed in the field, such as policy practice and research. Further, the contract promotes the integration of new learning and progress towards competencies. The learning contract utilizes adult learning theory principles, and, beyond integration, captures the learning process through learning transfer and self-awareness (Boital & Fromm).

Based on the literature and signature pedagogical principles a field learning contract should be designed to incorporate social work competencies and course work (CSWE, 2015), student goals, and systematic evaluations while reinforcing a collaborative team approach in the creation of academic outcomes. The contract should be one comprehensive document that bridges all facets of the field education experience and tracks progress over the duration of the field placement. Evaluation and assessment of integration are assessed through documented behaviors and

activities and embraces outcomes-based learning. The contract holistically assesses principles of signature pedagogy.

At the author's university, the contract is known as the Field Learning and Education Plan (FLEP). The FLEP contains elements of a contract in that the student agrees to meet educational goals, and the practice behaviors associated with the goals are assessed by the field instructor. However, the "plan' implies that the student and supervisor engage in a dynamic process of creating and revising goals based on the environment, availability of experiences, student's learning priorities, and the necessity of incorporating behaviors associated with competencies. At the onset of the field education course, the student, field instructor, and field liaison should utilize a team approach to create both short-term and long-term goals and outcomes rooted in each social work competency. Further, the team works together to identify tasks, evaluation methods, and anticipated completion dates. Goals and outcomes incorporate specific behaviors, theories, policies, research methods, ethics and values, and other relevant curriculum into the agency setting. Through the goals and objectives, experiences are created to shape students to think, act, and ultimately self-identify as a social worker

Students are encouraged to assimilate classroom assignments into field experiences and document these expectations on the FLEP, thereby bridging both educational paradigms in social work education. For instance, a generalist practice course might require a student to attend a Board of Director's (BOD) meeting to understand agency culture. Building on this, the field instructor recommends the student help advocate for policy changes at the next board meeting. As a result, the student is able to construct a goal where they attend the BOD meeting, assess boardroom culture, and speak to the board regarding their personal experiences with agency policy. After completion of this goal, they may process this experience with their field instructor- in-supervision to understand the interdependency or intersectionality of different social work concepts as a whole in a real-world situation. This example illustrates the collaborative process and supports the tenets of signature pedagogy, explicitly the integrative process in outcome-based behaviors that demonstrate acquisition of a social work competency.

After goals and outcomes are formulated, the FLEP should be reviewed and updated periodically. Moreover, students and field instructors are encouraged to engage in formal evaluations midway through the semester and at the conclusion of the semester. The FLEP is designed for students and field instructors to work together to rate student performance in each competency area. This ongoing rating procedure, in turn, helps with continued professional development, monitoring of outcomes, and personal reflection of strengths and areas of concern. Because of this arrangement, if student performance concerns exist, they are recognized and addressed quickly. Likewise, if strengths are noted, the FLEP is easily adapted where the team can modify goals and outcomes to further challenge a student's educational experience. The FLEP assists in strengthening students' competencies and confidence in areas of strength and supports growth in areas where skills require further development.

This design of the FLEP incorporates both subjective and objective review rooted in competency behaviors and outcomes. The completion of tasks and goals serves as the objective review. For the subjective review, field instructors and students

work together to assess progress. One suggestion for review is assigning a numerical reference, using a Likert-Type scale, to observed improvement. This comprehensive FLEP design incorporates essential elements to assess student's acquisition of the three structures (implicit, explicit and deep) important to signature pedagogy (Boital & Fromm, 2014). An example of the FLEP is shown in Figure 2.

Competency 3: Advance Human Rights and Social, Economic, and Environmental Justice					
Learning Outcomes for Competency 3	**FALL EVALUATION**			**SPRING EVALUATION**	
	Midterm	Final		Midterm	Final
Understand the forms and mechanisms of oppression and discrimination.	_____	_____		_____	_____
Advocate for human rights and social and economic justice.	_____	_____		_____	_____
Engage in practices that advance social and economic justice.	_____	_____		_____	_____

Learning Activities/Tasks and Completion Dates:
Please list the activities and tasks that the student will undertake to achieve the educational outcomes. Indicate the due date or that the activity is ongoing.

Learning **Behaviors:** Fall Semester	Target Dates
_____	_____
_____	_____
_____	_____
Comments_____	
Updated Behaviors: Spring Semester	
_____	_____
_____	_____
_____	_____
_____	_____
Comments:_____	

Figure 2. A Field Learning and Education Plan (FLEP)

Literature explicates the importance of the duties and obligations of the field liaison (Faria, Brownstein, & Smith, 1988; Hendricks, Finch, & Franks, 2013; Ligon & Ward, 2005; Lyter, 2011; Tully, 2015; Urbanowski & Dwyer, 1988; Wayne et al., 2008). Ligon and Ward (2005) state, "…the liaison has the integral role in student site placements, serving as the link between the institution and field placements, as the evaluator of field educational outcomes, and as administrator of the overall experience" (p. 35). Further, the field liaison serves in the role of advocate, teacher, gatekeeper, mediator advisor and consultant, among other roles (Faria et al., 1988; Hendricks, et al., 2013; Tully, 2015). The liaison is responsible for overseeing the integration of field and coursework as well as documenting behaviorally-based indications of a student's understanding of the social work competencies (Bogo, 2015; Hendricks et al., 2013). Despite the importance of the field liaison role in the social work curriculum, the literature suggests that this position within a department of social work varies. For example, many liaisons are part time, may not teach in the classroom, and may work independently from the university (Hendricks et al., 2013; Tully, 2015).

Ligon and Ward's (2005) survey on field liaison roles found that undergraduate programs devote more time to the liaison role (more time on-site visits and overall student learning) than graduate liaisons, and undergraduate liaisons are more likely to be full-time status than graduate level liaisons. The authors found that less than 75% of liaisons used a learning plan consistently in conjunction with their field activities. This research highlights two major problems concerning liaisons positions within social work programs: (1) graduate faculty may not be as invested in the field experience despite practicum being identified as the signature pedagogy, and (2) assessing competency in the field is not consistent across universities (Ligon & Ward, 2005).

When reflecting on the significance of the field liaison to both the student's learning process and the application of program standards, arguable a faculty member would best serve as the field liaison. Further, in an integrative field education model, the faculty field liaison (FFL) should be intimately involved in each student's field education experience. Faculty members broadly and specifically understand how social work pedagogy is manifested into social work curriculum. Consequently, the faculty member can effectively monitor the integration of field and coursework and maintain a constructive relationship between the social work program and the practicum agency.

The FFL monitors integration in several ways. First, written assignments reflect the internalization of explicit and implicit learning. Papers allow students to reflect on thoughts, feelings, and behaviors related to experiential work at their practicums, while also processing how the experiences relate to social work ethics, values, and competencies. Further papers may assess how coursework influences decision-making around using interpersonal skills, techniques, and interventions. The relationship developed by the FFL with the agency also plays a crucial role in student learning (Bogo, 2015). The liaison readily bridges the gap between institution and agency, enabling greater collaboration. Lastly, the FFL can accurately monitor and assess student progress through ongoing oversight and meet with students

individually and in groups (Tully, 2015) to strengthen integration, reflect and process on experiences, and closely monitor any challenges that may arise. The FFL assigns a letter grade for the field education course, thus holding the student accountable for their learning,

Arguably, using full time faculty members as liaisons may not be feasible at many institutions. Course load, scholarship, and service responsibilities often preclude tasks outside of these realms. Ideally, and field liaison should be knowledgeable with the social work curriculum and the complexities of competency-based education. Adjunct faculty may serve in the role of faculty field liaison, but in this model it is recommended that the adjunct faculty member also have experience with teaching social work curriculum, and their activities be closely monitored and structured by the field education director.

A Field Education Course

We assert that field education is best housed within a field education course. Literature supports that most of the monitoring of field and course work is done within a field seminar course (Ligon & Ward, 2005). A collective, peer-based group learning environment offers opportunities for the accountability element of Shulman's (2005; 2005b signature pedagogy requirements. (Wayne et al., 2013). However, and particularly in MSW programs, field education is often viewed as a separate educational component, and thus field education lacks congruence with university coursework (Olson-Morrison, et al., 2016). Results from a pilot study researching integration of field and coursework in CSWE-accredited MSW programs (Olson-Morrison, et al.) indicated that a variety of mediums are used to assess student competency in field education. Some universities used informal mediums of assessment, such as dialogue, while others relied on more formal assessment processes, such as presentations and papers. Further, seminar and course instructors may or may not be a faculty member, which makes the program vulnerable to incongruence between the way students enact outcome-based competency behaviors in field work, and how they are discussed in their seminar classes. The seminar instructor who is not familiar with the students' behaviors in the field assigns a grade based on class assignments rather than rooted in integration and performance.

We propose the solution to this dilemma is the creation of a formalized course where the FFL is also the field seminar instructor. This course is not viewed as separate from the field education component, where students may or may be in a seminar class once or twice a week and the seminar instructor may or may not oversee the practicum placement. Therefore, we used the term "field education course" rather than field seminar to refer to this formalized component. In the classifying of field education as a formal course, the student gains an opportunity to demonstrate integration on all levels, and activities are monitored by the FFL who is also the course instructor. The fully credited course allows the opportunity for the FFL to assess learning and progress on students' FLEP goals, their behaviors related to social work competencies, and through self-reflection and demonstration of applied learning through written assignments and classroom activities. With firsthand knowledge of the placement agency and student's roles within the agency, the FFL also plays a fundamentally

important role of the bridge between the program and the agency and can assign grades consistent with outcomes based learning. The field education course provides ongoing integrated oversight of the student in the context of both classroom and field, thereby upholding the integrity of field education the signature pedagogy, providing the opportunity for students to demonstrate bi-directional integration on all levels, as monitored by FFL who is also the course instructor. A secondary benefit of the field education course is the FFL can receive course credit towards their required teaching load because the liaison serves as the course instructor. Thus, field education maintains equal status when faculty are dedicated to field instruction and course instruction equally.

The field education course may offer individualized and group instruction. Specific course assignments related directly to integration in field education may include weekly reflection papers, where students discuss behaviors and situations related to competencies and course work applications, and the FLEP. A final paper for the course serves to help the student reflect on personal and professional growth as a social worker. The field instructor may also elect to assess other important areas of field education, such as professional behaviors (showing up on time to practicum, completing paperwork in a timely manner, and even simply dressing appropriately for the agency). All components of the field education course serve to strengthen signature pedagogy principles around learning how to think and act like a social worker (see Table 1).

Table 1
Roles for Each Field Education Component

Faculty Field Liaison	Field Education Course	Field Learning and Education Plan
Assigns and grades written work	Houses practicum	Co-created goals and objectives to behaviorally demonstrate competencies
Completes overall assessments for field education grade Monitors FLEP	Provides structure for collaboration between agency and university as the FFL is responsible for assigning course grade	Provides structure for integrated learning
Meets with students individually and within a group Maintains ongoing documentation Maintains regular contact with field instructor	Provides structure for student learning as they earn grade in the course Provides bi-directional feedback loop	

Recommendations and Generalizability of Model

By thoroughly exploring a model for social work education, other disciplines may explore how signature pedagogy may be incorporated and assessed in clinical practice. Some commonalities exist across disciplines with maintaining fidelity across student learning experiences and assessment process (Butler & Cuenca, 2012; Greenberg et al., 2011; Mannix, et al., 2006; Polglase & Treseder, 2012; Rider & Nawotniak, 2010). However, the authors noticed that related disciplines commonly use field education as a capstone experience when students have little contact with their educational institution. The capstone model removes opportunities for bi-directional integration of classroom and field. Educational programs may reconsider redefining field education as a course taken simultaneously with other courses that will enhance field learning. They may also consider housing field education in its own course, taught by faculty, that requires graded reflection of how experiences in the field relate to classroom learning and competencies. Synthesizing the competencies of the profession into a comprehensive learning plan used by the field instructor and the liaison enhances integration of field and coursework and maintains a strong connection between agency and university. The learning plan co-created by student, field instructor, and liaison tracks attainment of competencies with fidelity and provides students the opportunity to fully realize the goals of the profession as defined by the signature pedagogy.

Table 2
Using Model Elements to Strengthen Field Education Structure

Current Structure	Strengthened Structure	Element
Field experience is Capstone, isolates learning from classroom experience	Field Learning is integrated into curriculum where learning is supported by coursework, with an emphasis on assessment of attainment of discipline competencies and behaviors	Field Education Course
Learning goals are created by institution or field director	Learning goals are co-created by FFL, student and Field Instructor, and goals are designed to meet competencies.	Field Learning and Education Plan
Student is monitored solely by agency field instructor with minimal involvement by the institution	Student's progress is monitored by the faculty field liaison and agency field instructor, creating intentional bi-directional learning experience between institution and agency. Assessment is completed by FFL *and* field instructor.	Faculty Field Liaison

While social work is not unique in incorporating field education, naming field education as the signature pedagogy presents unique challenges. In social work, the model addresses the basic tenant by CSWE (2015) that field education and course work should be given equal weight and share equal importance in curriculum. The authors provide a detailed plan to help guide MSW programs, and programs in related disciplines, to administer field education in such a way that integration of course work and competencies is done with fidelity and integrity. Specifically, it is recommended the faculty liaison be a full time or adjunct faculty member familiar with social work curricula and competencies. The field practicum should be housed in its own course overseen by the faculty field liaison, and as such the student demonstrates integration through written work among other modalities. Finally, the FLEP, co-created by the student, liaison, and field supervisor, should guide the development of the social work student in the context of the professions' competencies. Assessment of students' acquisition of skills and behaviors relating to each competency are assessed by the FLL when applying a grade in the field education course and guided by progress on the FLEP.

It is worth noting that the model presented in this paper has proven successful in the program where it has been implemented for the past four years. Through formal program evaluation assessments completed at the end of the academic year, students report they strongly agree the program bi-directionally integrates course work, field work and competencies. Students and field instructors perceive the FLEP to be effective in promoting growth and attainment of competencies, and students largely feel supported by their FFL. Further, the program has seen less than 10% disruption in placements over the time period. Students report feeling competent in integrating the competencies into practice and feel confident in their social work skills.

Conclusion

The purpose of this paper is to explore how field education as a signature pedagogy could be strengthened through an integrative model. The authors use social work's field education programming as an example in order to highlight some of the challenges with field education and also provide a framework to meet such challenges. The integrative framework includes elements supported by literature, specifically in regard to integrating field, course work and competencies, thus providing a conceptual framework for this study. While a moderate amount of literature exists on discussing the implications of field work as a signature pedagogy for social work, minimal literature details operationalization and implementation of programming in social work curricula, specifically in regard to the accomplishment of bi-directional integration implied across all levels of signature pedagogical principles.

As is true in many disciplines, the social work policies for guiding the implementation of field education prove vague. The authors agree with the literature in concluding that the vagueness leads to varying quality of the signature pedagogy (Bogo, 2015). Due to current inconsistencies and dilemmas in administering field education, Bogo calls for the restructuring of field education and moving programs into field-centric models. However, comprehensive restructuring may not prove viable for many institutions, particularly as field liaisons and educators are pressured

to produce academic scholarly work at the expense of providing quality field education oversight. Further, budget constraints, or even shortages of available faculty to serve as liaisons may prohibit the implementation of such a model.

Field education across disciplines should strive to be more consistent and focused, structured to include elements already supported by the literature. The additions proposed in this paper align with signature pedagogy and strengthen the possibility of providing integrative field education. The framework proposed may assist other professions to strengthen the fidelity of clinical and field experiences and provide students opportunities to more fully identify with their professions.

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"Student success has a major impact on the strength and vitality of our democracy. Simply put, student success, for all students, will determine what kind of society we leave for future generations."

~ George L. Mehaffy and Jo Arney, "Introduction: Re-Imagining the First Year of College (RFY) American Association of State Colleges and Universities," *Journal of the Scholarship of Teaching and Learning*

SoTL's Impact on Teaching Goals: A Case Study from a Regional University

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This study reviewed the impact of a Scholarship of Teaching and Learning (SoTL) program offered at a university. While there is a plethora of literature available that addresses the impact on scholars' teaching methods and classroom research, few publications address SoTL's impact on teaching goals. Twelve faculty scholars participated in the cohort-based program and completed the Angelo and Cross' (1993a) Teaching Goals Inventory (TGI) before and after participation in SoTL. Statistically significant increases with medium to large effect were noted for two TGI clusters. Faculty scholars' quotes provided evidence of how their practice changed after this SoTL program.

The Scholarship of Teaching and Learning, or SoTL, is a solid method of classroom research that can be traced back to Ernest Boyer's seminal book *Scholarship Reconsidered* (1990). As the years have passed and SoTL has grown in acceptance and spread to universities around the globe, more scholars have refined the definition and extolled its many benefits. Hodges (2013) suggested that SoTL is a mindset of "questioning old assumptions about what teaching entails and how our students learn, gathering and examining evidence of the effects of our approaches, and reflecting on and sharing insights gained" (p. 72). While the many benefits of SoTL are wide and varied, the main goal of SoTL is improving student learning. The skills that faculty develop through SoTL (reflection, collaboration, and collegiality) apply to research and service efforts as well (Case, 2013). Opening the dialogue with other colleagues about teaching benefits the academic community; shared SoTL findings lead to new teaching approaches (Dickson & Treml, 2013).

While most scholars agree SoTL has an impact on student learning, there is sparse scholarly activity about the impact that the Scholarship of Teaching and Learning has on scholarly participants' teaching goals. Stevenson and Harris (2014) said instructor teaching characteristics and differences are rarely mentioned. However, K.P. Cross (2005) touched on this idea by saying that classroom research is an ongoing effort of a teacher to evaluate the "accomplishment of his or her teaching goals" (p. 10). While she wasn't directly connecting teaching goals to SoTL, classroom research is the foundation of SoTL, so we should be able to determine if SoTL has an effect on faculty teaching goals. The purpose of this study is to determine if participating in a SoTL program affects scholar participants' teaching goals.

Increasing faculty engagement in SoTL benefits students. Faculty members pursue SoTL for various reasons such as enhancing learning, demonstrating teaching commitment, and supporting higher education's teaching and learning (Kenny & Evers, 2010). SoTL also enriches scholarly research activities of faculty scholars by offering tangible insights about the impact on learners. SoTL projects exhibit various methodologies and research paradigms, from qualitative to quantitative, literature reviews to meta-analyses, experimental or descriptive; they are SoTL projects nonetheless, as long as they are systematic and public (Kern, Mettetal, Dixson, & Morgan, 2015). With scant literature explicitly tying teaching goals to SoTL, researchers used two lines of research to build the foundation for this study: SoTL and its impact on students and professors and teaching goals and the Teaching Goals Inventory.

SoTL's Impact on Students, Professors, and Institutions

The SoTL movement has gained traction since Boyer's 1990 work. SoTL has an impact on students (Condon, Iverson, Manduca, Rutz, & Willett, 2016; Trigwell, 2013), faculty, and universities (Cox, 2004; Voelker & Martin, 2013). Universities are building support and spreading the SoTL message in a variety of ways. Faculty learning communities and cohorts are one way to add to the army of SoTL advocates on a campus. In a semester or two, faculty members learn how to conduct SoTL projects and add another research stream to their individual agendas and raise awareness about SoTL department by department. Faculty SoTL development initiatives influence teaching practices (Condon et al., 2016), and universities are investing in SoTL.

Academic write-ups about university SoTL programs report generally favorable outcomes. For example, the University of Wisconsin System found that 96% of participants (n = 130) in its 11-year SoTL history reported a positive impact from its program (Voelker & Martin, 2013). Sixty-two percent of participants published SoTL-related works. Sixty-six percent of the SoTL projects at Southeast Missouri State showed enhanced student learning (100 courses and 4,500 students affected) (Waterman et al., 2010). And lastly, Miami University uses faculty learning communities (FLCs) to foster a community-based approached to campus issues, including SoTL (Cox, 2004). Miami University's faculty learning communities (including SoTL) saw student learning increased as a result of the teaching projects, and faculty reported changes in student learning due to improved faculty attitude about teaching (Cox, 2004).

SoTL's benefits extend beyond faculty development programs — students benefit as well (Condon et al., 2016; Trigwell, 2013). Trigwell (2013) found support for connections between teachers using certain aspects of SoTL and the likelihood of improving their students' learning. SoTL requires faculty to question student learning and investigate it for the benefit of the individual classroom and the advancement of teaching and learning on a larger scale (Condon et al., 2016; Hutchings & Shulman, 1999). The SoTL impact may begin as a way to improve one class, but what a faculty

member discovers can inform their future classes and the academy as a whole (Marketti, VanDerZanden, & Leptien, 2015). For example, Marcketti, VanDerZanden, and Leptien (2015) found faculty continuing SoTL work for benefits beyond promotion and tenure. They looked at the impact SoTL had on the "SoTL champions" on one university campus. Professors who engaged in SoTL reported continuing their SoTL research even after achieving tenure or a promotion because of 1) the synergy it creates between research and teaching, 2) the additional community SoTL created — moving outside of traditional silos, and 3) an extended individual prominence. One respondent to the qualitative study said SoTL made his position "feel like one job instead of three different jobs" (p. 7). Another institution reported similar faculty perceived benefits after interviewing an inaugural SoTL cohort; participants expanded disciple-specific research agendas to include SoTL projects (Garza, Shaffer, Gentry, Maben, & McGahan, 2014, p. 11).

Faculty committed to SoTL early in their careers will increase their commitment to SoTL throughout their careers (Myers, 2008). Likewise, Auten and Twigg (2015) call for using SoTL as a way to teach graduate students and future professors about teaching; they said it would allow future teachers to read their classrooms and "locate themselves as learners and colleagues" (Auten & Twigg, 2015, p. 11). In essence, SoTL becomes part of beginning faculty members' identity and part of their core professional values (Nicholls, 2004). Simmons et al. (2013) cautioned that while maintaining both a SoTL and discipline-specific research agendas could be troublesome, the reward could be transformative.

These studies capture the impact of SoTL on students, professors and institutions, but they do not mention how or if SoTL programs, a type of professional development, impact a professor's teaching goals. Using the Teaching Goals Inventory, this study aims to provide a first effort at investigating such a connection.

Teaching Goals and the Teaching Goals Inventory

For this study, teaching goals are defined as what college faculty would like to prioritize or accomplish in their classroom, regardless of discipline. This definition aligns quite nicely with the research conducted by Angelo and Gross (1993a) when they developed the Teaching Goals Inventory to score these priorities. Why do teaching goals matter? Ortiz (2011) asserts that teaching goals are targets for student learning. To meet these goals, teachers will use methods based on their beliefs about students and student learning to meet these teaching goals (Ortiz, 2011). Teaching goals provide a framework for the teacher's course design and instructional choices (Friedrichsen & Dana, 2005; Grossman, 1990). Identifying teaching goals provides insights into a teacher's classroom approach including assessment strategies, assignments, textbook selection, and objectives (Grossman, 1990). Teaching goals significantly impact "subsequent teaching behaviors" (Wang, Hall, Goetz, & Frenzel, 2017, p. 101) and relate to use of learner-centered teaching methods (Richardson & Miller, 2011). Awareness of teaching goals could help faculty members identify disconnects between what they hope to achieve in the classroom and what is actually achieved (Richardson & Miller, 2011).

Identifying teaching goals provides insights into a teacher's classroom approach including assessment strategies, assignments, textbook selection, and objectives.

Professors select teaching goals by focusing on learning needs of students (Albornoz Pardo, 2013). SoTL helps investigate and isolate aspects of teaching and learning. It is with this logic that we assert changes to teaching goals imply changes to course decisions.

Angelo and Cross' Teaching Goals Inventory (TGI) is a questionnaire that measures goals for one particular course. An instrument description is included in the data analysis portion of this paper. Ortiz, for example, used the TGI to measure changes in goals for pre-service math teachers. An organization for the betterment of teaching in the geosciences suggests that the TGI be used for educators developing or revising a course, constructing a teaching philosophy or undergoing curriculum review (Science Education Resource Center at Carleton College, n.d.). Stanford University suggests that the TGI can help with course focus and syllabus development by setting reasonable expectations for what goals can be accomplished in a term (Define Your Goals, 1993). In evaluating faculty learning communities, Miami University categorized its FLC learning outcomes using TGI (Cox, 2004). Johnson (1997) used TGI to compare teaching goals of faculty members at research institutions.

From the Ivy League to community colleges, universities' centers for teaching excellence or instructional innovation offer the TGI as a resource to faculty members (see Vanderbilt University Center for Teaching, 2018, or Colorado Community Colleges, 2018). Researchers selected the TGI as the instrument to measure participant pre- and post- teaching goals because of the TGI's prominence in the US and online as well as the content measured. The TGI is worded to help instructors decide on teaching goals for one particular class at a time and offers many self-scoring versions online. Participants in a SoTL program could continue to make use of the resource in future independent SoTL research projects.

Study's Purpose and Rationale

The current study focuses on the following research question: Does faculty scholars' participation in a SoTL program offered at a regional university impact the scholars' teaching goals? The purpose of which is to determine if any of the goals changed after participating in the program. Researchers hope to gain insight into the SoTL program's influence on faculty scholars' perceptions and values related to teaching. If any of the goals change, the researchers plan to delve deeper into participant interview questions for future cohorts to determine why teaching goals changed. Based on the data, researchers will also make program revisions for future SoTL experiences.

Procedure

A regional university in the southern United States launched a SoTL program with an inaugural cohort of 12 faculty scholars that represented all colleges at the university. The program consisted of five workshops held on Saturdays throughout the 16-week spring semester. Topics covered during the workshops were What is SoTL and How Do I Get Started?; Generating the Research Question & Research Design; Navigating the IRB Process; Validity & Reliability; Available Resources; Collecting and Analyzing Data; and Project Completion & Presentation. The workshops were led by the Faculty Fellows, a group of five faculty representatives from the university's

colleges and the Director of the Center for Instructional Innovation. As a pre- and post-measure, faculty scholars completed two surveys: The Carnegie Academy for the Scholarship of Teaching and Learning (CASTL) survey (Carnegie Foundation for the Advancement of Teaching, 2004) and the Teaching Goals Inventory (TGI) (Angelo & Cross, 1993b). Both surveys were used with permission and selected to determine if participating in a SoTL program made an impact on the faculty scholars teaching practice and teaching goals. Only the TGI survey was addressed in this study since this manuscript's focus concerned the impact of this SoTL experience on faculty's teaching goals. Researchers decided to save the CASTL survey data for a future research writing project related to evaluating this inaugural SoTL experience's impact at an institutional level.

At the conclusion of the program, faculty scholars were asked six open-ended interview questions to determine their overall perception of the SoTL program and if it made a difference with their teaching methods, goals, and research agenda. This study focuses on comparing the results of the TGI survey and two of the six interview questions: "How has the SoTL experience impacted your teaching?" and "Is there anything else you want to say?" The remaining four questions focused on program improvement and impact on the faculty scholars' research agenda and are not included in this data analysis and results. The interview questions were asked by a trained graduate assistant with no involvement in the research other than as an interviewer. Quantitative and qualitative data analysis methods were used to support the findings.

The TGI Survey Instrument

When developing the TGI, Angelo and Cross (1993a) stated that the purpose of the TGI is threefold:

> (1) To help college teachers become more aware of what they want to accomplish in individual courses, (2) to help faculty locate Classroom Assessment Techniques they can adapt and use to assess how well they are achieving teaching and learning goals, and (3) to provide a starting point for discussions of teaching and learning goals among colleagues. (p. 20)

It "enables teachers to locate the assessment techniques that are most appropriate for their particular teaching goals" (Angelo & Cross, 1993a, p. xv). The TGI is a self-scoring survey comprised of 53 goal questions, grouped into six clusters. The six clusters are:

1. Higher-Order Thinking Skills (apply learning in authentic situations),
2. Basic Academic Success Skills (memory, literacy, and computation skills),
3. Discipline-Specific Knowledge and Skills (knowledge of theoretical frameworks related to discipline),
4. Liberal Arts and Academic Values (appreciation of new ideas, citizenship responsibilities, and lifelong learning),
5. Work and Career Preparation (leadership and the development of new skills), and
6. Personal Development (responsibility for personal behavior, self-efficacy related to the discipline skills, and respect for colleagues and collaboration). (Angelo & Cross, 1993a, p. 22)

The Teaching Goals Inventory is widely used for professional development by colleges and universities around the globe. The full inventory can be accessed at https://fm.iowa.uiowa.edu/fmi/xsl/tgi/data_entry.xsl?-db=tgi_data&-lay=Layout01&-view (University of Iowa, n.d.).

Data Analysis

For this study, TGI scores were analyzed using descriptive statistics. Fifty-two of the 53 questions were analyzed with the responses from the pre- and post-test. The 52 goal questions were based on a Likert scale. The 53rd question of the inventory was omitted from data analysis because it is not a Likert scale question like the other 52. The 53rd is a multiple choice question that asks respondent to rate their primary role as a teacher and is not included in the clusters (Angelo & Cross, 1993a, p. xv). Scholars had the opportunity to select one of five ratings per prompt in each cluster. The selections were essential (E), very important (VI), important (I), unimportant (U), and not applicable (NA). Researchers assigned numeric values for analysis: E=4, VI=3, I=2, U=1, NA=0. For each scholar, a mean response score was determined for each cluster and overall for both the pre- and post-SoTL TGI survey. These scores formed interval scales to compare gains and losses using means.

Parametric paired *t-test*s comparisons were reported pre/post- per TGI cluster using means and standard deviations, respectfully (see Table 1). Effect sizes (Cohen's *d*) of significant results were reported as well. Since the study has a small number of participants, normality assumptions were assessed using Shapiro-Wilk tests. The paired *t-test* was utilized for TGI pre- and post- cluster comparisons due to the robust nature and proven accuracy of the paired *t-test* with small sample sizes (De Winter, 2013; Sheskin, 2011).

The interview questions were asked by a graduate student with no vested interest in this research project. Interviews were recorded and transcribed for analysis. Researchers individually coded key words from the written transcripts and then met as a group to compare key word coding and synthesize the data into categories/themes. By using multiple coders, the researchers were able to construct categories or themes that capture recurring patterns across the data (Merriam, 2009). Several themes emerged. Those that did not pertain to teaching goals were not included in the results.

Results

The grouping of the TGI goal questions into clusters produced *interval-scale* measures for parametric paired *t*-test comparisons. The difference scores for all pre- and post- TGI interval-scale measures were normally distributed, as assessed by Shapiro-Wilk's tests. Two significant differences were discovered for faculty scholars among the six cluster parametric mean comparisons. TGI clusters IV (Liberal Arts and Academic Values) and VI (Personal Development) produced significant mean increases between pre (M=2.23, SD=.84/M=2.75, SD= .67) and post (M=2.48, SD=.77/M=3.07, SD=.70) measures, respectively (See Table 1). Pre- and post- TGI clusters IV and VI revealed medium to large effect sizes (d=.61) and (d=.68), respectively. Hattie (2009) redefined effect sizes for school learning and recommended d=.2 (small), d=.4 (medium), and d=.6 (large).

This study served as an initial investigation concerning the impact of this SoTL experience on faculty's teaching goals. Researchers chose to focus on the two clusters that were significantly different. However, it is important to note that most TGI clusters with the exception of TGI cluster three, Discipline-Specific Knowledge and Skills, and TGI goal five, Work and Career Preparation, revealed faculty impact mean increases from the pre- to post- SoTL experience (see Table 1).

Table 1
Results of Pre- and Post-SoTL TGI Surveys by the Six Clusters

Cluster	Phase	Mean (SD)	t-score	p-value	Cohen's d	W/p-value
1	Pre	3.08 (0.70)	0.59	0.56	na	.192
	Post	3.18 (0.70)				
2	Pre	2.68 (0.84)	0.58	0.56	na	.541
	Post	2.79 (0.88)				
3	Pre	2.96 (0.49)	-0.34	0.73	na	.999
	Post	2.91 (0.71)				
4	Pre	2.23 (0.84)	2.12	0.05*	.61	.865
	Post	2.48 (0.77)				
5	Pre	3.09 (0.67)	-0.63	0.54	na	.187
	Post	2.97 (0.72)				
6	Pre	2.75 (0.67)	2.35	0.03**	.68	.121
	Post	3.07 (0.70)				

Note. * $p<0.10$; ** $p<0.05$. 1=Higher Order Thinking Skills, 2=Basic Academic Success Skills, 3=Discipline Specific Knowledge and Skills, 4=Liberal Arts and Academic Values, 5=Work and Career preparation, and 6=Personal Development. Na=not applicable. W/p-value=Shapiro-Wilk test (W) of normality p-values. Significant results suggest a deviation from normality with the Shapiro-Wilk tests of normality. The gray highlight displays the two mean TGI goal decreases from the pre- to post-SoTL experience.

In addition to the quantitative analysis, the qualitative analysis revealed an overarching theme of transformational teaching in the interview data. As a result of participating in this program, several of the faculty scholars remarked that conducting classroom research has helped them refocus on their teaching methods and goals. Participant E learned that "being able to do research on what I'm passionate about, which is teaching, was kind of eye opening." This scholar added that going through this program made her aware of classroom research and has given her renewed focus on teaching. Participant H concurred and provided this statement: "It's definitely opened my mind to other possibilities in the way that I teach…It's given me great ideas and has made me really kind of reconsider my approach to teaching in the classroom." Participant J remarked, "It's definitely made me look at things in my classes to determine does this really impact my students? Is it impacting them in a way I want

them to be impacted with?" Participant B remarked, "…from actually learning about how you teach and being ready to implement that back into the classroom was very important." He succinctly stated what all the others inferred, "As a learning institute and for us to be better teachers, we need to keep doing as much scholarship on teaching and learning as we can."

While the other interview questions that dealt with program improvement and research impact were not included in this analysis, their responses did contain both positive and negative (but constructive) feedback. What the researchers found during qualitative analysis was that all 12 participants reported positive perceptions on the impact to their teaching, which was reflected in the quantitative analysis.

Discussion

Based on the qualitative and quantitative analysis of the pre- and post- SoTL surveys and faculty scholars' interviews and reflection of the program, completing a SoTL program had a positive impact on two teaching clusters (i.e., TGI clusters IV and VI, Liberal Arts and Academic Values and Personal Development). Gains were noted. Since the purpose of the SoTL program is to focus on classroom research for one course, faculty scholars were asked to concentrate on the student learning outcomes (also known as course objectives) for their course and how to assess their research project. Over the course of the program, the scholars openly shared their obstacles and successes. Through these cross-discipline discussions, scholars received constructive feedback and encouragement from each other and the program leaders. After the various discussions and strategies shared in SoTL meetings relating to building responsible and independent students who have an appreciation for learning, regardless of the discipline, researchers were not surprised clusters IV and VI improved. Many of the discussions centered on preparing students to be life-long learners who find confidence because they have taken advantage of the learning opportunities provided in their various disciplines and associated classes. This is supported by purpose number three of the TGI as stated by Angelo and Cross (1993a, p 20). The learning experiences with faculty scholars within the SoTL environment influenced positive gains in TGI cluster IV (Liberal Arts and Academic Values) and VI (Personal Development). Many of the scholars' statements reflected personal growth in teaching and research, which is consistent with the literature (Poole & Chick, 2015; Trigwell, 2013; Voelker & Martin, 2013; West, 2013). Faculty scholar D stated, "[SoTL] changed my perspective on my teaching and maybe not be so apprehensive about making changes in my teaching style." Faculty scholar G stated, "I've gone from just being someone in front of the room throwing information out to trying to get the students more involved and making it more of an engaging environment." This research shows a positive impact on teaching goals for existing faculty after participating in formalized SoTL instruction.

Although most of the TGI clusters, including the two clusters with significant differences, revealed mean increases from the pre- to post- SoTL experience, TGI clusters three and five produced mean decreases from the faculty scholars. The SoTL experience had less impact on faculty's perception regarding TGI cluster three, delivering discipline specific knowledge, since the SoTL experience focus and activities

center on research-based pedagogy and engaging instructional practices. Faculty may have determined the SoTL experience was a place for discovery and practice of research-based instructional strategies while their discipline specific terminal degree and educational training experiences provided the content to be delivered. "The best teachers are not always, not even usually, those teachers with the most sophisticated content knowledge. The best teachers do know their material, but they also know a lot about the process" (Weimer, 2007, p. 4). As with TGI cluster three, the mean decrease with TGI cluster five, Work and Career Preparation, may have resulted due to the faculty scholars' perceptions regarding work experience and maturity as the central experiences that prepare individuals for work and career culture. Future research projects could examine each cluster in-depth with both quantitative and qualitative methodologies to dispel speculation with inquiry based findings and results.

Ortiz (2011) maintained that teaching goals matter because they act as targets for student learning. Setting and working to fulfill teaching goals is a kind of exercise that benefits from professional development. Participating in a SoTL instructional program provides both personal and professional development. Whether by self-study, informal or formal instruction, those in teaching roles can develop the instructional part of their academic responsibilities. This study's findings are consistent with Trigwell, Rodriguez, and Han (2012), who found moderate evidence of positive impact on a professional development program for teaching. Their findings were consistent with other literature pointing to higher education professional development programs "changing teachers' conceptions of teaching and learning" (p. 507). Examples include Donnelly's (2008) study of a professional development program for educators in Ireland. Participants in her study reported multidimensional changes to their teaching, including adding new teaching strategies and approaches and altering their own beliefs about teaching and learning in higher education.

Postareff, Lindblom-Ylänne, and Nevgi (2008) argue that professional development courses for educators should focus on changing a teacher's "conceptions of teaching" rather than their techniques (p. 42). In the qualitative analysis, faculty scholars in the SoTL program described how they now thought about teaching and the value in conducting research on their instructional concepts.

A limitation of this study is the sample size from one university. The researchers plan to continue tracking the teaching goals of future cohorts of scholars to increase the participant pool size and determine if the results of this study are an anomaly or if SoTL continues to positively impact the teaching goals of scholars, which impacts how they approach course instruction (Friedrichsen & Dana, 2005, Grossman, 1990).

Implications and Future Research

Implications for research on teaching goals and SoTL could impact individual classrooms, departments, and institutions. Bernstein (2013) called for SoTL to be an "essential and continuous investment in human capital" at every institution (p. 39). Increases in teaching goal measures can provide assessment data to foster more extensive support and funding for SoTL research. From the department level, chairs might be more willing to offer course release or other incentives so faculty members

(and the department) would invest in SoTL and related professional development programs. Individual educators would have data to show professional development gains and value for their time for such training efforts. Looking back at the origins of SoTL thought and processes in various disciplines at the university level (Boyer, 1990), educators' ideas about teaching have been changing to include research regarding the effectiveness of teaching practices. Therefore, teaching and research are the best partners in any classroom seeking improved learning outcomes for students. In the past, research and teaching were primarily considered to be separate entities by many disciplines. Perhaps the greatest discovery for any educator may be the knowledge that research techniques provide answers to improve teaching and to determine the effectiveness of various teaching practices.

Ideas for future research include following up with SoTL scholars at intervals after the cohort program to see if they have integrated SoTL into their research agenda, and what lasting effects SoTL programs can have on professors, students, and institutions. Researchers will also explore adding the revised Approaches to Teaching Inventory (ATI) survey instrument as a pre- and post-test measure for program participants, as a way to connect this cohort to global studies. The ATI was developed to investigate relations between teaching methods and student learning in SoTL-type projects (Trigwell & Prosser, 2004). The researchers believe that administering the TGI and ATI for future cohorts in this program will strengthen the results. The TGI will provide data that will determine a change in the teaching goals of the individual faculty scholar while the ATI will provide data to determine a change in teaching approaches for the particular class studied in the SoTL program. Both will provide results that can be shared with the broader community.

In the past, research and teaching were primarily considered to be separate entities by many disciplines. Perhaps the greatest discovery for any educator may be the knowledge that research techniques provide answers to improve teaching and to determine the effectiveness of various teaching practices.

Conclusions

While there is much literature on the many benefits of the Scholarship of Teaching and Learning (SoTL) programs, there is scant literature about how participating in a SoTL program can impact faculty participants' teaching goals. This study was able to determine that faculty participants in an inaugural SoTL program reported that program participation reinvigorated their passion for teaching and allowed them to focus on improving student learning. By utilizing the Teaching Goals Inventory as a pre- and post-test measures, researchers were able to determine a teaching goal increase in two of the six clusters (cluster IV, Liberal Arts and Academic Value; cluster VI, Personal Development). SoTL provided faculty, using research language and methodology, a student-centered focus across disciplines igniting a university transformation to one of reflection and problem solving. SoTL brings the researcher mindset to the classroom. It is one way an educator can transform lackluster teaching techniques to reflection and evidence-based instruction to improve student learning. The SoTL experience has the capacity to influence faculty to value, thereby

include, new approaches in their respective classrooms. This value and new thinking toward teaching and learning by faculty scholars could lead to the use of approaches that support students in becoming life-long learners who appreciate new ideas (i.e., TGI cluster IV). Faculty who use approaches to aid their students in the development of respect for colleagues and the understanding of the need to collaborate with peers (i.e., TGI cluster VI) to accomplish critical tasks and projects have the power to influence and impact higher education curriculum, regardless of the discipline.

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Constraints on Innovative Teaching in British Universities: An American Perspective

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Effective teaching is often difficult to achieve because institutional frameworks and inertia – unique to the British educational system – inhibit teachers from being innovative. These challenges to more innovative teaching are the relatively short length of time to a degree, and the heavy institutional oversight of degree programs and individual courses. Also, the tradition of lack of regular feedback and failures in the supervision and marking of undergraduate dissertations also lead to a less-than-ideal educational experience. Fortunately, some of these challenges can be overcome and provide a better learning experience for students.

British universities are in the midst of fundamental changes that are forcing an otherwise rigid system to evolve quite rapidly. I began reflecting on my role as an educator in this new system amidst these changes, as well as the differences between American and British universities. I have come to understand that constraints imposed by the British educational system inhibit instructors from being more innovative. These constraints are not necessarily unique to the UK, but they appear to be more strongly fostered here and do more to limit innovation than elsewhere.

These constraints fall within two categories: institutional constraints and individual instructor constraints. Institutional constraints are those that have been imposed by the British university system and the organizations that fund and oversee the system. These constraints can be the most challenging to overcome, but some are beginning to be recognized as limiting innovation in education. In contrast, individual instructor constraints depend on how instructors conduct their teaching. Are they providing the most effective teaching? What techniques are they using? What is their educational philosophy? These constraints are easier to overcome but necessarily affect a smaller number of students. This article explores these two types of constraints on teaching and suggests ways to overcome them to improve teaching in the UK.

Two caveats should be stated up front. First, the issue of the Teaching Excellence Framework or TEF (HEFCE, 2017) as a way of recognizing and rewarding excellent teaching is not discussed here. TEF is a UK government assessment that purports to evaluate the quality of undergraduate teaching. Universities are responding to the criteria that TEF incorporates and to its outcomes, but these issues will only be discussed indirectly. Second, this article may not generalize to all universities, all programs, and all instructors. Nevertheless, I believe there to be some underlying generalities that can help academics be more innovative instructors.

For context, I was born and educated at three different universities in the US. I taught part-time at a community college and two other universities. In 2006, I moved to Finland and taught there for three years. Most recently, I have been teaching in the UK since 2010. My perspective in this article is largely from science subjects and from

my experience, but, where available and relevant, I have drawn linkages to other disciplines.

Institutional Constraints on Innovative Teaching

British universities have been in existence for almost a thousand years. The universities have withstood many pressures as the times have changed and new educational methods have become fashionable (Anderson, 2006). However, such a long history can also stifle innovation as change can be more difficult for older institutions and its academics (Willmott, 1995). Moreover, the rapid pace of change means that students will face challenges that they will not have seen in university. Students will need to be better prepared for lifelong learning than their instructors were when they were in university. As such, these changes in the needs of students requires innovative teaching. This section discusses two of the biggest constraints to innovative teaching: length of time to get a degree and heavy oversight of educational programs.

Length of Time to Obtain a Degree

One of the biggest differences between American and British university education is the length of time spent getting a degree. In the US, most BSc programs are four years long, and MSc programs are treated as graduate degrees and are two years or more (combined BSc–MSc degree programs may be as short as four or five years). In the UK, however, most BSc programs are three years long[1]; MSc programs are treated as undergraduate degrees and tend to be an additional year. There are obvious benefits to spending less time at university, such as reducing the burden on students from tuition and accommodation costs. The shorter time to graduation also attracts fee-paying international students to British universities (UCAS, 2014). Even the time in lectures is shorter in the UK. The typical class at an American university has three hours of lecture a week over a 15-week semester[2], whereas the typical class in the UK has two hours of lecture a week over a 12-week semester.

In part, these differences may be explained by the more specific training that British school students receive before university than typical American school students. British students tend to specialize earlier, so they take fewer courses outside their general science, engineering, or humanities pathways. For example, it is common that British students arriving to the university for a science degree may not have written an essay for several years, not having taken literature or history courses, as would be expected at a typical American high school. Even at British universities, students often take far fewer elective courses outside their major than at a comparable American university degree program. This difference may further explain the shorter time to a degree at British universities.

[1] Undergraduate honors programs in Scotland may be four years long.

[2] Some universities are on the quarter system: three 10-week quarters within one academic year.

With such a short time to obtain a degree, however, programs necessarily are more rigid, offering fewer electives and fewer courses in total than in the US. UK students take more of their courses within a single academic program, rarely exploring courses outside their intended degree. For example, science students needing differential equations or statistics may be taught these courses within their own department rather than by an instructor within the mathematics department. Yet, these science students may not even be exposed to arts, humanities, or even social sciences during their degree program. Even a liberal arts degree, where a range of courses from different disciplines are integrated into a coherent degree program, is a relatively new concept among some universities in the UK (Turner, 2016).

Two institutional issues prevent more classes being taught outside the department. First, the funding structure of most universities means that courses outside the department would involve load transfer, and schools are reluctant to give away precious resources. In contrast, American universities are more likely to take a more holistic view, where funds coming to departments are not so strictly determined by enrollment within individual courses. Second, the speedy three years means that focus must be on the core courses for the degree rather than on coursework from outside the department, even if it is relevant or complementary to the student's degree. Such issues keep students from seeing a broader perspective around the university and limit the potential for interdisciplinarity later in their careers (Hurley & Harnisch, 2012; Marcy, 2010). Furthermore, the short time to a BSc degree and the lack of a requirement of an MSc before entering a PhD program means that UK students often arrive to a PhD program with fewer courses and with less breadth of knowledge.

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More relevant to this article, however, shorter degree programs encourage less experimentation, which leads to less innovation. Core courses dominate, and opportunities to try new ways of teaching or different types of courses outside traditional curricula can be easily sidelined or not even considered because of the lack of time in the degree program. Without the flexibility of a large number of optional modules, the opportunity to innovate within an existing course or develop new one-time-only courses based on current events or temporary academic visitors is limited. This isn't to say that core modules can't be taught in an innovative manner, but that the flexibility, variety, and opportunities for innovation are limited with fewer optional modules.

Excessive Oversight

The major constraint limiting innovation on the institutional level – and perhaps the one that individual academics can influence the most – is the level of oversight that most programs maintain over individual taught courses. Such top-heavy management is common, whether it comes from departments with overbearing teaching committees, bureaucratic inertia to changing degree programs to accommodate disciplinary advances, imposition of university or UK-wide initiatives to force eLearning approaches regardless of whether it is the right solution for specific

courses, and external examiners (*The Guardian,* 2018; Jackson, 1997). Although some US educational institutions may have excessive oversight on an institutional level, there is little in the way to compare to the large and imposing UK sector-wide initiatives.

External examiners can be a particularly effective way to enforce discipline-specific homogeneity and limit the self-governance of individual departments to their own vision of excellence. The amount of time and money spent on catering to an academic external to the program to ensure nationwide homogeneity in "academic standards" could be used to advance the program from within. Indeed, evidence suggests that external examination has done little to improve student experience (Harvey & Newton, 2004). In contrast, such annual external examination is not common in the US, although programs may be examined by an external board every five years or so, perhaps as part of a re-accreditation process or introspection by the university, external professional body, or the program itself. Unlike in the UK, US professors, mostly uninhibited with oversight, have more time to focus on delivering quality education.

Let me state that I am not against evaluation of individual teaching or programs, but kowtowing to external forces can be harmful to innovation. Innovation is most effective when individuals are given the freedom to experiment with their classes. Those individuals then share successes through publications and presentations, developing greater visibility and uptake through the academic community. Too much top-down management of a program, as can happen with external examination, can kill this innovative spirit. Despite the importance of this bottom-up innovation, top-down management can have a place. It may be necessary to implement policies to facilitate innovations within a more rigid framework. Consequently, both bottom-up and top-down approaches must often be considered in order to implement and realize change.

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Instructor Constraints on Innovative Teaching

Although institutional constraints can be formidable, constraints resulting from individual instructors are more easily overcome. It is often as simple as finding successful innovations implemented by others and giving them a try. An open mind and a desire to improve one's teaching are often all that is necessary. Nevertheless, the rich traditions of British universities may not encourage individuals to deliver the best education. Instructors trapped in the 'that's how I was taught' mode can be reluctant to change. Moreover, rapid changes in the British educational system over a short time (increasing enrollments and increasing tuition fees) require more rapid and flexible strategies to adapt to these changes (Glass, McKillop, & Hyndman, 1995; Greenaway & Haynes, 2003). Two constraints facing UK instructors are discussed below: lack of regular feedback and the failures in the supervision and marking of undergraduate research dissertations.

Lack of Regular Feedback

Two important differences in philosophy exist between American and British universities. In my experience, students at American universities have more homework assignments, and the structure and requirements of the class are more clear, whereas students at British universities are expected to do more independent study, perform fewer assignments, and take a final exam that is a large fraction, if not 100%, of the final mark. Although the British system encourages more independent thinkers, it can lead to feelings of helplessness and isolation in some students (Boşcor, 2016). Regular assessment (including formative assessment[3]) throughout the semester is more effective at keeping students on top of the course material, by giving them smaller chunks of material to study (Leeming, 2002). Periodically testing students also helps instructors more regularly evaluate whether students are learning or not during the semester (Black & Wiliam, 2003; Sargent & Curcio, 2012). Although a single final exam is a mechanism for trying to synthesize the whole semester, it can lead to student stress and cramming, situations that are not conducive to good learning (Haberyan, 2003; Kling, McCorkle, Miller, & Reardon, 2005). By the time of the final exam, material that was never learned properly in the early weeks of the course may result in devastating consequences for the student. This excessive emphasis on final exams runs counter to effective learning.

One of the most basic ways to learn is to do something, to receive feedback, then to try again (Dyrud, 1994). Feedback is an essential requirement of higher education (Evans, 2013), yet the British educational system generally does not cater to this process effectively (Tee, 2016). Survey questions pertaining to feedback are among the lowest ranked results by full-time students on the National Student Survey (HEFCE, 2016) year upon year (questions 7–9 scoring 68–72), despite otherwise high overall satisfaction scores (question 22 scoring 85). These results are evidence that British universities are lacking in this regard. Within different programs and universities across the UK, students fail to receive feedback on their work. This failure leads to three problems.

1. British students often do not get to keep returned marked-up assignments and exams. If the student is not receiving the returned assignment, the student cannot study carefully what was marked wrong and improve.
2. If students do not get to keep their exams, then there is little incentive for the academic to carefully annotate their comments – or even justify their grades.
3. British students often do not get to even *see* graded exams. What if this material is prerequisite for the next semester's courses? How do they know what they need to relearn for next semester?

Thus, wherever possible, effective feedback on graded assignments that students can retain helps students learn from their mistakes, whether these students are British or American.

[3] The history of formative assessment in the UK educational system is described by Black and Wiliam (2003).

Another idea where most UK undergraduate degree programs are superior to those in the US is the importance placed on a final-year research projects, known in the UK as dissertations. Specifically, undergraduate research dissertations are more common in the UK than in the US. Given the large body of work supporting the importance of research to education (the reviews of Jenkins, Healey, & Zetter, 2007, Healey & Jenkins, 2009), British degree programs explicitly incorporate the potential to get students involved in cutting-edge research and to develop critical thinking skills (Healey, Lannin, Stibbe, & Derounian, 2013). At first glance, dissertations would appear to be a positive for UK institutions. However, the UK fails its students by often providing limited supervision and feedback, or this staff–student relationship may not even be spelled out explicitly (Derounian, 2011; *The Guardian,* 2018). My experience suggests that students who engage with supervisors generally perform better than students who do not engage with their supervisors (whether it is the student's or the supervisor's fault).

Sadly, this lack of supervision of student research is a result of three things.

1. Instructors spend too little time with their undergraduate research students because they themselves have too little time. The UK has the fourth highest number of students per academic staff (25) and the highest number of graduates per staff (7) within the European Union, United States, and Japan (St Aubyn, Pina, Garcia, & Pais, 2009, pp. 23–24), so UK academics are overworked compared to their colleagues. Some programs in the US incorporating dissertations only assign them to the highest-achieving students. Whether it is acceptable to disallow lower-achieving students from participating in research is arguable, but at least students who do attempt dissertations in the US are more likely to receive better supervision.
2. In my experience, UK undergraduates are expected to demonstrate their abilities independent of their advisor. Thus, some instructors argue that providing feedback during student projects leads to the instructor marking his or her own work, if that feedback is too detailed and specific. This approach may have worked in the days when fewer, more elite students went to university, but it is clearly inadequate now. Moreover, not helping the students does not prepare them for real life where collaboration, feedback, and teamwork are encouraged and necessary.
3. I am aware that some departments justify limiting supervisors' roles because of the variability in supervision that students receive. If a supervisor is aloof and unavailable, students who do poorly may complain to the department that students who received closer supervision were unfairly advantaged, particularly in the case of programs where students are assigned to specific supervisors in order to fairly balance workloads. So, rather than discipline inadequate supervisors and raise quality, departments acquiesce to the lowest level – no supervision for anyone (*The Guardian,* 2018).

This lack of feedback becomes a farce when undergraduate students doing

their dissertation – their first major independent project on this scale – are prohibited by the department from interacting with their supervisors! Universities don't treat PhD students like this; why do we treat our undergraduates like this, students who need *even more* supervision on their research?

Finally, after completing their dissertation and receiving a mark, students often do not ask to see their feedback and how it was marked. Why are they conditioned not to see their graded performance and inquire how they could improve?

One potential argument that I have heard against providing feedback is that if all students were to receive detailed feedback, then all students would submit first-class dissertations. (Ah, if it were only so simple!) In practice, however, even with detailed level of comments on drafts of essays, some are still unable to bring it to perfection. Students either are incapable of making the revisions because they do not understand what is being asked of them or because they do not want to invest the time required to write properly. So, even with proper marking, my experience suggests that the mean score may be boosted by 10 points (out of 100) across the cohort, but not much more. Individual students may achieve 20–30 points higher (and these clearly benefit from the feedback), but a surprising large number get less than 10 points improvement. I think most are not working hard enough or do not understand what quality editing takes, despite exercises intended to demonstrate just this point. Therefore, this argument against giving feedback is not supported.

Improving British University Education

Many of the constraints discussed in this article have resulted because of the increase in the number of students going to university in the UK. As an illustration of the rapid change over a short time, 15% of the cohort of UK leavers attended university in 1963 (Holmwood, 2014) versus 49% in 2013 (BBC, 2013). In contrast, 45% of US high-school graduates in 1959 attended colleges and universities versus 70% in 2009 (Bureau of Labor Statistics, 2010). The lower percentage of students attending university in the UK and the shorter degree programs mean that drop-out rates are much lower in the UK (40% of all US students who begin a bachelor's degree will drop out before graduation; that number is less than 1% in the UK; Morshed, 2016). Oversight of programs in the UK may have worked better when there were fewer universities, fewer programs, and fewer students, but the system is cracking under its own weight now. Likewise, expecting instructors to find the time to deliver extensive feedback, supervise undergraduate dissertations, and teach all their courses while the size of the cohort grows leads to more stress on academics and less time to innovate.

Moreover, the push for a neoliberal university economy (Kelly, Fair, & Evans, 2017) is being hampered by too much oversight. If the UK wishes to go to such a market-driven university system, then they should go full on, and stop regulating and ranking universities. Such rankings tend to have their own problems anyway (Lim, 2018; Royal Statistical Society, 2019). Let each university develop its own individuality and stop trying to force them all into the same mold through an emphasis on research and teaching metrics. Forcing all universities to emphasize the same things inhibits innovation and limits diversity. In contrast, the market competition among US universities has largely worked, providing value for money to students, regardless of

ability (Dill, 2007, p. 57).

UK academics do not have to be complacent about their role in the education of their students by delivering the same type and quality of courses that they themselves received in their own education. Movements to bring more innovative teaching approaches into courses have awoken many individuals that lectures and semester-end exams are not the most effective method for student learning. Students learn best by doing, through a mix of assessments, effective feedback on how to improve, and close supervision. Continuous learning through formative assessments – represented by assigned homeworks that are marked with feedback and returned – helps students learn better than cramming for an end-of-semester final exam. Regardless of what academics think of "the student as customer", student satisfaction at universities is being quantified, leading universities to become more focused on the student. This shift in emphasis means that educators need to become more customer oriented, too.

The following represent the key points from this article.

1. Short degree programs limit what courses students can take outside their core curriculum.
2. Oversight needs to be reduced, such as the external evaluator that is expensive in terms of both time and money and inhibits innovation in individual courses.
3. Academics should be given more individual control over their own courses, which fosters innovation.
4. Thorough feedback and a revision cycle on graded assignments help students learn from their mistakes.
5. Students should be allowed to retain marked assignments, dissertations, and exams.

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Exploring the Co-Teaching Experience in a Graduate-Level, Principal Preparation Course

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This article presents a case study conducted by three co-instructors (one faculty member and two practicing principals) who examined their experiences co-teaching a newly revised, graduate-level, principal preparation course. Three themes were identified through their experiential stories: strengths of the co-teaching model, supports and needs, and hindrances. These primary themes, along with notable subthemes are detailed. A discussion on co-teaching as an innovative teaching method in higher education is provided with a particular focus at the graduate level. Implications for practice and suggestions for future research are discussed in light of these unique findings on co-teaching experiences.

The role of the principal matters and remains a key variable in influencing student learning and school success (Branch, Hanushek, & Rivkin, 2013; Syed, 2015; Thomas & Kearny, 2010). More specifically, high-quality school leaders are able to develop strong school cultures that support student learning and encourage teacher retention (Loewenberg, 2016). Researchers have documented, however, that principal vacancies are expected to climb, and the difficulty of filling existing school leadership openings will continue to be a challenge moving forward (Ash, Hodge, & Connell, 2013; Gurley, Anast-May, & Lee, 2015; Russell & Sabina, 2014; Stone-Johnson, 2014). This concern is exacerbated under the understanding that even successful identification and recruitment of aspiring leaders "is not sufficient to ensure a highly qualified principal in every school" (Thomas & Kearny, 2010, p. 9). Certainly, the position of school leader requires more than a warm body or an individual who meets licensure qualifications; principals should be hired "with the capacity to lead students to higher achievement levels" (Ash et al., 2013, p. 95). In other words, aspiring school leaders must be effectively prepared and ready to serve as high-quality school leaders.

The need to adequately prepare future school leaders is evident. As a result, there is also a critical need to re-conceptualize teaching and learning for graduate-level coursework in principal preparation programs, and the scholarship of teaching and learning can support this necessity. For example, Draeger (2013) states, "the scholarship of teaching and learning offers the prospect of helping students learn more effectively and provides professors opportunities for intellectual growth" (p. 16). Undoubtedly, professors of principal preparation courses can look to such scholarship to redesign courses to meet student needs. Therefore, the purpose of this case study is

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to explore one co-teaching experience in a research university in the Western United States in an introductory graduate-level, principal preparation course. The course was revised in an effort to enhance the coursework experience and optimally prepare aspiring principals to serve as highly effective school leaders. The researchers, all co-instructors (one faculty member and two practicing principals), engaged in reflective writing and analysis to focus on the strengths, supports, and possible hindrances to the co-teaching experience as perceived by each co-instructor. The results offer insightful areas to consider in the scholarship of teaching and learning in this discipline, provide the co-teaching model as an innovative strategy to improve principal preparation programs, and contribute to a gap in the literature of co-teaching in higher education.

Relevant Literature Review

Three areas of literature support the work of this study. The first is rooted in the need to develop high-quality school principals and, in turn, the demands to improve principal preparation programs. The second portion of relevant literature relates to the efforts, key features, or components that tend to represent improvements for principal preparation programs. The last portion of our literature review narrows in on what could serve as a key feature of principal preparation programs but has been lacking among program improvement efforts. Specifically, relevant literature related to co-teaching is presented, particularly with notable outcomes in higher education.

Principal Preparation Programs

The adequate preparation of graduates from principal preparation programs is largely debated in the United States (Dodson, 2015). The need for high-quality principals, along with the criticisms of college and university principal preparation, have created demands for the redesign of educational leadership programs. For example, nearly two decades ago, the Southern Regional Education Board (SREB, 2002) highlighted universities in the lead for redesigning leadership preparation programs. The SREB (2002) reported institutional efforts that included university-district collaboration and a departure from the traditional model; they shared an increased focus on specific strategies, such as the inclusion of challenging problem-solving assignments, mentoring, and extensive, integrated field experiences. Efforts to enhance preparation programs are vast and commonly maintain a clear focus on intentional, real, hands-on experiences. Some of this work was captured since 2005 in the work of Fry, Bottoms, and O'Neill and more recently by the New York City Leadership Academy (2015). Interestingly, Dodson's (2015) study of seven states did not find a "clear cut relationship between requiring field experiences or internships and the overall education quality in the states studied" (p. 14). Still, meaningful internship experiences seem to be a consistent feature among program improvements

and have been identified as a critical component to the principal preparation process (Davis, 2016).

Program Improvements

Improvements for effective or innovative principal preparation programs include a coherent program of study, embedded field experiences, cohort-selection models, connections between theory and practice, strong district-university partnerships, and effective principals serving as mentors or coaches (Campanotta, Simpson, & Newton, 2016; Davis & Darling-Hammond, 2012). These improvements are essential because the course of study in particular is often not reflective of the principal's job (Davis, 2016). The coursework should reflect what principals need to know under the guidance of faculty members who encompass research expertise and practitioner experiences. Indeed, Campanotta et al.'s (2016) findings on elite leadership preparation programs affirmed that principals are better prepared for their roles when coursework integrates field experiences with research, theory, and practice. Understandably, a logical solution is to attract faculty members who reflect this type of course integration, but there are clear limitations in attracting faculty members who are researchers and have recent practitioner experiences (Davis, 2016). Perhaps an alternative method to reconcile the existing need for the researcher and practitioner lenses, in addition to the shortcomings of faculty members to fill this role, is to consider the use of a co-teaching model in graduate-level, principal preparation courses. Unfortunately, "the extent of co-teaching at the university level has been much less prevalent and very loosely studied" (Bacharach, Heck, & Dahlberg, 2008, p. 9).

Co-Teaching in Higher Education

A thorough literature review revealed that the scholarship of teaching and learning using a co-teaching model in principal preparation programs is visibly lacking. To illustrate, a literature review using the Academic Search Complete database, limited to peer-reviewed journals, and using the search terms, *higher education* and *co-teaching or team teaching or collaborative teaching or cooperative teaching*, listed only 248 articles within the last decade. A similar search using terms, *co-teaching* and *education* yielded only 140 articles within the last decade, and most articles focused on areas of pre-service teaching or inclusive settings for students with disabilities in K12 or undergraduate education. Altogether, none of the articles focused on the graduate level nor within principal preparation programs.

Researchers recognize that co-teaching has predominantly been part of the K12 educational setting and has only more recently reached higher education institutions (Ferguson & Wilson, 2011; Lusk, Sayman, Solkoski, Carrero, & Chui, 2016; Morelock et al., 2017). Lusk et al. (2017) found that co-teaching in higher education can "promote effective teaching for teacher educators and their teacher candidates" (p. 52). Outside the field of education, in a designs foundation course, Tillman, Arnold, and Barnett (2010) also found multiple benefits to co-teaching, such as highly effective management of the course, content, and workloads, while still enhancing student experiences. Although the aforementioned findings were at the undergraduate level,

similar benefits could occur within principal preparation programs for co-instructors and their aspiring principal candidates at the graduate level.

According to Cook and Friend (1995), co-teaching represents "two or more professionals delivering substantive instruction to a diverse, or blended, group of students in a physical space" (p. 2). Even though their work focused on the K12 setting and with a special education lens, the authors affirmed that co-teaching provides differing but complementary perspectives among the professionals who co-teach and increases instructional options for all students. At the higher education level, Bacharach, Heck, and Dahlberg (2008) similarly concluded that co-teaching "allows the blending of university theory and classroom practice" when different individuals can bring those perspectives into the coursework (p. 13). Bacharach et al. (2008) included planning, organization, delivery and assessment, and the physical space as part of the co-teaching model in higher education.

Furthermore, Bacharach et al. (2008) found multiple benefits for students and the co-instructors. For example, students reported instructional benefits, such as a lower student-to-teacher ratio, exposure to various perspectives, and enhanced use of instructional time; faculty appreciated the sharing in planning and teaching, reflection, and the ability to learn additional teaching and learning strategies. There were some shortcomings found by Bacharach et al., as reported by students; these included some confusion about grading, whom to seek when needing help, and some concerns with inequitable distribution of instructional time among those co-teaching. Each of these concerns were alleviated, however, through increased communication, such as overt statements related to course policies, practices, and grading (Bacharach et al., 2008).

Method

A qualitative methodological approach was used to examine co-instructor (one faculty member and two principals) reflections of their first time co-teaching a graduate-level, principal preparation introductory course on educational leadership, EL 700. The authors for this study (all co-instructors) were interested in exploring their co-teaching experiences through open-ended questioning to better understand the possible strengths and drawbacks with co-teaching in this unique setting. Considering the focus and inquiry, the use of qualitative research to explore and understand the meaning that others ascribe to a social or human issue is supported by Creswell (2014). Also within qualitative research, a case study is defined as "a single entity around which are boundaries (Merriam, 1998, p. 27). Therefore, EL 700, served as the bounded phenomena for this case study.

The Co-Teaching Approach

As a unique component within the complete redesign of a principal preparation program, the co-teaching model was implemented in the graduate-level course, EL 700, at a research university in the Western United States. The course highlights leadership styles, approaches, and theories, and exposes students to the Professional Standards for Educational Leadership (National Policy Board for Educational Administration, 2015). The course was revised as part of the university-district partnership to redesign the program; from that partnership, two of the principals involved in the revision volunteered to co-teach the course with the lead

faculty member. The redesign team opted to include both principals because one focuses on the secondary level and the other focuses on the primary level. The aim was that their perspectives, along with the faculty member's lens, would further enhance the aspiring school leaders' experiences in the course.

The principal preparation course was co-taught by all three co-instructors during Spring 2017 to a cohort of 25 aspiring school leaders who were admitted to the program that semester. The course was taught once weekly, and the principals alternated teaching weeks, so that only two individuals (one faculty member and one principal) were in the physical space at once. However, all three instructors were in the course together during the first and last meetings of the semester. Specific weekly planning to revisit prior group decisions occurred throughout the week, but the principals and faculty member met every week, one hour before class to solidify the week's lesson plan, reflect, and consider necessary refinements to the course.

Importantly, from a budgetary standpoint, this commitment to the program and course redesign required an additional cost to have the instructors hired on a Letter of Appointment (LOA) contract. As an LOA, the cost at this institution's college of education is approximately $1,000 per credit. Therefore, the approximate cost for a 3-credit course is $3,000 per semester, but because the co-instructors were alternating weeks, then that total cost was split between both instructors.

Research Questions

During Spring 2018, all three co-instructors met in person and communicated via email to identify a structure for the study. This meeting was intentionally arranged after the conclusion of the first co-teaching experience but prior to co-teaching the course for a second time so that each co-instructor could reflectively and specifically focus only on the first teaching experience. The faculty member (lead author) facilitated all processes of the study's design but sought input from both principals (co-authors). The first meeting focused on the study's outline and potential research questions. Then, email communication was used to determine, review, and revise open-ended questions to reflect upon the co-teaching experience.

The first four open-ended questions were framed using the work by Davis (2016) and Campanotta et al. (2016) to better understand each co-instructor's practical lens, experiences, and personal motivations that might lend themselves to bridging principal preparation improvements with a co-teaching model. The next four open-ended questions were based on co-teaching research (Bacharach et al. 2008; Cook & Friend, 2008; Tillman et al., 2010) to specifically examine and hone in on possible benefits and shortcomings within the higher education setting. The questions that were identified were: (a) Describe your leadership background, (b) Why did you want to work to redesign a master's course? (c) What were your hesitations to teaching? (d) What did you see as your strengths to teaching? (e) What supports the process of co-teaching, from your perspective? (f) What hinders (or could hinder) the process of co-teaching, from your perspective? (g) What practical implications does a co-teaching model offer? (h) What would someone in this position need to know to be successful?

Data Collection and Analysis

Once these questions were finalized, the faculty member and the two principals agreed to provide written responses to these questions, in narrative form, to

serve as data for the case study. The faculty member and principals agreed to independently write the responses and not read/review others' responses until all authors' writing was complete. The authors believed this would strengthen the study and could help to reduce bias, as reading co-instructors' responses could inherently shape one's responses.

After all writing was complete, the faculty member asked the principals to consider each set of responses (narratives) as separate data sources. The authors then independently read their own responses and looked for themes, read others' responses and looked for themes, and finally explored all three narratives together to consider central themes. This process was used as a form of triangulation (Creswell, 2014; Stake, 2010). After this analysis occurred independently, the three authors met to discuss themes and agree upon the findings of this case study.

Of note, Creswell's (2014) validity strategies (i.e., triangulation, member checking, articulation of bias) were integrated, but the authors understand that individual identity, experiences, and characteristics can still impact findings and interpretations. Despite efforts to be objective in the process, biases can have some influence on a case study (Treacy, Casillas, & Wiest, 2013). For example, all co-instructors initially agreed to co-teach because they believed it was an important opportunity to enhance the preparation of aspiring school leaders. This belief could inherently influence responses related to the experience. In addition, each author understood that responses from the lead author, who is a university faculty member, could be inherently different than the responses from co-authors, who are primarily external to the university as current school principals.

Findings

Three themes were identified in this study. The participants' narratives focused on strengths of the co-teaching model, supports and needs for effective co-teaching, and potential hindrances to successful co-teaching. Notably, most of the written evidence within these themes centered on the strengths of co-teaching, as well as on the supports and needs essential to its effectiveness. As a result, subthemes were found within strengths of co-teaching, as well as within the supports and needs for effective co-teaching. The narratives also exposed similarities related to potential hindrances, but this theme was not as pronounced as the others. Also, even though a formal analysis of student learning outcomes was not conducted for this study, students' general responses are shared within the findings, given the importance of student learning outcomes within the context of the scholarship on teaching and learning.

Strengths of the Co-Teaching Model

Participant narratives focused on various strengths within the co-teaching experience. The strengths were identified by the data as three subthemes. The most salient subtheme was focused on the blending of theory to practice within the course; the next subtheme was uniquely centered on course relevancy for students, and the

third subtheme was focused on the co-instructors' personal experiences that served to enhance the co-teaching experience.

Blending of theory to practice. The course revision stemmed from a need to develop high-quality school principals. The lead faculty member (lead author) not only recognized this need but also recognized her personal shortcomings as a practitioner that could be reconciled through the co-teaching model. In her narrative, Jafeth wrote, "I was lacking personal experience of having been a school principal. I understood the school principal role through my research…but I imagined that the person (or people) co-teaching with me could be fantastic to work with and really make an impact at multiple levels." Kelly stated, "I feel that it bridges theory and practice in offering both conceptual and applied experiences." Kelly explained that co-teaching provided the "ability to bring expertise from theory and practice to graduate level students…[*original ellipse*] the melding of perspectives, and honest and deeper conversations about possible disconnects between concepts and one's ability to apply them." Similarly, Kevin noted that the blending of theory to practice strengthens the co-teaching experience as "this type of model gives students many different perspectives on leadership theory and application." Thus, all participants seemed to recognize a blending of theoretical and practical perspectives through their co-teaching experience.

Course relevancy. Connected to the theory to practice perspective in the course, all participants stressed that a strength to the co-teaching model and experience was the course relevancy for students in the graduate-level, principal preparation course. Kelly affirmed, "the level of preparedness of educational leaders varies widely and this partnership to redesign a program has the potential to offer an exceptional experience in training and preparing leaders." She added that co-teaching provides "very specific applied examples of 'leadership in practice' that has contextual relevance for many students who are part of the public school system, while pursuing their MA degree." This view was also evidenced in Kevin's narrative; he indicated that his leadership knowledge can uniquely engage students in discussions that helps them "to understand what leadership is and what it entails at different levels." While Jafeth addressed the importance of continuing to include a research- and theory-based perspective, along with essential course activities through co-teaching, she also noted, "but an extension to that is that they [students] can then actually ask a principal more in-depth aspects about the topics at hand."

Personal experience. Personal experience can likely be tied to the course relevancy that was brought to the co-teaching experience in EL 700. All co-instructors referenced their personal experience or background in their narratives and identified contributions to the co-teaching model. For example, in Jafeth's narrative, she detailed that leadership experiences had been a part of most of her life in multiple ways. Jafeth stated, "As far back as I can remember, I have been in 'positions' of leadership." She described how early experiences in leadership and even recent experiences in becoming a mother have all strengthened her leadership lens. The author wrote, "I am comfortable serving as a master juggler and wearing many hats." The third author similarly referenced his personal experiences and indicated having been in education for over 26 years. Nevertheless, perhaps Kelly's statement serves as the most

compelling evidence of personal experience as a strength to co-teaching. The author reflected:

> Serving in diverse leadership roles over time has informed my practice and thinking around leadership. I have been an educational leader for 13 years in roles that include Lead Psychologist/Coordinator of Psychological Services, central office administrator offering support/supervision to schools, and elementary principal. These opportunities have all contributed to my growth and development as a leader…[*original ellipse*] and, ignited my desire to help grow future leaders.

Thus, co-instructors seemed to recognize personal leadership experience and their respective contributions to the co-teaching experiences in the course.

Supports and Needs

While the co-instructors' experiential stories revealed specific strengths of the co-teaching experience, they also referenced the types of supports that were essential or addressed specific needs that could foster a successful co-teaching experience in a graduate-level, principal preparation program. Two subthemes – positive relationships and open communication – were identified as the dominant findings related to supports and needs.

Positive relationships. Positive relationships seemed to be a necessary part of the co-teaching experience, as shared by the co-instructors. Words such as "flexible," "trusting," "understanding," "respect," "willingness," and "honest" were used by the co-instructors throughout their narrative responses. All co-instructors referenced positive co-instructor relationships as opportunities to learn together while also focusing on the best interest of students. Jafeth recalled being strangers when they first began the course revision for the program redesign and declared, "We are now colleagues and, even better, we are friends."

Open communication. Communication as a key support of the co-teaching experience was a prominent part of the co-instructors' narratives. For example, Kevin expressed that communication was essential to supporting the processes. He explained, "Being able to communicate and having an open mind allows us to complement each other's strengths that, in turn, benefits our students." The second author similarly noted that open communication reflected a willingness to welcome others' contributions, while "respecting the different strengths that each co-teacher brings to the course." In addition, Jafeth stated, "I thought that my calm, but outgoing, personality could help forge strong relationships to be open and transparent in the co-teaching experience." She added that they also needed open communication in order to "calibrate" on the expectations and grading processes, while celebrating moments that helped maintain a strong momentum for the co-teaching experience.

Hindrances

The co-instructors commonly reported *potential* hindrances to co-teaching. For example, Jafeth shared, "I was concerned about that extra time negatively impacting my focus on research, particularly at a research university," but wrote that

the effort could be transformational for the program and course, so she committed to it. Also related to time concerns, Kelly shared worries around "balancing my demands of my role as principal, family commitments, and life." The third author similarly pointed to the time commitment to co-teaching but indicated that it was not an issue in his own co-teaching experience for this course. Kevin affirmed, "I know if there is a lack of communication co-teaching will fail." In addition, "not being willing to relinquish 'control' or embrace equitable roles in facilitating the class – feeling differing degrees of ownership," was expressed by Kelly. Ultimately, the co-instructors referred to their stated supports or needs (i.e., characteristics of positive relationships, open communication) and indicated that a lack of these aspects could hinder the co-teaching experience.

Students' Responses

While a formal analysis of student learning outcomes was not conducted for this study, students' general responses are highlighted to augment the focus on the scholarship of teaching and learning. First, the majority of students in the course already held a master's degree, but they indicated having pursued this course as part of their second master's degree specifically because of the co-teaching model and the opportunity to gain a theory-to-practice perspective with each course session. Students communicated that they believed this would make them a stronger candidate for a school leadership role. Second, throughout the semester, many students commented that the class could benefit from an extra 30 minutes to allow even more time for discussion and questions. This finding affirmed that students identified course activities as being relevant and meaningful. Third, after some classes, students actually clapped at the conclusion of the course to praise the session activities and experience; indeed, each co-instructor noted that it was the first time having experienced this type of positive feedback after a course session.

Along with general feedback from students indicating that they were valuing their learning experiences, the co-teaching model also seemed to foster the opportunity for students and co-instructors to build a strong rapport. For example, as the semester was nearing its end, students suggested meeting after the last course session for a happy hour event to thank the co-instructors and connect outside of the course. Furthermore, to the co-instructors' surprise, on the final course day, students gave each co-instructor a personalized thank you card that had been signed by every student. In the card, students referenced various learning experiences that they valued from the course and its co-instructors. In addition, a general review of the university's student evaluations indicated that the students' mean ratings were higher for EL 700 as compared to the college and university mean ratings during the Spring 2017 semester. Finally, all 25 students persisted in the program and graduated in the fall of 2018.

Discussion

The themes in this case study for the EL 700 co-teaching experience at the graduate level, in combination with the increased need to improve principal preparation programs and the limited scholarship in teaching and learning, support

the possible expansion of co-teaching in this discipline. Moreover, the themes reveal that co-teaching at the graduate level can reflect positive experiences for those involved, but there are specific aspects that must be undertaken in that process to make it successful. Indeed, Tsai and Wang (2017) indicated that this is a different teaching approach with pros and cons to the model. In Dickey, Kline, and Lindsteadt's (2016) work, the researchers posited that establishing new models of instruction could help graduates remain competitive elsewhere.

Perhaps, most importantly, it appears that each finding in this study reflects the co-instructors' deep commitment to co-teaching in order to improve aspiring school leader outcomes. Draeger (2013) asserted that "the scholarship of teaching and learning matters because learning matters" (p. 17), so if educational leaders are indeed invested in preparing high-quality school leaders, further scholarship must occur that documents innovative efforts in this regard. Recently, Henley and Cook (2018) called for a re-envisioning of the university, including the funding of co-teaching partnerships and respective support for this research and teaching. Those with the ability to transform the scholarship in teaching and learning in any field of study should not shy away from opportunities to explore co-teaching in higher education, especially at the graduate level. Perhaps equally urgent, to enhance principal preparation programs and their candidates, the co-teaching model could serve as a key feature within this unique discipline.

Implications for Practice

There are several implications for practice, especially for those interested in implementing a co-teaching model for graduate-level coursework in principal preparation programs. For example, the budgetary implications of multiple instructors in a course must be accepted. The cost to support a co-teaching model will certainly vary by institution, college, and discipline. Therefore, it requires a clear commitment from all stakeholders involved. Certainly, grants exist as a viable option to enhance students' meaningful learning experiences, but sustainability of such a model should be strongly supported by existing funding, if possible. Also, university-district partnerships remain critical to principal preparation program improvement. In this study, that partnership served to establish this co-teaching model. In that same regard, individuals who partake in a course redesign to implement a co-teaching model should be encouraged to share their concerns or hesitations for the process, such as those shared by the co-instructors in this case study. Doing so can allow courageous conversations to occur while helping to ease the process of co-teaching. More generally, at the onset of any co-teaching experience, co-teaching (or group) norms should be established to help nurture the process, including the strengths, as well as the supports and needs, identified in this study. The establishment of these norms could also help reduce potential hindrances (time concerns, balancing of roles, etc.) to support successful co-teaching experiences. Those involved in the process should be ready to be flexible, while also being willing to contribute ideas and experiences.

Those with the ability to transform the scholarship in teaching and learning in any field of study should not shy away from opportunities to explore co-teaching in higher education, especially at the graduate level.

Efforts to ensure that co-teaching brings diverse perspectives should be embraced in order to include theoretical and practical perspectives that can enhance the course experience and bring light to the needs of the ever-changing principal role.

Recommendations for Future Research

The findings of this case study identified themes that supported successful co-teaching experience. Research related to poor, challenging, or unsuccessful experiences would help to illuminate more areas to explore and consider in the co-teaching experience. Also, the students' experiences in EL 700 were not formally captured in this study; it would be beneficial to include the student voice in future studies, along with their course evaluations and course outcomes as a direct analysis of student learning. Furthermore, while this captured one first-time experience in co-teaching, it would be valuable to consider similar cases using longitudinal case studies to determine how these findings change or shift over time. Finally, replication of the current study, but in other classes and with other co-instructors within the same discipline, should be conducted to contribute to this literature and provide a better understanding of the co-teaching model at the graduate level.

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"Rather than thinking in terms of the traditional dichotomy of research and teaching, a separation that often paralyzed higher education in the twentieth century, we can begin to think of ourselves as a learning university concerned with the learning of both faculty (research) and students (teaching) and the ways in which the learning of one can benefit the other."

~ Ken Bain, *What the Best College Teachers Do*

Using Student Perceptions of Collaborative Mapping to Facilitate Interdisciplinary Learning

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This article reports on a study that investigated student perceptions of the effectiveness of collaborative mapping as a teaching strategy to facilitate interdisciplinary learning. Forty-five students enrolled in an introduction to interdisciplinary studies course participated in the study. Qualitative data, collaborative maps and student evaluations were analyzed using content and thematic analysis. Findings provide new understandings about using student perceptions of learning experiences to inform classroom practice. These understandings have implications for addressing the increasing pressure to demonstrate teaching effectiveness and learning outcomes in higher education.

Introduction

The value of interdisciplinary learning in higher education is receiving increased attention and recognition (Boix Mansilla, 2005; Holley, 2009; Krometis, Clark, Gonzalez, & Leslie, 2011; Lattuca, Voigt, & Fath, 2004; Repko, 2012; Repko, Szostak, & Buchberger, 2017; Szostak, 2007). This is due in part to understanding the essential role interdisciplinary thinking plays in resolving the serious and complex issues facing society today. Engaging in interdisciplinary work requires and develops a specific set of cognitive abilities and skills (Repko, 2012; Everett, 2016). Cognitive abilities include holistic, reflective, critical, problem-solving and creative thinking; skills developed include perspective-taking, collaboration and ethical consciousness (Repko et al., 2017). Importantly, these are the capabilities that are listed as top skills employers are looking for today (Brassler & Dettmers, 2017; NACE, 2018).

Interdisciplinary learning involves making connections between two or more academic disciplines. The key cognitive task involved is integration. Repko (2012) defines interdisciplinary integration as, "The cognitive process of critically evaluating disciplinary insights and creating common ground among them to construct a more comprehensive understanding. The new understanding is the result of the integrative process" (p. 263). Integration is a challenging concept for students to understand and perform. It requires engaging in higher order thinking that goes beyond making comparisons, requiring students to critically analyze and synthesize information across disciplines (Carmichael & LaPierre, 2014).

Identifying strategies that help students achieve learning outcomes is an essential part of teaching. As an instructor of interdisciplinary studies, this concept means employing teaching and learning strategies that facilitate the cognitive process of bringing together ideas from different disciplines and helping students understand and engage in the process of integration. Teaching strategies used in higher education to facilitate interdisciplinary learning include problem based and project-based learning (see Brassler & Dettmers, 2017; Imafuku, Kataoka, Mayahara, & Suzuki, 2014; Ng, Yap, & Hoh, 2011; Stentoft, 2017). Additional teaching methods for helping

students make connections are mind maps and concept maps, terms that are frequently used interchangeably. While both mapping strategies serve as a graphic representation of ideas, the purpose and design of the two mapping methods are different. Mind maps were developed as a tool for organizing and brainstorming ideas. As shown in Figure 1, they have a radial design, one main idea in the center with themes branching outward, and typically include color, words and images (Buzan, 1994). Concept maps were developed for understanding science knowledge (Novak, 1990). Illustrated in Figure 2, they have a hierarchal design, drawn top-down, from general to more specific concepts (Duffill, 2013; Novak & Cañas, 2008).

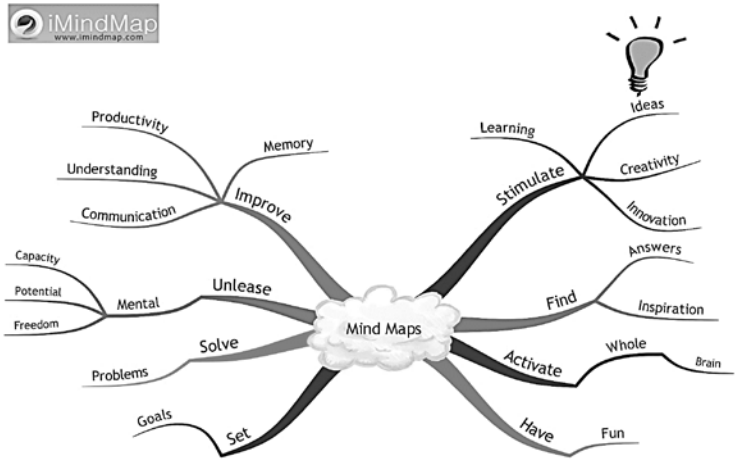

Figure 1. Mind Map[1]

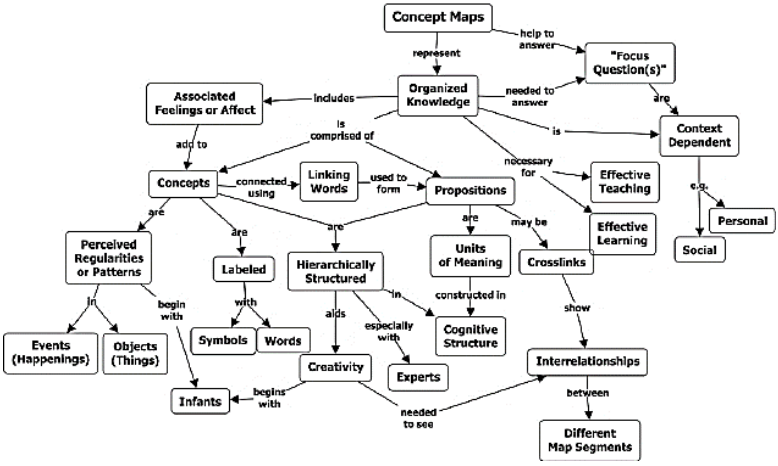

Figure 2. Concept Map (Novak & Cañas, 2008)

[1] Mind Maps is a registered trademark of the Buzan Organisation Limited 1990, "www.tonybuzan.com."

The literature on the use of mind and concept maps in higher education provides support for its effectiveness as a teaching strategy (Chiou, 2008; Hay, Kinchin, & Lygo-Baker, 2008). To date, they have been used primarily in science education and as an individual student activity. Though not as commonly used, collaborative mapping, defined in this study as students creating mind maps and/or concept maps as a small group activity, has been found to enhance learning by encouraging the exchange of ideas (Kinchin & Hay, 2005; Novak & Cañas, 2008). In addition to being an instructional strategy, mind and concept maps have also been used as a tool for assessing learning (see Hay, Wells, & Kinchin, 2008; Quinn, Mintzes, & Laws, 2003).

Assessing the effectiveness of instructional methods used to meet learning objectives is a key factor in improving teaching practice. Although studies have been published on assessment of interdisciplinary learning (see Carmichael & LaPierre, 2014; Mueller et al., 2014), the body of research is still in its infancy (You, Marshall, & Delgado, 2018). While what has been reported provides insights on pedagogical principles for teaching interdisciplinary studies, including team teaching, learning communities, and discovery-based learning (Haynes, 2002; Klein, 2005), additional scholarship is needed to identify specific instructional strategies that promote an understanding of the process of integration. The purpose of this article is to report findings from a study that investigated the use of collaborative maps as a teaching method for facilitating interdisciplinary learning.

Theoretical Framework

This research is informed by the social constructivist perspective that learning is an active process shaped by prior knowledge and the social interactions and environment in which the learning takes place (Bruner, 1986; Vygotsky, 1978). Social constructivists view the role of the teacher as facilitator, providing students with a learner-centered, supportive and stimulating environment that promotes social interaction and discovery (Powell & Kalina, 2009). Pedagogical applications of social constructivism in the context of higher education focus on small group cooperative and collaborative learning. Although there is considerable debate over the use and definition of the two terms, they have different theoretical underpinnings and expected outcomes. Cooperative learning is based on social interdependence theory (Johnson & Johnson, 1999). It entails working together for a shared purpose. Collaborative learning stems from a social constructivism perspective. It is a teaching strategy that involves bringing together different ideas to "increase knowledge" or "deepen understanding" (Barkley, Cross, & Major, 2014, p. 4). Barkley et al., (2014) identify three essential features of collaborative learning: (1) Planning – intentional design, (2) Process – co-laboring, all members contributing, and (3) Result – meaningful learning.

Positive outcomes from providing opportunities for students to interact with peers include encouraging dialogue and discussion that may lead to deeper levels of learning, promoting teamwork, and developing the ability to listen to diverse perspectives (Barkley et al., 2014). While there is a strong theoretical foundation for collaborative learning, there are challenges associated with using it in the classroom. Common complaints from students about group projects are group members who do not contribute their fair share of the work and interpersonal conflicts (Allen, 2016;

Machemer & Crawford, 2007). Strategies for addressing these issues include explaining the rationale for engaging in collaborative learning, establishing policies before the start of the project, and building in strategies for assessment at the individual and group level (Channon, Davis, Goode, & May, 2017).

The theory of interdisciplinary studies as a way of understanding the world focuses on complexity and the nature of complex systems (Newell, 2001). Understanding complex systems requires a holistic and integrative approach to knowledge construction, one that promotes the exchange of ideas and integration of insights across disciplines. The purpose of engaging in interdisciplinary studies is to gain a more comprehensive understanding of complex issues, which may lead to new viable solutions (Repko, 2012). Collaborative mapping as a pedagogical strategy brings together theoretical principles of social constructivism and interdisciplinary learning—active engagement, creative and holistic thinking, integration of knowledge and collaboration. The focus of this research is to investigate students' perceptions of its effectiveness as a teaching method for facilitating an understanding of interdisciplinary integration.

Collaborative mapping as a pedagogical strategy brings together theoretical principles of social constructivism and interdisciplinary learning—active engagement, creative and holistic thinking, integration of knowledge and collaboration.

Description of the Study

This study was conducted during the 2017- 2018 fall and spring semesters at a medium-size, four-year public liberal arts institution located in southeastern US. Participants were 45 students enrolled in a 300-level three-credit Introduction to Interdisciplinary Studies (IDS) course. Although it is an upper-level course, it is open to all majors and academic levels. It fulfills an IDS major core requirement and serves as a cognate course for non-IDS majors.

The course is delivered face-to-face, two 75-minute class meetings per week for 15 weeks. The required textbook for the course is Repko, Szostak and Buchberger's (2017) *Introduction to Interdisciplinary Studies*. The overarching goal of the course is to provide students with theoretical and practical applications of interdisciplinary studies. Specific learning outcomes focus on students demonstrating an understanding of the process and result of engaging in the interdisciplinary research process (IRP) (Repko et al., 2017).

The purpose of the current study was to assess the effectiveness of using collaborative maps to facilitate student learning outcomes from an 8-week small group interdisciplinary project. The project involved researching a complex real-world problem for the purpose of designing a museum exhibit that presented an interdisciplinary understanding of the problem and solutions that emerge from the new understanding. Students self-selected groups and topics. Eleven groups participated in the study, 5 groups during the fall 2017 term, 6 groups in the spring 2018 term. Group size ranged from 3–5 students. The groups consisted of students from different academic interests and backgrounds.

The first five weeks of the semester were spent covering the material presented in the course textbook. The group project was introduced during the sixth week of classes. Groups started the project by brainstorming complex real-world problems to use as the topic for their museum exhibit. After a topic was identified, students followed the steps in the IRP presented in the textbook to develop and design their museum exhibit. During the project, students worked on different assignments; some assignments were individual, other assignments were completed as a group. Key assignments included an annotated bibliography (individual), disciplinary insights table (group), and a written discussion of the interdisciplinary understanding of the problem (group). The final assignment was a written museum exhibit proposal and an oral presentation of the proposal (group).

In the initial stages of the project, students conducted research to understand the problem from relevant disciplinary perspectives, each student responsible for understanding the problem from a different discipline. During the later stages, students shared discipline-specific insights about the problem with their group members. At specific times during the 8-week project, students were instructed to produce maps. Before drawing the first map, the instructor provided an overview of mapping and showed students examples of mind and concept maps. In this study, because maps were used for brainstorming and to generate new knowledge, students were given the freedom to use a design that made the most sense to members of the group. After the teaching strategy was introduced, the instructor referred to both mapping strategies, mind and concept maps, as "mind maps" for the duration of the course. Each group produced a series of four maps: Map 1 – potentially relevant disciplines (collaborative), Map 2 – most relevant disciplines (collaborative), Map 3 – discipline-specific map (individual), and Map 4 – "integration" map (collaborative).

Data Generation and Analysis

Data were generated from two sources: (1) 11 group collaborative integration maps, and (2) 42 individual student evaluations; due to absences, three students did not provide evaluation comments. The first data set, the collaborative integration maps (Map 4), provided a graphic representation of the relationships between insights from different disciplines. Before starting work on this map, students were instructed to find and show connections between insights, to identify interdisciplinary themes, and to provide a legend to help interpret their map. They had the choice of hand drawing their maps using the paper and drawing materials (markers / highlighters) provided or using their laptop computers. Students were given class time to work as a group to create their integration maps. A primary goal for the activity was for students to use these maps to write a discussion of the interdisciplinary understanding of the problem.

Student evaluations used to gain an understanding of student perceptions served as the second data set. After students completed their interdisciplinary discussion assignment, they provided a written evaluation of the collaborative mapping exercise. They were asked to reflect on the process of constructing the integration map and to assess its effectiveness in helping them understand the process and result of interdisciplinary integration. The prompt for the written evaluation was *Do you feel the integration map helped you / your group construct an interdisciplinary*

understanding of the problem you're using for the museum exhibit project? If yes, in what ways did it help? If no, why not?

Qualitative content and thematic analysis (Patton, 2002) were employed to analyze the data. Analysis occurred in two stages: (1) collaborative integration maps, (2) student evaluations. The following steps were used to analyze graphic representations of the interdisciplinary integration process presented in the collaborative maps:

1. Categorizing maps by design: modified mind map, modified concept map, other
2. Viewing and re-viewing the maps to identify structure and layers
3. Viewing and re-viewing the maps to assess connections between disciplinary insights
4. Viewing and re-viewing the maps to identify and record interdisciplinary themes

Student evaluations were analyzed by:

1. Entering all comments on a MS Word document
2. Color-coding comments into three categories: effective, not effective, not sure
3. Placing comments under appropriate category headings
4. Reading and analyzing comments under each heading to identify patterns of repeated words and phrases
5. Using the "find" function to count frequency of repeated words
6. Organizing comments into initial sub-categories
7. Re-reading comments and revising sub-category headings
8. Reading comments under each sub-category to identify emergent themes

Analysis of the two data sets served to meet the research aims to understand students' perceptions of the effectiveness of collaborative mapping as an instructional strategy.

Findings

The study's findings are presented in two sections: (1) analysis of visual representations of the interdisciplinary integration process and (2) analysis of evaluation comments to gain students' perceptions of using collaborative maps as an instructional strategy for facilitating interdisciplinary learning.

Visual Representations

Figures 3 – 7 on p. 119 illustrate the variety of designs groups used to present the process of interdisciplinary integration. Many groups created modified mind maps using a radial design with the problem in the center, disciplines and disciplinary insights branching outward (e.g., Figures 3 and 4); one group designed their mind map from the outside in, with disciplinary insights radiating inward from interdisciplinary themes (Figure 5); one group produced a modified concept map using a hierarchical design (Figure 6); one group used a tree design (Figure 7). The structure of the maps also varied. While the relevant disciplines used to investigate the problem served as the main categories in seven maps (e.g., Figure 4), some groups used interdisciplinary

themes (e.g., Figure 5); 1 group used "connections" "disagreements" and "new understandings" as the main categories on their map.

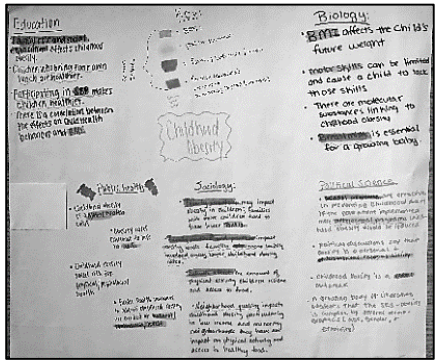

Figure 3. Collborative Map (F5)

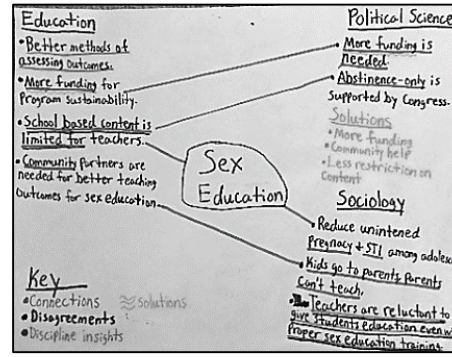

Figure 4. Collborative Map (S3)

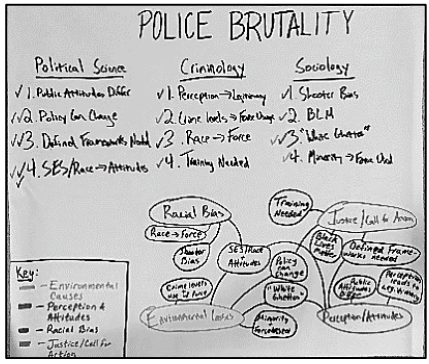

Figure 5. Collborative Map (S6)

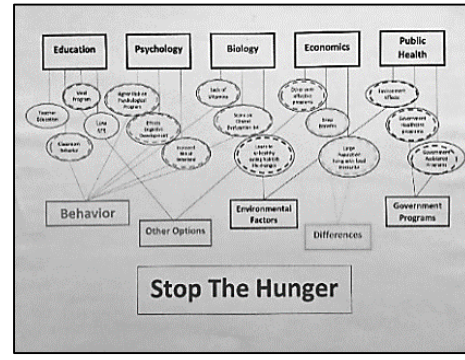

Figure 6. Collborative Map (F3)

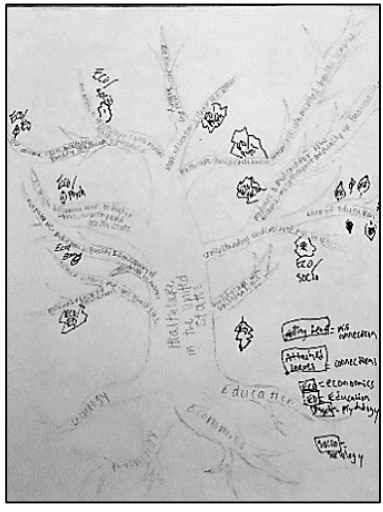

Figure 7. Collborative Map (F2)

Groups employed different approaches to show the connections between disciplinary insights. Four groups chose to use color coding (e.g., Figure 3); six groups used both color coding and lines to show commonalities and differences between insights (e.g., Figures 4 and 6); one group used branches and leaves (Figure 7). Concerning the legends used to explain maps, four groups used interdisciplinary themes (e.g., Figures 3 and 5), legends on four maps included similarities and differences between insights (e.g., Figure 4); two groups included "solutions" (Figures 3 and 4). Discipline names and "attached" and "falling" leaves were the descriptors provided on the tree map legend. The range of designs and ways of representing connections and themes suggests

that students used the freedom they had to express the group's collective creativity and to personalize the meaning-making experience.

The collaborative maps were also analyzed to assess graphic representations of the steps involved in the interdisciplinary integration process: identifying conflicts and commonalities between insights across disciplines, finding common ground, and generating interdisciplinary themes. While all groups identified connections, the relationships between disciplinary insights were easier to identify on maps produced by certain groups. The number of connections and the number of disciplines connected to each theme also varied.

Table 1 presents the topic, the names of the disciplines each group used for the project, and the interdisciplinary themes identified. Analysis of the themes suggests that groups reached different levels of understanding the integrative process. For example, the map created by group S6 (Figure 5) presents a clear representation of the process of identifying connections between interdisciplinary insights and generating themes across all three disciplines, indicating a high level of interdisciplinary integration. In comparison, the map produced by group F2 (Figure 7), does not include interdisciplinary themes, and thus shows little evidence of interdisciplinary integration. Many factors could have influenced the difference in the degree of interdisciplinary integration demonstrated on the maps, including drawing ability, prior experience with mapping, degree of understanding the task and the integrative process, relationship with / seeking help from the instructor, level of engagement, motivation and interest in the topic, commitment to learning and project success, and group dynamics. It is worth noting that the groups that demonstrated a deeper level of interdisciplinary integration on their collaborative maps were also the groups that received the highest grades on their final project.

Table 1
Collaborative maps – topic, disciplines and interdisciplinary themes

Group ID	Topic	Disciplines	Interdisciplinary Themes (Disciplines)
F1	Climate Change	Biology (BIO) Economics (ECO) Sociology (SOC) Environmental Science (ES) Political Science (PS)	- Poor water quality (BIO / ES) - Human health & livelihood (BIO / SOC) - Migration (BIO / SOC) - Economic performance (BIO / ECO / ES) - Accelerated by pollutants (BIO / PS / ES) - Global topic (BIO / ECO / SOC / ES / PS)
F2	Health Care in the US	Economics (ECO) Education (ED) Sociology (SOC) Psychology (PSY)	

Table 1 Continued

Group ID	Topic	Disciplines	Interdisciplinary Themes (Disciplines)
F3	Hunger in the US	Education (ED) Psychology (PSY) Biology (BIO) Economics (ECO) Public Health (PH)	- Behavior (ED / PSY / BIO) - Environmental factors (BIO / PH) - Government programs (PH)
F4	Marine Plastic Pollution	Marine Biology (MB) Environmental Science (ES) Economics (ECO) Sociology (SOC) Education (ED)	- Behavior (SOC / EDU / ECO) - Knowledge (SOC / MB / EDU / ECO / ES) - Policy (SOC / MB / ECO / ES)
F5	Childhood Obesity	Education (ED) Biology (BIO) Public Health (PH) Sociology (SOC) Political Science (PS)	- BMIs (ED / SOC / BIO) - Physical promotion (BIO / PH / SOC / PS) - Family / school (ED / SOC / BIO / PS) - Global awareness (ED / PH / PS)
S1	Homeless Veterans	Political Science (PS) Public Health (PH) Education (EDU) Psychology (PSY) Economics (ECO)	- Community support (PH / PSY) - Funding (PH / ECO / EDU) - Policy (PS / PH) - Programs (PH / EDU)
S2	Legalization of Marijuana	Economics (ECO) Law (LAW) Psychology (PSY) Public Health (PH)	- Illicit use (ECO / LAW / PH) - Effects (ECO / LAW / PSY / PH)
S3	Sex Education	Education (ED) Political Science (PS) Sociology (SOC)	- Funding (ED / SOC / PS) - Community support (ED / SOC / PS) - Content (ED / SOC / PS)
S4	Climate Change	Environmental Law (EL) International Relations (IR) Economics (ECO) Biology (BIO)	- Law & policy (EL / IR / ECO / BIO) - Environmental health (EL / IR / ECO / BIO) - Global impacts (EL / IR / ECO / BIO) - Economic impacts (EL / IR / ECO / BIO)

Table 1 Continued

Group ID	Topic	Disciplines	Interdisciplinary Themes (Disciplines)
S5	Women's Choice	Religious Studies (RS) Psychology (PSY) Women Studies (WGS)	- Individual vs societal / religious (RS / PSY / WGS) - Consequences (RS / PSY / WGS)
S6	Police Brutality	Political Science (PS) Criminology (CRIM) Sociology (SOC)	- Environmental causes (PS / CRIM / SOC) - Perceptions & attitudes (PS / CRIM / SOC) - Racial bias (PS / CRIM / SOC) - Justice / call for action (PS / CRIM / SOC)

Perceptions

Evaluation comments were analyzed to gain students' perceptions of using collaborative mind maps to facilitate an understanding of interdisciplinary integration. The vast majority of students expressed the view that the integration mind map helped them construct an interdisciplinary understanding of the problem; 38 students (90.5%) found it useful, 3 students (7.1%) did not find it useful, and 1 student (2.4 %) was not sure if it helped facilitate an understanding of the integration process.

The reasons students provided for its effectiveness as a teaching and learning strategy focused on the benefits derived from the visual aspect of the activity, as a different way to see, clarify and organize information.

- The mind map did help me have a physical representation of what the connections look like. I tend to be more of a visual learner. So I needed that physical representation to put it all together.
- I like using mind maps because it lays out ideas visually. I am a visual learner so I understand the process better when it comes to an IDS understanding of a complex real-world problem.
- Absolutely. Personally, my thoughts were scattered until I saw the completed mind-map.
- Being a visual learner, it especially helped me see everything more clearly and more organized and laid out.

Additional benefits identified include facilitating the steps in the integration process: finding connections between disciplinary insights, creating common ground, integrating insights, and constructing an interdisciplinary understanding of the problem.

- By constructing a mind map, the connections between the disciplinary insights were much more visible.
- Made it easy to pick out connections, conflict, themes and create common ground.

- It helped by providing a visual of our thoughts together making it easier to integrate.
- Seeing all the insights, being able to highlight and physically make connections was very helpful in forming an interdisciplinary understanding.
- The integration mind-map helped me construct and interdisciplinary understanding of the problem because it helped me to see key themes and solutions to the problem.
- I think the mind maps are a great idea for helping students understand the process required to construct an interdisciplinary understanding of a complex real-world problem.
- It helps people … to see how other disciplines connect with others and it allows them to gain a better understanding as to why an interdisciplinary perspective can accomplish more than just a single discipline on its own.

In addition to facilitating the process of interdisciplinary integration, the mapping activity provided students with opportunities for creative and holistic thinking.

- Yes, much like IDS this is a different way of looking at things. ... Having something like this may help someone think outside the box, stimulate other parts of the brain as it did for me.
- Mind maps enable us to see the "pathways" to new ideas & insights that come from different disciplines. "All roads lead to a destination" and that destination is a new solution to a real world problem.
- Yes, I like thinking outside the box & "drawing" our perspectives & disciplines helped me to visualize & understand the concept better.
- Mind maps really do allow you to physically see your process of integrating disciplines to connect them and "see the bigger picture."
- Mind maps are a creative visual way to see what disciplines can bring to solve a complex problem. It also helps when students need ideas.

Student comments also highlight the active and collaborative nature of the activity:

- Yes, it completely helped our group who happened to be learners who were better with hands on and visual things. We got the chance to see our ideas come to life right in front of our eyes which truly helped us.
- The mind map helped by putting our thoughts on paper and playing around with different designs. The group made four common themes / connections between insights. The group had a great grasp on the multi-disciplinary process. We also had a good idea of the interdisciplinary process, which led to a better understanding of the problem.
- Each person had a different opinion which allowed us to have a discussion.
- I believe that the integration mind-map was very helpful because it gave us a nice visual and brought ideas that we had in our heads as a group.
- Yes, the integration mind map helped me individually and as a group to have a clear understanding of our topic / project as a whole.

- Yes, because it organizes everyone's ideas together to come up with a better understanding.

  Some students who found the instructional strategy useful, reported that it was confusing at first.
- Mind maps were okay, they can get a little confusing if you don't know how to follow, but if you personalized it like my group did it was helpful.

The view that mind maps can be confusing and preferences for other learning strategies were the reasons students provided for why collaborative mapping did not facilitate interdisciplinary learning.

- I believe charts are a better visual representation to understand the process, like the insights table or flow chart. The mind map gets too confusing sometimes to follow.
- Mind maps were rather confusing for me. I prefer things that are organized and the mind maps tended to be all over the place.
- The mind map to me personally seemed a little crazy, and hard to understand, color coding works better for me and helps me visually see connections between insights much better.

The student who was unsure about the teaching strategy's effectiveness, made a distinction between it helping to identify insights shared across disciplines and helping "develop a new interdisciplinary understanding."

Discussion & Implications

This study illustrates how student perceptions can be used to inform classroom practice. The findings reveal features of collaborative mapping that contributed to its effectiveness as a teaching strategy and the learning outcomes from the activity. They also provide suggestions for improvement.

Effective Features

The feature most frequently identified as contributing to its usefulness as an instructional strategy was the visual quality of the mapping task. Constructing a visual representation provided students with a different method for organizing their ideas. Interestingly, many students identified themselves as having a visual learning preference. Recent research finds little evidence to support the idea that tailoring instruction to different learning style preferences makes a difference in student learning outcomes (Rohrer & Pashler, 2012). Findings from this study suggests there may be some value in students identifying themselves as having a preferred learning style as it relates to using and seeing the learning benefits of specific teaching strategies. Additionally, the study illustrates how employing innovative pedagogies can present students with new experiences that may lead to deeper learning.

An additional feature of the activity that may have contributed to students' positive perceptions is the flexibility students had in designing their maps. The variety of the designs indicates that students used the freedom to create maps specific to each group's ideas for how to best understand the problem. Providing students with choice and ownership of their learning is a student-centered approach that can increase levels

of engagement and motivation (Wright, 2011) and promote creativity. The lack of uniformity and restrictions on how to draw mind maps was appropriate in this case because the purpose was for students to use the activity to foster the process of interdisciplinary integration; it was not used as a direct measure of learning. Building flexibility into the collaborative mapping assignment may have also served to accommodate students who are more comfortable using traditional structured learning strategies.

Learning Outcomes

The study's findings also provide insights about learning outcomes from the activity. Students indicated that the collaborative mapping exercise facilitated an understanding of interdisciplinary integration, primarily by making the connections between disciplinary insights visible. In addition to helping identify connections, students indicated that the collaborative maps helped the group generate interdisciplinary themes, perform integration, construct new understandings and develop solutions for the problem. A reason for why this method may facilitate the integrative process stems from its theoretical underpinnings, that knowledge is actively and socially constructed (Bruner, 1986; Vygotsky, 1978) and involves making links between concepts (Ausubel, 1968; Novak, 1990). Another factor that may have led to deeper learning is having students reflect on the experience (Kolb, 1984). Providing feedback about the strategy's effectiveness required students to engage in metacognition, to think about the experience and the learning outcomes.

Skill development is an additional learning outcome from the collaborative mapping exercise. The findings suggest that students developed a range of skills including holistic and creative thinking, critical thinking, problem-solving, and collaboration skills. Phrases students used to describe the cognitive skills developed include seeing "the big picture" and "pathways to new ideas," "thinking out of the box," and coming up with "new solutions." Critical thinking, problem-solving and collaborative skills were developed by listening to their group members' ideas and engaging in perspective-taking—analyzing different disciplinary perspectives on the problem (Repko, 2012). Higher education is under increased pressure to provide evidence that students are graduating with the knowledge and skills required to be successful in today's global society (Oliveri & Markle, 2017). Findings from this research illustrate how a teaching strategy can be used to increase learning and develop the skills that are in high demand.

Students indicated that the collaborative mapping exercise facilitated an understanding of interdisciplinary integration, primarily by making the connections between disciplinary insights visible.

Suggestions for Improvement

While students' positive perceptions of collaborative mapping provide support for its application in teaching interdisciplinary studies and its continued use in the course, the findings offer suggestions for improving its effectiveness in the

classroom. First, provide students with an introduction to the mapping assignment that includes an explanation of the learning objectives and the theoretical underpinnings and potential benefits derived from engaging in the activity. Instructors often focus on explaining the "how." Findings from this study illustrate the importance of also communicating the "why." If students see the value and personal relevance in what they are being asked to do, they are more likely to be actively involved in the learning process (Jessup-Anger, 2011). Second, to reduce the level of confusion and unease some students experience, provide additional time for students to experiment with different map designs to find a method that accommodates a range of preferred learning strategies. Third, to help students generate themes and deepen their interdisciplinary understanding of the problem, build in additional opportunities for students to become familiar with interdisciplinary research. Implementing these changes may strengthen the essential features of collaborative learning—planning, process and results (Barkley et al., 2014).

Limitations and Future Research

Although new insights were gained from the current study, there are possible limitations to the research findings. The findings are specific to one instructor's experience with students in one course. Additional research is needed to confirm its effectiveness in facilitating interdisciplinary learning and its wider application across disciplines. Furthermore, because student evaluations were identifiable, knowing the instructor would read the comments may have influenced the statements provided. Other areas for future research include further investigation into factors that affect the effectiveness of interdisciplinary teams and designing studies that assess the effectiveness of teaching strategies by providing direct measures of interdisciplinary learning.

Conclusion

This research contributes new understandings about using student perceptions to assess the effectiveness of a teaching and learning strategy. It illustrates that student perceptions of their learning experiences matter. They matter because these perceptions can inform and improve teaching practice which may result in higher levels of active engagement and learning. Additionally, gaining students' perceptions can communicate to students that they have a voice and that instructors are responsive to their learning needs. This study also provides insights about how important it is to employ instructional strategies that are best suited to achieving specific learning goals. In this study, collaborative mapping was selected in part to encourage active engagement with the additional purpose of helping students integrate insights across disciplines, the primary cognitive task required for interdisciplinary learning. Finally, the findings demonstrate how teaching strategies should aim not only to increase knowledge, but to develop the personal, academic and professional skills needed today. Making changes to current practice requires time, effort and a strong commitment to continuous improvement—a commitment that may lead to improving teaching effectiveness in higher education.

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Call for Papers

Volume 15: *Scholarly Teaching and Learning*

InSight: A Journal of Scholarly Teaching is a scholarly publication designed to highlight the work of postsecondary faculty at colleges and universities across the United States. It is a refereed scholarly journal published annually by the Faculty Center for Innovation (FCI) at Park University that features theoretical and empirically-based research articles, critical reflection pieces, case studies, and classroom innovations relevant to teaching, learning, and assessment.

InSight articles focus broadly on Scholarly Teaching. Faculty are encouraged to submit original manuscripts that showcase scholarly teaching processes or critically discuss the scholarship of teaching and learning (SoTL) as a scholarship paradigm. While reports of scholarly teaching projects are welcome, *InSight* is also committed to continuing broader conversations about SoTL's value as a tool for advancing student learning and demonstrating faculty commitment to teaching.

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- Developing institution or discipline-specific understandings/definitions of SoTL
- Status reports of SoTL's role in a particular discipline (and what other disciplines might learn from the report)
- Guidance to faculty new to SoTL (on developing inquiry questions, determining methodologies, making SoTL work public, etc.)
- Examples of SoTL projects at the course or discipline-level
- Intersections of SoTL and service-learning, eLearning, learning communities, and other learning initiatives
- Future directions in SoTL
- Cross-disciplinary and cross-institutional collaborations for promoting SoTL

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- LENGTH – Manuscripts may range from 2,000 – 5,000 words (not including abstract, references or appendices). Authors are encouraged to include appendices that promote application and integration of materials (i.e., assignments, rubrics, examples, etc.).
- ABSTRACT – Each manuscript must be summarized in an abstract of 50 to 100 words.
- AUTHOR – Each author should provide his/her full name, title and departmental affiliation, campus address, telephone number, and email address. Each author must also include a brief biography (no more than 100 words per author).
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The following "Quick Tips" provide suggestions and guidance for preparing manuscripts for potential publication in *InSight: A Journal of Scholarly Teaching*. *InSight* is a peer-reviewed publication highlighting the scholarly contributions of postsecondary faculty. As is the nature of refereed journals, acceptance and publication of original manuscripts is a competitive process. The goal of the following information is to assist faculty in preparing manuscripts in a manner that maximizes the chances of publication.

Preparing the Manuscript

The organization and style your manuscript will be largely dictated by the type of submission (e.g., theoretical, empirical, critical reflection, case study, classroom innovation, etc.). Thus, while guidelines will follow to assist you in preparing your manuscript, the key to successful submission is clear, effective communication that highlights the significance and implications of your work to post-secondary teaching and learning in relation to the target topic. To prepare and effectively communicate your scholarly work, the American Psychological Association (2010) provides the following general guidelines:

- Present the problem, question or issue early in the manuscript.
- Show how the issue is grounded, shaped, and directed by theory.
- Connect the issue to previous work in a literature review that is pertinent and informative but not exhaustive.
- State explicitly the hypotheses under investigation or the target of the theoretical review.
- Keep the conclusions within the boundaries of the findings and/or scope of the theory.
- Demonstrate how the study or scholarly approach has helped to address the original issue.
- Identify and discuss what theoretical or practical implications can be drawn from this work.

There is no mandatory format for *InSight* articles; rather authors should organize and present information in a manner that promotes communication and understanding of key points. As you write your manuscript, keep the following points in mind:

- Title - Generally speaking, titles should not exceed 15 words and should provide a clear introduction to your article. While it is okay to incorporate "catchy" titles to pique interest, be sure that your title effectively captures the point of your manuscript.

- Abstract - Do not underestimate the importance of your abstract. While the abstract is simply a short summary (50-100 words) of your work, it is often the only aspect of your article that individuals read. The abstract provides the basis from which individuals will decide whether or not to read your article, so be certain that your abstract is "accurate, self-contained, nonevaluative, coherent, and readable" (Calfee & Valencia, 2001).
- Body - Within the body of a manuscript, information should be organized and sub-headed in a structure that facilitates understanding of key issues. There is not a mandatory format for *InSight* articles; rather authors should use professional guidelines within their discipline to present information in a manner that is easily communicated to readers. For example:

    - *Empirical investigations* should be organized according to the traditional format that includes introduction (purpose, literature review, hypothesis), method (participants, materials, procedures), results, and discussion (implications). The following links provide general examples of this type of article:
        - http://www.thejeo.com/MandernachFinal.pdf
        - http://www.athleticInSight.com/Vol7Iss4/Selfesteem.htm
    - *Theoretical articles and literature reviews* should include an introduction (purpose), subheadings for the relevant perspectives and themes, and a detailed section(s) on conclusions (applications, recommendations, implications, etc.). The following links provide general examples of this type of article:
        - http://www.westga.edu/%7Edistance/ojdla/winter84/royal84.htm
        - http://www.westga.edu/%7Edistance/ojdla/winter84/mclean84.htm
    - *Classroom innovation and critical reflections* should be organized via an introduction (purpose, problem, or challenge), relevant background literature, project description, evaluation of effectiveness (may include student feedback, self-reflections, peer-insights, etc.), and conclusions (applications, implications, recommendations, etc.). If describing classroom-based work, please include copies of relevant assignments, handouts, rubrics, etc. as appendices. The following link provides a general example of a critical reflections article:
        - http://www.compositionstudies.tcu.edu/coursedesigns/online/33-2/ritter.htmlv

The limited length of *InSight* articles (manuscript should be no more than 5000 words, not including abstract, references or appendices) requires authors to focus on the most significant, relevant factors and implications.

- References - Select your references carefully to ensure that your citations include the most current and relevant sources. As you select your references, give preference to published sources that have proven pertinent and valuable to the relevant investigations. The goal is not to incorporate ALL relevant references, but rather to include the most important ones.

- Tables, Figures, Appendices & Graphics - Authors are encouraged to include supporting documents to illustrate the findings, relevance or utilization of materials. Particularly relevant are documents that promote easy, efficient integration of suggestions, findings or techniques into the classroom (such as rubrics, assignments, etc.). Supplemental information should enhance, rather than duplicate, information in the text.

The importance of clear, effective communication cannot be highlighted enough. Many manuscripts with relevant, original, applicable ideas will be rejected because authors do not communicate the information in a manner that facilitates easy understanding and application of key points. The value of a manuscript is lost if readers are unable to overcome written communication barriers that prevent use of the knowledge. With this in mind, authors are strongly advised to seek informal feedback from peers and colleagues on manuscripts prior to submission to *InSight*. Requesting informal reviews from relevant professionals can highlight and correct many concerns prior to formal submission, thus improving chances of publication.

References

American Psychological Association. (2010). *Publication manual of the American Psychological Association* (6th ed.). Washington, DC: Author.

Calfee, R. & Valencia, R. (2001). *APA Guide to preparing manuscripts for journal publication*. Washington, DC: APA.

"Teachers face the gargantuan task of integrating information from a myriad of sources in order to best help their students learn. So, we all need to do our part to make sure research is accessible to educators, and the educators are open to research findings. "
Yana Weinstein, Megan Sumeracki, and Oliver Caviglioli, *Understanding How We Learn: A Visual Guide*