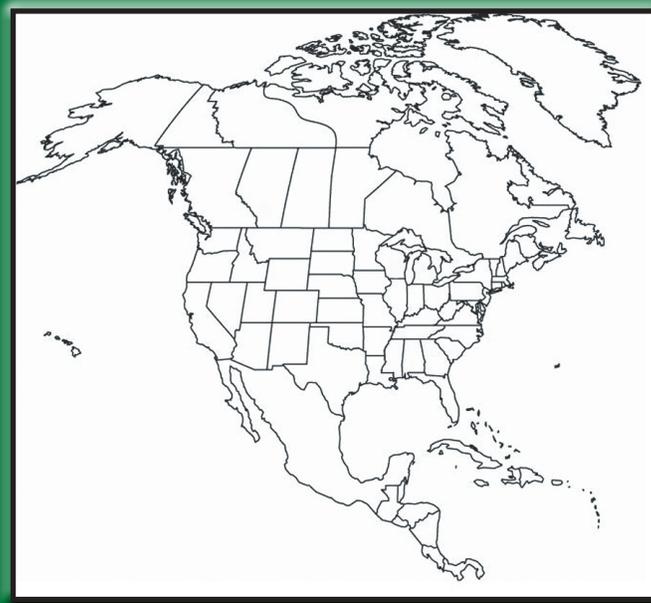


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*A national quarterly journal of research and innovative techniques in
education for America and beyond*



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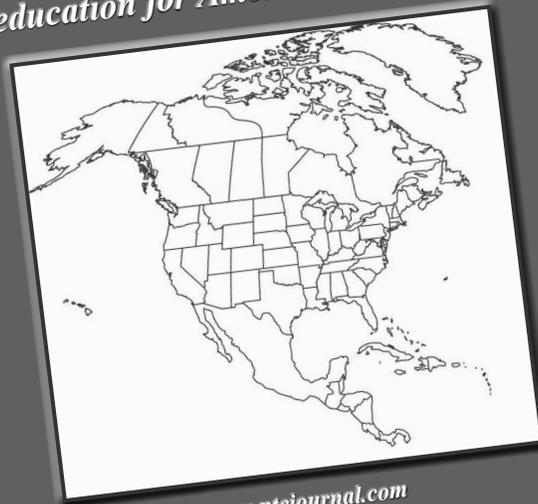
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Research, Design, and Implementation of an Inclusive Teacher Residency Model

Kerry Kretchmar
Kimberly White
Kimberly Hofkamp
Kathrine Kramer

Abstract: This paper reports on lessons learned through the implementation of a teacher residency model to develop teacher candidates who serve as advocates of marginalized students, particularly those identified with disabilities. This analysis is grounded in a five-year longitudinal case study researching the Inclusive Teacher Residency Program designed by University and School District partners to develop effective educators and enhance teacher candidates' understanding and practice of inclusive teaching. The objectives of the paper include: a) identify the Inclusive Teacher Residency Program structure, b) describe themes from the resident year and candidates' first one to four years in the profession, and 3) discuss implications of the research themes for preparing teachers to serve all students in inclusive environments.

About the Authors: *Kerry Kretchmar, PhD is an Associate Professor of Education at Carroll University. Kimberly White, PhD is Chair of the Department of Education and an Associate Professor of Education at Carroll University. Kimberly Hofkamp is the Director of Clinical Experiences and an Assistant Professor of Education at Carroll University. Kathrine Kramer, PhD is the Director of Graduate Education Studies and an Assistant Professor of Education at Carroll University.*

Keywords: Residency, Teacher Education, Clinical Experiences, Inclusive Education

INTRODUCTION

The goal of teacher education is to prepare educators who will serve the needs of all students within rich, learner-centered environments. And yet, students with diverse academic, social and emotional needs are historically underserved in schools. They are frequently separated from their peers, receive direct instruction and interventions focused on basic skills, and are often required to complete work that is different than and unequal to that of their peers (Frattura & Capper, 2007). Research demonstrates the importance of teacher preparation programs focusing on meaningful and long-term interactions in inclusive settings to support candidates' knowledge, skills, and dispositions for teaching all students, including those with disabilities (Pugach & Blanton, 2012). While attention has been given to teacher residency models that prepare educators for working in urban settings, less attention is paid to models that support inclusive teaching. This paper reports on lessons learned through the implementation of a teacher residency model to develop teacher candidates who serve as advocates of marginalized students, particularly those identified with disabilities. This analysis is grounded in a five-year

longitudinal case study researching the Inclusive Teacher Residency Program (ITRP) designed by University and School District partners to develop effective educators and enhance teacher candidates' understanding and practice of inclusive teaching.

The objectives of the paper include the following: a) identify the Inclusive Teacher Residency Program structure, b) describe themes from the resident year and candidates' first one to four years in the profession, and 3) discuss implications of the research themes for preparing teachers to serve all students in inclusive environments.

The research on the ITRP builds on the existing literature for residency models and inclusive teaching. It analyzes the perspectives of teacher residents and new educators who entered the profession through the residency program. While this analysis is limited to one case study, the implications of the study can inform the structure and implementation of other residency models and teacher preparation programs related to the development of teachers who advocate for students often marginalized in mainstream classrooms.

LITERATURE REVIEW

The residency approach is an innovative model of teacher education (Papay, West, Fullerton & Kane, 2011; Solomon, 2009) that is viewed as the “new standard for clinical teacher preparation (Dennis, 2016, p. 14).” Borrowing from the medical profession, the teacher residency model was developed as a “third space” response to the disconnection between educational theory and teaching practice as residents’ experiences are grounded in the classrooms of effective teachers, and then strategically framed by broader conversations about effective teaching and schooling (Klein, Taylor, Onore, Strom, & Abrams, 2013; Wrenn & Wrenn, 2009). Early research on residency models has indicated many positive impacts. The financial incentives have aided in the recruitment of diverse teacher candidates in high need areas and increased retention of educators in the field (Guha, Hyler, & Darling-Hammond, 2017). As a relatively new model, research on the impact of student achievement remains limited, but several studies have suggested that residents and graduates are more effective than novice teachers in relation to standardized test scores (Guha, Hyler, & Darling-Hammond, 2017; Papay, West, Fullerton, & Kane, 2012; Sloan & Blazevski, 2015). Other research has examined the challenges for coherent visions of teacher preparation as the number of stakeholders increase who come from a variety of perspectives (Beck, 2016). Many have contended that the residency model’s close connection to K-12 partners will prepare stronger teachers (Futrell, 2010), and yet limited research examines the impact on teacher development.

While urban residency models have been used as an innovative model for the preparation of teachers for high-need urban settings, ITRP addresses the need to prepare educators to serve all students across educational settings with a focus on inclusive practices. Baglieri and Knopf (2004) note that special education can be transformed by constructing differences as natural, acceptable, and ordinary and contend, “A truly inclusive school reflects a democratic philosophy whereby all students are valued, educators normalize difference through differentiated instruction, and the school culture reflects an ethic of caring and community” (Baglieri and Knopf, 2004, p. 525). This study draws on the work of these researchers when defining inclusive teaching practices. For the purposes of this study, inclusive teaching is characterized by:

- Creating environments of belonging
- Promoting relationships that lead to mutual caring
- Approaching learners with an asset

perspective drawing upon student strengths, interests and background

- Personalizing learning around each student’s strengths and needs
- Implementing curriculum and instruction that includes multiple perspectives and student choice
- Reducing prejudice by confronting negative stereotypes toward dis/ability
- Providing access and opportunity for all students

The goal of both urban and inclusive teacher residencies is to prepare educators to meet the diverse needs of all students. By grounding experiences of teacher candidates in inclusive environments modeling these seven teaching practices, residents can meld theory and practice to recognize and respond to the diverse needs of students, particularly those identified with disabilities.

INCLUSIVE TEACHER RESIDENCY STRUCTURE

The Inclusive Teacher Residency Program (ITRP) is housed in the Department of Education at a small, private liberal arts institution of higher education located in southeastern Wisconsin. The university records annual enrollment of about 3450 undergraduate and graduate students. The Department of Education serves approximately 250-300 students, with a range of 20-40 student teachers each semester. Students are able to enroll in education courses in their first semester and typically apply to the Teacher Education Program in their second year of enrollment. The majority of candidates complete their student teaching placements in their fourth and final year of enrollment. Licensure programs are offered in early childhood education, elementary education, special education, secondary education, music teacher education, art education, and physical and health education. Candidates who seek licensure in special education complete a dual licensure program, earning licensure in either early childhood-elementary education and early childhood special education or elementary education and cross-categorical special education. This study focuses on the candidates who completed dual licensure programs and were selected for the ITRP as an alternative to completing a traditional 18-week student teaching placement.

In this particular model, a teacher resident is a pre-service undergraduate education candidate enrolled in the last two to three semesters of his or her teacher preparation program. Residents engage in a variety

of intentional teaching and learning experiences for a full K-12 academic year in one school district, and most often in one school within that district. In the first semester of the program referred to as a Residency Semester, the candidate completes embedded university coursework while engaging in clinical experiences in the district for over 20 hours per week. In the resident's final semester, the experience culminates with an 18-week Student Teaching placement. While the majority of residents complete one Residency Semester prior to the Student Teaching Semester, some residents complete two Residency Semesters, embedding them in the school and district for an extended time beyond the one academic year placement. The resident is included in team and staff development and, in most cases, is a paid staff member in the district. Residents are part of a university cohort, which serves as a peer group that provides ongoing support and collaborative learning.

Residents participate in the school in a variety of ways, such as: designing and facilitating whole class or small group learning with attention to individual needs; providing individual student support and instruction; developing and implementing Individualized Education or Learning Plans; analyzing student work; assessing student learning and providing feedback; and, engaging in team meetings and conversations. Similar to all student teaching placements, residents are supported by a cooperating teacher and university faculty. In addition, residents are assigned a resident coach, who serves as a point person for the resident when she or he is completing clinical placements in a grade level or building other than where the cooperating teacher is located. The resident coach provides support in identifying relevant placements, helps the resident to develop connections with colleagues, and provides feedback to the resident.

The ITRP is offered in partnership with three school districts, and the structure of the residency allows for more reciprocal benefits between the school and university. Residents benefit through the development of in depth knowledge, skills, and expertise gained through the year-long involvement in all aspects of teacher responsibilities and operations including professional development, as well as from mentoring and feedback from a variety of professionals and perspectives. They collaborate with students, teachers, staff, administrators, and families as a staff member rather than as a pre-service teacher. The majority of residents receive a stipend from the district, which supports their prolonged and extensive engagement in the school community.

For schools and districts, the residency promotes quality inclusive educational practices, increases the number of educators able to work with students, and takes a significant role in the development of prospective teachers. The residency provides the opportunity to partner with a University to enhance theory to practice connections, share resources, and network. It connects the professional development initiatives in the district to graduate programs.

METHODS

The overarching research question for this programmatic case study is: In what ways can a teacher residency model facilitate K-16 school and university partnerships to enhance the development of teacher candidates who serve as advocates of marginalized students, particularly those with disabilities? This paper focuses specifically on themes that have direct implications for the implementation of an inclusive teacher residency model.

An instrumental case study (Stake, 2000) was conducted to analyze the impact of the residency model on teacher candidate development. This method was chosen to gain insight and build theory around what components of a residency model are most effective in supporting teacher preparation. A longitudinal study has been conducted over a five-year period by a research team of faculty members including the Chair of the Department, the Director of Clinical Experience, the edTPA Coordinator, and the Director of Graduate Studies in Education. To date, participants have included twenty-one resident teachers and early educators. Data have been collected each year on residents and data collection has included resident alumni in their first, second, third, and fourth years of teaching. This longitudinal approach has allowed the researchers to examine the impact of the residency model on teacher preparation, as well as how this preparation equipped early career teachers as they transition from pre-service to in-service teachers.

A mixed methods approach was utilized with both quantitative and qualitative measures. Efficacy scales and surveys were collected at the start and end of each resident year. Candidate reflections, edTPA portfolios and related documents were also collected from teacher residents. At the end of each academic year, the research team conducted a summer focus group with recent resident teacher completers and resident alumni teachers. Surveys were distributed and two researchers took meeting notes for comparison purposes. In years two through five, the research team also conducted quarterly

induction professional learning community (iPLC) meetings. These meetings brought current and alumni residents together in a discussion facilitated by partner teachers from districts in which the residents served. These teachers were available to help the preservice and inservice teachers process the successes and challenges they faced working in inclusive environments. In addition, this research draws on surveys and discussions with ten cooperating teachers. The research team completed document analysis on memos, notes from stakeholder meetings, and research discussions.

Quantitative measures were analyzed for efficacy and growth. Qualitative data sources were coded for deductive themes aligning with the seven characteristics of inclusive teaching; inductive themes were also coded. The researchers conducted a member-check by presenting their findings to the participants and receiving feedback on the analysis. This cross-checking of analysis validates the research findings, as all perspectives were included when coming to consensus on the findings and implications.

THEMES

Four major themes emerged from the residency research: 1) navigating the complexity of collaboration, 2) developing systemic perspectives of teaching and learning, 3) enhancing connections between theory and practice, and 4) capitalizing on the importance of critical friends. Each of these findings is drawn from the data provided by residents and new educators who entered the profession through a residency model, and these findings provide insight into program development.

Complexity of Collaboration

Teacher educators have long argued that effective preparation and successful K-12 schools require reciprocal partnerships between university based teacher preparation and school districts, in which they combine efforts, resources, and expertise to build a teaching force that can meet the needs of all students (Goodlad, 1994). The residency model is designed to place these collaborations at the forefront, as PK-21 partners communicate and collaborate regularly regarding logistics, embedded methods courses, professional development, and support for the residents. The research on the implementation of the residency model illuminated the challenges of collaborating across institutions. Navigating the complexity of this teacher development model requires a collaborative commitment between the University and the Districts in

the preparation of teachers.

When analyzing data from early program implementation, a theme that surfaced related to differing definitions and practices surrounding the term “inclusive practice.” The term inclusion became the central focus of two discussions: being inclusive of all students within the classroom context, as well as considering how to be inclusive of the various school and university perspectives on working with students with individualized learning needs. One of the key examples of these discussions arose in placements. Many placements modeled inclusive environments aligning with the University and District visions for meeting the needs of all learners. In these placements, residents were able to make theory-to-practice connections and develop their skills and dispositions as inclusive educators. At the end of student teaching one candidate stated, “Teaching students in mixed-age settings and with different abilities really required that I take a student-centered approach to teach each student and not classes of students.”

In other placements, teachers demonstrated a theoretical understanding of inclusion, but struggled to put theory into practice, or displayed practices and perceptions that conflicted with the University and District definition of inclusive practice. At times, these placements proved challenging for residents who struggled with issues such as having to enact pedagogy that conflicted with their commitments and feeling frustrated over the ways teaching can work against authentic inclusive practice. One resident stated, “This semester I was challenged by the philosophy of my first cooperating teacher’s philosophy. She did not take on the same philosophy that I do, that I learned. Yet I grew in a way of using flexible thinking in order to do what is best for the students.”

While candidates gained valuable experiences in all placements, the research on the residency model illuminated the importance of identifying placements where candidates experience alignment between the theory and teaching of inclusive education. When grappling with the question of whether to prepare pre-service teachers for the ideal or the reality, the partners decided it was key to prepare pre-service teachers for the ideal, while also acknowledging the challenges inherent in this work. One of those challenges in the current context of education is identifying and supporting enough mentors who can model the ideal in inclusive practice. It became clear that the various groups needed to collaboratively consider how to ensure all parties were working with shared understandings and communicating across professional roles. The research

team also recognized that the residency program could be leveraged to develop more intentional placement classrooms by supporting in-service teachers in their professional development. As a result of these findings, University faculty and teachers and administrators worked to create shared definitions of inclusive teaching and learning and implemented additional structures for placements.

Through data from residents, alumni, and faculty, it became clear that the success of a residency model required finding a difficult balance between providing flexibility for a variety of partners and implementing clear expectations and structures for the residents. Data analysis illustrated that each partnership required its own unique relationships and structures. In larger districts, our collaborative structures often start with central office administration and require different communication tools in order to reach principals and cooperating teachers. In smaller districts, principals have been involved in conversations from the beginning, and they are often active in communicating expectations with teachers.

As we have continued to expand and grow the residency model, University faculty have recognized a few consistent structures and expectations that are key to successful partnerships, and other elements that require flexibility. Districts, principals, cooperating teachers, and residents are provided with a handbook that includes goals for all parties, definitions for roles, and expectations for each constituency. This document was developed collaboratively and will continue to evolve. All principals, cooperating teachers, residents, and involved faculty participate in a residency orientation each summer to build relationships, define shared visions of inclusive practice, and discuss expectations. The processes for communication, logistics, scheduling and placements take different forms for each district in response to their structures and systems. At our small institution, this sort of personalized approach to each district is manageable. But in terms of decreasing resources for teacher education programs (Zeichner & Pena-Sandoval, 2015), larger institutions will need to consider how they can develop flexible collaboration structures.

Systemic Perspectives

While traditional teacher education candidates spend extensive amounts of time in classrooms, data analysis indicated that for resident teachers, spending an entire year as an employee of a particular school environment led to a different and deeper contextual understanding

of the impact systems-level decisions have on teaching and learning in the classroom. Residents regularly participated in school-based experiences beyond field work prior to the student teaching semester; examples included participating in professional development, providing supervision during recess duty, assuming instructional responsibilities for individual students or small groups, and participating in parent teacher conferences across the academic year. Many paid residents noted that they were able to participate more fully in these school activities because they did not need to juggle part-time work outside of the experience.

Analysis of the data revealed that through these school and district experiences, residents understood factors that impact teaching and learning at a classroom level and at a broader school and systems level. One resident stated:

I understand the intricacies of decision-making. I went to board meetings; we were in the district office. We saw a line of decision-making. Granted, it was a small district, everyone was connected to everyone. We were aware of all of the things that were impacting our classroom.

A cooperating teacher also emphasized the ways the broader perspective on multiple classrooms deepened residents' experiences when stating, "Quite often, the residents I worked with would reference their experiences in other classrooms/schools in the district as part of their processing and reflection. These contexts helped them bring more meaning to their personal philosophies and decisions they made with all learners."

Another resident reflected on the relationships they were able to build with students and teachers and the way that contributed to a wider systemic understanding:

One specific challenge of student teaching was dealing with the emotions that come from working at a Title 1 school as summer approaches. Most of those children would not get 3 meals a day and some would be put in unsafe situations. That was tough to swallow and navigate. Had I not been at the school for a whole year and grown in my understanding of those systems, I don't know how I would have handled it. The great support of fantastic CT's was also amazing in those times. The relationships I built with my CT's was fantastic. I will actually see one for lunch tomorrow.

The residency model provided opportunities for candidates to experience teaching from a classroom and

a systems perspective, which allowed for a more global understanding of curricular and structural decisions.

The carry-over of the systems perspective from the residency program to the early induction years was evidenced in several ways, proving to be a challenge in some instances and a benefit in other times. Candidates consistently noted a higher sense of teacher efficacy in the residency year than in the first year of teaching. Often, their efficacy was related to struggles navigating a system that did not align with their philosophical beliefs. Yet many alumni noted increased confidence in seeking out resources and support in order to address the mismatch of expectations. One alumni of the residency program said, "In my job now, I'm less afraid of my principal. . . Being a resident, I had a different confidence level."

Although the tension between systems and philosophy continued to be an issue for many new teachers, those who participated in the residency program had many examples of the ways they have learned to navigate the tension. As one noted:

I feel very strongly about allowing students to demonstrate their learning in whatever way works best for them. That does not always align with the district rules and regulations, though. We are still required to give common math assessments. What I have been doing as a way to sort of allow students to demonstrate their learning is to talk through their assessments with me and they will sometimes write down their thinking or if they need a bit more guidance I will write for them. I have seen great success with this as students are able to be successful and show their understanding without the anxiety and stress that can impede them from starting or completing their assessments in the past.

This example demonstrates how early career resident alumni were able to modify district-level requirements in ways to support the learning of individual students within their classrooms.

Longitudinal data show that over time, early career teachers who completed the residency program were actively involved in school and district learning communities and committees. They participated in activities that provided them with the opportunity to advocate at a systems level for the individual learning needs of their classroom students. They engaged in larger systemic conversations about inclusive practice and personalized learning with national organizations

via conferences and social media. Through these larger conversations, the teachers engaged in advocacy for all students beyond the walls of their classrooms.

Theory to Practice Connections

During the residency semester(s) prior to student teaching, candidates work in schools each day while also completing university coursework. A key finding in the data indicates this model as supporting preservice teachers' abilities to make theory to practice connections. One resident stated:

Being in the school and in class during the semester allowed me to see and experience new things and then I could bring it back to class and process it in class. It was great to be in class and in the classroom to make the connection between theory and classroom. It helped me see how to put things in action across a variety of settings.

The opportunity for residents to be simultaneously working in schools and completing coursework on campus allowed them to examine theory and practice with authentic experiences and examples. A resident noted the impact of becoming a resident, "Being paid caused me to give more attention and dedication to my position as a resident because the district had invested that much more in me up front. At the time, it seemed like my growth as a pre-professional was an important priority for the university and the district as a result." As residents, they were deeply invested and took ownership over their role as a formal employee within a school.

As first year teachers, the resident alumni reported a sense of confidence in their theoretical understanding and practical application of inclusive practice and viewed it as a key component of their philosophy. They cited three aspects of the residency program as instrumental in enhancing their theory to practice understanding. First, they had a full-year in schools to gain teaching experience. Through school activities such as parent teacher conferences, they had the opportunity to build relationships with students, staff and families. And lastly, through the residency program they had reflection opportunities with critical friends. A resident alum said,

The residency was the best learning experience I have been part of. With my colleagues (permanent staff and residents), I was able to create and engage in learning experiences that challenged me to grow as a person. All off the experiences I had as a resident are experiences I still draw from and reflect on to date, and I know I will continue to do so as I progress

forward in life.

One principal shared about a new teacher, she “truly understands that she has not taught something until a student has learned it. Her beliefs and philosophy are spot on!” The teachers articulated a sense of preparedness for the first year of teaching and feedback from their principals supported a strong theoretical foundation and its practical application.

An inductive theme that surfaced from the data is the cooperating teachers who worked with residents also noted the power of the residency model in helping them to connect theory to practice in reflective ways. One cooperating teacher described how working with a resident:

Gave me additional opportunities to pause, think about my practice and confirm my choices/beliefs or amend them. In addition, I often found myself thinking about what I was doing while I was doing it and wondering if it was a good example of inclusive practice for residents or not. Even as a naturally reflective person, having a resident helps me hold a mirror to myself.

The research team described this finding as making “theory to practice to theory connections.” The residency model supported preservice teachers’ abilities to connect the theory of their coursework to their practice in classrooms. Furthermore, working with resident teachers encouraged cooperating teachers to make connections between their classroom practice back to the theory of inclusive teaching and learning.

Importance of Critical Friends

Residents relied on the iTRP cohort to navigate the nuances of the school system and the responsibilities of a teacher. Residents expressed the advantages of processing experiences, sharing ideas, and contemplating the challenges of connecting theory to practice as they increased their capacity as teachers. In particular, the residents indicated the cohort provided a safe place for residents to debrief their experiences; they had the freedom to discuss mistakes without feeling negatively judged. One resident said:

I believe that the “tribe” of peers and professors that I worked with throughout really supported me through my student teaching experience. Having to work in an environment that was not a safe space to make mistakes and ask questions was hard for me to see growth within myself. Working within the residency program

helped me navigate through this time and these frustrations.

Data also revealed that throughout their first two years of teaching, and despite teaching in different locations, members of the residency cohorts engaged in ongoing conversations with each other, their cooperating teachers from the residency program, and university faculty.

One resident alum described these continued connections in the following way, “It has helped me to become more grounded in my professional identity and philosophies. It has helped me to reflect on things I am experiencing in my building and with other educators.” Through social media and face-to-face gatherings, the new teachers shared challenges, celebrations, and posed questions to each other. One resident commented: “I think... it gave us a network. It gave us people to go to during the first year. We could go to each other. [The cohort] formed that sense of community.” The critical friends (Costa & Kallick, 1993) identified through the residency provided a touch point for the new teachers as they navigated their environments. These findings suggest a cohort model supports pre-service teachers as they develop into critically reflective practitioners. One candidate described that without the collective reflection of the group, “It is harder to think differently and be proactive.”

Implications for Teacher Preparation

The themes that arose from this research have implications for the Inclusive Teacher Residency Program at our institution and more widely for our teacher preparation program. Candidates in our study indicated that their extended time and role in schools through the residency model helped them to gain a deeper understanding of systemic perspectives, clearly connect theory and practice, and develop a cohort of critical friends. The foremost implication is that this teacher residency model is effective through the broad perspective it affords candidates and the sustained immersive experiences that enhance relationships and theory to practice connections. Further, all of the themes that arose from the residency model had implications for our teacher preparation program.

While we have long partnered with schools and school districts, the ITRP created a sense of shared ownership between the University and the Districts in the preparation of pre-service teachers. Our experiences navigating the complexity of these partnerships led us to create structures for collaboration as we expanded the residency model, and also helped us continue and develop our tools related to dynamic and fluid relationship

building and flexibility in our structures and processes in order to meet the unique needs of all partner districts. Ultimately, authentic partnerships between districts and universities offer significant benefits to all. However these relationships are constantly evolving and require institutional support through time and resources.

This Inclusive Teacher Residency Program also highlighted the need to develop all teacher candidates' understanding of schools and school districts and to provide tools to navigate those systems. This research revealed a need for our program to more explicitly support students in the development of tools and professional sustainable identities that are prepared to understand, question, and negotiate increasingly complex and intensifying contexts of teacher work under the pressure of market-based reform movements (Au, 2007; Darling-Hammond, 2004; Kumashiro, 2015; Zeichner, 2010). As a result, we shifted our coursework to incorporate a course that examines educational policies, systems, and professional identity. This course is taken the semester prior to student teaching so all candidates have prior experiences upon which to reflect as they prepare for their sustained engagement as a student teacher.

The research findings of this study further supported the well-documented notion that theory to practice connections are key to teacher development. The theory to practice connections led to a program redesign to embed methods course in K-12 schools to increase opportunities for candidates to connect theory to practice. This allowed all of our candidates, even those not in the residency program, to explore methods content in a clinical context and strengthened partnerships with area schools.

Critical friend communities proved important to candidates, and our Department of Education continued the Induction Professional Learning Community (iPLC) model to continue to bring alumni back together to

support and learn from each other. As a University, we offered a space for an alumni-lead meeting four to five times a year. Faculty and mentors participated to support the conversations. While candidates were provided with induction support through their districts at the beginning of their careers, we found that the district sponsored support focused on onboarding, whereas the iPLC model provided a safe place for new educators to come together across districts and schools and discuss their work and challenges. Ultimately, it is our hope that this community will enhance effective teaching and learning and support retention in the field of education.

CONCLUSION

The analysis of the Inclusive Teacher Residency Program provides key insights into inclusive teaching practices and developing teacher candidates who serve as advocates of students with disabilities. The design and implementation of the ITRP gave pre-service teachers opportunities to gain extended teaching experiences, connect theory and practice, and develop a systemic understanding of inclusive education. The residents enter classrooms with a belief that all students can learn, and are committed to providing an environment to meet the needs of all students. These findings add to the literature base identifying reciprocal partnerships as a key feature of effective teacher preparation (i.e., Goodlad, 1994; Zeichner & Liston, 2010). This analysis provides structures for enhancing collaborative relationships in ways that promote critical dialogue and mutually beneficial exchanges. While the findings are based on one particular case study, the implications may be generalizable to other residency models. These findings invite all teacher education programs to implement innovative practices that move teacher preparation forward in ways that engage K-12 students who are often marginalized through deficit thinking and approaches in schools and communities.

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How do Teacher Candidates Perceive Disposition Assessment and Development?

Pattie Johnson
Megan Civil
Gina Almerico

Abstract: The recent push seen in accrediting bodies and in evaluation instruments for teacher intern dispositional accountability has required teacher preparation faculty to create sound measures of disposition for assessment and remediation. As a result, teacher preparation faculty have now begun to recognize the need to teach dispositions to enhance demonstration of relevant behaviors in future teaching experiences. This article describes the impact of teaching options for professors including peer-assessment, professor assessment, peer nominations and individual discourse. Results suggest students do not benefit from self-assessment, value professor feedback and want feedback to be direct.

***About the Authors:** Pattie Johnston is an Associate Professor of Measurement and Research at The University of Tampa. She has chaired the Department of Education and currently directs the graduate program in Curriculum and Instruction. Megan Civil supervises the final practicum for secondary students at The University of Tampa. Gina Almerico is a Professor of Education at The University of Tampa. She serves as the Director of Educator Preparation Program review.*

Keywords: disposition assessment, teacher candidates

HOW DO TEACHER CANDIDATES PERCEIVE DISPOSITION ASSESSMENT AND DEVELOPMENT?

There has been a recent push for the assessment of teacher candidate dispositions in internships. Candidate accountability of disposition during internship has direct roots in recent mandates from the *Council for Accreditation of Educator Preparation* (CAEP, 2013) requiring assessment using psychometrically sound measures. A major reason for assessing dispositions in internship is that dispositional concerns can be identified, remediated and transferred into subsequent practice. The identification, formative assessment and remediation may also apply to teaching candidates from non-CAEP accredited preparation programs because candidates are accountable for dispositional behaviors in major summative evaluations (Marzano, 2013; Danielson, 2013).

This accountability is not easily met. CAEP (2013) accreditation mandates have required the teacher preparation program researchers to develop valid and reliable measures of disposition. Development of such

a measure is effortful and time consuming. The AERA, APA and NCME (2014) suggest guidelines to follow when creating sound measures.

Psychometrically sound measures begin with a collective definition of the construct. Disposition has been defined as the personal qualities or characteristics that are possessed by individuals, including attitudes, beliefs, interests, appreciations, values, and modes of adjustments (Taylor & Wascisko, 2000). The Interstate Teacher Assessment and Support Consortium (InTASC, 2013) used the following descriptors to encompass the concept of dispositions: adopts, appreciates, believes, is committed, has enthusiasm, persists, realizes, recognizes responds, seeks, is sensitive to, understands, and values.

Researchers then use definitions to validate behavioral indicators to be rated by experts as representative aspects of disposition. These indicators can then be turned into assessments by basing rubrics or Likert scales on the identified dispositions. The assessment may then be given to multiple raters of the same candidates to estimate the inter-rater reliability of the scale. The measurement is then able to be used as a

psychometrically sound assessment of teacher candidate disposition.

TEACHING DISPOSITIONS

Schussler (2006) challenged teachers to consider a greater purpose beyond assessment of dispositions required for evaluation accountability and accreditation. He suggested teacher preparation programs define professional dispositions and focus on the scholarship of teaching and learning related to disposition. In essence, study, teach, practice and apply them. Diez (2007) suggested that a key idea to keep in mind is disposition development will deepen over time when exposed to multiple methods of assessing and teaching them in the curriculum. This research provides an impetus for schools to build experiences that nurture disposition development especially for newer teachers. Breese and Nawrocki-Chabin (2007) referred to dispositions as the educational heart of teaching that required systematic development and assessment in teacher training. They challenged teacher educators to structure curriculum in a way that allows candidates to study the works of researchers such as, Novak and Purkey (2005), Noddings (1986) and McCombs (1998) to develop a deep understanding of the importance of dispositions and student-teacher relationship.

RESEARCH QUESTION

These above combined findings suggest that disposition teaching informed by formative assessment be purposefully integrated into educational curricula. Creating psychometrically sound assessments and teaching dispositions are worth the effort as long as substantive and transferable learning is occurring. Thus far, studies have been examining the value of dispositions focused on relationships between well-disposed teachers and student outcomes (Notar, Riley, & Taylor, (2009). This study is asking another question. We want to know if the assessment and teaching of dispositions is thought to be of value to those candidates in teacher training programs.

Blazer and Kraft (2017) suggest that learning is demonstrated by cognitive and behavioral shifts. The purpose of this study is to examine possible shifts associated with effective disposition teaching from the learners' vantage point. Specifically, we wanted to know if there were (a) perceived benefits as a result of the teaching process (b) cognitive changes about what the dispositions are as a result of teaching and (c) behavioral changes as a result of teaching.

METHOD

Procedure

Teacher candidates in a university cohort enrolled in undergraduate education coursework participated in disposition teaching activities (N=13). Good teaching, according to Palmer (1998) requires self-knowledge, the ability to look inward and recognize ones strengths and areas for growth in both the professional and personal arenas. Candidates who can self-assess and openly receive the assessment of others demonstrate the ability to observe, analyze, and judge his or her performance based on criteria determined through the assessment tool (Diez, 2007). This candidate can then use this information to develop a plan to make improvements as needed. Given this finding, students at the semester end were given a psychometrically evaluated assessment and asked to self-assess their selves in nine dispositions identified (Almerico, Johnston & Wilson, 2017). Additionally, they were asked to nominate peers who had perceived strengths and weaknesses in each of the dispositions. Each student scheduled an individual appointment to meet with two full time professors who each taught the same cohort to discuss the self-ratings and nominations. Each meeting lasted approximately 30 minutes.

Instrumentation

Almerico, Johnston and Wilson (2017) developed a valid and reliable assessment of teacher disposition. The dispositions in the instrument provides candidates with clear descriptions of the behaviors that lead to success in the profession. The assessment developed, the Educator Disposition Assessment (EDA), has been used to assess candidate dispositions at program admission and as they traverse through the program. It also has formative use for new teachers as an affective navigational tool in their new school setting because the disposition categories included in the tool are aligned with Danielson et.al. (2009) and Marzano and Brown (2009). These are two major evaluation instruments used within the profession that include dispositions in teaching.

RESULTS

The results in this study are based on student reactions to the research questions asked about their experience with the self-assessment, peer nominations and professor conferences.

Effective Process

The response to the overall process was very positive. However, the self-assessment was not reported to be useful. Students indicated that their ratings were not accurate because they did not want to appear to be problematic to the professor or classmates. Feedback from the professors was important. Pre-semester and post semester assessment by the professor was suggested. Another suggestion given was to provide the candidate with more elaboration on negative nomination information. The candidates also indicated the professors be more direct and explicit with their feedback and to include professor ratings comparing them to each other and to a master teacher versus compared to each other.

Students robustly reported to value information gained from peer nominations. Specifically, they said gaining others' perspective for teacher candidates promoted the critical analysis of their own dispositions. The candidates in this experience perceived peer and professor input as nonthreatening and helpful to self-reflection. Most seemed amenable to discussing perceived areas for dispositional growth as a result of this experience.

Cognitive Changes

There was evidence of notable cognitive change as a result of the meetings. As a recent transfer from a business major to education, one teacher candidate discussed the implications of her overall communication skills and her reaction to feedback from peers and professors. *"After our meeting, I did experience shifts in my thinking. I thought more about not flying under the radar. I was more aware about my participation in class and communicating more with my classmates."*

Another student discussed a broad shift in her thinking. She indicated progress in evaluating her performance within teacher preparation, *"Before the conference, I was not very confident in my abilities (compared to members on the cohort). However, after we met, I realized that not only do my peers have confidence in me, but so do my professors... I shifted my thinking to belief that I am a strong candidate in the program."*

While several teacher candidates demonstrated immediate shifts in thinking and ah-ha moments when discussing overall disposition indicators and response to feedback, questions remained. Would the awareness and attitude change sustain long term cognitive change? Would behavioral changes then result from the increased awareness?

Behavioral Change

Candidates were forthright in their feedback and offered insight into how this process affected their thinking about dispositions and consequently the behaviors impacted by them. Behavioral changes were reported by many of the participants. One example of a behavior change observed by a teacher candidate was shared. This candidate is a mixed race female, who identifies herself as a lesbian who was adopted and reared by two mothers. In response to the first question regarding mental shifts, she replied, *"Before the experience, I don't know that I really realized just how much my passion for diversity and inclusion affects my behavior. After the experience, I can definitely see how obvious it must be to others. I don't see this as a bad thing, but others definitely might given how unwavering my thinking is"*. Her reflection to the second question where she described instances where she acted differently as a result of the experience follows: *"During one of my peers' read alouds in the Children's Literature course, she defined a son as when a mommy and daddy have a boy child. I respectfully asked her to be careful using language about families. By saying a mommy and daddy she excluded a huge number of families like same-sex families, single parent families, and guardians"*. The change of behavior was obvious to the candidate. As she shared this story with her professor in conversation after the event, she said the peer feedback she received helped her temper her response which prior to this experience would have been more of an angry outburst as opposed to the respectful dissent she demonstrated.

In a self-described account where behaviors have changed, our transfer student notes, *"As a result of the disposition exploration, in class I started to speak up more and voice my opinions. I also started to talk more in our group chat and make an effort to show my personality to avoid being "the forgotten one" or seen as flying under the radar."*

IMPLICATIONS

Implications of this study are applicable to professors trying to assess and teach dispositions in teacher preparation programs. One useful implication is the cautious use of self-assessments because of the reported lack of value. Professors in teacher preparation programs may want to omit this activity and substitute a more meaningful one. An idea provided in student feedback was that professors could substitute the pre-semester/post-semester assessment. Peer nominations were seen as very helpful so this activity could be integrated into the teaching of dispositions.

Perhaps the most relevant suggestion was that professors need to be “stiffer” with their feedback to students. This tough feedback can be uncomfortable for a professor to deliver especially if there are multiple issues associated with one student. This immediate discomfort must be balanced with the helpfulness in the long term. That is, if dispositional problems do not get remediated, the long term cost to the candidate may be much greater than the immediate pain.

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Effects of Microteaching on the Pre-Service Teachers' Teaching Competance - A Case in Bhutan

Sangay Wangchuk

Abstract: Microteaching, an efficient teacher training technique, provides teachers an opportunity to enhance their teaching competencies. This study explored the effects of microteaching on the teaching skills of the pre-service teachers at a college of education in Bhutan. The study pursued a mixed mode of research methodology adopting a quasi-experimental pretest-posttest design. A sample of 64 B. Ed second year students were selected to participate by clustered random sampling. The students received microteaching guidance from a team of four tutors including the researcher. The data source included teaching skills assessment, assessment of the analysis report and students' reflective journal. After performing satisfactory validity and reliability checks, the quantitative data assembled from pretests and posttests and reflective journals were analyzed and interpreted using inferential statistics t-test with $p < 0.05$ level of significance, mean, standard deviation and descriptive statistics frequency. Qualitative data was analyzed based on the grounded theory of Strauss and Corbin (1998). Analysis from the teaching skills assessment, analysis report and student's reflective journal revealed that microteaching not only improved the teaching skills of the pre-service teachers but also enhanced their confidence in lives.

About the Author: Sangay Wangchuk is a Lecturer at Royal University of Bhutan

Keywords: microteaching, analysis report, teaching skills, pre-conference, post-conference, feedback

INTRODUCTION

The current issue of the perceived decline in the quality of education in Bhutan has induced a change in policy. The ministry of education introduced Dr. Spencer Kagan's transformative pedagogy on cooperative learning structure in Bhutan. The driving force behind the new pedagogical orientation was that the ministry felt conventional teaching method, practiced across the schools in Bhutan, failed to take care of learning abilities of the students (Wangdi, 2016). This brave assertion, although without any empirical evidence, seemingly challenged the current pedagogical orientation and the art of teaching which is certainly attributed to pre-service training avenues offered by the two teaching colleges; namely Samtse College of Education (SCE) and Paro College of Education (PCE). Almost all the teachers received their pre-service training from the two teaching colleges.

The paucity of research studies to validate the effectiveness of pre-service training program offered at these colleges has encouraged the ministry to embrace transformative pedagogical practice, adopted from Dr Spencer Kagan's collaborative learning structures,

overtly. Hence an immediate study on the effectiveness of pre-service training program at the two colleges of education is imperative to validate or offer a varied perspective while such initiatives, as aforementioned, are apparently being pursued, nationwide.

Apparently, PCE and SCE offers multiple modules including Learning Process, Introduction to Research Methodology, Creative Arts, Teaching Skills, Teaching Strategy, Curriculum Studies, to name few, in order to prepare the pre-service teachers. However, the art of teaching cannot be determined by the students' performance in these modules. "The classrooms cannot be used as a learning platform for acquiring primary teaching skills" (Remesh, 2013; p. 158). A student who excels in these modules may not necessarily possess the best teaching competence. Therefore, a study on the core skill training practice like the microteaching would guarantee a valid result that ought to determine the effectiveness of the pre-service teachers' training programme at the two colleges of education, in Bhutan. The current study on the 'Effect of Micro Teaching on the Pre-service Teachers' Teaching Competence – a Case in Bhutan' will offer a broader perspective to multiple stake holders, at large.

LITERATURE REVIEW

Definitions of Microteaching

Microteaching is an efficient teacher training technique that plays a pivotal role to enhance the teaching skills of the pre-service teachers. It is a technique aiming to prepare teacher candidates to the real classroom setting (Brent & Thomson, 1996; Uzun, 2012). It is considered an innovative approach to preservice teacher education training since its initial introduction in the early 1960s (Ostrosky et al, 2013). According to Amobi (2005) microteaching is a technique employed to train pre-service teachers to master specific skills in a teacher education program. Similarly Uzun (2012) describes it as a teaching technique especially used for teacher trainees to train them systematically by allowing them to experiment important teacher behaviours. Ananthkrishnan (1993) defines it as:

A vehicle of continuous training process applicable at all stages not only to teachers at the onset of their career but also for more senior teachers who are already in the teaching field (p. 143).

Nowadays in many teacher education programs, the use of microteaching has expanded from its original focus of helping preservice teachers to master discrete teaching skills, to giving them the complete teaching experience (Amobi, 2005). Through the microteaching experience both pre-service and in-service teachers rectify specific errors and excel their ways of teaching.

Significance of Microteaching

Microteaching is an effective means of improving teaching skills that shape pre-service teachers' teaching skills. With the proven success among the pre-service and in-service teachers, it helps to promote real-time teaching experiences (Remesh, 2013). It focuses on sharpening, developing and enhancing the learner teachers' confidence. With the help of microteaching practice, teacher candidates experiment and learn teaching skills by breaking them into smaller parts and varied components (Uzun, 2012). The core skills of microteaching such as presentation and reinforcement help pre-service teachers to improve their teaching skills to the maximum extent. He and Yan (2010) in their study on exploring authenticity of microteaching in pre-service teacher education programmes discovered microteaching as an efficient tool for the pre-service teachers' professional development.

Fernandez (2012) in his study on 'Learning Through

Microteaching Lesson Study in Teacher Preparation' found out microteaching as an efficient tool in improving the teaching skills of the pre-service teachers. The study investigated microteaching lesson study (MLS), an experienced based on a successful Japanese lesson study. A qualitative analysis of various data sources was conducted, demonstrating the learning and perceptions of 36 prospective teachers to be very beneficial. Beyond providing teaching experience, the MLS facilitated enhancement of their understanding of reform-oriented teaching and knowledge of subject matter through collaboration with peers and feedback from an instructor. Feedback is found to be the key element in enhancing overall teaching competence of the teacher candidates.

The Role of Feedback in Microteaching – Pre and Post-conference

Microteaching provides skilled supervision with an opportunity to accommodate constructive feedback (Ananthkrishnan, 1993) and feedbacks provided during the pre-conference and post-conference plays a pivotal role in enhancing the pre-service teachers' skill by enabling them to pursue a reflective teaching experience. Using microteaching and feedback helps educators become better teachers (Re, 2008). Microteaching scales down the complexities of real teaching as immediate feedback can be sought after each practice session (Remesh, 2013). These feedbacks would enable them to reflect on their strengths and rectify their errors, thereby enhancing their overall teaching skills. This methodological process also offers them opportunities for discovering and reflecting on both their own and others' teaching styles, at the same time enabling them to learn about new teaching techniques (Wahba, 1999). While instilling teaching skills in pre-service teachers through such practice, reciprocal negotiation of the students actively presenting and watching about the performances make great contribution to the acquisition of the skills (Taşdemir, 2006; Uzun, 2012).

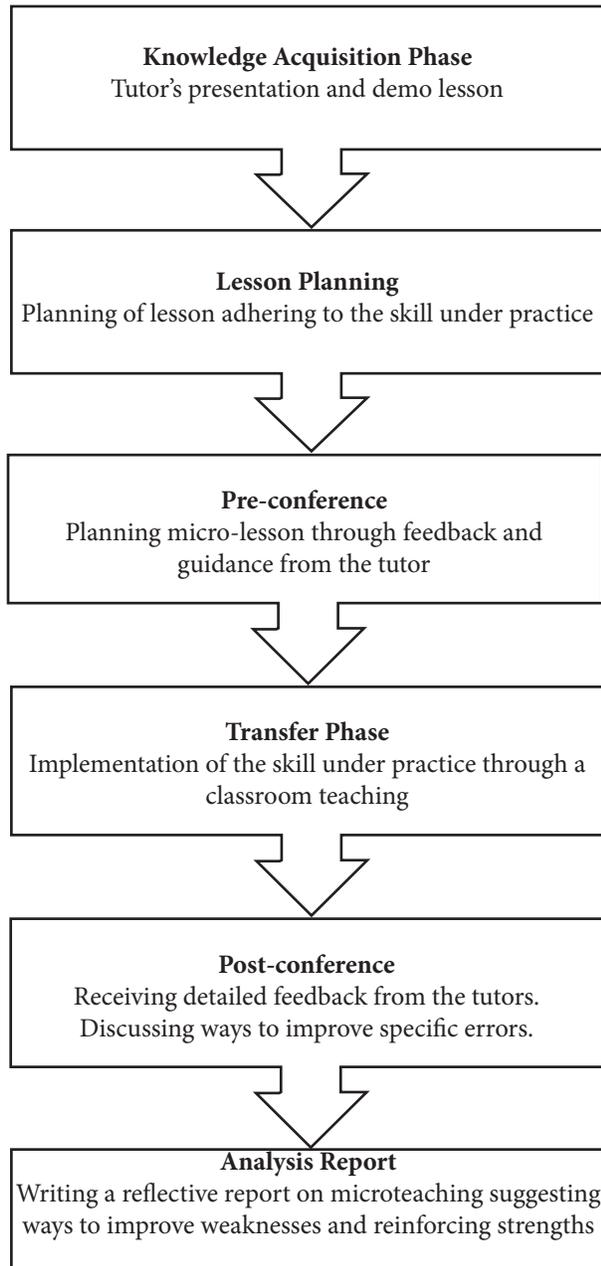
THE CONCEPTUAL FRAMEWORK

According to Choeda and Kinley (2013), teaching skill is a professional module offered at the two colleges of education in Bhutan to develop the pedagogical knowledge and skills of the student teachers. Owing to its significance in enhancing the teaching skills of the teacher candidate, microteaching, as a part of the teaching skill module, is practiced at the two college of education in Bhutan.

Microteaching at SCE

Microteaching, at SCE, is practised as an integral part of the teaching skills module. The main emphasis is placed on the performance aspect of the skills in microteaching situations, and to facilitate the professional development process in the art of teaching. It aims at strengthening the pre-service teachers' professional development through constant self-analysis/reflection, and feedback through observation in a microteaching situation (Dukpa, et al, 2013). The process of microteaching involves six phases as shown in figure 1.

Figure 1: SCE Microteaching Model



one skill in each microteaching session in a sequential manner. As shown in figure 1, the SCE microteaching model adheres to six varied phases. In the first phase, a team of microteaching experts (tutors) take turns to present each of the core teaching skills with a showcase of a demo lesson. This is the knowledge acquisition phase where the learners observe the skill, analyse its objectives and methodology. Once the learners have acquired enough information and understanding, they plan a lesson and meet the tutors for pre-conference.

During the pre-conference, the tutors and learners explore the superior ways to teach effectively. The tutors provide corrective feedback and guide the learners adhering to the skill under practice. This phase eventually leads to the transfer phase where the learners implements the core teaching skills through a classroom teaching. The tutors will cautiously observe, analyse and write down the strengths and weaknesses of the micro-teacher in the skill assessment form. During the post-conference the tutors will initially ask the learners to reflect on their microteaching. Subsequently, the tutors provide constructive feedback suggesting ways to correct specific errors and reinforce their strengths. The final phase involves analysis report writing where the learners write a detail report of their microteaching. This is a reflective piece which enables the learners to make commitments through a reflective writing.

OBJECTIVE OF THE STUDY

1. To investigate the effect of microteaching on pre-service teachers' teaching skills
2. To study the change in pre-service teachers teaching competence using analysis report writing exercise

MATERIALS AND METHODS

Research Design

The study pursued a mixed mode of research methodology adopting a quasi-experimental pretest-posttest design and a reflective journal with an aim to assess the effects of microteaching practice on the teaching skills of the pre-service teachers. According to Ponce and Pagan-Maldonado (2014) "a mixed method study is research intentionally combining or integrating quantitative and qualitative approaches as components of the research (p. 113). Similarly Johnson and Onwuegbuzie (2004) defines mix method research as the class of research where the researchers combine quantitative and qualitative research technique, methods, approaches, concepts or

languages into single study. They justify that mixed method research are likely to provide superior research findings and outcomes.

Sampling:

The researcher adopted cluster random sampling to select 64 pre-service teachers from B. Ed second year secondary program. Microteaching, as an integral part of the teaching skills module, is practiced during the second year of the B. Ed secondary program at SCE.

Research Instrument:

Intervention Instruments:

i. Demonstration of Eight Teaching Skills by the Tutors

Four tutors, including the researcher, presented instructional lectures on the nine teaching skills practiced at SCE. The nine teaching skills practiced during the microteaching sessions are Introductory Procedures & Closure and Classroom use of Language, Giving Instruction for Organizing Learning Activities, Instructional Objectives & Lesson Planning, Questioning and Handling Pupil's Responses, Use of Teaching Learning Materials, Stimulus Variation: Interaction Variation, Teaching of Concepts and Generalizations, Teaching of Skills and Procedures and Teaching of Values and Attitudes. The tutors also performed demo-lesson sessions for these teaching skills.

ii. Presentation on Reflective Analysis Report Writing by the Researcher

The researcher, also the co-tutor for micro teaching, taught the participants how to write a reflective analysis report. The researcher also showed a sample of a good analysis report and discussed in detail with the participants.

iii. Pre-conference, Post-conference and Microteaching Observation

Before performing their microteaching on varied teaching skills, participants were assigned to meet their respective tutors and discuss their lesson plans in detail. The tutors provided feedbacks and guidance. They also planned their microteaching lessons with support and guidance from the tutors. The participants then performed their microteachings and the respective tutors observed their microteaching, listing down their strengths and weakness in the teaching skills observation form. As soon as the microteaching was

done, participants had to meet the tutors for post-conference where the tutors provided relevant feedbacks and discussed the ways to improve specific errors and reinforce the strengths.

Data Collection Instruments:

The data was collected by employing the following tools:

i. Teaching Skills Assessment (Pretest and posttest)

Pre-test and post-test of classroom teaching using a standard assessment tool that incorporated all the components of teaching skills was conducted. Each core teaching skill was assessed out of ten marks. The pre-test was conducted before the first microteaching session and the post-test was conducted after the final microteaching session. The assessment tool incorporating the nine components of teaching skills are shown in table 1.

ii. Assessment of the Reflective Analysis Reports (Pretest and posttest)

The researcher taught the participants how to write an effective analysis report. A standard rubric to assess the analysis report was developed. The first analysis reports written by the participants were assessed and compared to the final analysis report which were assessed based on the same standard. The two reports were compared and analysed using paired sample t-test.

iii. Reflective Journal

The participants were asked to maintain three reflective journals. The guidelines to write the reflective journal were provided. The participants maintained the first reflective journal after the first microteaching session. The second reflective journal was maintained after the fourth microteaching session and the final reflective journal was maintained after the microteaching session on the ninth skill.

VALIDITY AND RELIABILITY OF RESEARCH INSTRUMENTS

Validity: The research instruments were validated by 3 experts including two senior professor/researchers, and a senior micro teaching expert from Samtse College of Education, Royal University of Bhutan. Item Objective Congruence (IOC) of the instruments was calculated to see if the items aligned with the learning objectives.

Table 1: Assessment form for assessing the teaching skills during the microteaching

SI No.	Teaching Skills	Total Marks	
		Score	Scored
1 st Skill	Instructional Objectives & Lesson Planning	10	
2 nd Skill	Introductory Procedures & Closure and Classroom use of Language	10	
3 rd Skill	Giving instruction for organizing learning activities	10	
4 th Skill	Questioning and handling pupil's responses	10	
5 th Skill	Use of Teaching Learning Materials	10	
6 th Skill	Stimulus Variation: Interaction Variation	10	
7 th Skill	Teaching of Concepts and Generalizations	10	
8 th Skill	Teaching of Skills and Procedures	10	
9 th Skill	Teaching of Values and Attitudes	10	
Total		90	

IOC was computed for the achievement test and analysis report.

IOC result index ranges from -1 to +1. If the rating is +1, it means that the item clearly matches stated objectives. If the rating is 0, it means that item is unclear or not sure whether the measures meet the objectives or not. If the rating is -1, it means that the item clearly does not match objective or it ensures that the measures do not meet the stated objectives. The value for any item is supposed to be 0.67 to 1.00. Each item is acceptable and considered valid when the index in the IOC range is 0.67 to 1.00 and unacceptable if the range is below 0.67 to -1. The formula for calculating the IOC is $\frac{\sum r}{n}$ where; 'r' is the sum of the scores of individual experts and 'n' is the number of experts.

Reliability: The achievement test was tried out with a section of B. Ed third year pre-service teachers who were apparently undergoing teaching practice at varied middle and higher secondary schools. This group of students had already practiced microteaching during their B. Ed second year secondary program. Same teaching skills assessment form was used for the reliability test group. Kuder-Richardson formula KR-20 was computed to find out the reliability coefficient of the learning achievement test. It was estimated at 0.79.

RESEARCH PROCEDURES

After performing satisfactory validity and reliability checks, a pre-test was conducted. The pre-test was conducted using a standard assessment form based on all the components of teaching skills. Over the period of five months, students were taught nine different teaching skills by the respective tutors. Alongside, the researcher briefed the student the guidelines to write reflective journal and analysis report. The first analysis report of each student was assessed using a standard assessment form and the marks were recorded. At the end of the treatment, post-test for the teaching skills was conducted and the final analysis report was also assessed using the same assessment form.

DATA ANALYSIS AND DISCUSSIONS

Analysis of Teaching Skills Assessment and Analysis Report Test Scores

The comparison between the pretest and posttest scores were done by conducting paired sample t-test to assess and compare the teaching skills and analysis reports of the students after the microteaching practice. The inferential statistics t- test with p level of significance was used to infer the results.

Table 2: Comparison of Pretest and Posttest within the group (Paired sample t-test)

Group	Test	Mean	Mean Difference	Standard Deviation	Sig. (2 tailed)
Teaching Skills	Pretest	32.4	74.6-32.4=42.2	1.85	0.00
	Posttest	74.6		1.96	
Analysis Report	Pretest	14.8	23.5-14.8=8.7	1.98	0.00
	Posttest	23.5		2.02	

Figure 2: Comparison of Pretest and Posttest score of teaching skills within the Group

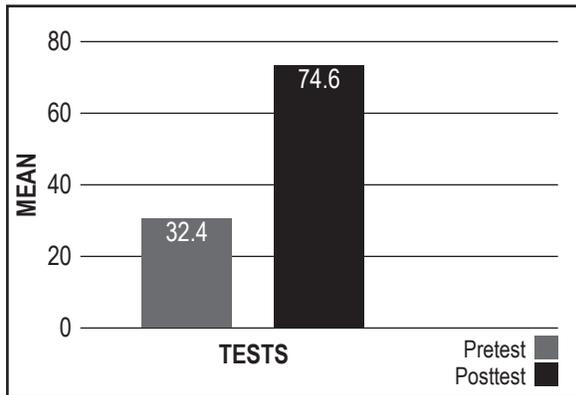
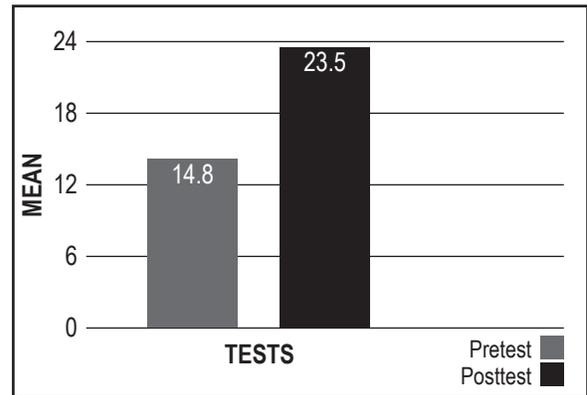


Figure 3: Comparison of Pretest and Posttest score of analysis report within the group



The comparison of pretest and posttest within the group for teaching skills assessment and analysis report was done by comparing mean, standard deviation and significance level P-value. From both the Table 2 and figure 2 it is apparent that in case of the teaching skills assessment, the mean of the pretest and the posttest scores of the participants were 32.4 and 74.6 respectively. The full mark of the test was 90. The mean difference of pretest and posttest was 42.2 resulting to the significance value (p) 0.00 which indicated there was statistically significant increase in the students' scores in the posttest when compared to the pretest. This indicated that the microteaching played a pivotal role in enhancing the teaching skills of the participants. The comparative difference in the marks scored during the evaluation of the teaching skill assessment is clearly depicted through a graphical representation in figure 2.

Similarly, in case of the assessment of the analysis report, it is evident from figure 3 (above) that the mean of the pretest and the posttest scores of the participants were 14.8 and 23.5 respectively. The full mark of the test was 30. It is clearly evident from figure 3 that the mean difference of the pretest and posttest was 8.7 resulting to the significance value (p) 0.00 which indicated that there

was statistically significant increase in the students' scores in the posttest when compared to the pretest. The improvement in the analysis report writing showed that students were able to reflect well on their teaching skills practice and write a good analysis report. The positive result on analysis report assessment induced a positive outcome in microteaching performance. Therefore, a distinct inference, through this analysis, is maintained that an improvement in the analysis report writing engendered a positive result on the overall assessment of the teaching skill performance. The figure 3, below, exhibits a positive difference in the pretest and posttest score of analysis report writing; therefore, explicitly validating the earlier inference.

Moreover, the analysis of the standard deviation assuredly validates the result of this study. A standard deviation is a statistic that describes the amount of variation in a measured process characteristic. Specifically, it computes how much data are concerted from the mean on average. A smaller standard deviation means greater consistency, predictability and quality (Wachs, n.d, Dorji, 2017 & Wangchuk, 2017). In case of teaching skills assessment, the standard deviation of the mean of pretest was 1.85 and that of the posttest was

1.96. Although the standard deviations showed a slight difference, because of the negligible difference (0.11) it indicated that the level of variation in scores of the pretest and posttest were almost similar. This further indicated that the learning ability of the students were similar, leading to a greater quality assessment. Consistency in the students learning ability engenders a valid outcome which is more reliable than inconsistencies observed in a sample group (Dorji, 2017).

ANALYSIS OF STUDENTS' REFLECTIVE JOURNAL

Data from students' reflective journals were analyzed using the grounded theory proposed by Strauss and Corbin (1998). The coding process included 3 level of analysis: open, axial and selective coding. In case of open coding, data obtained from the journals were systematically organized. When the data were identified and categorized, axial coding was used. Selective coding was used to categorize the data and interpret 3 core themes. The major themes concluded from the students' reflective journals were; 1) Gaining confidence, 2) Improved classroom use of language 3) Introductory Procedure and Closure. They are presented below.

1. Gaining Confidence

Majority of the participants noted that microteaching practice helped them in gaining confidence. Practicing varied skills of teaching with consistent support and guidance from the tutor has improved their confidence level and inspired them to teach better. They shared their common view that that the improvement in their confidence level has enabled them to organize effective instructional strategies and deliver effective classroom lessons. They also believed that microteaching experience has not only improved their classroom teaching skills but also their interpersonal skills which, they believe, shall play an instrumental role in their lives.

2. Improved Classroom Use of Language

Microteaching experience has enhanced one of the most important teaching skills "Classroom Use of Language" of the participants. Most of the participants agreed that their classroom usage of language has improved significantly because of the constant feedback from the tutor. The tutor ensured that participants practice the skill of effective classroom usage of language in every microteaching practice. Hence their speaking skills improved. Many participants realized the importance

of right choice of words, tone of voice and articulation in teaching. Respecting their students' opinions, empathetic response to inquiry and the values of "right speech" are the overriding skills which they learned through the microteaching practice.

3. Introductory Procedure and Closure

The skill to introduce a lesson by drawing students' attention, developing new lessons by relating it to the previous lessons, engaging the students in active learning participation and closing it professionally by revising the entire lesson was the most important skill that the participants learned through the microteaching practice. The participants mentioned that prior to the microteaching practice, they did not know how to introduce a lesson, let alone developing the lessons and closing the lesson in a professional way. Now some of the students even believe that they have apparently mastered the Introductory Procedure and Closure which is considered as an important skill that an effective teacher possess.

The conclusion drawn from reflective journals construed that microteaching had enhanced the overall teaching skills of the teacher candidates enabling them to gain confidence, improve their classroom usage of language and improve the most overriding teaching skill known as Introductory, Procedure and Closure.

CONCLUSION

The first objective of the study was "To investigate the effect of microteaching on pre-service teachers' teaching skills at SCE." In order to reap this objective a standard teaching skills assessment with a pretest and posttest design was employed. The posttest of the teaching skills assessment revealed that using micro teaching to enhance the overall teaching skills of the student teachers was very effective. The results of the mean, standard deviation and significant P-values generated by computing paired sample t-test explicitly showed that microteaching proved effective in enhancing the overall teaching competence of the pre-service teachers. There was a huge difference in posttest marks of the teaching skills assessment compared to its pretest as the average score in the posttest had increased by 42 marks compared to its pretest. Thus the primary objective of the study "To investigate the effect of microteaching on pre-service teachers' teaching skills at SCE" was achieved. The result was further reinforced by students' reflective journal where many students revealed that the micro teaching helped them mostly in gaining confidence,

improving their classroom usage of language and their mastery over the skill of “introductory, procedure and closure.”

The second objective was “To study the change in pre-service teachers teaching competence using analysis report writing exercise.” In order to reap the second objective a standard rubric to assess the analysis report was developed. The first analysis reports were assessed and maintained as the pretests and the final analysis reports were assessed and maintained as the posttests. The two reports were compared and analysed through a comparative statistical analysis using paired sample t-test. The mean difference of 8.7 explicitly indicated that the participants were able to reflect the strengths and weaknesses of their microteaching practice and thereby produce a good analysis report. Consequently, a significant increase in the posttest marks of analysis report writing was followed by a consequential increase in the posttest marks of the teaching skills performance. Therefore, a distinct inference, through this analysis, is maintained that an improvement in the analysis report writing engendered a positive result on the overall assessment of the teaching skill performance.

The findings of this study was similar to the findings of Benton-Kupper (2001) who in his study on ‘The Microteaching Experience: Student Perspectives’ concluded that microteaching experience was a very effective method of learning and mastering the art of teaching. Similarly Kilic (2010) concluded that microteaching showed a progress in teacher candidates’ teaching behaviors on the subject area, planning, teaching process, classroom management, communication and evaluation. Since the study found out that microteaching was effective in developing the pre-service teachers’ teaching competencies, the colleges of education are recommended to use microteaching as a pivotal tool in enhancing the overall teaching skills of the students. The colleges of education can make reference to this research findings in order to validate the effectiveness of the teaching skills module and offer a new perspective to the ministry of education and other stake holders.

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Technology Integration Attitudes and Practices among Early Childhood and Adolescent/Young Adult Pre-Service Teachers

Xiongyi Liu
Lan Li

Abstract: This study examines pre-service teachers' technology integration attitudes and practices during student teaching and whether such attitudes and practices are related to the specific age groups that they teach. Pre-service teachers in early childhood education (ECE; n = 82) and adolescent and young adult education (AYA; n = 84) completed a web-based survey. The results indicated that AYA participants reported more technology use in work-related communication and student learning activities, as well as more risk taking and effectiveness in technology use, whereas ECE participants reported receiving more support in technology use. There were no significant differences in either attitudes towards technology or the use of technology for administrative or instructional purposes. Implications and limitations of the findings are discussed.

About the authors: Xiongyi Liu, Ph.D., is an associate professor of educational psychology in the Department of Curriculum & Foundations at Cleveland State University. Lan Li, Ph.D., is an associate professor of classroom technology in the School of Teaching & Learning at Bowling Green State University.

Keywords: pre-service teachers, technology integration, attitudes and beliefs, early childhood education, adolescent and young adult education

INTRODUCTION

There is vast research evidence that well-planned and structured uses of technology have great potential to transform education (e.g., Fisher, Exley, & Ciobanu, 2014; Sivakumaran, Garcia, Davis, Jones, Choi, & Dawson, 2012; Smith, Gentry, & Blake, 2012). Consequently, educational leaders have made it a priority to provide schools with up-to-the-date technologies. In the United States, the past two decades have seen dramatic improvement in technology access in K-12 schools, with unprecedented prevalence of mobile devices. According to a national survey by Project Tomorrow (2014), access to laptops and tablets was very common, ranging from 50% to 66% among students in grades 3-12, whereas prevalence of smart phones was all time high at 89% for high schoolers, 73% for middle schoolers, and 50% for elementary students in grades 3-5. This rapid expansion, combined with other technology opportunities and challenges in education (e.g., digital texts, games, animations and simulations, virtual and augmented reality, 3D printing, flipped classrooms, online courses, and blended learning) requires teachers to be more competent technology users in the classroom.

In recognition of the fast growing and irreversible trend of technology use at all levels of education, policy makers, professional organizations and teacher preparation programs are paying increasing attention to teachers' technology competencies (Martin, 2011). The International Society for Technology in Education (ISTE) had released three consecutive versions of technology standards for teachers to address the constantly changing needs, challenges, and opportunities that the fast pacing technological world has brought to the teaching profession. While these standards have evolved with time, all three versions emphasize the critical role of effective technology integration. Since 2012, ISTE has collaborated with the Council for the Accreditation of Educator Preparation (CAEP) to develop standards for teacher preparation programs to integrate technology in all settings of clinical preparation, clinical placement, and clinical experiences, as well as specific standards for teachers and technology staff. The updated ISTE standards (2014) regarding teachers' technology competences highlighted the use of technology to facilitate student learning experiences and assessments, to model digital-

age work/digital learning/digital citizenship, and to enhance professional growth and leadership. To meet such professional standards, most teacher preparation programs have reshaped and expanded their curricula by offering a variety of instructional technology courses and stand-alone workshops/sessions, as well as incorporating technology components into regular courses (Kay, 2006; Tondeur, Roblin, van Braak, Fisser, & Voogt, 2013).

Heavy investment in educational technologies and serious efforts to provide adequate technology-related training in teacher education have led to much improved technology availability in the classrooms and significantly enhanced technology skills among classroom teachers (Agyei & Voogt, 2011). However, technology skills do not readily or necessarily translate to effective technology integration in the classroom even when technology availability is secured. Research indicates that teachers who are competent in technology use may still be reluctant using technology to reshape their instructional practices (Gibbone, Rukavina, & Silverman, 2010; Kotrlik & Redmann, 2009). Newly graduated teachers who were technologically literate in the personal sphere were no more likely than veteran teachers to use technology in their classrooms (The Richard W. Riley College of Education and Leadership at Walden University, 2010). A recent study (Authors, 2015) indicates that digital native pre-service teachers also show discrepancies between their professional and personal technology adoptions. In a 2017 national survey of digital trends in K-12 education by Project Tomorrow, half of the principals and two third of the technology leaders surveyed considered “motivating teachers to change their traditional instructional practices to use technology more meaningfully with students” (p. 2) their greatest challenge in promoting technology integration.

Teachers who incorporate technology at a higher level into their instructional practices seem to differ from their peers in attitudes, beliefs, and previous experiences. According to Vannatta and Fordham (2004), teachers with more openness to change (i.e., being willing to take risks, make mistakes and learn from them) and more time commitment (i.e., time spent in learning about and experimenting with technology use in the classroom) tended to report higher levels of classroom technology use than teachers who are reluctant to change or commit less time to technology use. Another study (Mueller, Wood, Willoughby, Ross, & Specht, 2008) comparing high vs. low integrators of technology among K-12 teachers indicates that high integrators tended to 1) be more comfortable with computers and more positive

about computer technology as an instructional tool, 2) have used computers more and experienced more positive outcomes, and 3) have a preference for work-related challenges. Another factor that may influence technology integration by teachers is the amount of support that they have received from the school. In the Project Tomorrow’s study (2017), the K-12 teachers indicated that the integration of digital contents and tools in their instructional practices required more planning time, more technological support, and more professional development opportunities.

Besides attitudes, beliefs and past experiences with technology, it seems that the age/grade levels of teaching may also play a role in teachers’ technology integration. Gorder (2008) invited teachers who were attending an educational technology academy to respond to a survey that queried their technology use and its integration in the classroom. It was found that teachers of higher grades (grades 9–12) tended to use and integrate technology in the classroom to a “significantly greater degree” (p.72) than K-5 and 6-8 teachers did. In a similar study, Schulze (2014) surveyed 134 teachers in five districts and found that compared to early childhood teachers, high school teachers reported more favorable perceptions of technology, more resource availability, more teacher integration, and more student use of technology. Middle school teachers rated their perception of technology and their integration of technology at a level that was comparable to ratings given by high school teachers, while their ratings of resource availability and student technology use were somewhere between ratings given by early childhood and high school teachers. Nevertheless, the observed differences were relatively small and the author reported only descriptive patterns without inferential statistics to test the significance of any differences.

Not all research has supported the superiority of secondary teachers regarding technology integration. Wozney, Venkatesh, and Abrami (2006) surveyed 764 elementary and secondary teachers in Quebec, Canada. They reported that elementary teachers used computers more frequently than secondary teachers did for “instructional,” “recreational,” “creative,” “expressive,” and “informative” purposes, whereas the secondary teachers utilized computers for “analytic” use more often than the elementary teachers did. Proctor and Marks (2013) surveyed award-winning teachers over a period of 16 years and found that exemplary teachers of grades 6-12 did not perceive computer games as useful for in-class pedagogical purposes as those teaching grades K-5 did, even though the trend analysis indicated that both groups had become more positive about the

usefulness of computer games over the years. Findings of these two studies, however, may not be generalized to the population of interest in the present study of preservice teachers in the U.S., since the first study was conducted over 11 years ago with a sample of Canadian teachers and the second study was conducted with highly experienced, award-winning U.S. teachers.

In order to reform and individualize technology curricula that can better address the specific characteristics and needs of possibly distinct pre-service teacher groups, more research is needed to better understand group differences in the patterns and determining factors of technology integration among pre-service teachers of different age groups/grade levels. The purpose of this study is to examine the attitudes and practices among pre-service teachers as they observe and experiment with technology integration in a real classroom during student teaching. In particular, this study aims to determine if there is any difference in such attitudes and practices among pre-service teachers in teaching licensure programs that cater to different age groups: early childhood education (ECE) and adolescent and young adult education (AYA). Specifically, we pose the following research questions:

1. Is there significant difference in risk-taking and comfort with technology use between ECE and AYA pre-service teachers?
2. Is there significant difference in perceived benefits of technology use between ECE and AYA pre-service teachers?
3. Are there significant differences in self-reported teacher technology use for administrative, instructional or communication purposes between ECE and AYA pre-service teachers?
4. Are there significant differences in self-reported student technology use for general or specific learning purposes between ECE and AYA pre-service teachers?
5. Is there significant difference in the perceived support for technology use between ECE and AYA pre-service teachers?

We hypothesize that compared to the ECE cohort of pre-service teachers, the AYA cohort tend to have more positive attitudes toward technology use, integrate technology more in various aspects of teaching and student learning, and receive more technology support.

METHOD

Participants

The participants were recruited at a mid-Western university from the teacher education candidates who were student teaching at the time of the study. The final sample included 82 in the ECE programs and 84 in the AYA programs. We chose not to include candidates in middle childhood education in our study because the sample size was too small to derive meaningful comparisons. In terms of demographics, the participants were predominantly young, female, white and non-Hispanic. Except one participant of unknown gender, 31 (18.8%) were male and 134 (81.2%) were female. All but six were in the age ranges of 20–21 years (54.8%) or 22–24 years (41.6%). In terms of ethnicity, 92.2% were white and non-Hispanic. Only 13 (7.8%) were of other ethnicities: five African American, two Hispanic, two Asian/Pacific Islanders, two bi-racial, one Native American, and one multi-racial.

Procedures

Licensure-seeking teacher education candidates who were student teaching were invited through their course instructors to participate in our study by filling out a web-based survey. The researchers obtained IRB approval from the participating university's Human Subject Review Board prior to dispensing the survey. The survey was completed in a period of two weeks. The participation of the students in the study was encouraged but voluntary, and they were able to withdraw at any time. The instructors sent their students the link to the survey, or they posted an announcement on the Canvas learning management system. The consent form was presented on the first page of the survey, and the responses were recorded digitally. Of 289 ECE and AYA pre-service teachers that were initially contacted, 166 completed the survey, which was a response rate of 57%.

Measures

The web-based survey consisted of two sections. The first section consisted of demographic questions (e.g., age, gender, ethnicity, licensure grade level, licensure subjects, graduation year, etc.) and questions about how frequently the participants used a variety of specific technology tools in the classroom, how much time they spent each week using certain technologies in their personal life, and what barriers to technology integration they perceived in the classroom. The second section of the questionnaire comprised eight scales

adopted from the Teacher Technology Integration Survey (TTIS), which was developed by Vannatta and Banister (2009). In their validation study, the authors explored the structure of the TTIS using data from 279 in-service K–12 teachers in the state of Ohio. The results of the factor analysis indicated that the solution with eight factors resulted in strong factor loadings and accounted for 67% of the original variance. In the following subsections, we describe each of the eight subscales in detail.

Risk taking and comfort with technology

This scale measures emotional responses of comfort or anxiety in risk taking or troubleshooting new technology. It contains nine statements that were adapted from previously published measures of computer self-efficacy and teacher attributes. The participants were asked to indicate their level of agreement with each statement using a five-point Likert scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree. This scale includes statements such as “I enjoy finding new ways that my students and I can use technology in the classroom,” and “I get excited when I am able to show my students a new technology application or tool.” Three of the nine items were reverse worded. Vannatta and Banister (2009) reported a Cronbach’s alpha of .85 for this scale.

Perceived benefits of technology use

This scale measures “how one perceives the emotional and academic benefits of using technology for both the teachers and the students” (Vannatta & Banister, 2009, p.330). It contains five statements. The participants rated each statement using the same 5-point Likert scale. This scale includes statements such as “Technology can be an effective learning tool for students,” and “Computer technologies help me be better organized in my classroom.” The internal consistency of this subscale was satisfactory with Cronbach’s alpha = .85 (Vannatta & Banister, 2009).

Beliefs and behaviors about classroom technology use

This scale measures “general beliefs and behaviors that support technology integration but do not require the actual use of technology” (Vannatta & Banister, 2009, p.330). It contains six statements. The participants rated each statement using the same 5-point Likert scale. This scale includes statements such as “Using technology in the classroom is a priority for me,” and “Teaching students how to use technology is a part of my job.” Vannatta and Banister (2009) reported satisfactory

reliability of this scale, with a Cronbach’s alpha of .88.

Technology support

This scale measures external support for teacher classroom technology use through “shared vision, access, technical assistance, and support policies” (Vannatta & Banister, 2009, p. 330). It contains five statements. The participants rated each statement using the same 5-point Likert type scale. This scale includes statements such as “Technology support is available in my building to assist with troubleshooting,” and “A vision for technology use in our school is clearly communicated to faculty.” The internal consistency of this subscale using Cronbach’s alpha was .80 (Vannatta & Banister, 2009).

Teacher technology use

This scale measures the extent to which teachers use technology for administrative, instructional, and communication purposes. It consists of three subscales: teacher administrative use (TAU, 6 items), teacher instructional use (TIU, 4 items), and teacher communication use (TCU, 3 items). The participants were asked to indicate how often they used technology for various communication purposes. The participants responded using the following five-point scale: 1=never, 2=1–2 times, 3=several times, 4=often, 5=daily. Sample items are “Prepare or maintain individualized education programs (IEP) on the computer” and “Use the computer to create instructional handouts or assessments for students” (TAU subscale); “Provide/create electronic learning centers” and “Use technology to adapt an activity to students’ individual needs” (TIU subscale), and “Use email and/or other electronic messaging to communicate with students or parents” and “Use email and/or other electronic messaging to communicate with colleagues or administrators in your school/district” (TCU subscale).

This scale was adapted from the teacher technology use scale developed by Vannatta and Banister (2009), which reported a three-factor structure of this construct and presented three subscales to measure these three factors: teacher instruction and instructional support (alpha = .82), teacher communication use (alpha = .54), and teacher overall use (alpha = .79). In an unpublished, updated version, Vannatta and Banister revised this scale to differentiate between administrative use, communication use, and instructional use of technology among teachers. We chose the updated version and found Cronbach’s alphas of .69 for TAU, .87 for TIU, and .73 for TCU.

Student use of technology

According to Vannatta and Banister (2009), the extent of technology integration in the classroom is indicated by both the teacher's use of technology and the students' use of technology. They developed two subscales to measure two areas of student use separately: general use and specific use. There are 12 items on general use and 4 items on specific use. Sample items of students' general use of technology include "Use Internet to research topics and gather information" and "Use technology to produce multimedia projects that use digital images, video, and audio," and sample items of students' specific use include "Use a handheld device to gather and/or organize data, create concepts maps, and write" and "Use simulation/gaming software to learn and apply information." Vannatta and Banister reported a Cronbach's alpha of .91 for the subscale of general use and .58 for the subscale of specific use. In our study, we found even better reliability, with a Cronbach's alpha of .97 for the subscale of general use and of .87 for the subscale of specific use.

RESULTS

The results of the data analysis consist of both descriptive analysis and inferential statistics. In the descriptive analysis, we examined the means and standard deviations of the criterion variables in the ECE student teacher group, the AYA student teacher group, and the

two groups combined. We also reported the correlations among these variables based on the combined data. In the inferential analysis, independent sample t-tests were conducted using SPSS 22.0 to test our hypotheses about the differences between ECE and AYA groups in each criterion. The assumption of homogeneity of variance was also tested in each t-test, and the findings were reported based on whether the assumption was maintained or not.

Descriptive analysis

As shown in Table 1, the pre-service teachers generally reported positive attitudes toward technology integration in the classroom, with means between 3.5 and 4.5 on the three 5-point Likert scales used to report attitudes. In general, the participants seemed to take risks and be comfortable with the use of technology applications and tools, and they tended to view the use of technology in the classroom as both beneficial and important. Relatively, their perceptions of the benefits of technology integration were stronger than their beliefs and behaviors that acknowledged the importance of technology integration in their teaching practice. With a mean value of 3.75 on a 5-point scale, their levels of risk taking and comfort with technology use appeared to have much room for improvement. We observed some differences between the ECE and AYP groups in their mean ratings of risk taking (3.67 vs. 3.83) and beliefs (3.68 vs. 3.56), whereas their mean ratings of benefits were almost identical. With regard to technology use, as

Table 1: Means and standard deviations of attitudinal variables for ECE, AYA, and combined groups

	<u>ECE</u>		<u>AYA</u>		<u>Combined</u>	
	Mean	SD	Mean	SD	Mean	SD
Risk-taking	3.67†	.55	3.83†	.57	3.75	.56
Benefits	4.14	.57	4.18	.60	4.16	.59
Beliefs	3.68	.58	3.56	.65	3.62	.61
Support	3.58*	.68	3.31*	.76	3.45	.73
TAU	3.71	.94	3.82	.65	3.76	.81
TCU	3.36**	1.26	3.87**	1.09	3.62	1.20
TIU	3.70	1.07	3.56	1.06	3.63	1.07
SGU	1.91***	1.17	2.87***	1.19	2.42	1.27
SSU	1.98**	1.12	2.62**	1.22	2.30	1.21

Notes. TAU = teacher administrative use of technology; TCU = teacher communication use of technology; TIU = teacher instructional use of technology; SGU = student general use of technology; SSU = student specific use of technology; ECE = early childhood education; AYA = adolescent and young adult education; SD = standard deviation. † $p < .10$. * $p < .05$. ** $p < .01$. *** $p < .001$.

shown in Table 1, the results revealed that the teacher use of technology was more extensive than the student use of technology. On the same 5-point scale, the pre-service teachers rated the frequency of their own use of technology higher (3.62 for communication use, 3.63 for instructional use, and 3.76 for administrative use) than they rated the frequency of involving students in the use of technology (2.30 for general use, and 2.42 for specific use). Compared to their ECE peers, the AYA pre-service teachers reported a dramatically higher frequency of student use of technology (2.87 vs. 1.91 for general use, and 2.62 vs. 1.98 for specific use). They also reported more use of technology for communication purposes (3.87 vs. 3.36). However, the differences in the level of technology use for administrative and instructional purposes between the two groups were negligible.

With regard to perceived technology support from external sources, interestingly the ECE group indicated that they received more support than the AYA group indicated (3.58 vs. 3.31). However, it should be noted that the overall level of technology support reported by these pre-service teachers remained low at a combined mean of 3.45 out of 5.

Table 2 shows the correlations among the major criterion variables. As shown in Table 2, almost all of the criterion variables were significantly correlated except for a few, including the correlations between risk taking and TAU or TCU, between benefits and TCU, between support and TCU, and between SGU and risk taking or benefits.

Inferential statistics

We used t-tests to examine the differences between the ECE and AYA groups according to the variables of attitudes. On one hand, we found a marginally significant difference in their level of risk taking and comfort with technology, $t(161) = 1.822$, $p = .07$. On the other hand, there was no significant difference in their perceived benefits of technology use, $t(161) = .422$, $p = .674$, and no significant difference in their beliefs and behaviors that demonstrated the perceived importance of classroom technology use, $t(153) = 1.292$, $p = .198$.

We also examined the differences between the ECE and AYA groups according to the variables of technology use. We found no significant difference in teacher administrative use of technology, $t(161) = 0.879$, $p = .381$. However, homogeneity of variance assumption was violated, $F(1,163) = 9.507$, $p < .01$. With equal variance not assumed, t-test led to the same result of no significant difference, $t(143.71) = .881$, $p = .38$. There was significant difference on Teacher Communication with Technology, $t(162) = 2.75$, $p < .01$. However, homogeneity of variance assumption was violated, $F(1,162) = 5.314$, $p < .05$. With equal variance not assumed, t-test led to the same result of significant difference, $t(157.83) = 2.745$, $p < .01$. There was no significant difference on Teacher Instructional Use of Technology, $t(160) = .799$, $p = .425$. There was significant difference on Student General Use of Technology, $t(153) = 5.074$, $p < .001$, and significant difference on Student Specific Use of Technology, $t(161) = 3.476$, $p = .001$.

Table 2: *Bi-variate correlations among attitudinal variables*

	Risk-taking	Benefits	Beliefs	Support	TAU	TCU	TIU	SGU	SSU
Risk-taking	1								
Benefits	.406**	1							
Beliefs	.447**	.614**	1						
Support	.222**	.329**	.446**	1					
TAU	.124	.166*	.353**	.201*	1				
TCU	.147	.144	.250**	.132	.604**	1			
TIU	.329**	.305**	.609**	.387**	.672**	.502**	1		
SGU	.154	.028	.283**	.188*	.435**	.480**	.483**	1	
SSU	.199*	.157*	.395**	.283**	.393**	.369**	.522**	.730**	1

Notes. * $p < .05$, ** $p < .01$.

With regard to technology support, there was a significant difference between the ECE and AYA groups, $t(161) = 2.351$, $p < .05$. The ECE pre-service teachers reported a higher level of technology support from administrators, colleagues, and parents, than the AYA pre-service teachers reported.

DISCUSSION AND CONCLUSION

Although there is plenty of research on technology integration attitudes and practices of pre-service teachers, little has been done to examine differences in such attitudes and practices among those teaching different age groups. Our study helps to fill this gap by comparing two cohorts of pre-service teachers: one seeking early childhood education (ECE) licensures and the other seeking licensures for teaching adolescents and young adults (AYA). The findings of our study indicate that the age group these pre-service teachers taught was related to certain aspects of technology integration. Compared to the ECE cohort, the AYA cohort was more likely to take risks and felt more comfortable in using technology. The AYA cohort also used more technology to facilitate communication, and their students were more likely to engage in learning tasks that used general or specific technological tools and applications. However, the ECE cohort reported receiving more support for technology integration than their APA peers did. The two cohorts held comparable positive attitudes and beliefs regarding technology use, and they reported similar levels of technology integration in the areas of administrative use and instructional use.

The findings of our study present an interesting contrast to findings of previous research involving in-service teachers (e.g., Gorder, 2008; Schulze, 2014). While our findings indicate a similar pattern among pre-service teachers that teaching older students may be associated with greater use of technology in the classroom, such a relationship does not seem to be consistent across different areas of technology integration. The pre-service teachers in our study reported the same levels of technology integration practices for administrative purposes and instructional purposes, regardless of the age group that they were working with during student teaching. Although we have to reject our hypotheses of significant cohort differences in those areas, the findings are considered encouraging because they indicate that reforming teacher preparation programs to emphasize specific technology integration skills may eventually lead to the narrowing of previously noted gap in technology integration practices between in-service teachers of lower vs. higher grades. Our hypothesis

that the AYA cohort would receive more support for incorporating technology in classroom teaching than the ECE cohort was not supported by the results, either. The finding that the ECE cohort reported receiving more support than the AYA cohort is reassuring, since previous research indicates that elementary teachers often need more support and encouragement than secondary teachers and the lack of technology support is considered a main external barrier that negatively influences teachers' integration of technology in the curriculum (Ertmer, 1999; Uluyol & Şahin, 2014).

Our hypothesis regarding more technology use for communication purposes among pre-service teachers of adolescent and young adults was supported. Previous research provided substantial evidence of the influence of teacher-family, teacher-administrator, and teacher-colleague communication on student engagement and achievement (e.g., Kraft & Dougherty, 2013). In the 21st century, almost all parties rely on technology tools for communication at an unprecedented level. For some, it is the only tool of communication. It is reasonable to believe that teachers' inadequate communication through technology may lead to less family engagement in education, reduced leadership effectiveness, and lack of relationship building among teachers, all of which may have a detrimental effect on teaching effectiveness and important student outcomes. Future research could explore the reasons that early childhood pre-service teachers did not use technology for communication as much as their AYA counterparts. Furthermore, future research could provide guidelines for teacher education programs to provide more training for pre-service teachers of younger students to use technology in age-appropriate ways for communication purposes.

Our hypothesis regarding the association between teaching older students and more technology use for engaging students in completing learning tasks was also supported. It is possible that the ECE pre-service teachers' reluctance to use technology more in this area was related to their perceptions of younger children's technological competency and/or their pedagogical beliefs regarding the use of technology by this age group. The ECE pre-service teachers might consider young children less competent with technology, and held pedagogical beliefs that encouraged them to engage young children predominantly in activities that involved the use of traditional, tangible materials and tools instead of computers or computer-based applications. The ECE cohort could also have made a conscious decision to limit the use of technology by their young students so they could practice language skills and fine motor skills required for handwriting. Ertmer (2001)

indicated that there was a strong link between teachers' pedagogical beliefs and their instructional behaviors in math, reading, and science classrooms. He further presented a conceptual overview of the ways in which teachers' pedagogical beliefs could be a vital factor in determining their technology use behaviors in the classroom. We postulate that the ECE and the AYA cohorts might have developed different pedagogical beliefs based on the distinct characteristics of their students. Future studies are needed to investigate the roles that such pedagogical beliefs play in shaping their attitudes toward technology and their integration of technology in the classroom. Future mixed method approaches that combine survey data with observations of teacher candidates in actual classrooms could help us to better understand the internal and external factors that determine the degree to which students of various age/grade levels use technology for completing their learning tasks.

The findings of this study have important implications for teacher education. Current teachers are under great pressure to embrace technology to prepare their students for success in the 21st century. The experiences of pre-service teachers in using technology during student teaching may greatly influence the quality and quantity of their integration of technology when they begin their teaching career (Agyei & Voogt, 2011). It is therefore critical that teacher preparation programs consider pre-service teachers' technology use and attitudes and understand how these variables may differ across cohorts of different age groups. Findings of our study are generally positive in that the ECE and AYA cohorts showed similar attitudes (i.e., perceived benefits and importance of technology) and practices (i.e., administrative use and instructional use) regarding technology integration. The ECE cohort even reported receiving more technological support. Such findings suggest that the teacher education programs in which these pre-service teachers were enrolled as well as the local school districts where they gained teaching experience successfully addressed their needs in regards to technology use and integration. However, the ECE cohort still reported less technology use than the AYA cohort to facilitate communication and student engagement. While the practice of limiting technology use for younger students may be justified by pedagogical considerations to some extent, the presence of laptops and tablets has become ubiquitous in elementary school classrooms and young children are entering schools with unprecedented technology experience and competence (Palfrey & Gasser, 2016). A better approach may be to adapt to this unstoppable trend and foster real learning in the students (Prensky, 2010) by equipping our pre-

service teachers with the knowledge and skills to use appropriate technology in appropriate ways that fit the interests and abilities of young digital natives.

LIMITATIONS

The present study has several limitations. First, the sample included pre-service teachers at a midwestern American university, so the findings may not be generalizable to other populations. Second, we administered the survey on-line with incentives. It is possible that pre-service teachers who typically respond to web-based surveys or surveys with incentives could differ in major ways from those who do not respond to such surveys. Third, even though it was our intention to include middle childhood pre-service teachers in our study sample, because there were so few respondents from this group, we had to exclude them from analysis. We reported our findings assuming a linear relationship among the grade levels of teaching licensure, technology attitudes, and technology use. However, the addition of middle grade levels in study sample may have led to the discovery of a curvilinear pattern. Fourth, differences between candidate self-reporting of technology use and actual technology use in classroom settings could be explored with mixed methods studies that include classroom observations. Such studies may also better determine distinctions in technology use among teacher candidates in early childhood education, middle childhood education, and adolescent and young adults education programs. Finally, a variety of theoretical frameworks and measures has been proposed regarding teacher technology integration constructs. Our findings might not be replicated if different frameworks were adopted and/or different measures were used for the constructs included. Therefore, future research is needed to explore the relation between grade level and technology integration in different student teaching populations, including middle grade levels, using different theories and measurements of technology integration.

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Effective Social Interaction in Online Learning

SunHong Hwang
Holim Song

Abstract: Growing number of life-long learners and unprecedented technology-supported communications bring a new way of learning environment: online learning. It has been increasing rapidly since the 1990s. Currently, online learning is becoming a more common learning environment for offering higher education level of learning. Even though emerging new learning environments require new learning theories and best practices, few researchers have been examined to analyze the fundamental concept in an online learning environment. In particular, two major theme: sense of isolation and lack of social interaction. In this article, the authors try to identify the feeling of isolation and different types and levels of social interaction in an online learning environment.

About the Authors: Dr. SunHong Hwang is an instructional designer at University of Houston. Dr. Holim Song is an associate professor at Texas Southern University.

INTRODUCTION

With the emerge of new computer-mediated communication tools such as Internet or World Wide Web, online learning is becoming a chief descendant of distance education and requires new theories, administration policies, and practices (Kearsley, 2000; Bonk, 2009). Rumble (2001) described the current shift from distance education to online learning as “an evolution from a modernist form of education to a phenomenon that fits with postmodernist developments” (p.31). The necessities of new theory and best practice of new online learning environment is on the rise.

In spite of the necessities of new theories, policies and practices, most online learning is still suffering from lack of theories, inappropriate administration policies, and wrong direction of practices, causing students’ dissatisfaction, frustration and feeling of isolation in online learning. Hara and King (2000) identified students’ frustration and feeling of isolation in their online learning case study. They claimed that more considerable thoughts and plans are needed to solve the most difficult issues to address: feeling of isolation and lack of social interaction (Gouseti, 2011; Altinay, 2017)

The purpose of this article is to shed light on the critical issues of current online learning. In this article, the authors describe two most critical issues of online learning. The first one is a sense of isolation. The other is the lack of interaction. The authors mentioned that the concept of interaction can trace back to the idea of Dewey. Also, the authors introduce Moore’s three types of interaction and Hirumi’s different levels of interaction.

FUNDAMENTAL ISSUE OF ONLINE LEARNING: ISOLATION

The common reflection of numerous experienced online learning students is that they were suffering from feeling of isolation. In fact, isolation that many students may feel is one of the major reasons that students drop out their online courses (Palloff & Pratt, 1999; Altinay, 2017). Altinay argued that the feeling of isolation in distance education is not geographical distance, but psychological distance. Altinay also claimed that students’ feeling of distant feeling is closely associated with their satisfaction with the web-based online course.

Wegerif (1998) sought the reason for students’ frustration from characteristics of medium by examining one of the students’ comments in his online course. In one of his students’ comments, “It is a cold medium. Unlike face-to-face communication, you get no instant feedback. You do not know how people responded to your comments; they just go out into silence. This feels isolating and unnerving. It is not warm and supportive. This course requires self-discipline. It is too easy to drop out. If you don’t log on you lose contact and get no reminders. Perhaps another form of communication is needed as well.” (p. 38)

Another reason for students’ frustration is that technical problems. Students are often overwhelmed by the amount of technology skills that they have to know for taking online course. Even when they are familiar with utilizing technology, several technical problems occur quite often. Thus, students feel frustration and dissatisfaction in this situation. Often it is considered inevitable that students who study online will suffer a

sense of isolation. This sense of isolation can, however, be minimized if careful consideration is given to the development of the online course by the educators involved. Many educators pay attention to the role of social interaction in online learning to reduce students' feeling of isolation (Dewey, 1938; Driscoll, 2000; Vygotsky, 1978). Next section will briefly address the definition and importance of social interaction.

INTERACTION IN ONLINE LEARNING ENVIRONMENT

Interaction has been considered one of the fundamental components of development and learning. (Dewey, 1938; Vygotsky, 1978). As long ago as 1938, John Dewey stated that interaction is one axis of learning experience along with situatedness. Interaction is crucial because it enables learners to gain other people's perspective through interaction, a critical component in constructivist learning theories (Jonassen, 1991; Jonassen, 1992; Jonassen, 1995, Jonassen, 1996, Jonassen, 2000). In addition, interaction is essential to create the learning communities advocated by Lave and Wenger (1991), and other learning theorists who emphasize the crucial role of community in learning. Interaction has been stated as one of the critical aspects of online learning environment (Moore, 1989; Wagner, 1994). Much attention has been given to the lack of interaction as the major issues in online learning.

Despite the importance of interaction mentioned above, it is quite complicated to find out a precise definition of interaction in the educational literature. Anderson and Garrison (1998) examined various definitions of the multifaceted concept with deep length and recommended Wagner's definition of interaction. Wagner (1994) defines interaction as "reciprocal events that require at least two objects and two actions. Interactions occur when these objects and events mutually influence one another."(p.8) Also, she tried to differentiate from the definition of interaction and interactivity, which are commonly used interchangeably. According to Wagner, interaction is differ from interactivity in that "the former maybe perceived as an outcome of using interactive instructional delivery and the latter may eventually be viewed as a machine attribute" (p.26). While interaction can be recognized as the means of learners and instructors communicate their knowledge and thought, interactivity is a mechanical characteristic of the medium, allowing the users to experience various exchanges through the technology. The following section will address the types of social interaction in online learning.

TYPES OF SOCIAL INTERACTION IN ONLINE LEARNING ENVIRONMENT

Numerous distance education scholars have tried to identify types of interaction. Moore (1989) categorized well-known three types of interaction based upon communication-based framework: learner to content, learner to instructor, and learner to learner. Hillman, Willis, and Gunawardena (1994) claimed that Moore's three types of interactions have not provided the account of interaction to occur: "the learner has to interact with medium." Thus, they proposed learner to interface interaction as the fourth class of interaction.

Learner-content interaction refers to learner's interaction with subject matter of content. When learners utilize audio, video, text, and graphic representations of the subject matter to study, this fundamental type of interaction occurs (Sutton, 2001). Sometime, a student interacts only with the course content and never interacts with the instructor, other students, or the interface. Learner to instructor interaction can be defined as interaction between students and the instructor. Extensive result of media comparison research reveals that media itself has insignificant influence on students' learning (Clark, 1994). According to Hirumi (2002), "Instructional design has a great impact on student achievement than the media used to deliver the content." As a result, learner to instructor interaction is considered as the indispensable component of students' learning. Providing feedback in a timely matter is a good example of well-prepared learner to instructor interaction. Comprehensive result of feedback research requires further analysis into design of the critical learner to instructor interaction. Learner to learner interaction has been relatively less emphasized so far compared to other interactions (Sutton, 2001). In fact, much attention has been given to the field of learner to content and learner to instructor interaction.

Moore (1989) claimed that "learner to learner interaction can be an extremely valuable resource for learning, and is sometimes even essential" (p.4). The evolution of computer-mediated communication enables students to work collaboratively quite often, which makes it possible to focus on the learner-to-learner interaction. Research results show that students who interact regularly with other students are highly motivated and have better learning experience (Jonassen, 1995). As mentioned earlier, Hillman et al. (1994) proposed learner to interface interaction to represent the characteristics of online learning. Learners cannot handle content information if they are not able to use the interface of technology. Thus, it is essential for students to use the technology to

interact with the content and the instructor.

In addition to these four interactions, Anderson and Garrison (1998) added three more classes of interaction, emphasizing the importance of teachers' role. The interactions are teacher to teacher interaction, teacher to content interaction, and content to content interaction. Teacher to teacher interaction refers to collaboration between teachers in relation to the mass education systems, where various experiences of teachers, courses providers or designers are required. Teacher to content interaction can be considered as teachers' organization and preparation of the subject matter of a course. Content to content interaction refers to the idea of semantic web initiated by Berners-Lee (1999). He provided the concept of semantic web in which "content can be formalized and manipulated, stored, searched, and computed automatically through autonomous agent technologies." This capacity will encourage transfer to content-based forms of interaction. These types of interaction are also found in Hirumi's (2002) three levels of interaction model. The following section will address the Hirumi's levels of interaction.

THREE HIERARCHICAL LEVELS OF INTERACTION IN ONLINE LEARNING ENVIRONMENT

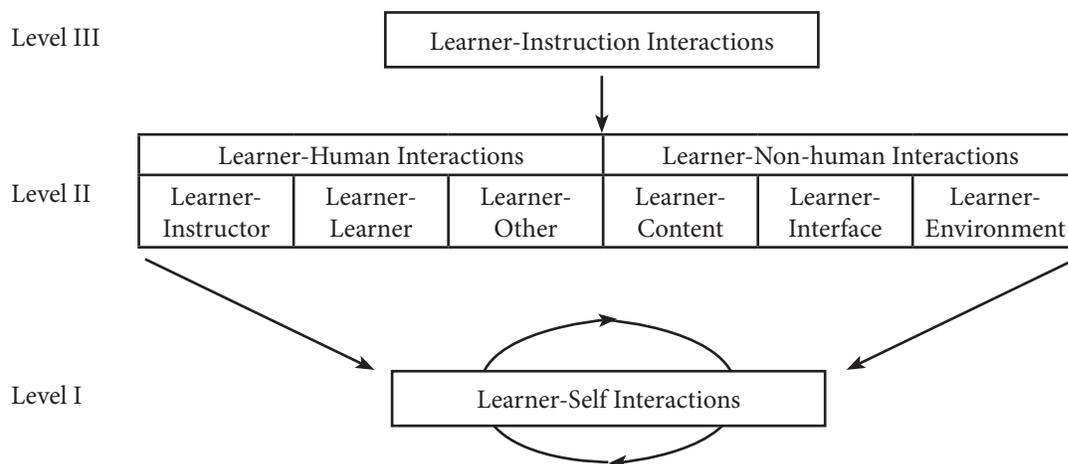
Hirumi (2002) critiqued the current analysis of types of interaction neither offer relationship between each interaction, nor provide effective and applicable principles for fostering online learning interactions to help students' learning better. Thus, Hirumi proposed three hierarchical levels of interaction framework.

He presented this framework "for delineating the relationships between fundamental communication-based interactions and for illustrating how the framework may be used to analyze, design, and sequence planned eLearning interaction." (p.148)

Level I refers to learner-self interactions, which occur within each individual learner. They include both the cognitive operations that constitute learner as well as metacognitive processes that help individuals monitor and regulate their learning (Hirumi, 2002). Each individual operates his or her cognitive ability to check their learning process.

Level II can be divided into two groups. The first group is learner to human interactions such as learner to instructor, learner to learner, and learner to other. Learner to other interaction indicates interacting with other people who are not directly involved in the course e.g. colleagues at work, family, community. This kind of interaction may be formally integrated as part of the course but more often occurs informally on a uniquely individual basis and, is little known to the course providers. The second group is learner to non-human interactions such as learner to content, learner to interface, and learner to environment interactions. Learners to environment interactions refer to the manipulations of tools, artifacts, or other equipment outside of the computer interface. This interaction might include activities such as performing experiments, engaging field trips, attending seminar.

Level III, learner to instruction interactions includes a considerate instructional event to enhance learning. According to Hirumi (2002), "Learner-instruction



Hirumi's three levels of interaction framework

interactions are differentiated from Level II and Level I interactions to illustrate how theoretically grounded instructional strategies may be used to help distance educators design and sequence planned interactions.” (p.148)

CRITIQUE OF HIRUMI’S FRAMEWORK

Hirumi’s level of interaction framework can be used effectively to analyze the level of interaction in online course because much attention of the framework is placed “in accordance with learner-centered approaches to instructional design” (p.143). According to Hirumi, the framework was not designed to apply any particular learning theory or epistemology. Instructional designers’ epistemological belief will influence on how to interpret the framework. Thus, he provided various types of sample outlines about how to use the framework based upon different learning theories such as nine events of instruction, student-centered learning, simulation model, direct instruction, and problem-based learning. However, Hirumi (200) did not consider distinctive characteristic of online learning environment, where constructivism-learning theory may works better than other theories. In online learning environment, the pre-designed texts are provided in place of the lectures, which are the critical activity of a teacher in face-to-face classroom. Text in online learning environment is a hypertext, which means that the formation of the information is packaged in a

nonlinear way. Therefore, the teaching material cannot be precisely organized by an instructor and transmitted to learners. The instructors may find it difficult to teach nonlinear organized information from beginning to end with a conventional teaching style. In addition, online environment requires quite different levels of participation. In face-to-face classroom, an instructor can notice students’ presence even though students do not attend discussions or class activities. However, the instructor has no way to recognize the presence of the students without students’ participation or involvement in online learning environment (Palloff & Pratt, 1999).

CONCLUSION

As Hirumi proposed, if an instructor’s epistemological belief will decide how the framework will be used, and then it will be mostly utilized in the format of teacher-centered method. The reason is that, as Jonassen (1995) pointed out, most practitioners or teachers tend to bring their conventional pedagogical belief, which works well from their previous teaching experience in face-to-face class. They hold their assumptions from traditional environments about teaching and learning, and apply to the new learning environment, and neglect the potential of online learning environment. Thus, to reveal the true potential of interaction via online, the role of the particular learning theory for online learning should be examined and emphasized to find out a more in-depth framework of social interaction.

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Concrete to Abstract Thinking when Manipulating Algebraic Fractions

Petrina St. Agathe

Abstract: Recent research has revealed that rational expressions (also known as fractions) are the most cognitively challenging topics for students in today's classrooms (NMAP, 2008; Lamon, 2007; Wu, 2001). The purpose of this study was to determine whether a concrete to abstract teaching approach will positively affect students' conceptual understanding and procedural fluency with rational expressions as well as their attitudes toward mathematics. Students ($n = 107$) enrolled in Integrated Algebra (i.e., Algebra I) were randomly assigned to a concrete to abstract learning condition or to a control/traditional instructional group. Participants completed a mathematics attitude survey, multiple-choice items on fraction misconceptions, and short-answer items on numeric and algebraic fractions. Results from statistical analyses showed that the control group did better on the short-answer items at the time of the pre-test ($p < .05$), but there was no significant difference between the groups at the time of the post-test.

About the author: Dr. Petrina St. Agathe is currently a high school mathematics teacher in New York City. She received her doctoral degree in Learning and Teaching from Hofstra University in 2015.

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INTRODUCTION

Manipulating numerical fractions has been one of the most difficult mathematical skills to transfer to abstract problems (Behr, Wachsmuth, Post, & Lesh, 1984; Hiebert, 1985; McLeod & Armstrong, 1982; Ni, 2001). The nature of fractions requires students to understand that different fractions may refer to different or equivalent quantities. Also, understanding rational numbers in the form of a/b ($a, b \in \mathbb{I}$ and $b \neq 0$) provides students with the necessary foundation for advanced level mathematics courses. The National Mathematics Advisory Panel (NMAP, 2008) identified mathematical areas of concern in the United States, and the panel's report indicated that at least 40 percent of middle school students struggled with fractions, and nearly 50 percent of middle school and high school students had difficulty with elementary level fraction topics (Misquitta, 2011). This report raises a concern because the understanding of fractions is a foundational skill needed to function in modern society (NMAP, 2008). Fractions continue to be one of the topics that spans from elementary school grades to university level courses. It requires cognitive development in students, and in order to gain success in higher level mathematics and science courses, a conceptual understanding of this topic is needed.

The National Council of Teachers of Mathematics

(NCTM, 1989, 2000, 2006) recommends that fractions be taught as part of the number line, as well as the relationship of fractions to whole numbers. Fractional equivalence, including adding, subtracting, multiplying, and dividing improper, proper, and mixed numbers should be emphasized. The NMAP (2008) suggests that students should be able to identify and represent fractions by grade 4, compare magnitudes as well as add and subtract fractions by the end of grade 5, be able to multiply and divide fractions by the end of grade 6, and should be fluent in all operations with positive and negative fractions by the end of grade 7. Students are able to do these things by the end of grade 7, but the problem arises when they use the same algorithmic approaches from middle school grades on algebraic fractions in grade 9. Fraction manipulations are frequently not taught logistically when studied at the high school level. Instead, they are taught with quick rules that do not represent logistical approaches or the mathematical structures.

IMPORTANCE OF FRACTIONS

The National Mathematics Advisory Panel claims that an understanding and familiarity with fractions is essential for students' mathematical competence, and for entry into the American workforce (NMAP, 2008).

Researcher Susan Lamon, has written many books and articles on fractions, ratios and proportions, including the Rational Numbers and Proportional Reasoning chapter in the Second Handbook of Research on Mathematics Teaching and Learning. Lamon (2007) claimed that fractions are among the most complex mathematical topics to teach, the most cognitively challenging to students, and necessary for higher level mathematics and science courses. Educators are noticing that students who lack conceptual understanding of fractions often have a difficult time in high school algebra. Wu (2001) stated that fractions are an excellent way to introduce students to the importance of variables, and projected that algebra failure rates will continue unless fraction instruction is improved. If conceptual understanding is gained, then a student can reconstruct a procedure that may have been forgotten. On the other hand, if procedural knowledge is limited to meaningless algorithms, there is no way for students to reconstruct a forgotten procedure (Kazemi & Stipek, 2008). This is clearly seen when students are introduced to algebraic fractions in high school and are expected to transfer their conceptual understanding of numeric fractions to fractions involving variables.

NEW YORK STATE NEXT GENERATION MATHEMATICS LEARNING STANDARDS

The Common Core State Standards (CCSS) were released in June 2010 and were developed under the sponsorship of the National Governors Association (NGA) and the Council of Chief State School Officers (CCSSO). These standards were reviewed and revised in 2015, and the New York State Next Generation Mathematics Learning Standards (2017) reflects revisions and additions. These new standards are not too different from the CCSS. Even though the standards only address the content and not the design of the curriculum, the identification of cognitive processes within the standards should not be ignored. The standards are intended to promote teaching methods that focus less on test preparation and drill-and-practice and more on methods for promoting cognitive development. The New York State Next Generation Mathematics Learning Standards on the high school level are organized by conceptual categories showing the body of knowledge students should learn in order to be academically successful.

For over a decade research in mathematics education in high-performing countries has recognized that the mathematics curriculum in the United States was too broad and lacked focus. Consequently, the new

mathematics standards provide for a more coherent and focused curriculum. As a result, teachers are now expected to cover fewer topics thoroughly, as opposed to covering a large number of topics superficially. The intention of the mathematics standards is a dual emphasis on both conceptual understanding and procedural fluency, starting in the early grades. Additionally, more class time is expected to be provided for teaching and reinforcing mathematical concepts throughout all grade levels. With these new standards in place, a topic such as fractions is expected to be taught thoroughly and understood by students in earlier grades, which should better support the learning of algebraic fractions on the high school level.

THEORETICAL FRAMEWORK: RESEARCH QUESTIONS

It was anticipated that this study would corroborate prior findings that students entering high school typically have difficulties with concepts involving numeric fractions and algebraic fractions. Research questions that were investigated in this study were as follows:

1. To what extent does a concrete to abstract teaching approach affect the procedural fluency and conceptual knowledge of numeric fractions and algebraic fractions?
2. To what extent does a concrete to abstract teaching approach affect attitudes towards mathematics?

METHODOLOGY

Participants

An urban, middle-class high school located in Queens, NY with an approximate enrollment of 1200 students supplied participants for this study. The school, located just west of the Long Island border, is an ethnically and socioeconomically diverse population with approximately 40% of the students receiving free or reduced-price lunch. The high school's population is made up of 41% African-American, 17% Hispanic, 12% White, 24% Asian, and 6% other, which includes 14% special education students and 3% English language learners. The male to female student ratio is 1:1.

The sample consisted of 182 freshmen enrolled in the course, Integrated Algebra. Random assignment of participants was not possible, since the students for

each class was determined by the school administration during the summer before the participants' first year of high school. Consequently, extraneous variables may have been introduced due to student assignments, thereby posing possible threats to the study's internal validity. Two teachers were selected to participate in the study, based on their willingness to take part in this research. Each teacher was assigned to provide both treatment and control conditions, creating two trials for the study. This provided some control for teacher effects.

Research Design

This was an experimental study, employing a pre-test/post-test design. The study was designed to determine differences between treatment and control conditions with respect to students' conceptual knowledge and procedural fluency with numeric and algebraic fractions. There were six 9th grade sections (three sections per teacher/trial), of which four were designated as the treatment group. For each teacher/trial, section 1 was the control group, and sections 2 and 3 were the treatment group. Students in the control group received instruction using traditional methods (lectures, handouts, and procedural techniques). Students in the treatment group received instruction focusing on problem-based activities, visual aids, scaffolding, and mathematical structure. Additionally, there was an emphasis on remediation of common misconceptions which literature has indicated are prevalent among students pertaining to rational expressions (Kieren, 1980; Lamon, 1999; Ding et al., 2011). The dependent variables were measured by participating students' scores on the post-test administered after intervention.

Dependent Variables

Pre-Test/Post-Test. Based on the review of the literature, students have difficulty with the following: (1) separating the knowledge of whole number theory with the understanding of fractions, (2) comparing fractions with like denominators and unlike denominators, (3) understanding fraction magnitude, (4) understanding fraction equivalence and (5) adding and subtracting fractions. Items on the pre-test/post-test included common misconceptions that students develop in elementary and middle school grades (see Appendix A). Each item has a response of "Yes", "No", and "Sometimes". The post-test was the same as the pre-test with the exception of the short answer questions. Before teaching algebraic fractions, it is important to know what students do and do not understand about numeric fractions. The results may also show that incoming high

school students may still have difficulty with fraction concepts, which was reported in the reviewed literature. Four 8th grade short-answer questions taken from middle school mathematics textbooks were included at the end of the pre-test and post-test to see if students had difficulty with adding or subtracting algebraic fractions. The remaining eight short-answer questions came from past Integrated Algebra New York standardized examinations called the Regents Examinations for 9th grade students. Regents Examinations are developed and administered by the New York State Education Department (NYSED) every January, June and August of each school year. These questions were given to see if students had difficulty with adding or subtracting algebraic fractions. Errors were categorized as (1) procedural and conceptual error, (2) conceptual error, (3) procedural error, and (4) no error. The type of errors that were considered to be in these categories was decided by individuals in the field of mathematics and mathematics education. These categories gave the clearest picture as to the specific mathematical skill(s) in which students have difficulty. Since the survey items on the post-test are the same as the pre-test, there were no validity or reliability threats as a result of changed test items.

The test was administered once before the topic was taught and once after the topic was taught. Students did not learn the correct answers to the test until after they took it the second time. Therefore, even if they remembered the questions on the test, they were only able to respond correctly if they understood all concepts taught during intervention.

STEM Semantics Survey. To measure students' attitude towards mathematics, the mathematical section of the STEM Semantics Survey (Tyler-Wood, Knezek, & Christensen, 2010) was administered once to all participants before the pre-test and once to all participants before the post-test. The STEM Semantics Survey is a Likert-scale format that consists of 25 questions examining five subcategories: science, mathematics, engineering, technology, and careers. Each subcategory is scored on a 1 – 7 adjective scale, which is summarized in Table 1.

The reliability Cronbach's alpha for all items is .94; individual internal consistency reliabilities for each subcategory range from .84 to .93, making this a reliable instrument for this measure.

Table 1: Adjective pairs used in each subcategory of the STEM Semantics Survey

Adjective Pair Scale	
1	7
Fascinating	Mundane
Appealing	Unappealing
Exciting	Unexciting
Boring	Interesting
Means Nothing	Means a Lot

Note: Adapted from “Instruments for assessing interest in STEM content and careers,” by T. Tyler-Wood, G. Knezek, and R. Christensen, 2010, *Journal of Technology and Teacher Education*, 18(2), p. 341-363.

Independent Variables

Control/Treatment Instruction Designation. There were two trials in this study, one teacher per trial. In each trial, there were two 9th grade classes designated as the treatment group, and one 9th grade class designated as the control group. The treatment group received instruction based on problem based activities, visual aids, scaffolding, and mathematical structure. The control group received instruction based on lectures and procedural techniques. Instructional conditions are explained in detail below. Participants in both groups were also given the opportunity to receive additional mathematics help from their teacher. Since this was offered to all students, help in mathematics was included as an independent variable.

Ethnicity. Previous research has shown that African American and Latino high school students take fewer advanced level courses than their White peers due to having difficulty in required mathematical courses in earlier grades (Riegle-Crumb, 2006; Robinson, 2003). Difficulty in middle school mathematics courses may result in students’ difficulty in high school courses such as Integrated Algebra, Geometry, and Algebra 2/Trigonometry. Rigorous mathematics and science courses are usually taken with the greatest frequency by ethnic groups in the following order: Asians, Whites, Hispanics, and African Americans (Trusty, 2002; Robinson, 2003). To account for ethnicity-related mathematics performance, ethnicity was included as an independent variable in this study.

Instructional Conditions

The 9th grade students participating in the current study were pre-grouped into six sections; three sections were taught by one mathematics teacher (trial 1) and three sections were taught by the other mathematics teacher (trial 2). Two out of the three sections for each teacher were designated as the treatment group, and the remaining section was designated as the control group. Thus, each of the two teachers taught two sections of the treatment group and one section of the control group. There were 68 students from the combined sections of the treatment group and 39 students from the combined sections of the control group.

Control Condition. Instruction for the control group was characterized by lectures, worksheets, procedural techniques and assessments. The content focused on algebraic fractions since incoming ninth graders have already been taught numeric fractions in middle school.

The second unit in Integrated Algebra included factoring algebraic expressions such as $6x + 36$ and $x^2 + 7x + 6$. Factoring is a skill that is necessary when manipulating algebraic fractions because often times the expressions in the problem must be factored first to be used in writing fractions in alternate forms before adding, subtracting, multiplying, or dividing. The traditional instructional sequence of algebraic fractions is as follows:

Day 1 – Students were asked what it meant for a fraction to be undefined. This is related to algebraic fractions such as $\frac{x}{x+2}$, in which students must find the value of x that will make the denominator zero (in this case, -2).

Students were expected to simplify algebraic fractions (e.g. $\frac{c+7}{c^2-49}$) by factoring the numerator and denominator $\frac{c+7}{(c+7)(c-7)}$ to eliminate factors of one (a non-zero number divided by itself). Students were then given a worksheet with 28 problems in which they simplified algebraic fractions and indicated any excluded values for x . After all problems were completed, the teacher went over the questions that gave students the most difficulty.

Day 2 – At the beginning of class, students were given two algebraic fractions that had to be simplified. Students were also asked what made the algebraic fractions undefined. Students were then encouraged to list the rules that they had learned in middle school when adding, subtracting, multiplying and dividing fractions. After students shared their rules with the class, they

were informed that the same rules that they learned in middle school, were the same rules that could be applied to algebraic fractions. Students solved one subtraction and one division problem involving algebraic fractions. Students were shown at most two examples using numerical fractions. The class was given a handout with 14 problems which included all four operations. After all problems were completed, the teacher went over them with the class.

The Integrated Algebra teachers reported that, in the past, they would only take two days of instruction to teach algebraic fractions due to the frustration that students have with this topic. They did agree that students have a much easier time with multiplication and division than addition and subtraction. They also expected that additional practice will help students develop procedural fluency in manipulating algebraic fractions over time.

Treatment Condition. Participants assigned to the treatment condition will review the concepts of fractions. Lesson ideas were taken from mathematician and Professor, Dr. Albert Bennett, Jr. who designed a program which intends to provide students with conceptual understandings of fractions (Bennett, 2001). Dr. Bennett designed 49 durable plastic bars that represent halves, thirds, fourths, fifths, sixths, tenths, and twelfths, which are used to teach the concepts of equivalent fractions, adding, subtracting, multiplying and dividing fractions. Permission for using these materials in this study was provided by Dr. Bennett via email. Instruction for the treatment group was as follows:

Day 1 – Students were asked to verbalize their own definitions of a fraction. Within this discussion, students were asked about division by zero, that is, fractions with a denominator of zero. One of the misconceptions that students have is that a number divided by zero is zero. Thus, students were guided in discovering that division by zero is undefined. The teacher scaffolded this discovery by using the definition of division and mathematical structure.

Students were given a handout where they had to shade in given fractions (e.g., $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, etc.) and figure out equivalent fractions by using a clear ruler and matching up fraction bars. For example, these procedures are shown in Figure 1.

Students were also asked what makes a fraction value smaller or larger than another fraction. This activity opened up the discussion on fraction magnitude.

Figure 1. Equivalent fractions using fraction bars.

To determine if the following two fractions, $\frac{4}{6}$ and $\frac{2}{3}$, are equivalent, place one bar beneath the other. If the shaded parts are equivalent the shaded parts will be aligned with each other. Therefore, $\frac{4}{6} = \frac{2}{3}$



To ensure that students understood that numerical equivalent fractions have equivalent shaded amounts, students worked in groups of four to organize the 49 plastic fraction bars into equivalent fraction groups.

There was a class discussion on the meaning of equivalent fractions, and how numerical equivalent fractions can be created when they are multiplied by a form of 1. This is exemplified in the first problem in Figure 2.

Figure 2. Creating equivalent fractions.

The fraction $\frac{2}{3}$ represents a form of one because the number $\frac{3}{3}$ is being divided by itself. When $\frac{2}{3}$ is being multiplied by this form of one, an equivalent fraction is created.

Numerical Fraction: $\frac{2}{3} \cdot \frac{3}{3} = \frac{6}{9}$

Algebraic Fraction: $\frac{x+2}{x+3} \cdot \frac{3}{3} = \frac{3x+6}{3x+9}$

In order to show this concretely, students found the fraction bar that represented $\frac{2}{3}$. If each fractional part was split into three equal pieces, students will see there are 6 parts shaded out of 9, which means $\frac{6}{9}$ is the same as $\frac{2}{3}$, which shows that multiplying by $\frac{3}{3}$ creates the same result.

This was part of the algebraic structure that students needed to understand in order to be successful with algebraic fractions. Students were asked, “In how many different ways can the number one be represented as a fraction?” Eventually, students realized that any non-zero number or expression which is divided by itself is equivalent to one (e.g., forms of 1 are: $\frac{4}{4}$, $\frac{y}{y}$, $\frac{x+2}{x+2}$, etc.). In addition, when a fraction is multiplied by a form of 1, the fraction value does not change (the definition of multiplicative identity). Algebraic fractions were

defined as fractions with variables, and students were shown how a numerical example is very similar to algebraic examples (problem 2, Figure 2). Students were given practice examples involving equivalent fractions.

Students were shown how to write a numerical fraction in lowest terms by writing the prime factorization of the numerator and denominator, and then eliminating all factors that are equivalent to one. This process was then applied to algebraic fractions. This is illustrated in Figure 3.

Figure 3. *Writing a fraction in lowest terms.*

The fraction $\frac{6}{9}$ can be written as $\frac{2 \cdot 3}{3 \cdot 3}$ which are all prime numbers. A prime number is a Natural number that is greater than 1 that has no divisors other than one and itself. If one is eliminated, the remaining fraction is in lowest terms. The one is eliminated because any number multiplied by 1 is itself

$$\text{(e.g., } \frac{2 \cdot 3}{3 \cdot 3} = \frac{2}{3} \cdot 1 = \frac{2}{3} \text{)}$$

$$\text{Numerical Fraction: } \frac{2 \cdot \cancel{3}}{3 \cdot \cancel{3}} = \frac{2}{3}$$

$$\text{Algebraic Fraction: } \frac{3x \cdot \cancel{6}}{3x \cdot \cancel{9}} = \frac{\cancel{3}(x+2)}{\cancel{3}(x+3)} = \frac{x+2}{x+3}$$

Since the previous topic was on factoring different kinds of algebraic expressions, students had an idea of how to write the prime factorization for such problems. Students were given practice problems involving simplifying algebraic fractions and were given the opportunity to share their work with their peers.

Day 2 – Students were asked to write and share five equivalent fractions for $\frac{3x}{2y}$. This was a review from the previous class session. Students then compared the following two fraction bars and decided on which one was greater. They quickly decided that the blue fraction bar is greater than the yellow one. This is illustrated in Figure 4.

After this, students came up with their own strategy when comparing two fractions. They eventually compared fractions to $\frac{1}{2}$ or 1 to decide if one was greater than the other. Students were then asked to find two fraction bars that had the same total amount of parts with different amounts shaded, and add them (e.g., fraction bars like $\frac{1}{7}$ and $\frac{3}{7}$). Since it was expected that

Figure 4. *Fraction inequalities*

When placing the gray fraction bar above the white fraction bar, it is easy to see that the white fraction bar is greater than the gray one. Therefore, $\frac{3}{4} > \frac{2}{3}$.



most students will not make the mistake of adding the numerators and denominators, they were encouraged to explain why this approach was incorrect. For example, when adding the above fractions correctly, the answer is $\frac{4}{7}$ which is greater than one-half. If the numerators and denominators were added together, the answer is $\frac{4}{14}$ which is less than one-half. This approach was used for subtracting numeric fractions, and students saw that if the denominators were subtracted, they will get a denominator of zero which does not make sense because you cannot divide something by nothing. This showed why the numerators are only added or subtracted when adding and subtracting fractions with like denominators. Students were given algebraic problems where the denominators were the same to see if they could relate adding numeric fractions to adding algebraic fractions (problem 1, Figure 5). Creating equivalent fractions was revisited, and students learned how to add and subtract fractions with unlike denominators using prime factorization to create common denominators (problem 2, Figure 5). Students were given problems with numerical fractions where they had to use prime factorization. Using this approach, students were asked how they could add two algebraic fractions with unlike numeric denominators (problem 3, Figure 5), and were given practice problems similar to these.

After adding and subtracting numeric fractions and algebraic fractions with unlike numeric denominators, students were given examples where the denominators are unlike algebraic expressions. This is shown in Figure 6.

Day 3 – Students were given three questions involving addition and subtraction to review concepts from the previous lesson. Students were then asked how multiplication is related to addition. Students are often taught to memorize the multiplication tables without understanding the concept of multiplication. Students were shown that when two numbers are multiplied together, it is repeated addition ($4 \cdot 6 = 6 + 6 + 6 + 6$

Figure 5. Adding numerical and algebraic fractions.

Algebraic Fraction (Like Denominators):

$$\frac{6x + 3}{x - 7} + \frac{4x - 1}{x - 7} = \frac{10x + 2}{x - 7}$$

Numerical Fraction:

$$\frac{1}{8} + \frac{3}{4} = \frac{1}{2 \cdot 2 \cdot 2} + \frac{3}{2 \cdot 2} \cdot \frac{2}{2} = \frac{1}{8} + \frac{6}{8} = \frac{7}{8}$$

Algebraic Fraction:

$$\frac{2x + 3}{3} + \frac{4x - 1}{5} = \frac{2x + 3}{3} \cdot \frac{5}{5} + \frac{4x - 1}{5} \cdot \frac{3}{3} = \frac{10x + 15 + 12x - 3}{15} = \frac{22x + 12}{15}$$

Figure 6. Adding algebraic fractions with unlike algebraic denominators.

$$\frac{1}{24x} + \frac{x + 2}{6x^3} = \frac{1}{2 \cdot 2 \cdot 2 \cdot 3 \cdot x} + \frac{x + 2}{2 \cdot 3 \cdot x \cdot x \cdot x}$$

where each fraction is multiplied by a form of 1 to get the common denominator of $24x^3$.

= 24; 4 groups of 6). Using this concept, when a whole number is multiplied by a fraction, the fraction is added repeatedly a certain number of times

$$\text{(e.g., } 4 \cdot \frac{1}{3} = \frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{3} = \frac{4}{3} \text{)}.$$

Students were shown more examples using this method, and it showed that a quick way of multiplying a whole number by a fraction is to rewrite the whole number as a fraction with the denominator of 1 (which does not change the value), then multiply the numerators and denominators together (e.g. $\frac{5}{1} \cdot \frac{2}{13} = \frac{10}{13}$). This concept

was applied to algebraic fractions where one variable is multiplied to an algebraic fraction

$$\text{(e.g., } \frac{x}{1} \cdot \frac{x + 3}{5} = \frac{x^2 + 3x}{5} \text{)},$$

and students were given practice problems. Students already knew when multiplying two fractions together, the numerators and denominators are multiplied. Area

models were used to prove why this is so, as shown in Figure 7.

Students were given multiplication problems where they had to draw area models in order to show how to get the answer. When multiplying two numeric fractions without an area model, students were shown how to simplify the fractions first by using prime factorization and elimination before multiplying the numerators and denominators. This is exemplified in Figure 8 on the next page.

Day 4 – Students were given three multiplication questions to solve which was a review from the previous lesson. Students were then given the problem $\frac{1}{6} \div \frac{2}{7}$.

Students already knew that the first fraction must be multiplied by the reciprocal of the second fraction, but they did not know why. They were shown that this

Figure 7. Area model for multiplying fractions.

The diagram shows the multiplication of two fractions.

There are 6 cells shaded for both fractions, so the answer is $\frac{6}{24}$.

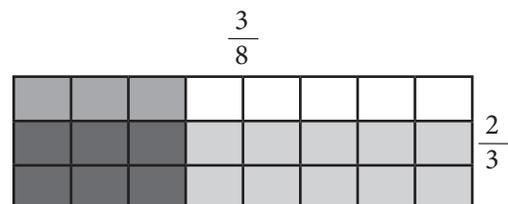


Figure 8. *Multiplying numeric and algebraic fractions.*

Numerical Fraction:

$$\frac{3}{9} \cdot \frac{7}{10} = \frac{\cancel{3} \cdot 7}{\cancel{3} \cdot 3 \cdot 5 \cdot 2} = \frac{7}{30}$$

Algebraic Fraction:

$$\frac{x+2}{2} \cdot \frac{10}{x+1} = \frac{x+2}{\cancel{2}} \cdot \frac{\cancel{2} \cdot 5}{x+1} = \frac{5(x+2)}{x+1}$$

problem could be written vertically and the only way the denominator can become a 1 (which will make the fraction appear less complicated), is to multiply the denominator by $\frac{7}{2}$, which is the reciprocal. To keep the value of the original fraction the same, the numerator must be multiplied by $\frac{7}{2}$ as well to create a problem equivalent to the original. Figure 9 shows why the division rule of multiplying the first fraction by the reciprocal of the second fraction works. This was applied to algebraic fractions, and since it required students to multiply the fractions in the end, it was a review from the prior class.

DATA COLLECTION PROCEDURE

Figure 9. *Dividing numerical fractions.*

$$\frac{\frac{1}{6}}{\frac{2}{7}} \cdot \frac{7}{2} = \frac{1 \cdot 7}{6 \cdot 2} = \frac{7}{12}$$

Parental consent forms were given to all students before the unit was taught, and students were given up to one week to return them. The pre-test/post-test was administered once before the topic was taught and once after the topic was taught. Demographic information, as well as mathematics attitude scores from the STEM Semantics Survey was reported by each student at the time of pre-test. All students were identified by the last four digits of their ID number. Factor analyses and reliability statistics were performed on this test after all participants took it for the second time. Algebraic fractions are in the third unit of Integrated Algebra which is approximately taught from early-March to early-April. During these weeks, students in both the control and treatment groups received

instruction on factoring algebraic expressions, adding, subtracting, multiplying, and dividing numeric fractions and algebraic fractions. The control group received traditional instruction that included lectures, procedural techniques and worksheets made up of textbook problems in which concrete examples are limited. The treatment group received instruction based upon the concepts of fractions which included understanding them concretely. During the last week of the unit, the post-test was administered. Since all tests had correct responses, an answer key was made before any test was administered.

DATA ANALYSIS PROCEDURE

There was no established validity or reliability information on the pre-test/post-test used in this study, since they were created by the investigator. Before deriving any correlations or performing regressions analyses, a factorial analysis was carried out using the Statistical Package for the Social Sciences (SPSS) where each wrong survey answer was coded as 0, and each correct answer was coded as 1. The factorial analysis grouped all test items into factors, and any question that had a low coefficient ($< .5$) in the rotated matrix was eliminated from any further statistical procedure. This indicated that the question(s) were not answered consistently by the participants in the study and therefore needed to be removed. After a factorial analysis was conducted on the post-test instrument, and reliability and validity information was found, a correlation matrix was generated to see if there were any pre-existing relationships among the independent variables and the pre-test scores. A significance level of $p < .05$ was the standard for all statistical procedures, which shows that there was less than a 5% probability of the event occurring by chance. Frequency tables with means and standard deviations were also reported.

In order to answer the research questions, an independent samples t-test on the control and treatment groups was used to investigate whether students exposed to the treatment instruction or traditional instruction on numeric fractions and algebraic fractions improved significantly from pre-test to post-test. This procedure was also used to establish whether or not students exposed to the treatment instruction or traditional instruction improved in mathematical attitude from pre-test to post-test.

To investigate the relationships between the pre-test and post-test scores of the treatment and control groups, a Multivariate Analysis of Covariance (MANCOVA) was

utilized (while controlling for mathematics average, gender, mathematics attitude scores and highest parental/guardian education).

RESULTS

The data were loaded into the Statistical Program for Social Sciences (SPSS) version 21. A total of 182 students enrolled in six sections of Integrated Algebra participated in this study. In order for each student to be included in the study, a complete data profile consisting of a pre-test, post-test, parental consent form, student assent form, and demographic survey, had to be obtained. Of the 182 students, 107 had complete data and were subsequently used in the data analysis. The six sections were randomly assigned to either the treatment (concrete to abstract instruction) or control (traditional instruction) group. Of the 107 students, 68 students were in the treatment group and 39 students were in the control group.

Students were administered a pre-test and post-test on their mathematical attitudes, fraction knowledge misconceptions, and operations with numeric and algebraic fractions, for which psychometric tests were performed. Statistical tests were performed on the data to answer the research question as to whether students assigned to the concrete to abstract instruction (treatment) group would develop greater gains in procedural fluency and conceptual knowledge than those assigned to the traditional instruction (control) group. These tests were also used to answer the research question as to whether students assigned to the treatment group would develop more positive attitudes than those assigned to the control group. Fraction knowledge misconceptions were coded dichotomously (0 = incorrect, 1 = correct), and short answer items involving operations with numeric and algebraic fractions were coded by the type of error that was made (0 = no answer, 1 = conceptual and procedural error, 2 = conceptual error, 3 = procedural error, 4 = no error). Total scores reflecting the sum of the items on each section of the pre- and post-test were calculated and new variables reflecting these total scores were entered. The categorical non-dichotomous predictor variables, ethnicity, mother's highest education level, father's highest education level, and mathematics help were entered using dummy coding in order to correctly measure how well the dependent variables can be predicted from the knowledge of the predictor variables.

Table 2
Principle Component Analysis of Short-Answer Items

Item	Coefficient
PostShort3	.90
PostShort2	.86
PostShort9	.80
PostShort1	.77
PostShort10	.76
PostShort4	.75
PostShort11	.69
PostShort7	.56

Factor Analysis of Short-Answer Items

A principal component analysis was performed in order to determine the best set of test items to be used in the data analysis. For this analysis, the minimum Eigenvalues were set to 1.0. After several factor analyses were performed, 8 items from the original 12 items were extracted. The KMO measure of sampling adequacy yielded an acceptable value of .89. The analysis produced a one-factor, eight-item model which accounted for 58.59% of the variance. Loadings of the eight items ranged from .56 to .90 (see Table 2). For the short-answer items involving operations with numeric and algebraic fractions, the eight items produced a Cronbach's alpha of .89, which indicates a high level of internal consistency reliability.

Scoring of Short-Answer Items

In order to correctly score the short-answer items on procedural and conceptual errors made when adding, subtracting, multiplying and dividing numeric and algebraic fractions, a survey was created and given to 14 mathematics teachers and professors. Each question had the following four answer choices: (1) procedural error, (2) conceptual error, (3) procedural and conceptual error, and (4) neither a procedural or conceptual error. An abbreviated version of the questions with the most selected answer choice is shown in Table 3 on the next page. For the full questions, please refer to Appendix B. Questions that had unclear errors were shown to three other mathematics educators before a final decision was made on scoring.

Table 3. *Procedural and Conceptual Errors Involving Algebraic Fractions Survey and Response*

Question	Answer Selected	Freq.
A student makes a mistake of adding algebraic fractions...	Procedural and Conceptual Error	7
While adding and subtracting algebraic fractions...	Procedural Error	12
When adding and subtracting algebraic fractions, a student finds a common denominator...	Procedural Error	6
When simplifying an algebraic fraction...	Conceptual Error	12
A student cannot recognize that $(x+1)/2$ and $(3x+3)/6$ are equal...	Conceptual Error	11
A student multiplies or divides algebraic fractions incorrectly...	Procedural Error	9

Descriptive Statistics

Due to random assignment of sections, and each teacher having 3 out of 6 sections to teach both conditions, the concrete to abstract and traditional instruction groups had unequal amounts of participants. A total of 68 students were assigned to the treatment group and 39 students were assigned to the control group. Descriptive data including frequencies and percentages that portray the make-up of the participants on categorical variables are shown in Table 4. Table 5 reports descriptive statistics including measures of central tendencies, variability, skewness and kurtosis of quantitative variables which includes mathematics average and the total scores on each section of the pre- and post-test.

The values of skewness and kurtosis should be zero on a normal distribution. With the exception of the pre-short answer total for the treatment group, all values of skewness and kurtosis are near zero, which shows that the distribution of data is acceptable for all variables in Table 5.

Independent Samples t-Test

An independent samples t-test was conducted on the pre-test scores to make sure that there were no significant group mean differences at time of pre-test and that the assumption of equal variances assumed was met. An independent samples t-test was used to evaluate the mean differences between the treatment and control groups for the dependent variables: post-attitude total scores, post-misconception total scores, and post-short-answer total scores.

The assumption of homogeneity of variance was fully satisfied, and Levene's test was not significant for any of the pre-test scores or post-test scores.

The results from the independent-samples t-test showed that there was a significant difference between the control group ($M = 5.62$, $SD = 4.54$) and treatment group ($M = 3.84$, $SD = 3.56$) on the pre-short answer total scores ($t[105] = 2.24$, $p = .03$), indicating that the control group scored on average 1.78 points higher on the pre-short answer items than students in the treatment group. Since there was no significance due to grouping at time of post-test for the short-answer items, a preliminary assumption can be made that the treatment group ($M = 11.54$, $SD = 8.61$) did improve and performed just as well as the control group ($M = 11.85$, $SD = 9.41$) at time of post-test ($t[105] = .17$, $p = .87$).

Four-Group Analysis

The data on the 107 participants were split up into four groups involving low and high mathematical averages. The mathematical average of the 107 participants ($M = 76.38$, $SD = 14.33$) was used as a cut-off score in order to separate the participants in to low- and high-average groups, still accounting for control or treatment group assignment. Since the median ($Mdn = 80.00$, $SD = 14.33$) was comparatively close to the mathematical average, the overall data was fairly equalized. A total of 50 participants had low mathematical averages, and a total of 57 participants had high mathematical averages. Means and standard deviations for all quantitative variables, separated by math average status are reported in Tables 6 and 7.

Independent Samples t-test for Low-Average Students.

An independent samples t-test was used to evaluate the mean differences between the treatment and control groups for low-average students for the dependent variables: post-attitude total scores, post-misconception total scores, and post-short answer total scores. First, an independent samples t-test was performed on the pre-test

Table 4. *Descriptive Statistics for Categorical Variables*

Variable	Value Label	frequency	percentage
Instruction	Control Group	39	36.4
	Treatment Group	68	63.6
Gender	Male	44	41.2
	Female	63	58.9
Ethnicity	White	12	11.2
	Hispanic	11	10.3
	Black	36	33.6
	Native American/American Indian	2	1.9
	Asian-Pacific Islander	21	19.6
	Other/Multi-Racial	25	23.4
	Less than High School	1	0.9
MotherEd	High School/GED	27	25.2
	Some College	20	18.7
	2-Year College Degree	13	12.1
	4-Year College Degree	20	18.7
	Master's Degree	13	12.1
	Not Applicable	13	12.1
	Less than High School	3	2.8
FatherEd	High School/GED	35	32.7
	Some College	15	14
	2-Year College Degree	10	9.3
	4-Year College Degree	18	16.8
	Master's Degree	10	9.3
	Doctoral Degree	2	1.9
	Not Applicable	14	13.1
MathHelp	Often	37	34.6
	Sometimes	31	29
	Rarely	19	17.8
	Never	20	18.7

Table 5. Means and Standard Deviations for Pre-Tests and Post-Tests by Group

Covariates & DVs	Instruction Intervention	N	M	SD	Med.	Var.	Skew.	Kurt.	Range	Min.	Max.
MathAvg	Control	3	75	17.2	83	298	-0.8	0.50	75	23	98
		9	33	4		.23	5				
	Treatment	6	79	12.4	79	154	-0.7	0.94	64	36	100
		8	99	4	5	.88	2				
PreAttitude	Control	3	22	5.71	22	32	-0.5	1.13	28	5	33
		9	28			63	6				
	Treatment	6	22	6.68	22	44	-0.1	1	30	5	35
		8	78			68	4				
PreMiscTotal	Control	3	3.8	1.63	4	2.6	-0.5	-0.43	6	0	6
		9	5			6	5				
	Treatment	6	4	1.30	4	1.7	-0.6	0.06	6	0	6
		8	6				1				
PreShortTotal	Control	3	5.6	4.54	4	20	1.3	0.75	16	0	16
		9	2			61	0				
	Treatment	6	3.8	3.56	4	12	1.5	2.9	16	0	16
		8	4			68	2				
PostAttitude	Control	3	21	6.64	21	44	-0.1	0.13	30	5	35
		9	5			10	4				
	Treatment	6	23	7.68	23	59	-0.2	-0.39	30	5	35
		8	34			3	7				
PostMiscTotal	Control	3	4.2	1.75	5	3.0	-0.5	-1	5	1	6
		9	1			6	8				
	Treatment	6	4.1	1.72	5	2.9	-1.0	.019	6	0	6
		8	6			7	1				
PostShortTotal	Control	3	11	9.42	10	88	0.6	-0.49	32	0	32
		9	85			71	5				
	Treatment	6	11	8.61	8.5	74	0.8	-0.40	31	1	32
		8	54			19	4				

Note: MathAvg = Mathematics Average, PreAttitude = Pre-test Attitude Score, PreMiscTotal = Pre-test Fraction Knowledge Misconception Total Score, PreShortTotal = Pre-test Short-Answer Total Score, PostAttitude = Post-Test Attitude Score, PostMiscTotal = Post-test Fraction Knowledge Misconception Total Score, PostShortTotal = Post-test Short-Answer Total Score.

scores to make sure that there were no significant mean differences at time of pre-test and that the assumption of equal variances assumed was met.

The assumption of equality of variance was fully satisfied for the pre-test scores - Levene's test was not significant. The assumption of equality of variance was only partially satisfied for the post-test scores. Levene's test was significant for the post-short answer total scores ($p = .009$).

The results from the independent samples t-test showed that there was a significant difference when equal variances are not assumed between the control group ($M = 4.74$, $SD = 3.71$) and treatment group ($M = 10.65$, $SD = 7.27$) on the post-short answer total scores ($t[46.82] = -3.79$, $p = .00$), indicating that the treatment group scored on average 5.91 points higher on the post-short answer items than students in the control group.

MANCOVA for Low-Average Students.

The Shapiro-Wilk test of normality was used to determine whether the assumption of multivariate normality was violated. The test was significant ($p < .05$) for all variables with the exception of pre- and

post-attitude scores, which indicates that the data for the other pre- and post-tests were not normally distributed. The misconception total scores were negatively skewed, and the short-answer total scores were positively skewed. Since the sizes of the treatment and control groups were unequal, Box's Test of Equality of Covariance Matrices was used to indicate whether the data violated the assumption of homogeneity. The Box's Test was not found to be significant ($p = .17$), therefore the assumption of homogeneity of variances/covariance matrices has been satisfied. Since not all of the assumptions for MANCOVA were satisfied, the results should be accepted with caution.

The MANCOVA (controlling for mathematics average, gender, parental education, and pre-test scores) indicated that the instruction grouping variable did contribute significantly to the variance of the two dependent variables (mathematical attitude post-test total scores and post-short answer total scores): Wilks' Lambda = .61, $F(3, 18) = 3.79$, partial eta squared = .39, $p = .03$. These results indicate that there were only significant differences between the treatment and control groups due to instruction on post-attitude and post-short answer total scores (see Table 8).

Table 6. Means and Standard Deviations for Quantitative Variables of Low-Average Students, by Group

	Instruction Intervention	N	Mean	SD
MathAvg	Conttol	19	60.32	12.07
	Treatment	31	66.26	9.11
PreAttitude	Conttol	19	21.84	5.17
	Treatment	31	21.13	6.41
PreMisc Total	Conttol	19	3.16	1.71
	Treatment	31	3.90	1.35
PreShortTotal	Conttol	19	3.53	2.74
	Treatment	31	3.16	1.99
PostAttitude	Conttol	19	18.16	5.57
	Treatment	31	20.84	7.61
PostMiscTotal	Conttol	19	3.21	1.78
	Treatment	31	3.48	1.63
PostShortTotal	Conttol	19	4.74	3.71
	Treatment	31	10.65	7.27

Table 7. Means and Standard Deviations for Quantitative Variables of High-Average Students, by Group

	Instruction Intervention	N	Mean	SD
MathAvg	Conttol	20	89.60	4.33
	Treatment	37	85.97	6.08
PreAttitude	Conttol	20	22.70	6.29
	Treatment	37	24.16	6.68
PreMisc Total	Conttol	20	4.50	1.28
	Treatment	37	4.19	1.27
PreShortTotal	Conttol	20	7.60	5.06
	Treatment	37	4.41	4.43
PostAttitude	Conttol	20	23.80	6.52
	Treatment	37	25.43	7.19
PostMiscTotal	Conttol	20	5.15	1.09
	Treatment	37	4.73	1.61
PostShortTotal	Conttol	20	18.60	8.11
	Treatment	37	12.30	9.63

Table 8. *Multivariate Analysis of Differences between Groups on Dependent Variables*

Variable	Effect	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Instruction	Pillai's Trace	.39	3.79	3.00	18.00	.03	.39
	Wilks' Lambda	.61	3.79	3.00	18.00	.03	.39
	Hotelling's Trace	.63	3.79	3.00	18.00	.03	.39
	Roy's Largest Root	.63	3.79	3.00	18.00	.03	.39

Synopsis of Specific Findings

Independent Samples t-test.

An independent samples t-test showed a significant mean difference in pre-short-answer total scores. At time of pretest, the control group scored on average 1.78 points higher than the treatment group. These results indicate that the control and treatment groups were not equal at time of pre-test which discounts the findings of the post-test results, if in fact it was found significant. An independent samples t-test did not show a significant mean difference in post-short answer total scores which indicates that the students in the treatment group made greater gains from pre-test to post-test than the control group.

When the sample was divided into two more groups, low-average and high-average students, the independent samples t-test results showed that there was a significant mean difference in post-short-answer test scores between the control and treatment groups when equal variances are not assumed. The treatment group scored on average 5.91 points higher than the control group. There was a significant mean difference in pre- and post-short answer scores for high-average students, but the control group outscored the treatment group on both accounts (an average of 3.19 points higher at time of pre-test, and 6.30 points higher at time of post-test). These results indicate that students with high mathematical averages may be more successful with traditional instruction than those with low averages in mathematics.

MANCOVA

The MANCOVA (controlling for mathematics average, gender, parental education, and pre-test scores) indicated that the instruction grouping variable did contribute

significantly to the variance of two dependent variables, post-attitude total scores and post-short-answer total scores, for low-average students. The treatment group scored on average 2.68 points higher than the control group on post-attitude total scores and an average of 5.91 points on the post-short answer total scores. This indicates that a concrete to abstract approach to instruction may be more beneficial for students who struggle in mathematics.

CONCLUSIONS AND IMPLICATIONS

Results and Suggested Meanings

After data were collected, they were entered into SPSS version 21 and analyzed using both descriptive and inferential statistics. An independent samples t-test was employed to determine whether there were differences between groups on the dependent variables (post-attitude total scores, post-misconception total scores and post-short-answer total scores). Before this was done, statistical tests were conducted on the pre-test scores to confirm that both groups were performing equally well at the time of the pre-test. A MANCOVA was also used to determine whether there were differences between the groups on the dependent variables.

While the MANCOVA did not detect significant differences between the treatment and control groups on the post-test short-answer items, the independent samples t-test revealed that even though groups did not perform equally well at the time of the pre-test (the control group outperformed the treatment group), both groups did perform equally well at the time of the post-test. These results indicate that students in the concrete to abstract instruction group made greater gains in procedural fluency and conceptual knowledge of numeric and algebraic fractions than the control group. After the sample was separated into high-average and

low-average groups, some other significant findings emerged. Even though there were no significant differences between the treatment and control groups of high-average students on procedural fluency and conceptual knowledge, significant differences were revealed for low-average students. The independent samples t-test and the MANCOVA revealed that students in the treatment group outperformed students in the control group on the post-test short-answer items. This shows the need to diversify instruction for the needs of low-average students. While the independent samples t-test did not detect differences in mathematical attitudes, the MANCOVA showed that students in the treatment group developed better attitudes than students in the control group.

Instructional Design

The instructional design used in this study focused on concrete to abstract learning, as part of the overall pedagogical strategy of teaching numeric and algebraic fractions. Students were given opportunities to work with manipulatives and visual representation to foster fraction skills, and then were able to take what they had learned and applied it to abstract problems. Despite a limited amount of research on fraction instruction, researchers who have conducted studies on this topic have found success in using a concrete to abstract teaching approach (e.g., Butler et al., 2003, Jordan et al., 1999).

In spite of the success that low-average students had with learning from a concrete to abstract instructional approach, the results were opposite for high-average students. With the short-answer items, the control group outperformed the treatment group on the pre-test and post-test. The fact that this type of instruction was not as successful with students who did not struggle in mathematics warrants further explanation. The participating teachers in this study did reveal that the high-average students in the treatment group became quickly frustrated with the concrete to abstract teaching method. Possibly for these students, they already understood the concepts of numeric fractions concretely, and were cognitively ready to think more abstractly about the topic. The Common Core State Standards (CCSS) for Mathematics promote teaching methods that are less focused on test preparation and drill-and-practice and more centered on conceptual development. Since the high achieving students were already successful with traditional teaching methods, perhaps they were not as comfortable with a concrete to abstract teaching approach. Also, in the control group's classroom, an emphasis on explicit (sequential

and systematic) instruction was used to develop the understanding of numeric and algebraic fractions, and the few research studies that have used this approach have been successful with 7th and 9th grade students (e.g., Bottge et al., 1993, Kaylor, 2007, Kelly et al., 1990, Gersten et al., 1992).

Incorrect Strategies

While grading the short-answer items, there was evidence that students were using consistent strategies as they worked to simplify algebraic fractions, but these strategies were most often incorrect. As was predicted, there was an apparent reliance on visual cues, for instance, when students would cross out identical terms

during a simplification error (e.g., $\frac{\cancel{x} + 7}{\cancel{x}}$)

or would rewrite a term so that they could see a factor and draw a line across the division bar. The fact that students continue to make this error shows that future studies should focus more on mathematical structure of the multiplicative identity property and simplifying algebraic fractions and the connections to creating equivalent fractions. Additionally, students consistently added or subtracted numerators and denominators when given addition and subtraction problems which indicated that using such a strategy was based on a flawed conception of adding and subtracting fractions. One type of incorrect strategy that was not predicted before hand was cross-multiplication for addition and subtraction problems. These students ignored the addition and subtraction sign and decided to cross multiply as though there was an equal sign between the two fractions.

LIMITATIONS

Several limitations of this study are noteworthy. The small sample size ($n = 107$) indicates that the results may be questionable. Furthermore, teachers were given an alternative way of teaching numeric and algebraic fractions that was very different from their own teaching approach and how they learned the topic. When the teachers were given the lessons six months in advance, they had a difficult time learning this new approach to teaching this topic. Even though the teachers may have done the best that they could in delivering the lessons the way that they were written, perhaps results will be different if they were to do this a second time.

In addition to the teachers learning a concrete to abstract teaching approach, students had to relearn a topic in a non-traditional way. According to the two teachers,

students expressed frustration with the numeric fraction portion of the lessons because they claimed that they already learned this topic in middle school. Some students were so accustomed to the meaningless algorithms of numeric fractions that they learned in middle school, they were very resistant in experiencing a more conceptual way of learning the topic because it seemed more complicated. If procedural knowledge is limited to meaningless algorithms, students cannot reconstruct a forgotten procedure nor can they transfer conceptual knowledge of numeric fractions to algebraic fractions. Additionally, this research was conducted on a specific geographical sample. Results could differ with different populations of other geographical areas, different gender distribution, other ethnic groups, or students of different social economic status.

The length of time of the treatment was two weeks. The lessons that were taught to the treatment group could have been expanded beyond two weeks, which could have produced different or better results. Perhaps students who already had high mathematical averages would have developed an appreciation for the concrete to abstract teaching approach over time, therefore developing a better conceptual understanding of the topic, and may have performed higher on the post-tests.

Finally, empirical research on teaching methods of algebraic fractions is relatively new. The concrete to abstract teaching approach is one possible intervention that can be used to teach numeric and algebraic fractions. A different type of intervention could have produced the same or different results.

RECOMMENDATIONS FOR FUTURE RESEARCH

By the time students begin to study fractions, they have had three or more years of schooling in addition to seven or more years of diverse, individual experiences that contribute to their innate knowledge. Knowing the path that any student has taken in coming to grasp a particular strand of knowledge is impossible because, in fact, many different paths can lead to the same useful understanding. There is no single best way to reach a goal or to order instruction. Furthermore, students cannot be taught each and every context and application that is useful. The process of understanding numeric and algebraic fractions develops over time and brief teaching experiments have had disappointing results. There seems to be no substitute for longitudinal research that takes into account the full complexity of the classroom, the full complexity of students' empirical

backgrounds and intuitive knowledge, and the full intricacy of mathematics.

Students need a starting place in one of the rational number interpretations (part-whole comparisons, adding and subtracting with manipulatives, etc.) for their fraction instruction. In this space, they need to develop the ideas of unit and equivalence of fractions. They need to develop techniques for comparison so that they can estimate the relative size to fractional numbers. They need sufficient time to work in that interpretation without given rules so that they develop fraction sense, a comfort and flexibility in fraction thinking. When sufficient time is given, students will be able to bridge what they have learned and experience to operations with numeric and algebraic fractions.

CONCLUDING REMARKS

As conceptual learning is considered to lead to longer and deeper understanding (Sawyer, 2006), students may benefit from hands-on style interventions in the long term. Students could use their conceptual understanding to develop more appropriate representation of fractions, which might then help them create further procedural fluency. As shown in this study, students who were in the concrete to abstract instruction group showed improvement in their procedural skills on the post-test short-answer items. Their conceptual understanding of numerical fractions helped them deal with procedural skills.

One of the surprising results of this study was that high-average students of the control group outperformed the treatment group at time of pre-test and post-test. This seems related to the lessons that teachers gave students of the control group. In the control classes, teachers put more emphasis on procedural fluency than conceptual knowledge. If all students were given a maintenance test 10 weeks after intervention, it would be interesting to see whether or not these results would have been duplicated.

This study showed clear improvements in low-average students' conceptual knowledge and procedural fluency of fractions. The conceptual improvements allowed students to develop arithmetic procedures with fractions, but further research should investigate through longitudinal studies whether such interventions have long-lasting positive effects and whether, such conceptual improvements facilitate students' acquisition and use of procedures and help negate mathematical blockage at later stages of curriculum.

APPENDIX A

Student Number (last 4 digits of ID): _____ Fraction Knowledge (Pre/Post-Test)

Student Section: _____

Choose one circle between each adjective pair to indicate how you feel about the subject. To me, MATH is:

1.	boring	①	②	③	④	⑤	⑥	⑦	interesting
2.	unappealing	①	②	③	④	⑤	⑥	⑦	appealing
3.	mundane	①	②	③	④	⑤	⑥	⑦	fascinating
4.	unexciting	①	②	③	④	⑤	⑥	⑦	exciting
5.	means nothing	①	②	③	④	⑤	⑥	⑦	means a lot

**Choose one circle for each item below.
Think of both numerical and algebraic fractions.**

Item Question	Yes	No	Sometimes
1. Fractions may refer to parts of a set and parts of a whole.			
2. When a number is divided by smaller and smaller fractions, the quotient is smaller than the original number.			
3. Fractions and decimals are two different representations of the same concept.			
4. Fractions represent numbers that are less than one whole			
5. Fractions are added together by adding the numerators and adding the denominators.			
6. The bigger the denominator of a fraction, the bigger the fraction.			
7. Equivalent fractions are those that have the same value.			
8. The size of a fraction depends solely on the denominator.			
9. When multiplying one proper fraction by another proper fraction, the product is bigger than the first fraction.			
10. Equivalent fractions are created when multiplying by a form of 1.			
11. Fractions consist of two independent expression separated by a line.			
12. A whole number such as 1 and 2 cannot be written as a fraction.			
13. When comparing two fractions with the same numerator, the fraction with the biggest denominator is always the smallest.			
14. Equivalent fractions are two ways of describing the same amount by using different-sized fractional parts.			
15. When adding and subtracting numeric fractions and algebraic fractions with unlike denominators, prime factorization must be used.			
16. A number divided by zero is zero.			
17. A fraction represents division			

Please answer the following questions to the best of your ability. Show all of your work below.

1. $\frac{3}{x} + \frac{2}{5} =$

2. $\frac{2}{3x^2} + \frac{3}{12x} =$

3. $\frac{5}{6c} + \frac{3}{2c^4} =$

4. $\frac{1}{6} + \frac{7}{4} =$

5. $\frac{5x+3}{x} - \frac{x-1}{2x} =$

6. $\frac{2x+13}{2x+6} - \frac{3x-6}{2x+6} =$

7. $\frac{7}{12x} - \frac{y}{36x^2} =$

8. $\frac{6x}{x} + \frac{7}{15x+3} =$

9. $\frac{2x+6}{4x+12} \div \frac{x^2-4}{x+3} =$

10. Does $\frac{x+3}{6}$ equal $\frac{x+1}{2}$? Explain.

11. Does $\frac{5x^2}{10x}$ equal $\frac{x}{2}$? Explain.

12. Draw a diagram to show the product of $\frac{3}{8}$ and $\frac{1}{3}$. Explain your diagram using words.

APPENDIX B

Procedural and Conceptual Error Survey

INFORMED CONSENT: Please read the following statement and click “yes” below if you agree to participate in the study (detailed below) and have read the informed consent statement below. As a mathematics educator/student you are being asked to answer questions about procedural fluency errors and conceptual understanding errors involving algebraic fractions. Your participation will help improve the research in this area. Your answers will be anonymous and confidential and this survey will only take 10 minutes of your time. There are no potential risks to you for participating in this research.

- Yes, I agree to participate and have read the Informed Consent message (above)
- No, I do not wish to participate at this time

Please indicate your status

- College student studying Mathematics and/or Mathematics Education
- Mathematics Teacher
- Mathematics Professor
- Mathematics Education Professor

1. A student makes a mistake of adding algebraic fractions by adding the numerators and denominators. Identify the type of error that best describes the given situation.
 - procedural error
 - conceptual error
 - procedural and conceptual error
 - neither a procedural or conceptual error
2. While adding or subtracting algebraic fractions, a student adds or subtracts like terms incorrectly. Identify the type of error that best describes the given situation.
 - procedural error
 - conceptual error
 - procedural and conceptual error
 - neither a procedural or conceptual error
3. When adding and subtracting algebraic fractions, a student finds a common denominator but not the lowest common denominator. By doing so, their answers are not in simplest form. Identify the type of error that best describes the given situation.
 - procedural error
 - conceptual error
 - procedural and conceptual error
 - neither a procedural or conceptual error
4. When simplifying an algebraic fraction such as $\frac{x+2}{x}$, a student makes a mistake by crossing out the variables. Identify the type of error that best describes the given situation.
 - procedural error
 - conceptual error
 - procedural and conceptual error
 - neither a procedural or conceptual error

5. A student cannot recognize that $\frac{x+1}{2}$ and $\frac{3x+3}{6}$ are equal. Identify the type of error that best describes the given situation.
- procedural error
 - conceptual error
 - procedural and conceptual error
 - neither a procedural or conceptual error
6. A student multiplies or divides algebraic fractions incorrectly because of factoring mistakes. Identify the type of error that best describes the given situation.
- procedural error
 - conceptual error
 - procedural and conceptual error
 - neither a procedural or conceptual error

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Preservice Teachers Learning to Solve Multiplication Problems Using Multiple Strategies

Mary Gichobi

Abstract: This report describes elementary and middle school preservice teachers' (PSTs) strategies for multiplying multi-digit numbers using place value understanding and properties of operations before and after completing a multiplication unit in a mathematics content course. As indicated in the Standards for Preparing Teachers of Mathematics (AMTE, 2017); PSTs should enter classrooms with knowledge of progressions of students' thinking—levels of thinking through which students advance while they learn a specific mathematical topic” (p.11). In this report, PSTs strategies of multiplying two-digit numbers using multiple strategies are described and the explanations of those strategies are explicated.

About the Author: *Dr. Mary Gichobi is an Assistant Professor at UW-Green Bay. She instructs both mathematics content and methods courses for k-8 preservice teachers*

Keywords: multiplication strategies, preservice teachers' learning, standards for preparing teacher of mathematics

INTRODUCTION

Well prepared beginning teachers of mathematics have solid and flexible knowledge of core concepts and procedures they will teach, along with knowledge both beyond what they will teach and foundational to those core practices and procedures. (Association of Mathematics Teacher Educators, 2017, p. 11)

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Although the AMTE standards for preparing teachers of mathematics recommend that well-prepared beginning teachers should have “solid and flexible knowledge of the core concepts and procedures that they will teach” (11), research studies have indicated that elementary preservice teachers (PSTs) have limited mathematical content knowledge (Ball, 1990; Ball, Hill & Bass, 2005; Ma, 2010). Specifically, Ball (1990) reported that PSTs who participated in the study had “fragmented understanding” that was mostly “rule bound” (11). The findings in these studies are consistent with typical comments made by preservice teachers in a mathematics content course self-assessment at a U.S. Midwestern university:

I was born in 1973, so my elementary and secondary mathematics education took place during the 1980s and 1990s. The teaching

style used in all of my math classrooms was the “I do, we do, you do” model and we were taught to memorize facts and formulas and to use the information we memorized to arrive at an answer using “one” right solution. There was very little discussion about why we did what we did in the classroom and how we might be able to use the information we were memorizing in the real world... (Preservice Teacher Reflection, fall 2016)

For most of my school years, I can remember being taught math using the “I do, we do, you do” method. Each day, the teacher would show us an example of a new math problem, we would try a few together on the board, and then we would do the rest on our own. My problem was that as soon as I would get home, I would completely forget how to do the problem. Due to this, I always feared math and just assumed that I was terrible at it. (Preservice teacher reflection, spring 2016)

I can remember specifically being in second grade and learning how to subtract with regrouping and being very confused and wanting to know why we were changing numbers and the whole process it takes to

subtract. My teacher kept telling me that I would get it eventually and kept reiterating the rules instead of explaining to me why a zero change to a nine and etcetera. I can remember feeling so frustrated, but I eventually gave up trying to understand why and just followed the rules. (Preservice teacher reflection, spring 2017)

Notably, these comments from preservice teachers in combination with findings of academic literature unmistakably demonstrate that a clear gap exist between professional standards for teachers of mathematics and the realities of preservice teacher knowledge of mathematics instruction and content. In particular, the preservice teachers' comments exemplify that they lack deeper conceptual understanding of mathematical concepts when they enroll in teacher preparation programs. Yet, teaching mathematics for understanding is a fundamental goal of mathematics teacher education today (CCSS.M, 2010; National Council of Teachers of Mathematics, 2000; Conference Board of Mathematical Sciences, 2012).

Furthermore, some mathematics teacher educators (MTEs) have reported challenges in dealing with PSTs' various mathematical backgrounds and struggle with how to differentiate instruction accordingly (Li & Castro-Superfine, 2018). Therefore, the instructional activities and the context in which PSTs are expected to learn "solid and flexible knowledge of the core concepts and procedures that they will teach" is still less obvious (AMTE, 2017, 2).

Common Core State Standards of Mathematics (CCSS-M) (2010) have set clear expectations for teaching and learning in grades K-12 mathematics. The standards aim to ensure that high school graduates possess the knowledge and skills needed for college and global workforce. It is anticipated that CCSS-M will enable K-12 students to develop deeper content knowledge and to develop habits of mind that are aligned with the Standards for Mathematical Practices (SMPs) (see Figure 1). However, as Ball (2005) argues, "to implement standards and curriculum effectively, school systems depend upon the work of skilled teachers who understand the subject matter" (1). Therefore, with the CCSS-M changes in what K-12 students need to learn, the way we prepare PSTs requires a quick and radical change.

THEORETICAL FRAMEWORK

This study is informed by existing literature that has emphasized the need to develop teachers' mathematical knowledge for teaching, (Ball, 2005; CBMS, 2012; Ma, 2010; Lampert, 1986; NRC, 2001). These studies emphasize that the quality of mathematics teaching in elementary classrooms depends on teachers' content knowledge and illuminate the need to improve that content knowledge as well as teachers' capacity to use it to do the work of teaching. Additionally, this body of research indicates that teacher knowledge is crucial in developing students' mathematical proficiency. Further, it suggests that teacher knowledge is central to teachers' capacity to use instructional materials wisely, to assess students' progress, and to make sound judgments about presentation, emphasis, and sequencing (NRC, 2001).

Expounding on the nature of content knowledge that teachers need, NRC (2001) emphasized that "teachers certainly need to be able to understand concepts correctly and perform procedures accurately, but they also must be able to understand the conceptual foundations of that knowledge" (378). Consequently, more recent reports and studies have reiterated the need for teacher preparation programs to ensure that PSTs are given opportunities to experience reform-based mathematics instruction that focuses on sense making and on developing an understanding of the mathematics that they will teach as beginning teachers (AMTE, 2017; CBMS, 2012; Thanheiser, 2015). However, the contexts in which PSTs are expected to learn how to facilitate reform-based mathematics instruction as articulated in CCSS-M is in need of further exploration.

This study also builds on prior research that suggests that, although PSTs are familiar with standard multiplication algorithms, it is challenging for them to: 1) explain how it works, 2) explain why an alternative multiplication algorithm works, and 3) develop or evaluate valid alternative multiplication strategies based on arithmetic properties like distributive or associative properties (Harkness & Thomas, 2008; Lo, Grant, & Flowers, 2008;

Figure 1: *Eight Standards for Mathematical Practices*

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.

Southwell & Penglase, 2005; Whitecare & Nickerson, 2016). Specifically, Southwell and Penglase (2005) reported that primary school teachers had difficulty coming up with any method other than the standard algorithm to compute 25×47 and few of the teachers used partial products explicitly or took advantage of the special affordances of the factor of 25. More recently, Whitecare and Nickerson (2016) examined how collective activity related to multiplication evolved over several class sessions in an elementary mathematics content course that was designed to foster preservice elementary teachers' number-sense development. These studies focus on the process of learning (Whitecare and Nickerson, 2016) and the challenges that PSTs face as they learn (Lo et al. 2008). In contrast, this current study focuses on the content that we need to include within the mathematics content course for PSTs in order for them to have solid and flexible knowledge of the multiplication concepts and procedures they will teach.

In an effort to develop PSTs' understanding of multiple strategies, this study focused on three research questions:

1. What prior knowledge of multiplication strategies do PSTs bring in the mathematics content courses?
2. To what extent would PSTs' understandings and conceptions of multiplying two two-digit numbers, using strategies based on place value and the properties of operations, develop in the context of a mathematics content course?
3. What content and instructional experiences would develop their understanding and conceptions of multiplying two two-digit using multiple strategies?

In this study, conceptualization of PSTs' understanding of multiplication strategies is congruent to previous research that has explained that a mathematical idea, procedure or fact is understood thoroughly if it is linked to existing ideas with stronger and more numerous connections and that understanding involves recognizing relationships between two pieces of information (Barmby, Harries, Higgins, & Suggate, 2009; Chinnappan & Forrester, 2014; Hiebert & Carpenter, 1992; Nickerson, 1985; NRC, 2001). Specifically, NRC (2001) indicates that "a significant indicator of conceptual understanding is being able to represent mathematical situations in different ways and knowing how different representations can be useful for different purposes" (119).

METHODS

The participants in this study were enrolled in an integrated mathematics content and methods course during the 2016-2017 academic year as part of their teacher education program. The study took place at a U.S. Midwestern regional comprehensive public university and was approved by Institutional Review Board (IRB). At the beginning of the semester, PSTs were informed about the study and it was clearly explained by a faculty member who was not the instructor of the course that they could withdraw their consent for participation at any time during the study. In total, fifty-seven PSTs ($N=57$) consented to their course work being used for research purposes. Specifically, 31 PSTs participated during fall 2016 and 26 participated during spring 2017 semester. Data used for this analysis is part of a larger study that explores the extent to which PSTs enrolled in an integrated mathematics content and methods course developed conceptions of SMPs outlined in the CCSS-M. (see Figure 1)

Although many artifacts were collected during the semester, the analysis and description of this study is limited to a mathematical task (described in Figure 6) that PSTs completed before and after completing an instructional unit that focused on multiplication of whole numbers.

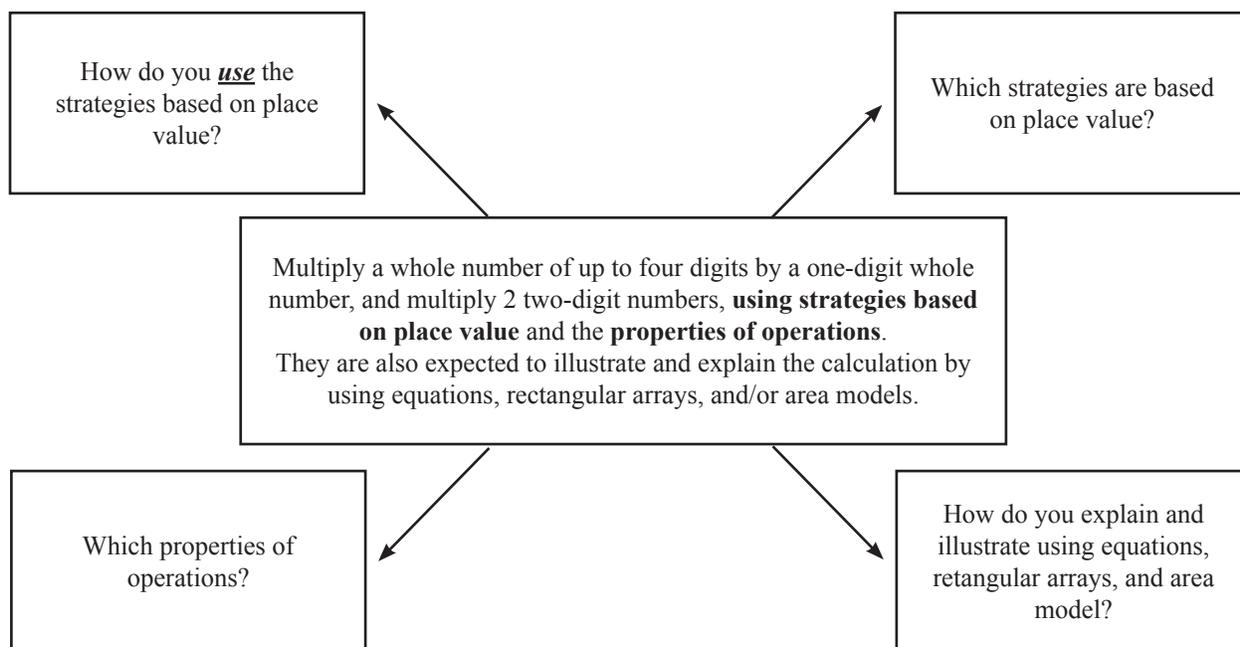
Data Collection Procedures

At the beginning of the unit, PSTs were instructed to multiply 48×25 using more than one strategy as a diagnostic assessment. The instructor collected the slips and did not provide the solution to the problem at the time. This was followed by two weeks instructional time that focused on CCSS M content standard (shown in Figure 2 on the next page).

Multiplication Instructional Unit

One of the course goals was to provide PSTs with reform-oriented experiences by creating an environment that is consistent with how they will facilitate their own classrooms. Instruction was focused on making sense of mathematical computations and teaching mathematics for understanding (Hiebert et al., 1997). For the two semesters discussed in this study, the mathematics content course mainly focused on the following domains: Counting and Cardinality, Number and Operation in Base 10, Operations and Algebraic Thinking and Number Quantity. As discussed in Hiebert et al. (1997), the instructor took the role of a facilitator and selected the mathematical tasks, provided directions for

Figure 2: Unpacking the CCSS-M Content Standard



mathematical activities, provided relevant information, shared alternative strategies and articulated ideas in student’s methods. PSTs were given opportunities to explore problems individually, in small groups, and as a whole class.

Across the instructional units, PSTs wrote story problems, solved problems using multiple strategies, and modelled mathematical concepts using tables, diagrams and equations. Also, PSTs justified their reasoning and critiqued the reasoning of others in written homework and class discussions, respectively. Both small and whole group discussions addressed “how” the computations are done and “why” the computations work. Specifically, the instructor developed a multiplication instructional unit that focused on multiplication as one of the big ideas and fundamental skills to learn in elementary mathematics. Multiplication was defined as: Number of groups \times Size of groups = Product. We unpacked the CCSS-M content standard using the questions shown in Figure 2. We focused on what it means to use strategies based on place value, use properties of operations and what it means to illustrate and explain calculations by using equations, rectangular area and /or area model.

The activities and tasks in the unit also focused on developing teacher candidates understanding

of properties of operations and how to use mental strategies based on properties of operations and place value understanding to multiply multi-digit numbers (see Figure 3).

Figure 3: Properties of Operations

1. Commutative Property
 $a \times b = b \times a$
2. Associative Property
 $a \times (b \times c) = (a \times b) \times c$
3. Distributive Property
 $(a+b) \times c = ac+ab$
 $(a-b) \times c = ac-bc$
 $(a+b) \times (c+d) = ac+ad+bc+bd$
4. Identity Property
 $a \times 1 = a$
5. Zero Property
 $a \times 0 = 0$

For example, a problem like 25×36 was multiplied using associative and distributive properties of multiplication as shown below:

$$\begin{aligned}
 25 \times 36 &= 5 \times 5 \times 6 \times 6 \\
 &= (5 \times 6) \times (5 \times 6) \text{ using associative property} \\
 &= 30 \times 30 = 900
 \end{aligned}$$

$$25 \times 36 = (20+5) \times (30+6)$$

$$= (20 \times 30) + (20 \times 6) + (5 \times 30) + (5 \times 6)$$

using Distributive property

$$= 600 + 120 + 150 + 30 = 900$$

At the end of the instructional unit, PSTs multiplied 25×48 using a) a strategy that made sense but *was not familiar* to them at the beginning of the unit, b) a strategy that was *comfortable for them* to facilitate in the classroom, and c) a strategy that would help *students' conceptual understanding of multiplication*. The instructor collected the exit slips, made copies, and returned the original copies to the students. PSTs' multiplication strategies and explanations from the beginning and the end of the unit were used as source of data. In addition, the instructors' notes and videotaped sessions were used to provide meaning to PSTs explanations.

DATA ANALYSIS

Data analysis was both quantitative and qualitative. Quantitative analysis focused on the frequencies with which specific strategies were used when solving the problem at the beginning of the unit and at the end of the unit. Qualitative analysis of PSTs' responses was done using interpretive research (Klein & Meyers, 1999; Golfashni, 2003; Walsham, 1995). As Walsham (1995) indicates, researchers in qualitative interpretive research focus on interpretation and the meaning assigned to specific phenomenon by other people and focus on analytically disclosing those meaning-making practices, while showing how those practices configure to generate observable outcomes. The sharable results in interpretive research should be in form of development of concepts, generation of theory, drawing specific implications as well as contribution of rich insights.

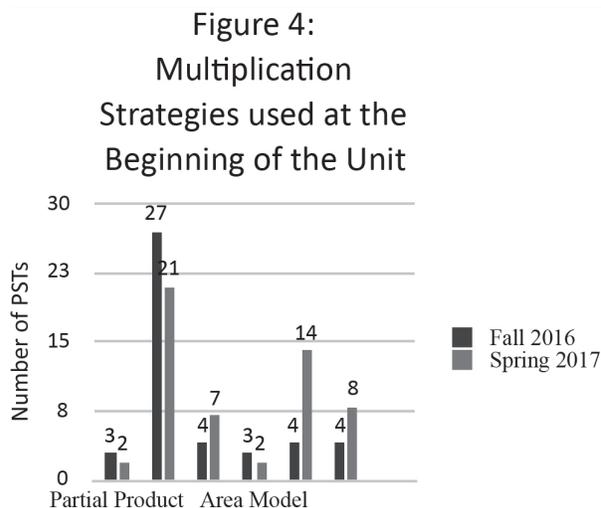
Hence, PSTs' explanations were examined to provide insights into PSTs' mathematical understanding or lack thereof in their description of strategies. Using literature that has focused on understanding of mathematical concepts (e.g. Barmby, Harries, Higgins, & Suggate, 2009; Chinnappan & Forrester, 2014; Hiebert & Carpenter, 1992; Nickerson, 1985; NRC, 2001) and explanations of strategies, PSTs' strategies of multiplying whole numbers were scrutinized to have more in-depth understanding of their conceptual understanding and procedural fluency. Specifically, Hiebert & Carpenter (1992) indicated that a "mathematical idea, procedure or fact is understood thoroughly if it is linked to existing ideas with stronger and more numerous connections and that understanding involves recognizing relationships between two pieces of information" (67- 68). Therefore,

PSTs explanations were examined to find the extent to which their understanding of multiplication of whole numbers developed in more meaningful ways.

To determine credibility, the instructor used the researcher's lens where the researcher determines how long to remain in the field to collect data that is "saturated enough to establish good themes and determine whether the analysis of data can evolve into good narratives" (3). This also involves "the researcher going to the field over and over again to see if the constructs, the categories, explanations and interpretations make sense" Patton (as cited in Creswell & Miller, 2000, 8). In this study, the researcher interacted with PSTs for a period of 14 weeks. Hence the researcher determined that the data collected could evolve into a good narrative.

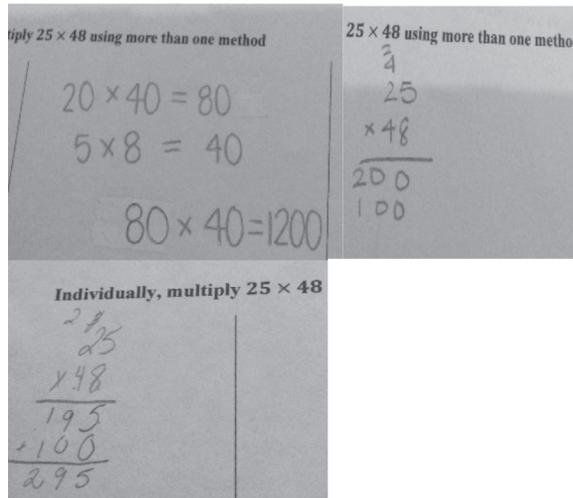
RESULTS

Results indicate that consistently across the two semesters, most PSTs (N=27) and N=21 who participated in this study used the standard algorithm strategy (either alone or in combination with others) to multiply two-to-two-digit numbers as they started off the multiplication unit (see Figure 4).



During the spring semester, more students (N=14) used properties of operation to multiply two digits by two-digit numbers compared with Fall semester when only 4 students used the properties of operations. The results also revealed misunderstanding that PSTs bring with them to content courses. For example, one PST (see Figure 5 on the next page) attempted to use the distributive property at the beginning of the unit but did not understand the rationale behind multiplying using the property.

Figure 5: Procedural Errors Made by PSTs at the Beginning of the Unit.



In addition, two other PSTs used the standard algorithm, but revealed a misconception with procedural knowledge of multiplying two-digit numbers using standard algorithm. After completing the multiplication unit, PSTs were prompted to solve the same multiplication problem using different strategies (see Figure 6 for prompts). PSTs were prompted to solve the same problem at the end of the unit to document how their conceptions and understanding had shifted after the unit. In the next section, I present the findings from the prompts.

Figure 6: Rethinking Multiplication Strategies

The multiplication problem 48×25 can be solved using different strategies. Solve the problem using;

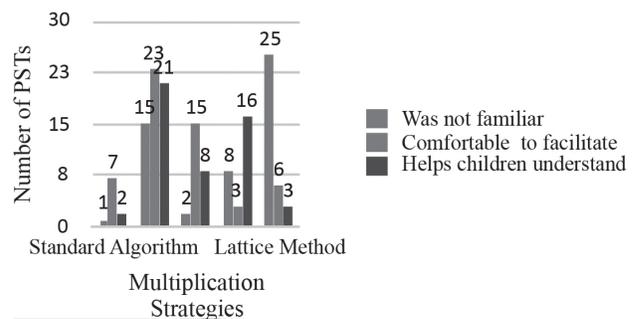
1. A Strategy that was not familiar to you but makes sense to you now. Explain
2. A strategy that you feel most comfortable to facilitate in your classroom. Explain your answer
3. A strategy that you anticipate would help students understand the meaning of

Was Not Familiar at the Beginning of the Unit

At the end of the unit, PSTs could flexibly use more than one strategy and, more often than not, the standard

algorithm. When prompted to identify the strategy that they didn't know at the beginning of the unit but made sense at the end of the unit, most PSTs identified different multiplication strategies (see Figure 7). Specifically, 25 PSTs indicated that lattice method was not a familiar strategy at the beginning of the unit, 15 PSTs indicated that partial product was not a familiar strategy and 8 PSTs indicated that rectangular area model was not a familiar strategy at the beginning of the unit.

Figure 7: Multiplication Strategies Identified at the end of the Unit



Perceived as Comfortable to Facilitate

When prompted to identify strategies perceived as comfortable to facilitate, 23 PSTs identified partial product, 15 PSTs identified using properties of operations and 3 PSTs identified rectangular area model. In reality, partial product, using distributive property of multiplication and rectangular area model decompose the two-digit numbers and students multiply smaller "friendlier" numbers and then add up the partial products. (see Appendix 1). In addition, 6 and 7 PSTs identified lattice method and standard algorithm as strategies perceived comfortable to facilitate respectively.

Perceived as Strategies that would Help Students Understand the Meaning of Multiplication

Of particular interest were the strategies that PSTs categorized as strategies that would help students understand the meaning of multiplication. Specifically,

¹ The total number of PSTs who identified a particular strategy might not sum up to 57 because PSTs identified different strategies under different categories. So the sum can be less than or more than N=57

most PSTs (N=21) identified partial product as a strategy that would help students understand the meaning of multiplication. In their rationale, one PSTs explained:

I believe the partial product method of multiplication would help students understand the meaning of multiplication the most because students are directly able to see that the number in the tens hundreds of places stands for a number greater than they appear. For example, adding the zeros after the 4 in the problem reminds students that this number stands for 40. (Preservice teacher, spring 2017)

Additionally, 16 PSTs identified rectangular area model as a strategy that would help students understand the meaning of multiplication. Eight PSTs identified using of properties of operations as a strategy that would help students understand the meaning of multiplication. Of the 8 PSTs, 5 had identified the distributive property while 3 identified the associative property. Finally, only 5 PSTs identified standard algorithm and lattice method as a strategy that would help students understand the meaning of multiplication.

PSTs' Explanations Across the Two Semesters

PSTs explanations of strategies that were not familiar, strategies that were comfortable to facilitate and strategies that PSTs perceived to help students understand the meaning of multiplication revealed noteworthy patterns. For the strategies identified as unfamiliar, most PSTs stated that they simply had never used them before. For example, one PST who identified rectangular area model as a strategy that was not familiar explained:

I used the rectangular model here because before this class, I had no idea you could solve a multiplication problem this way. I split the numerals up into tens and ones then multiply both numbers that connect each box then add up the 4 solutions. (Preservice teacher, spring 2017)

Another PST who identified lattice method as unfamiliar before completing the multiplication unit explained:

"I'd never seen the lattice method before this semester, but I understand how and why it works by thinking of the generic model below. (Preservice teacher, fall 2016)

Therefore, PSTs seemed to have gained more strategies

to multiply the two numbers.

For the strategies identified as comfortable to facilitate, PSTs provided explanations like "This is the way that I learned how to do multiplication," "this strategy closely relates to how I mentally solve multiplication in my head," and "because it is a good visual with simple numbers to multiply." As shown in Figure 7, most students (N=23) perceived partial product as the most comfortable. Some of the explanation for choosing the strategy included:

I'd feel most comfortable using this strategy to teach multiplication because this method allows you to see all the numbers broken down and it helps when explaining why the standard algorithm works (It is the condensed version of partial product). This strategy would help me teach this connection. (Preservice teacher, fall 2016)

I feel most comfortable to teach partial product. I find it much easier to explain to students how multiplying and adding work together rather than the standard algorithm. (Preservice teacher, spring 2017)

Although this might not be as deep a connection between the strategies as I would have expected, the shift was noticeable.

For PSTs who perceived rectangular area model as comfortable to facilitate, some of their explanations revealed the connections they were making with the other strategies. For example, one PST explained:

I think this is a great strategy to use because it gives students a visual. It goes hand in hand with the partial product. So teaching these two strategies together could be beneficial for students' understanding the breakdown of the numbers. (Preservice teacher, fall 2016)

I think this method makes multiplication meaning clearer because students can see why you end up with the answer you do in the context of units which is more concrete. You can show each individual unit if you want to show # of groups \times size of groups. (Preservice teacher, spring 2017)

In these responses, PSTs had started making connections between the partial product and the standards algorithm as well as how they can make connections

between multiplication and addition. PSTs also made connections between area model, partial product and use of distributive property.

Additionally, other PSTs (N=15) identified use of distributive property as a strategy perceived to be comfortable to facilitate. However, the explanation of their choice differed. For example, one PST who perceived the strategy as comfortable to facilitate explained:

I feel very comfortable with this method because it allows the students to break apart the larger numbers to multiply. I would have to make sure they distribute all of the numbers in the correct way, but I feel it would be beneficial in a classroom because of the breaking apart helpful aspect. (Preservice teacher, fall 2016)

Finally, most PSTs (N=21) perceived partial products as a strategy that would help students understand the meaning of multiplication, but the explanations also differed. For example, one PST who perceived partial product (See Figure 8) combined with rectangular area model as strategy that can help students understand the meaning of multiplication explained:

I feel like these methods really pull apart the meaning of multiplication in a way that relates to learners. When combining it [partial product] with rectangular model it gives a beneficial model and visual. (Preservice teacher, fall 2016)

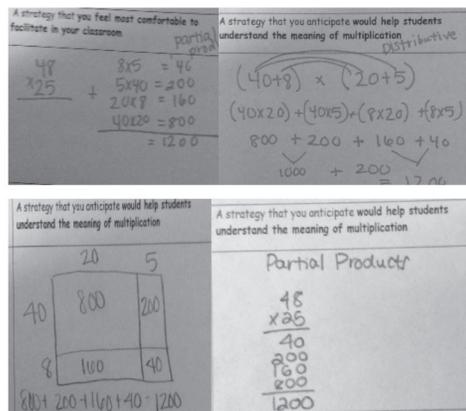
I think this is a great way to change the standard algorithm because it shows the breakdown of each multiplication problem and also gives students friendly numbers to work with without getting confused. (Preservice teacher, spring 2017)

Furthermore, other PSTs N=16 perceived the rectangular area model as a strategy that would help students understand the meaning of multiplication. (see Figure 8). Although the explanations differed most of them connected to students' understanding of place value. For example, one PST explained:

With the standard algorithm, it's more memorization of steps, but with area model, it is broken down into boxes (see Figure 8) and you can clearly see the values that make up a number. For example, 227 would be seen as 200, 20 and 7. I believe this is important

for students' understanding of multiplication. (Preservice teacher, fall 2016)

Figure 8: PSTs' Representations



DISCUSSION AND CONCLUSION

This study expands the growing body of research that has focused on the content and design of mathematics content courses. Specifically, this study focuses on the extent to which PSTs can learn multiplication strategies in order to develop flexible knowledge (both conceptual understanding and procedural knowledge) of the mathematics they will teach as beginning teachers. The study unpacks four foundational concepts:

- 1) Which strategies are based on place value?
- 2) How do you use the strategies based on place value?
- 3) How do you use strategies based on place value and properties of operations? and
- 4) How do you illustrate and explain the calculation by using equations, rectangular arrays, and/or area models?

The study alludes that these concepts are identified as benchmarks in the CCSS-M (2010) and are fundamental for PSTs to develop knowledge of multiplication of whole numbers, the progressions of multiplication strategies and might support PSTs' understanding of children's thinking about multiplication of whole numbers. Consequently, the instructor purposefully developed the multiplication instructional units that would develop PSTs' understanding of the fundamental skills identified.

As indicated in AMTE (2017) Standards of Preparing Teachers of Mathematics, "well-prepared beginning teachers of mathematics understand and solve problems in more than one way, explain the meanings of key

concepts, and explain the mathematical rationales underlying key procedures” (2). The results in this study indicate that most PST exhibited an understanding of more than one strategy and mostly not the standard algorithm. Across the two semesters, 23 PSTs indicated that they would feel comfortable facilitating the partial product algorithm because it is a procedure with connection to meaning while 15 PSTs indicated that they would be comfortable facilitating learning of multiplication using the properties of operations to multiply multi-digit numbers in K-12 classroom. Some PSTs also explained that area /array model is one of the strategies that would develop K-5 students’ conceptual understanding of two two-digit numbers multiplication. These results suggest that PSTs started interpreting the strategies in terms of their students’ learning and are likely to teach in a similar fashion that the content course was facilitated.

In addition, the results reveal that PSTs enrolled in the study’s mathematics content course developed their understanding of multiplication of two-digit numbers in meaningful ways. As NRC (2001) indicates, a “significant indicator of conceptual understanding is being able to represent mathematical situations in different ways and knowing how different representations can be useful for different purposes” (119). In general, PSTs appeared to have gained understanding of different strategies and the relationship between the different strategies at the end of the unit compared with beginning of the unit. For example, the partial products strategy was only used by 5 students at the beginning of the unit but was identified by 23 PSTs as a strategy that is comfortable to facilitate at the end of the unit. The rectangular area model was only used by 5 students at the beginning of the unit, but 16 PSTs perceived rectangular area model as a strategy that would help students understand the meaning of multiplication.

Results also indicate that PSTs connected the mathematical meaning in different representations like area model, partial product, standard algorithm and

even use of properties of operations. During the class discussions, PSTs were provided with opportunities to discuss how partial product is related to rectangular area model and the use of distributive property. Furthermore, PSTs made connections between the strategies and highlighted ways that teachers can select and sequence students in K-5 classrooms to share their strategies to foster more meaningful understanding of multiplication.

Further, results suggest issues regarding PSTs’ conceptions of these strategies and challenges they might encounter when facilitating the discussions in their classrooms. First, some of the strategies that were perceived as most comfortable were not necessarily the ones that the instructor identified as most likely to develop deep conceptual understanding as children learn how to multiply numbers. For example, some PSTs identified standard algorithm and lattice method as the strategy that they felt comfortable to facilitate in their classrooms. The explanations of their level of comfort was based on strategies that they experienced as mathematics learners. It is unclear whether or not they would consider introducing more meaningful strategies to the children in the classrooms. An extension to this study that would explore how the same PSTs facilitate teaching of multiplication of two-digit numbers during students teaching semester and as beginning teachers would provide more insights to their instructional practices.

In conclusion, as AMTE standards for preparing teachers of mathematics indicate, “Having a robust knowledge of the mathematics content being taught is foundational to the success of a well-prepared beginning teacher of mathematics” (AMTE, 2017, 25). Consequently, the need to facilitate content courses in a manner consistent with the way we expect PSTs to teach their own classrooms is imperative. The findings in this study suggest that teacher education should consider designing learning environments to provide productive learning opportunities to ensure that schools will have authentic implementation of the CCSS-M.

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APPENDIX 1: *Multiplication strategies*

Name of Strategy	Example	Name of Strategy	Example
Standard Algorithm	48x25 960 240 1200	Rectangular Area Model	20x40 20x8 5x40 5x8
Partial Product	48x25 800 200 160 40 1200	Distributive Property	48x25 = = (40+8) x (20+5) = 40(20+5) + 8(20+5) = 800+200+160+40 = 1000+200 = 1200
Associative Property	48x25 = = 6x8x5x5 = 6x5x8x5 = 30x40 = 1200	Lattice Method	

Do Your Students Know You Care?: A Phenomenological Study of Teacher Care

Reginald L. Todd

Abstract: This phenomenologically oriented, qualitative study investigated how the perceptions and lived experiences of select high school students relate to their understanding of teacher care. The data were collected from 11 high school seniors and two senior guidance counselors from an urban high school. Data collection occurred through in-depth, open-ended interviews. Analysis of the data revealed that students believed their teachers cared when their teachers exhibited the following characteristics: (a) enthusiasm for the subject/teaching, (b) high expectations for all students, (c) willingness to help students, (d) flexibility and adaptability, (e) establishment of personal relationships with students, and (f) respect for students. The participants expressed that teacher care positively influenced students' academic and personal successes. This research study identified and discussed limitations of the design and offered recommendations for further research on the topic.

About the Author: *Dr. Reginald L. Todd is an Assistant Professor of Mathematics Education in the College of Education at Texas Southern University. His research interests include diversity issues in education, teacher care, culturally responsive pedagogy, mathematics curriculum and instruction, and multicultural teacher education.*

Keywords: teacher care, ethic of care, instructional strategy

INTRODUCTION

Most people will never forget their favorite teacher; if questioned about why the teacher is so memorable or what they remember about this teacher, their frequent response is that the instructor sincerely cared about his or her students (Teven, 2001). Many researchers consider the concept of caring to be central to teaching and learning and essential to the success of a student's education. Though Noddings (1995, 2002) acknowledged that caring does not easily lend itself to an operational definition, caring can be described simply as a process of helping another to grow and to self-actualize. Caring is an action that either improves the well-being or eliminates the distress of another person.

Although students benefit significantly from educational institutions with well-designed and comprehensive curricula, state-of-the-art equipment, the latest technology, and strong instructional leadership, providing a classroom atmosphere with tenets of teacher care is also a major piece of the puzzle in helping students succeed. Researchers (Alder, 2002; Jansen & Bartell, 2013; Noblit, Rogers, & McCadden, 1995; Noddings, 2005; Roberts, 2010; Rogers & Webb, 1991; Teven, 2001) believe that teacher care affirms that students experience positive school outcomes, such as

improved attendance, attitude, self-esteem, effort, and identification with school, if they simply believe that their teacher cares for them and their well-being.

Although there is an unequal relationship between student and teacher, that fact does not impede the development of a caring relationship that aids both the student and teacher (Noblit, 1993; Noddings, 2005). However, perception of teacher care is highly subjective; therefore, similar teacher care behaviors would not likely be perceived the same way by every student in a class. Garza et al. (2014) state that teachers' understanding of how they should care for their students, which may not be congruent with their students' expectations, is what makes caring a challenging notion. It is imperative to comprehend the kind of actions students perceive as teacher care so that teachers are conscious of what actions allow students to receive the benefits of a caring teacher-student relationship. When both the teacher and student consider the relationship to be caring, then, and only then, will students receive these benefits.

THEORETICAL FRAMEWORK

Noddings' views on caring align substantially with this study. Her work on an ethic of care profoundly suggests that educators must care for their students and that the

concept of caring is deeply rooted in the success of students. In numerous publications, Noddings (1984, 1995, 2002, 2005, 2012, 2013) has comprehensively researched and discussed the ethic of care and the development of school structures that encourage caring relations; therefore, her theories provide the predominant theoretical framework for this study. Her perspectives illustrate the need for caring student-teacher relationships and help form a foundation for exploring the attitudes, beliefs, and practices of teacher care as perceived by students. Furthermore, Noddings (1995) believes that her four components of care—modeling, dialogue, practice, and confirmation—are key strategies teachers can use to involve students in caring relationships. This researcher used these components of care as the theoretical framework for this study because the emphasis on the establishment of caring encounters between teachers and students drives the line of inquiry for this study.

LITERATURE REVIEW

This study examined the experiences of students' interactions with teacher care. In addition, it explored the notion that students' experiences with teacher care should be considered an indispensable part of the educational system. In today's education systems, administrators and stakeholders place great importance on the academic attainment of students, thus averting attention from other imperative aspects of the learning process, such as ensuring students receive care. However, there is no reason schools cannot provide both opportunities for academic achievement and care. Therefore, the researcher reviewed literature on the following topics: ethic of care, Noddings' components of care, perceptions of caring, and the importance of care in education. Researchers (Alder, 2002; Ferreira & Bosworth, 2001; Garza et al., 2014; Jansen & Bartell, 2013; Tosolt, 2009; Zucker, 2001) suggest the need to increase the body of research pertaining to students' perceptions of teacher care to determine its potential impact, a view which has not yet been fully comprehended or valued in the field of education.

AN ETHIC OF CARE

Originating in the field of psychology and moral reasoning, the notion of care as a basic human need was developed by social scientists such as Erickson, Freud, Maslow, Piaget, and Kohlberg as the major designers of numerous philosophies for human moral development. For example, Kohlberg (1981) postulates

that moral development moves progressively toward more universalized and principled thinking; he also found that girls scored significantly lower than boys when tested on their moral development. Gilligan (1982) challenges Kohlberg's study and modifies it to involve the perspectives of women as well. As Gilligan worked with Kohlberg, her mentor, she noticed that males and females view the human experiences in totally different ways. Gilligan argues that Kohlberg's theory was established based on a study exclusively of men, thus eliminating the possibility of alternate perspectives of moral conduct and resulting in women's appearing to be deficient in their moral development.

After faulting Kohlberg's (1981) model of moral development for being gender biased, Gilligan (1982) published a book titled *In a Different Voice: Psychological Theory and Women's Development* to illustrate the results of her study that included the viewpoints of females. She found that both genders articulated the voice of care at different times but noted that the women's voice of care in earlier moral development studies had been overlooked. Gilligan proposes an ethic of care that conceptualizes moral maturity as the caring for and sensitivity to the needs of others.

Noddings, who is referred to as the mother of character education, has made great strides in encouraging all educators to develop, teach, and entertain the idea of an ethic of care. Noddings (2002) believes that an ethic of care began with the basic human need to be cared for—to be in a positive relationship with other humans. Because of its beginnings in natural attributes and events, caring can be identified with pragmatic naturalism. Caring for students is an act that comes naturally; it should not be considered an obligation, but more of a desire. Noddings (2002) suggests that the sense of "I must" (p. 13) exhibits a yearning or impulse—not an acknowledgment of an obligation. Furthermore, Noddings believes that a caring encounter must have the following three steps:

1. A cares for B—that is, A's consciousness is characterized by attention and motivational displacement—and
2. A performs some act in accordance with Step 1, and
3. B recognizes that A cares for B.

All of these steps must exist for true caring to take place. Noddings further contends that an ethic of care is feminine in the traditional concepts of responding, relationships, and reciprocity. She further states that for a caring relationship to exist, there must be the provider

of care or the one-caring and the receiver of care or the one cared-for, and that if the cared-for does not perceive the act as caring and does not respond, then there is no caring relationship.

Noblit (1993) suggests that the ethical use of power is prevalent through the use of caring in classrooms. His study describes a traditional teacher-centered classroom teacher and how she used her power to construct care. In Noblit's study, the teacher made each child feel special by using her position of power as a teacher to establish her moral authority in the classroom. Power is the moral responsibility to educate students, and Noblit agrees with Noddings (1984) that power does not render the Other into an object but rather maintains and promotes the Other as subject in a caring relationship. The two major concepts used in creating a context for connecting and constructing teacher-student relationships are power and caring. Noblit asserts that caring is a difficult relation in that the giver of care must be strong and courageous so that he or she can utilize the moral to regulate that which is immoral.

Rogers and Webb's (1991) study suggested a strong foundation upon which teacher education programs might emphasize an ethic of care in the curriculum based on the data collected during interviews for the Caring Study. This Caring Study was conducted during the 1989-1990 school year when six researchers completed classroom ethnographies in eight classrooms; each researcher did participant observations and conducted interviews with both teachers and students. The recurring theme from Rogers and Webb's study was that good teachers care and that excellent instruction is inevitably associated with explicit characteristics of teacher care. Rogers and Webb believe that caring should be given a fundamental locus in the curriculum of teacher education programs. Specifically, professors of teacher education courses must acknowledge the massive influences of teacher care on student success, and then make a commitment to their preservice teacher students by embodying an ethic of care in their teachings.

Vogt's (2002) exploratory study of 32 Swiss and English primary school teachers (22 women and 10 men) focused on caring conceptions of teachers and discussed the significance of implementing an ethic of care when teaching. At first, Vogt thought that the importance of teacher care was gender based, but she later found that both genders utilize aspects of teacher care when reflecting on their instruction; therefore, differences in gender are not important in relation to teacher care. This study also revealed that teacher care is a fundamental part of teaching and learning, but it suggests that it is

perceived in many unique ways and associated with a variety of connotations. To value the importance of teacher care without perpetuating masculine discourses which connect caring to femininity, Vogt suggested describing caring teachers as those who are committed to teaching and building positive rapport with students.

Ferreira, Bosworth, and Smith (1995) assert the notion that it is imperative not only to view caring as a set of actions, but also in contexts of an essential ethic that encourages and leads to the actions. This ethic of care extends beyond just mere behavior, but also serves as a moral basis for the development of policies and decisions, as well as the creation of structures and relations (Ferreira et al., 1995). Caring is more than merely having concern for a person; it is an ethic that is embedded in explicit contexts that impact the way people interact in relationships with each other.

NODDINGS' COMPONENTS OF CARE

Noddings (2002) believes that one of the most significant concepts students develop from their teachers is how to intermingle with society and other living things. She further explains that teacher who care attempt to recall their very own significant caring encounters and express those emotions to their students through several activities that nurture an ethic of care. Though some researchers have established descriptions of care, a limited number have developed proposals for the practice of the act itself. Noddings (1995, 2002, 2005, 2012, 2013) promotes a blueprint for the implementation of an ethic of care based on four components of care: modeling, dialogue, practice, and confirmation. Modeling, dialogue, practice, and confirmation, she suggests, are effective strategies instructors can use to involve their students in caring relationships and ensure students understand how to create future caring encounters.

Noddings (2005) suggests that if teachers possess the sincere desire to produce caring individuals, then they must exhibit care genuinely, that is, by offering themselves to their students honestly and openly. In their role as one-caring, teachers are tasked with exhibiting the meaning of care through their own acts of caring and connections with students. Noddings (2005) emphasizes that teachers who care do not command their students to care; they demonstrate care by establishing a caring rapport with their students.

Modeling is important to education in general and particularly significant to an education centered on

aspects of care (Bergman, 2004). Modeling is vital because the ability to demonstrate care could be based solely on one's sufficient involvement in being cared for by others. Teachers bear the obligation of providing a learning experience infused with the aspects of care and encouraging the development of care in their students, because students cannot easily cultivate characteristics of care without experiencing various acts of care from their own teachers (Rogers & Webb, 1991). Teachers cannot command students to care and provide them with literature on care to digest; rather teachers must demonstrate care to students by establishing encounters of care with them.

Owens and Ennis (2005) state that the idea of modeling affords teachers the opportunity to exhibit the techniques of care to their cared-for students by exercising caring traits in their own interactions with them. A teacher models caring by encouraging their students to recognize the value they behold in themselves. Furthermore, teachers serve as role models for what a caring person embodies for their students, because students will carefully interpret the actions of their teachers and then imitate those actions.

Sharing, speaking, listening, and responding are all characteristics of Noddings' second component of care, dialogue. Dialogue is simply a way to model the caring idea through communication (Bergman, 2004). Owens and Ennis (2005) note that the aim of dialogue is for the provider of care and the receiver of care to interact with each other's ideas and thoughts, thereby discovering information about each other's understanding. Through dialogue, noteworthy connections are developed between teachers and students that allow for students to become autonomous, caring persons. Caring relationships are created, continued, and reinforced as a result of sensitive and open dialogue between the two parties. Noddings (2005) explains that dialogue "connects us to each other and helps to maintain caring relations" (p. 23) because it "provides us with the knowledge of each other that forms a foundation for response in caring" (p. 23).

Noddings (2005) suggests that this dialogue "can be playful or serious, logical or imaginative, goal or process oriented, but it is always a genuine quest for something undetermined at the beginning" (p. 23). It is also intended to cultivate truthful relations between the two parties, an essential factor in creating classrooms with caring atmospheres. Furthermore, Noddings (2002) suggests that as students and teachers slip into ordinary conversation, they learn about one another. But they also learn from one another. Without imposing their values, teachers

can convey all sorts of messages about respect, taste, choice, time management, humor, human foibles, fears, [and] disappointments. (p. 142)

Lastly, dialogue supports the continued expansion and preservation of caring relationships since it permits students to interact with one another and their teacher through the expressions of common experiences and language, a condition which is necessary for establishing a classroom environment incorporating tenets of care.

Noddings (1995) asserts that practice is the third component of care. If educators desire to develop students into caring beings, then it is essential that students are given the opportunity to practice care and reflect on that practice. Noddings (2002) states that "students should be encouraged to work together, to help one another—not just to improve academic performance, but to gain competence in caring" (p. 20). She further believes that conveying the moral importance of cooperation to students is the special obligation of the teacher; therefore, teachers should encourage collaboration and small-group work when working on class assignments or participating in community service activities. Teachers who care develop precise and realistic expectations for the quality of class participation, collaborative learning experiences, and problem-solving exercises. Classrooms that afford students with the opportunities to exhibit care can also engage students in dialogues that build trustworthy relationships.

Additionally, students should practice caring well beyond the confines of the classroom. Bergman (2004) agrees with Noddings (1984) that the involvement of all students in caring apprenticeships with school support staff such as the custodians, cafeteria workers, and teacher aides for disabled students are essential to the component of practice. Opportunities for service should extend to places in the community like nursing homes, parks, and shelters. Bergman (2004) suggests that young people need to experience acts of care with adult beings who demonstrate how to care, discuss the complications and rewards of such care, and exhibit in their own actions that the ethical ideal of caring is vital.

Noddings' (1995) last component of care is confirmation. Teachers can achieve confirmation with their students by establishing positive relationships and understanding their students well enough to comprehend which academic and personal goals they possess. This teacher-student relationship strengthens over a period of time as teachers reveal "characteristics of engrossment, commitment, and a motivational shift toward the efforts of their cared-for students" (Owen & Ennis, 2005, p. 396). During the process of confirmation, students are

regarded through a perspective that considers only the students' best abilities and assumes the finest in terms of academic and personal achievement, rather than regarding students as desperate individuals. Noddings (2005) describes the component of confirmation as the obligation of a teacher to affirm and encourage the best in their students; she further believes that by identifying the better half of someone and encouraging its enhancement, teachers confirm that person.

When all of the components of caring—modeling, dialogue, practice, and confirmation—are evident in a classroom, the following things happen: students feel comfortable sharing their thoughts and opinions; trust and respect are freely given between the student and instructor; and the overall values of human interactions are honored (Shadiow, 2009). When educators exhibit characteristics of care in their instruction, students feel cared for and in return are willing to participate in class activities, thereby enhancing the process of learning. Focused modeling, thoughtful practice, genuine dialogue, and cautious confirmation, as Shadiow (2009) describes, “creates shared trust that is built beginning with the stories mutually constructed” (p. 199). Teachers who care work vigorously to satisfy their professional and personal obligations through the use of Noddings' components of care. Noddings (2005) believes that by allowing opportunities for cared-for students to experience care in various methods through the implementation of caring activities, the ethic of care is enriched.

PERCEPTIONS OF CARING

Knowledge of individuals' perceptions of care is vital for one to gain an understanding of the phenomenon of teacher care. However, the perceptions or voices of the students may be even more beneficial to developing this understanding since Noddings (2005) acknowledges that students determine whether a caring encounter occurs. Tosolt (2009) reiterates this claim when she explains that the literature is limited when considering the exploration of students' perceptions of teacher care, even though the students, as the receivers of such care, conclude whether or not a caring encounter has ensued. Acknowledging the missing voices of students in the literature on teacher-student caring relationships, numerous researchers (Alder, 2002; Ferreira & Bosworth, 2001; Teven, 2001; Tosolt, 2009) have questioned students directly about how they believed teachers cared for them.

In a qualitative study of 12 middle school students examining the creation and maintenance of caring

relationships between middle school students and their teachers, Alder (2002) concludes that caring relationships with teachers are viewed by students as important, that care was expressed to students by a teacher's willingness to help, and that a well sought out knowledge of the student is important for the establishment of caring relationships. He also suggests that an influential precursor to transforming educational institutions into more supporting and caring communities of learners is the need for teachers to help students first become skilled at caring.

Ferreira and Bosworth (2001) believe that “students' perspectives provide important insights on how to structure learning environments that sustain caring opportunities for youngsters and adults” (p. 24). Ferreira and Bosworth conducted a study to examine 101 middle school students' definitions of a caring teacher. After numerous observations and interviews, Ferreira and Bosworth developed two broad themes: teacher actions related to content and pedagogy, and teacher actions that implied a relationship between the teacher and the student. Student descriptions such as “helping with work, explaining work, checking for understanding, encouraging, maintaining an orderly classroom atmosphere, and providing fun activities” (Ferreira & Bosworth, 2001, p. 26) were labeled as teacher actions related to content and pedagogy. Other characteristics such as “treating their students as individuals,” (p. 27) being interested in them personally, showing respect and listening, and “attending extracurricular activities in which students participated” (p. 27) were teacher behaviors that implied a relationship.

In his study of 249 undergraduate students, Teven (2001) attempted to detail tangible traits and behavior patterns of teachers that denote caring to students and also to detail traits and misbehaviors of teachers that disrupt the students' perceptions of teacher care. Teven believes that an indispensable notion of effective instruction is the creation of a classroom atmosphere that is warm, caring, and understanding. Teven's study demonstrated that teacher immediacy, assertiveness, and responsiveness have significant, positive relationships with students' perceptions of teacher caring, while verbal aggressiveness has a significant, negative relationship.

In a study of 825 sixth-grade students' perceptions of teacher care focused on the minority status of the student, Tosolt (2009) suggests it is imperative to comprehend the actions students perceive as caring so that teachers can portray these actions allowing caring encounters to occur (p. 405). Tosolt's study investigated differences in students' perceptions of teacher care behaviors based

on students' minority status and illustrated that there are profound differences in how minority students perceive teacher care behaviors. Tosolt (2009) further posits,

While a teacher may wish to form a caring relationship with her or his students and may try to demonstrate her or his care in ways that seem caring to the teacher, the students may not view those behaviors as caring. Teachers must engage in conversations with their students about what care looks like and then must be willing to demonstrate their care in culturally congruent ways. (p. 414)

Her study essentially supports the notion that teachers form relationships with each individual student; that way, the teacher will have an idea of what the students perceive as teacher care so they can demonstrate those characteristics.

Garza et al. (2014) believe that "all students, regardless of race, benefit from the genuine caring efforts of teachers" (p. 1). In an exploratory qualitative study, Garza et al. (2014) examined four teachers' perceptions of their own behavior that the teachers believed conveyed caring. Garza et al. (2014) gathered the teachers' responses into four themes: (a) fostering a sense of belonging, (b) getting to know students personally, (c) supporting academic success, and (d) attending to physiological needs. Overall, this study encouraged schools to become communities of care because "for too many young people, the home is no longer a place of security and love but a battle ground where economic and emotional survival is a daily reality" (Garza et al., 2014, p. 5).

In a study of teachers' perspectives on how their caring practices were impacted by high-stakes testing, Wellman (2007) found that the need for caring relationships actually increased as a result of high-stakes testing. Additionally, Wellman found that in intensified testing environments, teachers feel forced to increase achievement scores and enhance the support they provide to their students. Wellman's study revealed these themes about the influence high-stakes testing has on the caring practices of teachers: heightened need for caring relationships with children, amplified concern for children, increased pressure for improving scores, intensified emotional impact, and reinforced need for supportive administrators.

Jansen and Bartell (2013) focused on students' and teachers' voices of caring in the context of mathematics instruction. Through their study, Jansen and Bartell developed a framework for the teaching of mathematics in a caring way to include these four concepts: (a)

teaching so that every student's learning matters, (b) communicating high expectations for students, (c) creating a welcoming classroom community, and (d) engaging students in learning mathematics. Jansen and Bartell (2013) further insist that "listening to students' voices, including their perspectives on caring instruction that go beyond what their teachers described, is essential for understanding the nature of caring instruction of which students are aware and value" (p. 46).

IMPORTANCE OF CARING IN EDUCATION

Students want to learn from educators who are compassionate and caring (Alder, 2002). In numerous publications, Noddings (1984, 1995, 2002, 2005, 2012, 2013) has successfully established the significance of caring and relationships as a fundamental aspect of the educational process from kindergarten to post-secondary education. Noddings (2002) believes that students and teachers are able to learn from one another through ordinary conversations. Her philosophy is grounded in the belief that experiences and stories are tools that assist teaching and learning to take place. In her book, *Educating Moral People: A Caring Alternative to Character Education*, Noddings (2002) writes, "without imposing their values, teachers can convey all sorts of messages about respect, taste, choice, time management, humor, human foibles, fears, [and] disappointments" (p. 142). She also believes that genuine dialogues encourage care, stimulate trust, and summon remembrance.

In Dewey's (1916) book, *Democracy and Education*, he pens "the very process of living together educates" (p. 6). Dewey believed that experiences and relationships are the foundation of education because people learn from their lived experiences. Whether these experiences are good or bad, a learning curve occurs. Dewey argued, years before Noddings, that instructors had to begin with their students' experiences and interests and patiently forge relations between that experience and the sanctioned educational content. This concept reinforces Noddings' (2005) views on caring relationships as an indispensable element of education. Noddings continues to be a vocal advocate for infusing caring into all educational structures. Noddings (2005) suggests "that caring is the very bedrock of all successful education" (p. 27), and further contends that students will not get a suitable education, let alone maximize their academic achievement, unless they know that they are cared for and develop the ability to care for another. Students need to recognize someone cares for them as human beings. As humans, Noddings argued, students are

inclined to do their finest for those teachers they care about. When students know that someone cares, even in their low moments, they will continue to participate in class activities out of conviction and passion for their teacher; then, better moments come along (Noddings, 2005).

Noddings (2005) further argues that the long-established arrangement of educational institutions is intellectually and morally insufficient for present-day culture. Noddings (2005) suggests that there needs to be a shift from the current emphasis on traditional disciplines toward a curriculum that is centered around themes of care, love, and friendship: "All students should be engaged in a general education that guides them in caring for self, intimate others, global others, plants, animals, and the environment, the human-made world, and ideas" (p. 173).

Emerging research evidence on an ethic of care asserts that teacher care should be a fundamental aspect of the instructional methods applied in schools (Roberts, 2010). The need for teacher care in educational systems is evident through numerous researchers' work. For example, Lumpkin (2007) explains that when teachers sincerely care, students recognize it and respond by heightening their commitment to the learning process and submitting more energy to accomplishing their potential. As Goldstein (1998) asserts,

Teachers who meet their students as ones-caring, and who look upon the act of teaching as an opportunity to participate in caring encounters, will be teaching their students more than academic knowledge. These children will have the opportunity to learn how to care. (p. 246)

Gholami and Tirri (2012) argue that "caring, as a relational phenomenon, demands that the teacher knows his/her students well in order to respond to their needs, desires, and struggles" (p. 2). For teachers to satisfy the needs, desires, and struggles of their students, teacher care must be present.

Noblit et al. (1995) suggest that "instruction, discipline, classroom organization, and all other pedagogical aspects of classroom work are based on a foundation of caring" (p. 680). For example, the study of two elementary school teachers illustrates the experiences of students they influenced using an ethic of care. Frequently, teachers strive to establish positive relationships of care when facilitating instruction because they understand that a student is unlikely to commit to the classroom activity if the student does not believe the

teacher is personally concerned and fervently devoted to that student's academic success. Noblit et al.'s study revealed that open relationships of care between teacher and student played a vital role in encouraging the social and academic development of many students. Zucker (2001) agrees with Noblit et al. when they express that consistent communication with teachers who care becomes the very currency of caring for students whose experiences at school are the only organizing influences in their lives. Zucker (2001) further argues that "a key finding in research on effective, alternative schools for at-risk youth is the consistent presence of caring, demanding, and well-prepared teachers" (p. 344).

Teven (2001) believes that for learning to be maximized, it is vital for teachers to establish a good rapport with their students because the relationship developed between the teachers and students, in part, governs the attentiveness and achievement level of students. Literature indicates that students need to perceive that their teachers care about them, desire the best for them, and are devoted to their academic and personal development before students will give their full participation to the learning process. According to Shann (1999), student and teacher perceptions support the findings that the highest achieving schools, combining an emphasis on curricula with an ethic of care, tend to produce high rates of pro-social behaviors and low rates of antisocial behaviors among students. Schools supporting more optimistic perceptions of teacher care correspond to high levels of academic success in those schools.

Collier (2005) discusses the need to increase teacher efficacy by placing special attention on an ethic of care as an avenue to achieving the goal of enhancing the design, execution, and products of quality instruction. Collier believes that caring enables a sense of connection from which springs endless occasions for learning. Yet, only after this sense of connection between student and teacher is established will the occasions for teaching and learning exist. She further expresses the need for teacher care in the classroom when she suggests,

Most often teachers work to develop caring relationships in their practice because they know a student is less likely to commit to the instructional program if the student does not believe the teacher is personally interested and emotionally invested in the success of that student. (Collier, 2005, p. 355)

Student and teacher triumphs experienced within caring atmospheres strengthen efficacy or assurance in one's teaching skills and one's ability to learn. Collier (2005) argues that, "caring is the fuel for teacher efficacy working in tandem to create the stable, capable and

committed teaching force required for the effective education of our nation's children" (p. 358).

In her study of how a culture of care impacted underserved students at a small, urban high school, Rivera-McCutchen (2012) conducted interviews of school staff, teachers, and alumni and completed observations of classrooms. Rivera-McCutchen (2012) suggests that "at the core of an effective pedagogical practice is the understanding that students, regardless of their life circumstances, must meet and exceed minimum academic standards" (p. 655). Her study found that even though teachers and staff provided emotional and academic support, in the end, the absence of the belief of students' being capable of meeting high academic standards produced ill-prepared students. Rivera-McCutchen (2012) further suggests that "a caring education provides students who have a history of poor academic outcomes with an environment that is both emotionally nurturing and academically rigorous" (p. 654).

Many researchers (Goldstein & Freedman, 2003; Goldstein & Lake, 2003; Lee & Ravizza, 2008; Owens & Ennis, 2005) acknowledge the need for caring in education, and further support the enhancement of an ethic of care as ultimate pedagogical content knowledge for teacher education programs. Goldstein and Lake (2003) believe that "caring teaching-learning relationships are a prerequisite for cognitive growth and development" (p. 116). In a study of 17 preservice teachers, Goldstein and Lake (2003) concluded that if "caring is indeed a central facet of good teaching, then teacher educators must make attention to caring a central facet of our teacher education programs" (p. 129).

Providing a curriculum infused with the major tenets of an ethic of care allows educators to establish an atmosphere where students feel protected and empowered. Noblit et al. (1995) suggest that "caring is central to education; it is the glue that binds teachers and students together and makes life in classrooms meaningful" (p. 680). This atmosphere of empowerment creates students who are more eager to learn because of the knowledge that they are fully accepted by their teachers, regardless of how much or how little they know academically. All students need to feel safe in their dealings with teachers; as Noddings (2005) suggests, "it must be acceptable to admit error, confusion, or even distaste for the subject at hand" (p. 108). This positive environment is full of highly motivated students who are eager and willing participants in the educational process. Foster's (2008) research asserts that "students' descriptions of their academic challenges reflect optimism, grounded in

realistic assessment of their academic challenges when they experience their teachers as genuinely caring, committed to their academic success, and trusting of their judgment and abilities" (p. 117).

A climate of care and trust is one in which people will want to do the right thing and will want to be good. Noddings (2012) suggests that "in such a climate, we can best meet individual needs, impart knowledge, and encourage the development of moral people" (p. 777). The capacity to enact teacher care in one's practice should be an expectation of effective teachers, and teachers need to be able to care for themselves, their students, the content, and other members of the school community. For instance, Kohl (1984) emphasized the significance of teacher care by stating that teachers have a responsibility to care for every student. Owens and Ennis (2005) suggest that, too often, the capacity to care is assumed instead of cultivated or trained, and "the need exists to better prepare future teachers and assist current teachers in understanding the ethic of care" (p. 392).

SUMMARY

A review of the research and literature on caring shows that teacher care might be an influential tool in the process of teaching and learning. Key strategies teachers can use to engage students in caring relationships are modeling, dialogue, practice, and confirmation (Noddings, 1995). Modeling is needed for students to understand caring because their instructors must show them the act of caring through simple actions. Dialogue is essential to caring because it reveals the needs of the one-caring and the cared-for. Practice in caring occurs in the classroom and other locations when students are allowed to exercise their care for their peers. Confirmation is the identification and continued development of one's best attributes.

Teachers can apply their caring behaviors to influence students' academic performance, personal development, and life decisions. Much of the inquiry regarding teacher care in schools has concentrated on observations of teachers with little attention to exploring teacher care from the experiences and perspectives of the students. The few studies exploring students' perspectives have involved elementary and middle school-aged students.

Nurturing an environment that endorses an exhibition of teacher care may encourage others to act in caring ways. These caring ways have the potential to inspire people to build caring relations that may be influential in the

success of students and teachers. Therefore, teachers should be encouraged to teach and interact with students in such a way that all students perceive them as acts of teacher care in order for them to mature academically and personally into positive, caring citizens.

METHODOLOGY

Research Design

To meet the needs of this study adequately, the researcher employed a phenomenological, qualitative research design. Since student perceptions of caring have not been thoroughly researched, it is necessary to begin by using a phenomenological approach. Patton (2002) explains that a phenomenological study emphasizes the accounts of what and how people experience what they experience. Johnson and Christensen (2000) state that the purpose of phenomenology is to gain access to individual's life-worlds and to describe their experiences of a phenomenon. Through this methodological perspective, the researcher was able to deeply examine how a select group of high school senior students perceived their instructors' acts of caring and how those acts impacted their personal and academic development.

This study was led by a heuristic inquiry since the researcher has direct involvement with the phenomenon in question: lived experiences of caring for students and being cared for by instructors. Heuristics is a type of phenomenological inquiry that propels to the forefront the personal experiences and perceptions of the investigator (Patton, 2002). Furthermore, heuristic inquiry entails the amalgamation of individual lived experiences and passion that produces a comprehension of the principles of the phenomenon.

Role of the Researcher

Imperative to qualitative research is the role of the researcher. The researcher has experienced numerous accounts of teacher care throughout his academic pursuits, from elementary school to post-secondary. The researcher also has experience providing teacher care to students as a middle school, high school, and community college mathematics instructor. As a student who received teacher care and an instructor who attempts to provide teacher care, the intertwined perspectives that the researcher provided to this study offered a sophisticated lens for outlining the data collected. Understanding the benefit of these experiences, the researcher had an intense desire to listen and learn in the data collection process, as well as in his efforts to

accurately analyze and interpret the perspectives of the participants in this study.

The researcher's role as a "human instrument" required the researcher to engage in the process of reflecting critically on one's self as the researcher (Lincoln & Guba, 1985, p. 193). Using a heuristic approach required that the researcher be open, receptive, and attuned to all parts of one's experience of a phenomenon, allowing understanding and compassion to mingle and recognizing the place and unity of intellect, emotion, and spirit (Moustakas, 1990).

Participants

Creswell (2007) stresses that the participants in a study should be cautiously selected to be persons who have all experienced, and can speak to the phenomenon under study so that the investigator, in the end, can develop a common understanding. To gain participants with these characteristics, this study utilized a purposeful sampling to select participants. Patton (2002) suggests the objective of purposeful sampling is to gather information-rich subjects whose review will illuminate the concepts under study. In qualitative research, this sampling technique is used to focus attention on the perceptions of those who have been identified to have experienced the phenomenon in question. Instead of considering the idea of generalizing the participant's experiences to a larger population, an exhaustive discovery of a person's lived experience is the aim of phenomenological studies (Lincoln & Guba, 1985). Johnson and Christensen (2000) suggest that most phenomenological studies conduct extended interviews with up to 10 participants.

Researchers (Alder, 2002; Ferreira & Bosworth, 2001; Garza et al., 2014; Tosolt, 2009; Zucker, 2001) suggest that extensive literature has been published about caring in education, but most has been from the perspective of educators, not students, even though a caring relationship cannot take place without the student's identifying the act of care. To address this gap in the research, the researcher chose as the participants for this study 11 Northwest Florida high school seniors and two senior guidance counselors. Of the 11 seniors, there were two White males, one Black male, four White females, two Black females, one Hispanic female, and one Brazilian female. The counselor participants included one White female and one Black female. Table 1 provides a description of the participants' demographics collected. Seniors were used as participants to ensure the participants had varied years of experience with teachers, and counselors were used to assist with triangulation. The researcher

Table 1: Participant Information

Pseudonym of Participant	Student/Counselor	Gender	Ethnic Background	Age	GPA Unweighted/Weighted
Ashley	Student	Female	White	18	3.00 / 3.00
Betty	Student	Female	Brazilian	18	4.00 / 4.05
Casey	Student	Female	White	18	3.07 / 3.49
Greg	Student	Male	White	18	3.39 / 4.31
Kevin	Student	Male	Black	18	2.46 / 2.54
Larry	Student	Male	White	18	2.04 / 2.04
Linda	Student	Female	White	17	3.50 / 4.35
Lucy	Student	Female	Black	18	2.82 / 3.34
Marisa	Student	Female	White	18	2.86 / 3.16
Martha	Student	Female	Hispanic	18	3.35 / 3.40
Ms. Cross	Counselor	Female	Black	29	N/A
Ms. Washington	Counselor	Female	White	44	N/A
Tiffany	Student	Female	Black	17	3.23 / 4.05

made an effort to achieve diversity in the selection of the participants, specifically pertaining to gender, ethnicity, and academic achievement.

The participants for this study were obtained by communicating with the two senior class guidance counselors at a Northwest Florida high school for assistance in identifying potential students who they believed had awareness of, association with, and direct experience with teacher care. After gaining the authorization of the selected educational system, the researcher communicated with the two senior class guidance counselors who signed consent forms, then agreed to provide selected students with a letter of interest to participate in the study. Interested students were then provided with informed assent and consent forms. The participants for this study received neither extra credit nor compensation for their participation.

PROCEDURES

Creswell (2007) points out that data collection in phenomenological studies frequently involves multiple in-depth interviews with participants. The major technique of data collection for this study was 25-minute, in-depth, open-ended interviews. Patton (2002) believes that a truly open-ended question permits the participant being questioned to select from their full repertoire of conceivable responses those that are most prominent. Each participant was interviewed once to gather the

participants' views regarding their lived experiences of teacher care. In typical phenomenological research, the researcher collects data using numerous in-depth interviews from several participants and illustrates their experience (Johnson & Christensen, 2000).

The interview questions utilized in this study were in-depth, open-ended interview questions. The development of the questions mirrored the purpose of the study with the aim of assisting in the exploration of select high school seniors' perceptions and lived experiences related to teacher care. The interview questions were based on Noddings' (1984) four components of teacher care (modeling, dialogue, practice, and confirmation). Two sets of interview questions were utilized. One set was the student interview questions, and the second set was the guidance counselor interview questions.

The interviews were directed by the researcher throughout the entire process; this process was used to promote consistency among the interviews. The researcher began each interview by thanking the participant for his or her time and effort, followed by asking the interview questions developed to allow the participants to draw upon their lived experiences of the phenomenon of teacher care using their own stories. The interviews, conducted separately, were recorded on audiotapes and then transcribed. After the data were transcribed, the researcher met with each participant again to allow the participant to assess the transcription to confirm all of the material was accurate.

Data Analysis

Qualitative data analysis is the process of making sense of, interpreting, or theorizing data (Patton, 2002). The data collected in this research were analyzed holistically with reflective considerations of the people, the perspectives, and most importantly the lived experiences that were observed in this study. Initially, the qualitative data were analyzed using a typological analysis approach as described by Hatch (2002). In this type of approach, typologies are predetermined by “theory, common sense, and/or research objectives” (p. 152); then, data are coded based on these typologies (Hatch, 2002). Noddings’ (1984) four components to practicing care in the classroom—modeling, dialogue, practice, and confirmation—served as the initial typologies. Ultimately, the researcher determined that solely using this approach to analyze data was limited because there were more themes and patterns that emerged throughout the research process.

The data analysis process was also guided by a heuristic approach since the researcher has a direct experience of the phenomenon in question: lived experiences of receiving and providing teacher care. Moustakas (1990) suggests that “in heuristic research the investigator must have had a direct, personal encounter with the phenomenon being investigated” (p. 14). Moustakas’ (1990) six phases of heuristic research—“the initial engagement, immersion into the topic and question, incubation, illumination, explication, and culmination of the research in a creative synthesis”—were utilized to assist with the data analysis process (p. 27).

For this research, data analysis continued with the process of organizing, reducing, and describing the data and concluded with the activity of drawing conclusions or themes from the data. Creswell (2007) suggests that those who analyze data go through it and highlight substantial statements, sentences, or quotes that exhibit an understanding of how the participants experienced the phenomenon; then, the researcher gathers clusters of meaning from these substantial statements into themes. Lastly, these themes are used to describe what participants experienced, a process referred to as textural description (Creswell, 2007).

Trustworthiness

A crucial aspect for approval in the world of academics and for allowing other researchers to perform further research on the topic is the issue of the trustworthiness of a qualitative research study. Lincoln and Guba (1985) suggest that the goal of trustworthiness in a qualitative

study is to affirm the notion that the “findings of an inquiry are worth paying attention to” (p. 290). Founded on Lincoln and Guba’s (1985) inquiry, establishing trustworthiness comprises attainment of the four main criteria: “credibility,” “transferability,” “dependability,” and “confirmability” (p. 300).

Triangulation increases validity in qualitative research (Patton, 2002), thereby involving the researcher in “cross-checking information and conclusions through the use of multiple procedures and sources” (Johnson & Christensen, 2000, p. 208). Triangulation for this study was initially engaged through in-depth, open-ended interviews with the two senior class guidance counselors as a separate set of data collected. To make the findings more authentic and trustworthy, the researcher used “theoretical triangulation,” a technique entailing the use of more than one theoretical position in interpreting data (Denzin, 1989). Discussing theoretical triangulation, Denzin (1989) suggests that “pitting alternative theories against the same body of data is a more efficient means of criticism—and it more comfortably conforms with the scientific method” (p. 240).

Confidence in the truth of the findings is defined as the credibility of the research. The researcher relied on triangulation to enhance the credibility of this study. According to Lincoln and Guba (1985), the technique of triangulation is further described as an aspect of enhancing the likelihood that results and explanations of a study will be found credible. Additionally, to heighten the credibility of the study, the researcher determined whether the participants perceived their interview transcripts to be accurate by utilizing a concept called member-checking. Since the aim of this study was to comprehend the participants’ perspectives, the participants themselves were the only ones who could legitimately judge the credibility of the data. Lincoln and Guba (1985) suggest that “the member check, whereby data, analytic categories, interpretations, and conclusions are tested with members of those stakeholding groups from whom the data were originally collected, is the most crucial technique for establishing credibility” (p. 314).

Transferability seeks to determine whether the results of the study have applicability in other contexts or groups (Lincoln & Guba, 1985). In this study, the researcher sought to enhance transferability by developing thick, rich descriptions of the contexts, perspectives, and findings that surround the participants’ experiences. By doing so, the researcher will allow reviewers of this study the opportunity to decide for themselves whether or not the results are transferable to other settings. Lincoln

and Guba suggest that it is not within the researcher's purview to develop a guide for transferability, but to provide only a database that makes transferability decisions possible.

Dependability suggests that the research shows that the findings are consistent over a period of time and could be replicated by other researchers (Lincoln & Guba, 1985). To address dependability in this study, the researcher asked each participant the same questions from the established interview protocol. Furthermore, the researcher used identical methods when arriving for the interview, conducting the interview, and recording the interview for each participant.

Confirmability describes the extent to which the findings of a study are shaped by the respondents and are not biased by the researcher's motivations or interests. The researcher enhanced confirmability through the continued use of triangulation.

All of these strategies were utilized to establish the trustworthiness of this research. Trustworthiness for this study was developed by following the four main criteria—credibility, transferability, dependability, and confirmability—suggested by Lincoln and Guba (1985).

FINDINGS

The results of this study indicated that the students perceived teacher care to be essential to their academic and personal development. To many students, teacher care was evident when teachers showed enthusiasm for the subject/teaching, possessed high expectations for all students, expressed a willingness to help students academically and personally, demonstrated flexibility and adaptability, established personal relationships with students, and treated students with respect. Noddings' components of care—modeling, dialogue, practice, and confirmation—provided a theoretical framework to explain how these themes could be used to exhibit teacher care. The themes developed through data analysis also aligned adequately with this study's research questions.

Theme 1: Enthusiasm for the Subject/Teaching

Teachers who show enthusiasm for their subject and for the art of teaching demonstrate one of the themes of teacher care based on the participant's perspectives in this study. Teacher enthusiasm contributes significantly to gaining students' attention, engaging students' interest, and developing students' positive attitudes toward learning. In other words, "the teachers who

actually like their job and want to be there and like the kids—they're more caring," responded Ashley, one of the study's participants. Martha suggests that "their attitude and the way that they present themselves as excited about teaching" lets her know that her teachers care. Also, participants Larry and Greg described situations when their teachers were excited about their understanding academic concepts. When asked how she shows students she cares, Ms. Cross, one of the guidance counselors, replied,

As a guidance counselor, I show them I care by just taking the time out to help them with their academic goals, plans for the future, and providing resources for them. I just show my care through the time, effort, and genuine enthusiasm I have for their life and future and simple gestures like asking, "How is your day going?" in the hallway.

One other participant, Marisa, expressed that when asking her teacher questions in class, "he does not have an attitude about it; he seems happy about helping me understand."

Theme 2: High Expectations for All Students

The theme of high expectations for all students was mentioned throughout the interviews by many participants. The student participants believed that teachers develop expectations of a student's academic ability and tend to treat students contrarily depending on these expectations. Therefore, educators should develop high expectations for all of their students. Teachers can enact this type of care for their students by providing them with challenging learning experiences. One participant, Larry, revealed his thoughts on high expectations as a form of teacher care received from his band director, Mr. Y., when he reflected,

I think he compliments us every day by making us work harder. He has high expectations for us, and he compliments us when he sees that we are working hard and that we were able to play something that we weren't able to play, say, a few days or a few weeks ago. He may not always come out and say it, but you can feel it.

Larry further reflected on teachers' high expectations when he discussed his mathematics teacher, Ms. Q., by stating,

I guess when you have somebody putting out positive vibes, you just . . . you feel it, and you get motivated a little bit, so, I guess when you have somebody else believing in you more than yourself, you just gotta do it!

Furthermore, the participants stressed that a teacher

shows he or she cares for students by not only having high expectations, but also by showing them that he or she believes in them. Many participants suggested that a teacher's belief in his or her students should be obvious. Teachers must be able to communicate to their students that they do sincerely care about their academic and personal development in order for students to perceive them as caring. Linda revealed that she needs to hear and feel her teacher's belief when she illustrated:

I wanted to drop out of College Algebra at the beginning of the year. But [Ms. R.] came to me and said, "But you're so good at this. You're so smart. You learn so fast." And by her doing that, [she] changed my mind. She said, "I think, better yet, I know you can do it, and it would be easier in high school." A lot of my teachers give compliments that do help bolster students' self-esteem and make decisions.

Another student, Casey, discussed her thoughts on her teachers' belief by saying,

I believe a lot of my instructors believed in me and pushed me. So, therefore, I believed in myself, more, I guess. So, I strived more and I did more. I took honors classes and all of that. Normally, I feel like if I didn't have the teachers I had before, I would not have tried honors.

Lastly, Kevin discussed his experiences by saying, "They showed me tough love; they never really took it easy on me, so they held me to a high standard." All of the participants' responses suggested that a teacher who cares has expectations, then that care contributes greatly to students' feelings and academic success. The students in this study wanted to be pushed to continue to grow as learners and considered being challenged academically by their teachers to be genuine acts of teacher care.

Theme 3: Willingness to Help Students

The theme of helping students, whether academically or personally, was also echoed in the responses of every participant, even the counselors. Caring teachers are concerned with the struggles their students face and do everything possible to help students thrive. The participants in this study agreed with this assertion by detailing a number of different ways their teachers helped them as students. Betty described one teacher by saying, "She helped us with anything that we had, even if it was for class or not for class." Linda echoed that sentiment by stating, "Being a real caring instructor is actually teaching your kids how to do things... it's helping them become a better person... helping them

with their life... helping them become more intelligent. It's more than just reading off what they give you to teach." Greg described a caring teacher by saying, "He helped all of us fill out our college applications." Larry had a similar experience when he spoke of his high school band director:

I do believe that he cares for me and also everyone else in band and like everybody in school really; he never wants to see or hear about someone going through something that they shouldn't have to. Or, for example, one of his students' having one of their family members pass away, you know, he would be there for whoever lost somebody. He is always there whenever you need him to be.

Another major aspect of teacher care is helping students with learning their academic content. In this study, the participants characterized teacher care as a student's perception of help and support with learning academic content. In fact, all of the participants resonated with the thought of helping students learn as an act of teacher care.

The student participants in this study favored teachers who assisted them in the classroom, helped them understand content, and explained concepts more than once if necessary. Responses from the participants suggested that teacher care was evident when teachers circulated throughout the classroom, asking if students needed extra help, answering questions, and providing feedback. These actions were indicated in this study as important aspects of teacher care when Linda shared this experience:

[Ms. R.] does this thing where she asks you over and over again, "Are you guys doing ok? Do you need me to go over this?" She doesn't just blow through things. She wants to make sure that everyone understands what they're doing... she doesn't just say, "Here, take this; read out of the book. If you don't get it, oh well." She goes back over things as many times as they are needed. One time, she ended up repeating one thing, like five times. [laughs] She just wants to make sure that you get it—and that you get it well—and it's not I just sort of understand it. She wants to make sure that you have a firm grasp of what you are supposed to be learning.

Larry also expressed his thoughts on being assisted with his academic content:

I know an instructor cares about me when they come and ask me if I need help. Because they can tell if I am struggling, they don't wanna/

or they are not gonna wait for me to come ask for help. They are gonna notice that I'm not having the best of luck on doing whatever the assignment is, or something. You know, if they come and ask me if I need help, that right there is showing me that they're paying attention and that I'm not just some kid in class, but that I matter.

Casey, when discussing her teachers, alluded to the fact that they were always coming to her desk asking if she needed help understanding the material. She even stated that if she needed extra tutoring "they were always willing to stay after school, or come before school." Casey further stated that "there are some teachers that will actually go the full mile to help you understand and basically do anything they can to help." Greg explained in his interview that his math teacher would "take time and make sure that before she moves on from anything that even the student in the class who is struggling the most understands the concept." Therefore, the participants' responses suggested that teachers who taught to their individual understanding, answered students' questions simply, and genuinely helped them with academic and personal problems were seen as caring. Therefore, the concept of helping students personally and academically is perceived as a crucial aspect of teacher care by the participants of this study.

Theme 4: Flexibility and Adaptability

Another important, recurring theme from the interviews about teacher care was teacher actions that demonstrate flexibility and adaptability. This theme is also twofold. First, participants explained that teachers who are flexible and willing to adapt their teaching styles to individual learning styles demonstrate an important concept of teacher care. In other words, teacher care was exhibited by teachers when they were compassionate towards students' diverse learning styles and willing to make adjustments to match their students' needs. The following examples from the data illustrate this assertion. Linda discussed this type of compassion from her teacher when she explained, "She matters a lot to me because she cares enough to teach in different ways, so that all students can understand." Lucy further illustrated this compassion from her teacher by stating that "he always took the time out to explain it differently for me, so I could understand." Greg described a similar situation that he had in his class:

She doesn't judge if you are not picking up on it maybe as fast as the other kids are; she has no problem with rearranging the class' activity if most people don't understand the topic or going

back over it the next class to make sure people learn.

Secondly, participants advocated that teachers who were able to be flexible and adapt to student issues that arose which conflicted with learning subject matter or meeting deadline dates were also exemplified as important characteristics of teacher care. Teachers who provide students with extra time to complete assignments were believed by the participants to possess teacher care by demonstrating flexibility and understanding. Casey believes that her teachers are flexible and adaptive to her needs when they ask her to "come talk to me so we can see what we can do, how we can work this situation out." Casey further illustrated,

If I didn't understand something, they'd come to my desk directly, and they would work with me for a long as I needed them to. Or, they would give me extra time on a paper that I didn't understand the [writing] prompt of, or something like that.

Lucy described a situation where her teacher was flexible by telling her, "I know you haven't completed your assignment because of playoffs, so just get it to me next week." The participants in this study defined teacher care as the acknowledgment and understanding of students' lives outside of the classroom and the willingness of that teacher to make adjustments as needed.

Theme 5: Establishment of Personal Relationships with Students

In this study, a number of the respondents' comments resonated with the importance of relationships as a characteristic of teacher care. When discussing an instructor who really mattered to her, Casey chose her teachers because she felt they "formed a bond a little bit." Marisa suggested that her instructors influenced her by "telling their life stories about how they went about high school and how it's important to try hard all four years and not to just wait until your senior year to start trying." Linda shared her experiences by saying,

Teachers ask you stuff. They might not be super personal, but, it's a "How was your day?" or, "Do you think you are gonna do well on this test?" They'll urge you to study, they don't want you to fail. So, they say these little things; they drop hints. Sometimes they are very obvious about it. Sometimes they're not. But, you can always tell that they are trying to get to know you because they care.

The student participants in this study expressed that it was important for them to have those individual talks

with their teachers about class or just life, and that these talks were a sign of teacher care. Ms. Cross agreed with the students when she stated that “for some students, who only have positive interactions at school, the conversations with their teachers become vital to their life and what they may believe is teacher care.” Martha agreed by sharing,

I have been influenced by my teachers because of their attitude and always being there for me when I needed them. Saying “you are not here alone—I’m there for you, even if you just need to talk about personal things—I am not just always here for academic talks,” cause not everyone has that person to talk to at home, or anywhere else.

Another participant, Betty, expressed that the teacher she thought really mattered “listens to me,” “discusses important matters with me,” and “wants to hear what I have to say and think.” Tiffany discussed her relationship with her English teacher:

I have an English teacher that, no matter what the situation was, I know I could go talk to her, no matter what time it was, whether she was busy or not. She would make time to talk because she cared. It was also those casual talks in the hallway that made our relationship great. If I was having a rough time at home, she could pick up on it because she knew me.

Ms. Washington, one of the senior counselors, stressed the importance of building relationships with students because they become more receptive to the information and her suggestions about their academics. She explained how she tried to establish and maintain those relationships by saying,

I’m mindful of the way I talk to them, by making eye contact with them, by calling them into my office, being honest and upfront about things, just being consistent and always being here and having an open-door policy. They’re always welcome to come in.

Theme 6: Respect for Students

The participants of this study expressed the belief that, for one to exhibit teacher care, one must respect students. Tiffany expressed the importance of respecting students when she responded, “With respect, teachers communicate that they care.” Greg described his experience with his mathematics teacher by saying, “She doesn’t discriminate at all in class, and she respects us, so that makes me feel comfortable.” Ashley stressed that her art teacher respected her and her classmates, encouraged them to respect others by insisting that they

follow classroom rules, and by simply telling them to “have respect for everybody and everybody’s art.”

Respect is a very important characteristic of a teacher-student relationship. In other words, “they respect you because they know that’s how you get respect in return,” responded Kevin. Ms. Cross discussed how to increase respect when she stated that “respect is developed in the classroom by showing respect to students and modeling to students how to show respect to their peers.”

DISCUSSION

The intent of this study was to detail the stories and descriptions of how selected high school students understood the practice of teacher care in their schools. To accomplish this goal, a phenomenologically oriented, qualitative research design that employed 13 participants (11 students and two counselors) at a Northwest Florida high school was considered. This study was guided by the following research questions: (a) How do selected high school seniors define or discuss their lived experiences in terms of teacher care? (b) How do selected high school seniors describe their lived experiences of being “cared for” by instructors? and (c) What are the beliefs and values of students in regard to their perceptions of teacher care on their personal and academic development? As mentioned in Chapter I, there is a lack of research on teacher care from the students’ perspective. Therefore, this study attempted to address this gap by considering the voices of students. The aim of the interviews was to gather comments from the participants explaining teacher care from the viewpoint of the individuals. This phenomenological inquiry revealed the views, opinions, attitudes, and perceptions of teacher care from the students, the ones who determined whether a caring encounter ever existed.

The results of this study indicated that the students perceived teacher care to be essential to their academic and personal development. To many students, teacher care was evident when teachers showed enthusiasm for the subject/teaching, possessed high expectations for all students, expressed a willingness to help students academically and personally, demonstrated flexibility and adaptability, established personal relationships with students, and treated students with respect. Noddings’ components of care—modeling, dialogue, practice, and confirmation—provided a theoretical framework to explain how these themes could be used to exhibit teacher care. The themes developed through data analysis also aligned adequately with this study’s research questions.

Limitations

Several limitations could have affected this study's outcome. This study involved only one high school, and this school may not be representative of all high schools in the United States. The perspectives obtained during this research could be specific to only the chosen participants and may not be representative of their grade level or school. This study evaluated the personal conceptualization of teacher care, and its purpose was to describe the perceptions of students, so the results presented here cannot be generalized; however, the insight shared can provide a foundation for school improvement. Lastly, the perspectives and experiences of the researcher may have also influence the research process; yet great efforts were made to ensure an unbiased selection of participants and an accurate analysis of the data collected.

Future Research

A considerable amount of research is needed to improve teachers' understanding of how students perceive characteristics of teacher care. The information, insights, and understandings gained from this study suggest directions for future educational researchers. First, replication of this study using different strategies would offer further considerations. Secondly, an examination of teacher education programs exploring how preservice teachers view teacher care during their coursework or during their student teaching might also be valuable.

A small phenomenological, qualitative study based on interviews with only 13 participants served as the central point of this research. For this reason, future research is encouraged to replicate this study using more participants with varied data collection and data analysis methods for the purpose of determining how students perceive characteristics of teacher care. Replication of this study in other areas of the nation would also help establish more understanding of how students perceive teacher care.

Research into how preservice teachers view teacher care from professors or how they exhibit teacher care during their student teaching might also be valuable. Since learning atmospheres that exhibit teacher care are the foundation for academic development, and since the goal of teacher education is to prepare teachers who can improve the academic status of students, teacher educators need to understand and incorporate an ethic of care in their curricula. Rogers and Webb (1991) argue that student teachers should be provided with plenty

of opportunities to examine and cultivate their own characteristics of teacher care and to reflect on how they will encourage caring in their students in their own classrooms.

Furthermore, the findings of this study might inspire other studies and thereby impact educational policies and programs that encourage teacher care in the school setting and contribute to the body of research on best practices used in educational pedagogy. Findings might contribute to an increase presence of teacher care in the school community and in teacher education programs. The results of further research might also encourage an overall caring environment, a situation that could result in improved academic achievement, students' feeling engaged in the academics and culture of their schools, and overall improved educational outcomes.

Recommendations for Practice

The findings of this research indicate that students and counselors perceived teacher care in many different ways and that there were numerous characteristics of teacher care. The characteristics of teacher care include, but was not limited to, exhibiting enthusiasm for subject matter/teaching, having high expectations for all students, demonstrating flexibility and adaptability, establishing personal relationships with students, and treating students with respect. The various findings, when viewed together, illustrated a very important point when considering the development of a strategy for teacher care implementation.

For teaching and learning. Teaching and learning can be more effective if teachers determine appropriate ways to utilize teacher care. Teacher care needs to be incorporated into the teaching and learning process so that teachers and students can build on the positive influences of caring teacher-student relationships. Rivera-McCutchen (2012) suggested that "educators work to understand the experiences of their students and their families and use the personal connections they forge to help students achieve academic success" (p. 654). Teachers need to consider the implications of research findings and determine how their findings relate to their courses, students, and personal teaching pedagogy.

Teachers should think about and continually evaluate their personal theories of teacher care. Furthermore, teachers should experiment with different strategies of teacher care and monitor the results by listening to students' reflections of their care. Lastly, students should be encouraged to evaluate their own notions of

an ethic of care, and should be given opportunities to exhibit this care as well.

For teacher education programs. Teacher education programs need to give teacher care an essential place in the curriculum. It is important for teacher education programs to expose preservice teachers to literature on caring (Goldstein & Lake, 2003). For teacher educators, this research will provide tangible examples of teacher care characteristics that are effective in terms of connecting with students and engaging them in the learning process, thereby allowing teacher educators to enlighten preservice teachers by giving them a guide to use in regard to what they can and should make sure to pay attention to when they get the opportunity to work directly with students in their own classrooms. Professors within teacher education programs must recognize the infinite possibilities of caring and then make a commitment to their preservice teachers to make an ethic of care the touchstone of their practice (Rogers & Webb, 1991).

For educational policy makers. Noddings (2005) asserted that “the traditional organization of schooling is intellectually and morally inadequate for contemporary society” (p. 173). Policy makers may be able to apply this research to address this issue and improve the

quality of educational systems. The themes presented in this research offer insight into how students perceive teacher care, insight which presents policy makers with numerous implications for education reform. Noddings (2005) further asserts that caring is the very bedrock of all effective teaching and that modern-day teaching should be revitalized in its light.

Since the findings of this research suggested a need for caring relationships between teachers and students, policy makers could encourage a component of teacher evaluation systems that gauge teachers’ rapport and relationships with students. There also exists a significant need for caring teachers; it may be important for policy makers to develop guidelines for teacher hiring practices. These guidelines may encourage the creation of interview questions that extract teacher care qualities, thereby allowing school administrators to select teachers who, in addition to having a strong instructional skill set, have beliefs and values that align with qualities of teacher care. Policy makers could also permit funding for ongoing training and resources for teachers to further develop pedagogy in the area of teacher care. Allowing teachers the opportunities to discuss best practices of teacher care essentially helps them build their capacity to create positive, caring school cultures.

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Fleshing out the owl pellet: Making connections to STEM education with pre-service teachers

Puneet Gill
Nicole Vaux

Abstract: This study investigates the perceptions of pre-service teachers at a workshop during the Conference for the Advancement of Science Teaching (CAST). Pre-service teachers participated in a workshop which showed them how to connect STEM education through an owl pellet dissection. Pre-service teachers also learned how to scaffold understanding of basic science and math tools in the owl pellet investigation, and to make connections to bone structure and anatomy in human physiology. Through participant observation, teacher observation, and analysis of completed workshop handouts, pre-service teachers shared their experiences with each other in small groups and with the lead teacher. The results of this study indicate learning about concepts through a community of teachers is significant to teacher perceptions of dissections, and scaffolding experiences is essential to teacher pedagogical knowledge relating to the dissection.

About the Authors: *Dr. Gill is an assistant professor at Texas A&M International University. Her research interests include STEM education and pedagogy and sex education/policies. Dr. Vaux is a graduate professor of Educational Leadership at Lindenwood University in St. Charles, MO. Dr. Vaux is certified in quantitative statistics and STEAM. Her research interests are primarily in organizational theory with a focus on culture and climate.*

Keywords: Owl pellet, anatomy

INTRODUCTION

How do pre-service teachers learn about structure and function of organs in relationship to bone structure and anatomy in elementary grades? Can we conduct inquiry investigations that integrate mathematics and science tools? The disciplinary core standards in the Next Generation of Science Standards promote teaching about the internal structures of plants and animals and the role they play in survival, growth and reproduction. At the K-2 grade level, there is specific reference for children to know the heart, lungs, stomach and brain (NGSS, 2016). A similar but important issue is children in elementary school do not receive adequate understandings about their body and about health education in general (FOSE 2011). Children should have a basic understanding of proper names for body parts including male and female anatomy by the end of 2nd grade. By the end of fifth grade, students should be able to name male and female body parts and their functions (FOSE, 2011, p.12-14). One way to integrate understandings of body parts is to encourage teachers to conduct dissections that offer complex understandings of the human body through inquiry investigation. This

study analyzed pre-service teachers perceptions at a workshop during a science teaching conference about the content knowledge for dissections, the complexity of the dissection, and whether or not to incorporate science and mathematics tools.

Research questions raised during the workshop were:

1. What are pre-service teacher's perceptions of the owl pellet dissection?
2. How do pre-service teachers connect STEM education to the owl pellet dissection?
3. What factors of the dissection was more likely to help teachers conduct the owl pellet dissection in their own classroom and make connections to human anatomy/physiology and or health education?

REVIEW OF LITERATURE

The use of the owl pellet dissection lab has been beneficial to young students' education in several ways. Not only does it provide children with an opportunity to practice

lab safety procedures and familiarize themselves with the lab environment, but it also helps to improve communication with their peers and follow teacher directions. Currently, educators in science classes have been using this lab to improve students study skills, observational skills, identifying and categorizing the different bones found in the pellet, and to encourage discovery. However, the owl pellet dissection lab has the potential to be an introduction to more advanced science concepts.

An article published in *Science and Children* describes one use of the owl pellet lab for students in the fourth – sixth grades. The lab is separated into four key sections (Engage, Explore, Explain, Elaborate/Evaluate) designed to challenge the students to learn through discovery. In the engage section, the teacher engages the students in the activity by telling a short anecdote about the object they are about to receive. The only information the students are given about the objects is that a friend has been finding them out in their barn in the country. Then the teacher distributes the owl pellets and has the students each write a guess of what the object is, collects the responses, and reads through them to determine the students' knowledge of the object while still allowing the students to enjoy the excitement of discovery. In the explore section, the students are each given an O-W-L chart (Observe, Wonder, Learn) along with several lab tools such as scales, tape measures, and hand lenses, so that they may make observations and record them on the chart. Then the teacher asks the students to write their questions or "wonderings" in the wonder section of the chart. The teacher then use the *White Owl, Barn Owl* text to help students infer that they are looking at an owl pellet, and have the students continue to write more "wonderings" on their chart. In the explain section of the lab, the students are asked to separate the bones and different pieces found in the owl pellets, and determine what the owls ate using a bone chart. Then the teacher explains how the owl eating another animal is part of the food chain, creating an energy flow. The teacher also explains the concept of producers (things that produce energy) and consumers (things that eat other living things for energy) in the food chain. The elaborate/evaluate section of the lab allows for the students to apply what they've learned. The teacher explains that the origin of the energy flow comes from the sun, by the transfer of energy from one thing to another. The students are then challenged to create an example of the energy flow for the owl using the words producer and consumer to complete the Learn section of their chart (Grades 4-6: Pass the Energy, 2011).

In a similar publication, Ellen Schiller and Jacque

Melin include the use of the owl pellet lab as a part of assessment strategies for inquiry science. The lesson, which is centered completely on owls, is implemented to show the shift of classroom assessment strategies from rote memorization and repetition of course material to an examination of conceptual understanding of activities such as scientific reasoning skills, inquiry skills, performances and products. Using the 5E learning cycle model the inquiry process is expressed in the following steps: eliciting prior knowledge before a lesson or unit, checking for understanding throughout the unit, and conducting a summative assessment at the end of a unit to determine student learning. In doing so, the students are allowed to self-assess their own learning. Prior to the lesson the teacher identifies the learning targets that the students should be able to meet by the end of the unit. Then the students are asked to complete an "Anticipation Guide" on which they select whether they "agree" or "disagree" with each of the six statements listed on the guide. This serves as a tool to elicit prior knowledge from the students. The teacher then informs the students that throughout the lesson they will be able to identify whether each of the six statements are true or false by utilizing hands-on investigation, research, reading and video clips provided in the unit.

The article also touts the usefulness of embedded formative assessments which give the teacher valuable feedback about the children's learning throughout the duration of the unit. In this particular lesson, the students work in pairs and utilize a "think dot" activity. In the activity the children roll a standard six-faced die and respond to the topic indicated by the number on the die including eyesight, hearing, silent flight, talons and beak, behavior, and diet. For example, if the child were to roll a one, then they are to discuss with their classmate different things they have learned concerning owls' eyesight.

A third article written by Leonard P. Rivard, does an in-depth study of owls in the classroom setting. The author emphasized in this study that owls can be a human benefactor by eliminating unwanted prey that can be harmful to agriculture. The owl pellet dissection in this article is used to show the owl's role as predator in the food chain, and to help develop student's attitudes and increase their value of wildlife as it affects their own lives. The owl pellet dissection begins with an explanation of what the owl pellet is and how the regurgitated pieces in the pellet are a result of the owl incapacity to digest certain parts of their prey. The students are shown a video *Owls-Lords of Darkness* to further illustrate the feeding behavior of owls. By dissecting the owl pellet, the students are able to create a small mammal skeleton,

identify the mammal grouping by analyzing dentition and long bones, and construct and interpret data tables from the information the gained from the dissection. The students begin to interact with the owl pellet by measuring its mass length and diameter, and then recording the information along with creating a detailed drawing of the pellet. Then the students are directed to place the pellet onto a sheet of white paper and start separating the pellet into smaller pieces to locate the bones and feathers inside. After removing the fur from the pellet, the students are asked to weigh the bones and calculate what percentage of the pellets mass was made up of bone. The student use a chart to determine what species of bird the pellet came from by comparing the mass of the bone found in the pellet. Then the student separate the bones into different piles based on the type of bone, and create a count of each of the different types of bones they have. The students are then asked to reconstruct a skeleton of a mammal by gluing the pieces onto a sheet of paper and drawing in the missing pieces. The student should use the skull characteristics and dentition formulas to try to determine what species of mammal the bird had eaten. The students are then asked to compile all of their data and create charts comparing the different pellets, and the diet of the birds. The author uses the end of this lab to emphasize critical thinking questions for the students by posing several questions such as if owls were provided with a steady diet, how many prey species could an animal eat within a year, and should owls be protected from hunting just as other predators are? This article goes beyond the basic scope of use for the owl pellet dissection lab and implements more critical thinking skills, as well as instilling a sense of value for wildlife and the impact their lives can have on our own. Each of these articles addresses differing educational tools utilizing the same commonly used science lab. However, building upon these tools and expanding the applications of this lab can create a gateway for younger children to learn advanced science concepts at an early age.

THEORETICAL PERSPECTIVE

This study aimed to understand pre-service teacher's pedagogical content knowledge (PCK), which is a distinct type of knowledge teachers develop in relation to expertise and teaching. This type of knowledge transforms subject matter, and pedagogy as well as contextual knowledge of teaching. PCK can be used as a heuristic for teacher knowledge and can be used to understand the complexity of teaching (Schneider & Plasman, 2011). Another important aspect of PCK varies for different teachers but is a foundation

for teacher's professional knowledge and expertise (Loughran, Berry & Mulhall, 2012). Teachers PCK was analyzed as it related to their understanding of science curriculum, science instructional strategies and how their knowledge changes with new strategies with the owl pellet dissection.

METHODS AND SETTING

This investigation analyzed teachers throughout the workshop at the Conference for the Advancement of Science Teaching (CAST) which was conducted with 20 teachers for a duration of 90 minutes. The participants were teachers in schools across Texas and were science teachers. Participants were asked to dissect an owl pellet during the workshop. Participants that attended the workshop were pre-service teachers that had little to no experience with the owl pellet dissection. Methods used to analyze pre-service teachers were handouts participants used during the workshop. Secondly, participant conversations during the workshop with small groups and with the lead teacher was also analyzed for understanding of science, and mathematics tools, and factors that could contribute to pre-service teachers conducting dissections and making connections to human anatomy and physiology. Lastly, the lead teacher also observed through participation to examine changes in participants beliefs and knowledge about the owl pellet dissection, its relationship to mathematics and science concepts and connections to human anatomy and physiology.

RESULTS

The owl pellet dissection can be an important initial step to understand the basic organization of bones and organs. In the science classroom, classes can make an important link to understandings about structure and function in the TEKS and health education by utilizing inquiry oriented owl pellet dissections. Not only can these dissections help students make connections between bones and organs, children can utilize STEM toolboxes to help them dissect, sort and infer where the bones belong. STEM toolboxes integrate the use of scientific technology and technology to help students with these investigations. These "toolboxes contain pictures of basic scientific and math tools, what units are used, and how each tool utilizes math. If students learn about basic scientific tools teachers can scaffold the tools in higher grades. This can help students to think critically about what familiar and unfamiliar tools can be used in investigations or experiments." (Gill,

2015). In the owl pellet dissection, at the elementary level students can utilize I pads to create charts, digital balances, magnifying glasses, plastic forceps, and digital microscopes to examine, weigh, sort and compare and contrast the bones in the owl pellet.

In the first step of the sorting process during the workshop, it was important to allow pre-service teachers to collaborate with one another and sort the different bones on a sorting worksheet that lists the different types of bones and pictures of these bones. Here, pre-service teachers integrated basic process skills in science with the use of dissecting microscopes or magnifying glasses, plastic forceps and small rulers to help them see the bone structure and determine its place on the sorting sheet according to its size and dimensions.

After this initial sorting phase, pre-service teachers were given an outlined picture of the skeleton of a mole or shrew. Communication is key in this step. Pre-service teachers debated which bone is most analogous to the various bones listed in the worksheet. The teachers learned not to use all of the bones in the owl pellet. Thus, pre-service teachers picked the bones that they initially sorted on the first worksheet and then communicated with one another again to determine where bones should be placed on the second worksheet. Next, they taped the bones onto the analogous bone on a second worksheet that outlines the organisms entire bone structure. Lastly, pre-service teachers were given a worksheet with a diagram of a shrew and its body organs. Pre-service teachers provided an explanation of what the body organs were and their function. Next, the pre-service teachers color and cut out the pictures of the body organs and inferred where the body organs were located inside the diagram that had the bones taped on the picture of the organism. Lastly, pre-service teachers inferred whether their organism was a male or female by placing the male or female reproductive organs in the appropriate place. After the pre-service teachers grasped the understanding that moles have body organs, they can then see links to other organisms – rats and shrews -and they began to make analogous connections to human body parts.

DISCUSSION

Several major themes emerged from analysis of teachers during this period. Handouts teachers completed indicated the scaffolded method of introducing bones, organs, working with the science and math tools helped them to understand how to scaffold knowledge. Teachers agreed the mathematics and science tools were

significant because they helped them to understand the organism through measurement, magnification and applying basic process skills like observations and inferences. One group commented on how this lesson plan, and similar dissections, helps students make connections to the nature of science, kind of like an archaeologist digging through an artifact.

Pre-service teachers who participated in the workshop commented on the benefit of introducing this lesson plan before students learn about anatomy/physiology or perform dissections in high school. Most participants agreed overlaying the organs on top of the bones was key to scaffolding students' knowledge of bones structure and organs. The act of coloring, cutting, and pasting the organs on top of the bone structure could help children understand how different bodily systems relate to one another. However, teachers PCK was different from teacher to teacher. Some pre-service teachers held strong beliefs about the extensions that could happen with the lesson plan, where others did not. When asked how to make connections to health education, three teachers felt strongly that learning about reproductive bones and organs could also help facilitate discussions in science classrooms that related to health education and further develop student's understandings of their bodies. The pre-service teachers in the workshop also discussed the importance of the discussion of reproductive organs with younger students, and connections to the evolutionary process.

Collectively, the pre-service teachers gained content knowledge, and understanding of how to extend their knowledge of the owl pellet dissection to other systems while incorporating the use of science and math tools. Connections were made to a diverse range of topics that included: evolution, health education, reproductive organs and other dissections like the pig dissection, cat dissection and frog dissection. The results of this study also indicate teachers PCK varies according to how much exposure to other dissections, tools and academic areas they understand. The results could be used to conduct future studies on why teachers vary in their pedagogical knowledge and how this impacts development of PCK. This present study could also be used to test how teachers develop PCK with communities of teachers. The nature of the workshop helped pre-service teachers discuss common ideas and develop the confidence to integrate multiple concepts to dissections and with a community of other teachers.

CONCLUSION

The workshop exposed pre-service teachers to a community of teachers, and helped them understand how dissections integrate multiple concepts when scaffolded appropriately. Pre-service teachers learned that the owl pellet dissection can connect to discussions about organs, STEM knowledge, human anatomy and physiology, evolution, and other dissections in upper grades. Pre-service teachers PCK varied according to their exposure to the science curriculum, other dissections and science and math tools. Overall, they did learn this lesson can set the foundation for important understandings about the human body, science and math tools, which expand students' knowledge.

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Teachers' Beliefs About the Purpose of Education in a High-Stakes Testing Environment

Kristina M. Veselak

Abstract: For three decades, standardized testing has been one of the central pillars of American educational policy. This study investigates the ways in which these high-stakes standardized tests have influenced teachers' beliefs about the purpose of education. Using a phenomenological approach, this researcher interviewed 6 New York City elementary school teachers working in high-poverty/high-minority enrollment schools and classrooms. Results suggest that teachers in these educational settings were likely to believe that complex and abstract thinking skills were too difficult for their students, and instead tended to believe that the purpose of education was for their students to learn the basic skills needed to function in the world, or to prepare students for relatively low-paying future careers. The implications of such beliefs are discussed, as well as policy recommendations and recommendations for future research.

About the Author: *Kristina Veselak is an Instructor in the Social Sciences Department at Gateway Community College in New Haven, CT. This study was conducted while the author was a doctoral student at Stony Brook University's School of Social Welfare.*

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INTRODUCTION

For three decades, standardized testing has been one of the central pillars of American educational policy. From *A Nation at Risk* in 1983, to *No Child Left Behind* (NCLB) in 2002, to 2015's *Every Student Succeeds Act* (ESSA) and *Common Core State Standards*, standardized testing has become a mainstay of public education across the United States. The existing literature suggests that these standardized tests affect teachers' classroom practices, in both what they teach and how they teach it, and that this has both short- and long-term consequences for students, particularly poor and minority students.

Historically, much research in the areas of education, sociology, and social psychology has been dedicated to the relationship between teachers' expectations of their students and students' subsequent academic performance, and the relationship between socioeconomic status and teacher expectations (see, for example, Jussim & Harber 2005). However, relatively little has been written about the ways in which high-stakes testing may have complicated these relationships. Especially absent in this debate are the voices of teachers themselves.

Considering the current state of educational research, this study investigates the ways in which high-stakes standardized testing influences teachers' beliefs about the purpose of education. Research has shown that standardized testing has significant effects on many areas of a student's educational experience, from the amount of time spent on particular subjects (for example, Pederson 2007; Center on Education Policy [CEP] 2006), to the quality of the teacher in a particular classroom (for example, Peske & Haycock 2006), to the pedagogies utilized by classroom teachers (for example, Au 2007). However, there is comparatively little research available which examines the effects of standardized testing on the ways in which teachers think about the purpose of education (e.g., Firestone, Mayrowetz, & Fairman 1998; Frawley 2014), especially among elementary school teachers, the focus of the current study.

Teachers are the main educational points of contact for elementary school students. They spend hundreds of hours per year with their students, exert significant influence, and in many cases make impressions that will last for years or even lifetimes. To fully understand the impact of testing policies, therefore, it is necessary to examine the lived experiences of teachers as they navigate testing and instruction. This article will first present a brief literature review of the effects of

standardized testing on students and teachers. It will then describe the methods used in the current study. Next, this article will examine the findings of the research, and, finally, a discussion of implications and suggestions for future research.

LITERATURE REVIEW

In the wake of the passage of No Child Left Behind, researchers began focusing on the effects of the policy's testing requirements. Though some positive effects have been observed, the evidence suggests that students, particularly students living in poverty and students of color, have experienced many negative effects associated with standardized testing.

“Teaching to the Test”

One of the major negative effects of the national focus on standardized tests has been “teaching to the test” (Toch 2006). Schools, districts, and states have a lot at stake, including rankings and funding, as a result of test scores. This pressure means that many schools have abandoned a varied and enriched curriculum in order to ensure that students are as prepared as possible on test day. One nationally representative survey of 300 school districts in all 50 U.S. states found that for many students, the curriculum has been narrowed as a result of standardized testing programs (CEP 2006). The CEP found that, in the wake of NCLB, 71% of school districts reduced instructional time in at least one other subject to make more time for reading and math. However, the impact was even more severe in high poverty schools, where 97% had policies that restricted the curriculum offered to their students (CEP 2006). In some ways, this seems to represent a common sense approach to raising the test scores of students living in poverty. However, in schools which focus so heavily on test preparation, students report an almost complete loss of interest in schooling (Berliner 2009), higher levels of anxiety, and lower levels of confidence (Jones et al. 1999), which means that the most at-risk students are suffering disproportionately.

The impact of curriculum narrowing can also be seen in Deke and Haimson's (2006) report summarizing the findings of Mathematica's Valuing Competencies study, which analyzed the effects of the academic and nonacademic competencies of high school students on their earnings after graduation using a national, longitudinal dataset. The researchers differentiated between six different competencies: academic achievement, work habits, sports-related competencies,

leadership skills, prosocial behavior, and attitudes toward determinants of success (the extent to which students believe success is a result of hard work as opposed to luck). The researchers estimated the effect of improvement in each competency on postsecondary earnings and educational attainment, and concluded that while academic achievement was a significant predictor of postsecondary earnings for many of the students in their sample, more students benefitted more from improving one of the other nonacademic competencies, and the benefits gained depended on which competencies students possessed at the beginning of the study. This data suggests that there are long-term, post-schooling negative consequences of curriculum narrowing, in addition to the in-school consequences noted by Berliner (2009) and Jones et al. (1999) above.

“Gaming the System”

Another well-documented negative outcome of the reliance on standardized testing is known as “gaming the system,” or falsifying and manipulating data to avoid the consequences of low test scores (Heilig & Darling-Hammond 2008). Based on data from one Texas school district, Heilig and Darling-Hammond (2008) found evidence that schools retained students in the 9th grade in order to avoid having those students take the high-stakes test in 10th grade. At one point, more than 30% of 9th graders were retained for one or more years. Of those retained, only 12% ever ended up taking the 10th grade test, and only 8% passed it. Similar patterns were observed in each year of the longitudinal data. For each cohort included in the data, moreover, African Americans and Latinos were retained at significantly higher rates than Whites and Asians and a majority of the students who were retained left school as dropouts or “disappearances;” that is, they were not coded in the information management system as having officially dropped out or withdrawn, but rather, they were missing from the data (Heilig & Darling-Hammond 2008). The strategy of retaining students allowed schools to keep certain low-scoring students out of the pivotal 10th grade, thereby inflating standardized test scores.

Heilig and Darling-Hammond note several other gaming strategies used by Texas schools to avoid the penalties associated with poor performance. Numerous students were retained in 9th grade for multiple years and then skipped straight to the 11th or 12th grade, therefore bypassing the 10th grade standardized test and adding to the school's retention statistics. Often, these students, disproportionately African American and Latino, received special education exemptions, allowing them to graduate without having passed the 10th

grade test, thereby improving the school's graduation rate. Though the dataset used did not include special education designation information, the researchers note a significant and positive correlation of .45 between the proportion of African American and special education students in the dataset (Heilig & Darling-Hammond 2008).

Effects of Testing on Teachers' Beliefs

Much of the existing research focuses on the quantitative, objectively measurable effects of standardized testing. Considering the American policy preference for measurable outcomes, this is not surprising. However, in order to fully understand the effects of any policy, it is necessary to look beyond the numbers and investigate the lived experiences of the people affected by policy decisions. Firestone et al. (1998) used interviews to examine the ways in which assessments have changed mathematics teaching under low and moderate stakes conditions in Maine and Maryland. These researchers asked teachers why they thought mathematics should be taught in schools. A majority of teachers referred to "practical applications," and gave examples such as balancing a checkbook or measuring cooking ingredients, both of which are rather low-level skills requiring only calculations. Teachers did not think that students needed to learn theories or more advanced concepts if they were not going to attend college, and so structured both the content of their lessons and their pedagogical approaches accordingly, emphasizing routine, procedure, and accurate calculations. It is important to note that Firestone et al. (1998) conducted their research with middle school teachers. Middle school students are usually between the ages of 11 and 14. These teachers, who were working with relatively young students, had already made a judgment as to whether or not these students would be attending college, and adjusted their teaching strategies and the content presented according to their own assumptions. Frawley (2014) investigated a similar phenomenon in writing instruction in a high-stakes testing environment in Melbourne, Australia's state high schools. In the researcher's interviews and focus groups, English teachers revealed that there was a greater emphasis on creative expression, freedom, and aesthetics in pre-testing grades. Teachers in these years were hesitant to place grades on students' creative work, for fear of stifling their creativity and discouraging students from writing artistically. As students moved into the later years of their schooling careers, and approached testing time, teachers were more likely to discourage the sort of unbridled creativity which was encouraged in the earlier years.

According to Frawley (2014), Australian students take the Victorian Certificate of Education (VCE) in their final year of high school. In the writing section, students are instructed to respond to a given prompt in an expository, persuasive, or imaginative style. Teachers in Frawley's study reported steering students away from imaginative writing, particularly those who were viewed as less capable readers or writers. Respondents reported student preferences for the expository and persuasive style, and the need for "formulas" to make writing responses easier and more clear. Imaginative writing was often deemed too "airy fairy" (i.e. "non-prescriptive") by these teachers, and therefore beyond the capabilities of their students (Frawley 2014, p. 21). This focus on formulaic, prescriptive writing as a result of high-stakes testing appears to echo Firestone et al.'s (1998) conclusions in the math arena. Basic, lower-level thinking skills and processes are emphasized, while higher-level thinking skills or "airy fairy" academic exercises are reserved only for the best students.

The Current Study

Both Frawley (2014) and Firestone et al (1998) investigated the ways in which standardized testing affects teachers' beliefs about the purpose of education. The current research also investigated this issue, with a unique focus on elementary school teachers of poor and minority students, to answer the following research question:

How have teachers' experiences with standardized testing affected their beliefs about the purpose of education?

METHODS

Phenomenology

This study followed a phenomenological research design, which seeks to understand the lived experiences of individuals who have shared a common phenomenon. With its roots in philosophy, phenomenology aims to discover the commonalities that exist among small groups of people who have experienced a particular phenomenon, in order to be able to describe and understand the phenomenon's basic essence, or "grasp of the very nature of the thing" (van Manen 1990, p. 177).

Phenomenology's focus on meaning and experience, and the use of relatively small sample sizes, is in many ways the antithesis of the educational policy community's conception of "data". Since NCLB, the

educational community has become increasingly reliant on Data-Driven Decision Making (DDDM) to inform instructional practices and accountability systems (Marsh, Pane, & Hamilton 2006). Teachers and administrators use test scores throughout the school year to determine which students are struggling in particular areas, and target their instruction accordingly. Value-added models, or VAMs, attempt to isolate the effects of education factors (such as schools and teachers) from non-education factors (such as family background) on student achievement, and are often used to determine a teacher's effectiveness rating. Other statistics, such as student attendance, student mobility, and graduation rates, are also used to identify problem areas for schools and administrators (Marsh et al. 2006). This type of data stands in stark contrast to the type of qualitative data collected through phenomenological research.

Sample

Smith, Flowers, and Larkin (2009) refer to the sampling methods used in phenomenological analysis as "purposive homogenous sampling" because it is the researcher's job to select participants "on the basis that they can grant us access to a particular perspective on the phenomena under study" (p. 49). Smith et al. (2009) also suggest that participants in a phenomenological study be as similar as possible on characteristics important to the study.

With this in mind, to be included in this study, participants were currently working in a New York City public school, teaching grade 3, 4, or 5, with primary responsibility for teaching Math, English Language Arts (ELA), or both. Participants were drawn from schools with high minority student enrollment and high student poverty levels. Alternatively, teachers were included if their particular class demographics met these criteria, even if the school as a whole did not. According to the most recent demographics available from the New York City Department of Education, schools in the top 1/3 for minority student enrollment are at least 94% nonwhite, and schools in the top 1/3 for student poverty levels have at least 96% of the students receiving free or reduced-price lunches. Therefore, these same parameters were used to determine eligibility for inclusion in this study on a class-by-class basis, rather than a schoolwide basis. Individuals who did not meet these criteria were excluded from participation.

Recruitment

Recruitment for this study took place in accordance with New York City Department of Education

Institution Review Board (NYC DOE IRB) guidelines. First, high poverty/high-minority enrollment schools were identified using data from the New York City Department of Education. Informational letters to principals, which describe the study, were sent to those schools identified. Additionally, principals were sent the NYC DOE IRB Permission to Conduct Research in Schools form, which needed to be signed and returned to the researcher before recruitment could proceed.

Once the Permission to Conduct Research in Schools form was received, the researcher arranged a time to visit the school, speak to teachers about the study, and distribute flyers, which included information about the study and contact information. Teachers who were interested in participating were instructed to contact the researcher to arrange for a time and place for the interview to occur. Prior to scheduling the interview, the researcher determined if the participant was eligible for the study by confirming that his/her school or classroom met the above-mentioned criteria for high-poverty/high-minority enrollment status.

Participants provided informed consent to participate, and participation was voluntary. They were not financially compensated for their participation, and had the option to discontinue participation at any time. The IRB at the university with which this author is affiliated, and the New York City Department of Education's IRB both provided approval for this study.

Recruitment efforts yielded six participants for this study, working at three different schools. Participants' demographic and professional characteristics are summarized in Figure 1.

Data collection and analysis

Data collection for this study took the form of in-depth interviews with elementary school teachers currently working in the New York City school system. The interviews followed a guide of 8 questions plus follow up questions. In the tradition of phenomenological research, questions were open-ended and posed neutrally. Questions focused on teachers' experiences with testing and the resulting effects on their classroom practices and educational beliefs. Interviews were conducted in person, recorded on a digital recorder, and later transcribed by a transcription service.

The researcher analyzed transcripts using the procedure laid out by Smith et al. (2009). Initial notations were done by hand, while later phases of the coding process utilized NVivo 12 for Mac.

Figure 1: Participant Characteristics

Pseudonym	Years Teaching	Race	Current Grade Teaching	Student Population(s)
Diane	23	White	5th	Gen. Ed.
Jane	4	White	4th	Sp. Ed. Gen. Ed. ELL
Jenny	8	Hispanic	3rd	Bi-lingual Gen. Ed. ELL
Sally	5	Hispanic	5th	Sp. Ed. Gen. Ed.
Susan	18	Black	3rd	Gen. Ed.
Veronica	9	Black	4th	Sp. Ed. Gen. Ed.

FINDINGS

Analysis of the interview transcripts suggested that teachers' beliefs about the purpose of education are indeed affected by their experiences with standardized testing.

Experiences with Standardized Testing

All respondents reported that the standardized tests were a significant focus for their administrators, and felt significant pressure to raise student test scores.

Susan: I really think that...maybe it's me...but I think that everything they do is really towards the test.

Another respondent added:

Jenny: Administration is always talking about tests, and the tests this and the tests that. They throw tests at us, and they think it'll be okay, but it's not.

Several respondents were not only concerned with the amount of emphasis administration places on testing, but also on test preparation. At Jenny's school, for example, there are multiple after school activities dedicated to test preparation, including Saturday school for students who are on grade level, a two-hour program two days a week for middle-low readers, and an additional two hour, two days a week program for ELLs to prepare for the NYSESLAT. All of these programs are mandatory for specifically identified students. She goes on to describe other test preparation activities mandated by administration:

Interviewer: I'm kind of taking everything you're saying and kind of putting it together.

Would you say then that testing is a big focus of what goes on in this school?

Jenny: Yes, huge. Huge. Besides the regular test prep, let's say that they order a test prep book and we practice it every day. We give maybe a little bit of homework on it, maybe a little bit of independent work by yourself. Besides that, every couple of months they order Ready books from the Ready, whatever New York Ready something. We have to give a test out of that. We have to grade those tests... On top of that, every math unit, every chapter has a math test...Right, and the tests are very, very hard. If you don't do the entire chapter, you can't do the entire test...The Ready tests, which we have to do two, and it takes three days each [for Math and ELA], and we do this at least twice before the state test. That's, what is it, 12 days dedicated, 12 school days, because it takes hours to dedicate only to those tests. Plus there's the inquiry tests...

Administration's emphasis on test scores led many of the teachers interviewed here to focus their energy and instruction on testing. Several respondents mentioned that, from the very beginning of the school year, the tests are important. For example:

Veronica: Get the books out. Get the books out. Get the testing them. The first day of school or the second day of school.

Sally's interview occurred during just the fourth week of school:

Sally: [The tests are] on my mind, maybe the back of my mind right now, but I know I have to teach where the children understand and get

it and be prepared for those testing dates...It is [the end goal].

With testing at the forefront of their minds, these teachers tended to narrow their curriculum in order to provide additional instruction in Math and ELA, the subjects in which their students would be tested. Their remarks echo much of the previous research in the area of standardized testing and curriculum narrowing (see, for example, Jones et al., 1999; CEP, 2006; Au, 2007; and Berliner, 2009). For example, Sally mentioned that the administration's focus on standardized testing and the push for better test scores had a significant impact on her own instructional focus:

Sally: Last year the math scores were really low, but now [the administration] is really focusing on ELA. So now I'm afraid that if I spend all this time on ELA, the math scores will fall again. Forget about science and social studies. I made them do the same BS work together, "Read the charts, and answer the questions. Then you're going to make a sheet. You're going to fold it in fours, and you're going to write about the...Pick any four tools that scientists use. Draw a picture and write about it." {rolls eyes}

Interviewer: You find that you have trouble getting to it?

Sally: {Nods head} It's ridiculous.

What Sally seems to be saying here is that her science instruction is an afterthought. Her rolling her eyes as she described one of her science lessons suggested that she did not think that was a high-quality lesson, but she was much more concerned with using her math and ELA time effectively.

For Diane, there was also a concern that the math curriculum used at her school was not very well aligned to the state test, and therefore would not prepare students appropriately.

Diane: [Our math curriculum] doesn't really align to state tests. The [test prep program] aligns to the state test much more than our [curriculum], so we need to...We don't have books for that. Then we have to go online. We have to print everything out...make copies. It's a lot of work extra. We love the book. Then it's like they tie our hands, and they don't let us do it the way we want.

In other words, Diane seems to be suggesting that if she were able to "do it the way she wants," she would be teaching exclusively using the test preparation materials. For Diane, testing should be the only thing driving the

curriculum.

Several respondents reported that social and other types of nonacademic learning is also largely neglected in favor of focusing on tested subjects. Susan reflected on this issue:

Susan: I've heard so many teachers saying the things they used to do when they first started teaching, they've dropped. Some people don't even do Scholastic book orders anymore. Some people, they cut the parties down...Not that school is for parties, but for some kids, that might be their only party. For some kids, all their friends are right there. There's just different things they used to do. Take them on certain trips. We used to take...kids on certain trips that had nothing to really do with their particular curriculum. Might have still been educational. But no, now even for trips it's so, have to write out how [it relates to the curriculum]... Just trust me. Let me take them. Let me give them some experiences, because school is not all academic. School is social too.

Standardized testing also had deleterious effects on teachers' relationships with three different groups: their administrators, their students, and their fellow teachers. Almost all of the respondents reported distrustful relationships with their administrators, and, on numerous occasions, outright hostile interactions as a result of the pressures of standardized testing. Susan made a direct connection between the lack of trust between administrators and teachers and the statewide standardized tests:

Susan: I just think that the whole reason the tests came about is just because they want accountability for teachers, right?

Interviewer: Okay, so you think it doesn't have anything to do with the students, really?

Susan: Right...we're doing it for accountability, because you're really just checking on the teachers, it's because you don't trust that they're doing the right thing. If you trust they're doing the right thing, then you give them all the tests that you think that are important. The most important ones. And let them teach in a way that's going to lead up to them proving what it is that you wanted.

Susan was especially reflective in her interview, and she was the only teacher to make this clear connection between standardized testing and the administrator/teacher relationship. For her, the mandated tests are not about children at all, but are instead a way of

confirming that teachers are doing their jobs. This system has therefore led to distrust between teachers and administrators.

Teacher/student relationships also appeared to be significantly affected by standardized testing. Though the teachers here overwhelmingly expressed affection for their students, many also reported being frustrated and angry with their students' inability to meet the requirements set forth by the standardized testing program. Jenny describes this feeling:

Interviewer: How does [the test] affect you, your feelings about your job, your interactions with your students, how you prepare for your day? How does it affect you?

Jenny: It's very frustrating. I feel very short tempered. When I look back at the day, I'm thinking, "Oh, I should not have snapped on that one. It was an accident. I didn't mean to do that."

Interviewer: Why do you think it has that effect on you? Why do you feel –

Jenny: Stress. Stress, because you know that they're supposed to be doing something this week, and they're not doing it yet.

The high stakes associated with standardized testing also had negative effects on teachers' relationships with their coworkers. These relationships were often characterized by competitiveness, rather than cooperation:

Jane: It's a competition. No one wants to really help each other. Some people do. It's like, "Oh, it's a competition. I want to look the best. I want to make sure that administration sees what I'm doing, and that I'm doing it correctly." Instead of sharing the idea, it's all for one...It's just for me...There's some people who just are very selfish and want to keep it for themselves.

These feelings of competition sometimes led some teachers to feel embarrassed when their students' scores weren't as high as the scores of students in other classes. This was particularly an issue for Veronica, who works in a very small school and works closely with many other teachers. Veronica's class was a designated ICT class, which meant that it should have had both a full time Special Education teacher and a full time General Education teacher. Due to staffing issues, Veronica was the only teacher in that class for the majority of the school year, and Veronica is not a Special Education teacher. This is a violation of federal law, but, as Veronica put it, "nobody seemed to care too much." The only other class on the same grade level at Veronica's school was a General Education class.

As part of their test preparation program teachers at Veronica's school give the same weekly assessments and compare results across grade levels. Here, Veronica discusses what this experience is like for her each week:

Veronica: ...[E]very Friday too after we give the test, we have a score, we give it to the [Assistant Principal] and she puts up a graph. This class did well on this skill and this other class sucked. So what can you do to help this one because apparently her kids had issue with that...I teach the classroom with the issues...I feel like, I used to act like I don't care. Making like, "Oh so you [are] good at this. Your class [is] getting all these great scores and my class [is] not getting this score." I always feel like my class is not getting the great score. But my class, you can't compare, comparing two classes side to side, it doesn't work. Because everybody's different.

Even though Veronica reported having a good and cooperative working relationship with her coworkers, having her class's results displayed and analyzed by her colleagues was not a positive experience for her. She was able to cope with it by reminding herself that her class cannot be compared to other classes, but this was still a source of disappointment for her.

For these respondents, standardized testing had very real effects on their relationships with administrators, coworkers, and students, as well as ways in which they approached their teaching.

Purpose of Education

Respondents discussed five different purposes of education: future education and employment; real world functioning; low level practical skills; happiness; and testing. Each of these themes are discussed further here.

Future education and employment. A common belief among teachers interviewed for this study was that the purpose of education was to prepare students for subsequent levels of education and, eventually, a career. In the subject area of math, for example:

Jenny: You should be prepared in knowing enough math just to get through to the next level...

Veronica mentioned a similar goal, in relation to ELA education:

Veronica: You need to know, how to write an essay, if you're going to go to college.

These teachers connected the need to develop skills with students being employable in the future.

Jenny: Why do we need to learn about fractions? In the future, you might have a job where you have to cut a cake, even though we draw a whole bunch of cakes. You might have to have a job when you're cutting something, and you need to know what fraction goes to what person, and why the fraction is the size that it is. What does it mean when it's a smaller one or a bigger one, comparing, contrasting, and all this?

Similarly:

Veronica: I guess [the purpose of education is] to become a member who can be part of society. Be part of a home. Whichever way that you can contribute. Not everyone needs to have a doctorate, because otherwise who's going to fix the plumbing? Everybody needs their car, and not everybody is able to do everything... So, you know, there's some kids who are just not, people who are just not going to be brain surgeons.

Both Jenny and Veronica set expectations for their students relatively low. Though both are focused on future employability, Jenny mentions applying fractions to a job that requires one to cut something into pieces, while Veronica suggests that her students are "just not going to be brain surgeons." "Brain surgeon" is often used as a metaphor for a particularly challenging or difficult task, and saying that someone "isn't exactly a brain surgeon," or something similar, is a euphemism meant to suggest that person is not very intelligent. The use of this phrasing suggests that Veronica, like Jenny, has a rather low opinion of her students' abilities.

Diane also mentioned future educational attainment as an important purpose of elementary school education. However, she felt that much of what was asked of her students by the state standardized tests was "too much," and largely unnecessary for success in future education.

Diane: With ELA, I always had one kid ask, why do they need certain skills about making inferences, drawing conclusions, shit like that. When you read a book, you don't have to answer a million questions, like, you're reading a book for school, which is nonfiction. If you're in college, you're reading a nonfiction. You're not reading a fictional book and you have to find setting, characters, plot, this, that, the other thing. If you're reading a novel for your enjoyment, you're not answering 100 questions. You're reading it for enjoyment. I don't care what [the author's] purpose is. Her purpose is to entertain me. Compare, contrast.

I got to compare that and this...What the hell do I need that for?

For Diane, the specific skills her students are required to know for the ELA test – such as making inferences, drawing conclusions, identifying setting, characters, and plot, or comparing and contrasting – had no real world connection, were unnecessary for future education, and were therefore useless. Instead, she advocated for a "return to the basics" approach, particularly emphasizing speaking skills:

Diane: They need to know how to write. They need to know how to speak. Their writing skills are worse than their reading. They write the way they speak on the street. "Yo bro"... also, we're not teaching writing. They need to learn writing. They took out phonics. They took out grammar. It's all connected. We need to get back to basics. [I try to] do that. [Grammar instruction] that you could do on the overhead [projector]. What's the subject? What's the predicate? Where's the verb? You don't even have a verb in this sentence. Where's your noun? We need that old school stuff... we can't keep letting them learn from social media and listening to other kids that speak the same way...That's not going to be acceptable in society. They're never going to get jobs, real jobs. They might get a job at McDonald's.

The suggestion here is that even the relatively low-level skills covered by the state standardized tests are not low enough to address the shortcomings Diane has observed in her students' ELA skills. Without addressing these issues, her students will not be able to get "real jobs," emphasizing her belief in the idea that the purpose of education is future employment.

A similar sentiment was echoed by Jane, when she was discussing one of the skills her students are required to know, which is relating metric measurements to U.S. customary measurements:

Jane: In all honesty, let's be real. This conversion, we all use customary. If they're going to go into the medical field of science, that's when you're going to use metric. Why is it that you have to teach it to them now?

Here, Jane seems to be saying that certain skills are entirely unnecessary for students to learn, except in the context of specialized, career-specific education, once again pointing to a belief that the purpose of education is to prepare for future employment.

Real world functioning. Several respondents referred to the ability to simply function in the world as the purpose

of education. This seems to suggest a rather lower goal for students than employment or future education. These teachers were more focused on students' ability just to survive.

Sally: We do relate a lot of [our lessons] to the real world. So they can function in society.

Jane had difficulty in seeing the connection between specific required skills and what she thought was the overall goal of education:

Jane: If the goal is to get them to function in the world, this does not help.

In this instance, Jane was referring to a math skill known as front end estimation, which she admitted to having difficulty understanding and teaching. Consequently, she saw little reason for her students to be required to learn it: if a teacher has been able to function in society without this particular skill, it would be difficult to feel like having her students learn that skill would be essential. She elaborated:

Jane: I'm going to say not everybody's going to be a doctor or a lawyer, but they need to survive in the real world somehow. They need to read. They need to know basic math skills. They don't have to, ya know, be a mathematician.

This seems to reiterate the purpose of education as being basic survival, and Jane's belief that some level of basic mathematical ability is necessary for this survival. Interestingly, she also refers to a specific career path, mathematician, and seems to suggest that this career path is not a realistic option for the students with whom she is familiar.

Jenny said something similar, but expanded on it in a different way:

Jenny: [Education is] so that you can be functional in society, just to be able to get a basic understanding of the world, you need to have these basic skills. In early childhood and in childhood education, that's where you're going to get them. ELA and writing, even though you don't like it, like I myself, I am not a writer. I'm fine with reading, but I'm not a writer, but we all need to learn how to do it. We all need to learn how to read. We all need to learn how to read enough to understand difficult context, meanings underneath. What's the word I'm looking for...inferences or hidden meanings in a text that will help you understand the deeper meaning of a subject. That connects with social studies and science. Social studies and science teaches you about the world. Everything, education is connected. All these subjects are connected. We need to know that, just to

be a good working person in society, because everyone needs to be progressive. You can't be stagnant. You have to do something with your life.

Though here she was not referring to a specific career, the implication is that, in order to be functional in society, one must be capable of contributing and working. In contrast to Jane, however, Jenny suggests that certain skills taught at the elementary level – such as making inferences – are essential to one's ability to function on a fairly basic level in society. Making inferences requires abstract thinking and is, therefore, of a higher order than many of the skills other respondents were advocating for, such as basic grammar skills and identification of grammar-related terminology.

Low-level practical skill. Several respondents referred to examples of relatively low-level practical skills when asked to discuss the purpose of education. A few of the examples dealt specifically with handling money.

Diane: How do count change? If you're buying three things and you pay with \$20, you're supposed to know what your change is.

Similarly:

Veronica: I didn't think we needed math when I was in school, particularly. And now I go to the supermarket...the supermarket I use it to figure out like, \$100, how can I make it work. Budgeting yeah? Get my coupons and everything. Make it real, I guess. I used to take the kids, when I was [teaching] 1st grade, take them the store and give them a budget...they ring up themselves...So math is real.

In Susan's interview, she described a scenario in which administrators would visit her classroom and as part of her evaluation, talk to students and ask them what they're learning and why:

Interviewer: What would be the "right" answer to that question?

Susan: The right answer would be, so like if you were learning something about money, [the student] would say, "I would learn it so when I go to the supermarket, I could buy things."

There is again this subtheme of a low-level practical skill that Susan believes administrators think should be the purpose of education, though this does not necessarily reflect her beliefs.

Another set of practical skills mentioned multiple times by the respondents was related to the use of fractions in everyday life. Veronica said that, if not for the school-mandated test preparation program, she would give students hands-on experience with fractions by relating

them to cooking:

Veronica: [If it were] up to me? Let's say I'm teaching fractions. I would definitely come up here making pancakes. Recipe calls for 12 kids, I have 30. Figure it out...And not only that, literally make it...That would not take a sixty-minute math lesson, that would literally take two periods. So that's you learning about how to multiply, even like half it. If you do it by tables, okay this calls for 12 people, there's only 4 people at your table, how can you do that?

While useful in everyday life, Veronica's reference to the use of fractions does not appear to suggest high level abilities as the ultimate goal of education.

In general, respondents were less likely to mention specific skills related to ELA instruction, but when they did, they were especially low-level and basic. Veronica suggested that students need to learn to read in order to read and understand signs around the neighborhood and in stores, while Susan pointed to another skill:

Susan: I want kids to be able to go to the [learning] center [in the classroom], make lists, write random notes to their friends. People write lists in real life, right?

Writing letters was also mentioned as a basic skill that students should be able to develop through ELA instruction.

Veronica: So there's ELA, too. You need to know how to write a letter...You know, somebody pissed you off, you want to write the company a letter saying that you messed up my order... You can't always call. You know, you're writing an email to a company that messed up your [order].

When asked about the purpose of education, teachers were likely to mention some specific skill, and all of the skills mentioned were relatively simple. The teachers interviewed for this research teach 3rd through 5th graders, and most of the skills they teach on a daily basis are relatively basic, so it is logical that those are the first things they mention when asked. At the same time, this focus on very basic everyday skills, understood in the context of the previous discussion of the subthemes of future employment and basic functioning, may suggest that teachers do not believe their students are capable of higher-level skills, and are setting very low goals for them as a result.

Happiness. Two teachers, Jenny and Susan, suggested that education is necessary for happiness in life. For Jenny, though, this happiness came about only as a

result of the productivity that education produced:

Jenny: Social studies and science teaches you about the world. Everything, education is connected. All these subjects are connected. We need to know that, just to be a good working person in society, because everyone needs to be progressive. You can't be stagnant. You have to do something with your life. You're not going to be a happy person if you're not doing something with your life.

For Jenny, having a good, fulfilled life is directly connected to being able to work, and in order to work, one must possess a basic level of education.

Susan also discussed happiness as a possible purpose of education, but in a different way from Jenny:

Susan: ...The most essential things are reading, writing, math, and I might even argue art and music are more important than science and social studies if I had to.

Interviewer: How come? Argue that.

Susan: People need some type of expression and outlet. You can't all day [be] business, business, business all day. If you're an artistic person and you're not good at school, you're going to sit there and do what? Who do you become? You end up being a nobody and then you're so pissed. I love music though. I don't really care for art. But I'm just putting art and music together because where else would they learn it [other than school]?

For Susan, it appears that the focus on standardized testing is detracting from students' happiness. When school budgets are cut, subjects such as art and music are regularly downsized or eliminated. These subjects are seen as unimportant or unnecessary, as they will likely have little impact on a student's Math or ELA test scores. However, for Susan, this type of education is essential for happiness, and its absence from the curriculum is thus problematic.

Testing. Several of the teachers interviewed here suggested that, currently, the purpose of education is to produce students who can pass tests. It is important to note here, however, that respondents did not agree with this on a personal level, and instead believed that this system of education was largely harmful to students. As Jenny put it:

Jenny: Why am I telling you little kids to do these things if they're not ready to do them yet? Only because we're going to have a test on it?

Interviewer: What's the purpose then?

Jenny: Yea, the purpose is for the test. Just so

they can pass the test. It's not just because I love teaching math, or I love it when they discover things in books, or the strategies for reading are this and this and this. Once you use them, you can read this text by yourself. We can then talk about what these words mean. We can talk about all different things that have to do with these subjects. Practice is what they need. Testing is what's killing them.

In recounting a story about her own brother, Veronica seemed to suggest a similar notion:

Veronica: I have an older brother...He's not the book, pencil, text guy. But you literally take a radio and smash it and have him put it back together fine...You need somebody, some people have that gift...But then during school. Oh my gosh, he's failing every class. He's not reading. He does all this stuff and decides he can't read, he can't provide, he can't be part of this society, because he's not able to do what we think should be the rule. And we find that what the kids are capable of doing, gears them toward that.

Interviewer: Do you think, in its current form, school does that?

Veronica: No I think school wants you to be a paper pencil kind of person. Otherwise, why would they give a kid an IEP who can't really read, an extended reading time [on the test]?

Like Jenny, Veronica is saying that school is designed to produce students who are successful test takers. For those students who are not able to be successful in this one specific and limited way, the system simply declares them failures. It is evident throughout their interviews that both Veronica and Jenny do not support this model of education, but they are both very much under pressure to comply anyway.

In discussing administrators' visits to her classroom, Susan supported this concept of schools being designed with the purpose of creating effective test takers, and Susan and Veronica both noted that their students seem to be aware of this messaging.

Susan: But now, they come and interview the children, ask to see their notebooks, "What are you learning about, how do you feel?" All this, right? And they ask the kid like, "Well, what are you learning? Why are you learning this?" And I remember so many times the kids are like, "For the test"...because that's all we talk about so often.

Discussing some of her students' end-of-year behavior problems, Veronica echoed this idea:

Veronica: [There's] pressure from the beginning...you don't want to miss school because [you] have to take this [test] in June. And I think also that saying, "Test, test, test"-[now the] test is over. "You know what? I don't have to listen, I don't have to do anything." Right now it's what I'm working with. It's nothing but tests, "Why am I in school because you're telling me, from September, I gotta take this test. The test is over. Why am I here?...Why do I have to behave, why do I have to come to school? Because, the test is over. What's the point?"

Interviewer: So you find that things get worse?

Veronica: Yeah. Because they [are] done. We've been talking to you guys, take this test and the test is over. Now what? You gotta keep them entertained.

At least for Veronica and Susan's students, it would appear that they had internalized the belief that the purpose of education is to pass a test. The possible implications of this message are harmful, especially for those students who are not performing at or above the standards.

DISCUSSION

The purpose of this research was to examine the ways in which standardized testing programs have affected teachers' beliefs about the purpose of education and their classroom practices. A phenomenological approach allowed the subjects to describe and reflect on their lived experiences, free from the influence of the researcher's preconceived notions. This research focused on teachers of poor and minority students, as these students have been particularly vulnerable to the negative effects of standardized testing examined by previous researchers.

The findings presented here confirm and expand upon previous research on the effects of standardized testing programs, providing a deeper understanding of the ways in which standardized tests have affected teachers working with high-poverty/high-minority student populations. The data suggest that standardized testing programs have had an impact on teachers' classroom experiences and their beliefs about the purpose of education. The teachers interviewed for this research tended to believe that the purpose of education is for students to be able to function in the real world, and perform low-level skills, such as measuring ingredients and making lists. For teachers of poor and minority students, high-stakes standardized tests have moved the focus of education to low-level, practical skills,

while higher-level skills are thought of as too difficult or unnecessary for students to learn. These students are therefore being denied a critical component of the educational experience, which is now being reserved only for those students who teachers believe are capable. This not only further disadvantages already vulnerable student populations, but also has the potential to create angry and disengaged students.

The focus on career skills mentioned by several respondents is not surprising, considering the movement towards the Common Core State Standards that began under the Obama administration. While *No Child Left Behind* emphasized “proficiency,” Common Core focuses on career- and college-readiness. Though most likely an unintended consequence of this move away from proficiency, Common Core seems to have reinforced a two-tiered system of public education. A classroom in which a teacher is preparing students for high-skilled and high-paying careers will look quite different from a classroom in which a teacher is preparing students for careers cutting cakes and fixing the plumbing.

The data gathered for this study show that standardized testing is having a negative effect on teachers in a number of ways which previous research did not explore. The reasonable solution to this problem, however, is not to simply do away with standardized testing. In the current political and educational climate, that is an unrealistic proposition. Our 21st century economy is results-driven, focused on efficiency, and values measurable outcomes, and education is not an exception to that rule. Instead of focusing on ways to eliminate standardized testing, educators must find ways to combat the harmful effects of standardized testing within their own schools and classrooms.

Boser, Wilhelm, and Hanna (2014) offer several suggestions for addressing lowered teacher expectations which would also address the teachers’ beliefs about the purpose of education which were the focus of this study. For example, though they have been met with significant resistance, the Common Core State Standards have the potential to help raise expectations for all students across the country. These must be implemented with caution, however, as educators must ensure that the standards are both rigorous and developmentally appropriate, and include a variety of curriculum options for helping students meet the standards rather than a “one size fits all” approach. In other words, while educators should expect all students to achieve the same standards, it should be universally accepted that not all students will take the same path to those standards.

Boser et al. (2014) also suggest that teacher training programs should do more to expose teachers to high-performing, high-poverty/high-minority schools, as most teachers do not have experience with these populations prior to entering full time employment. This approach may serve to open teachers’ minds and reduce or eliminate bias which leads to lowered expectations. In New York City, new teachers are often concentrated in low-performing schools, as more experienced teachers leave these schools for better schools elsewhere. It is crucial that these teachers enter the profession free of a belief in the stereotype of the low-performing poor Black or Hispanic student.

Lastly, state departments of education and other officials at the state level responsible for setting standards and writing standardized tests must be made aware of the full extent of the harm done to teachers and students when tests emphasize low-level skills rather than more abstract thinking. Standardized tests in New York have continually evolved and today include many “open response” questions, which require students to explain their thought processes and their answers, rather than simply select one out of multiple possible answers. If standardized tests are going to be a fixture in American education, policymakers must continue to focus on increasing the level of skill necessary to pass such tests. This would mean that teachers, whose beliefs about the purpose of education are certainly influenced by standardized tests, would be required to raise their expectations of all of their students.

LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

Qualitative research utilizes small samples sizes, but provides a depth of understanding not available in quantitative research. As phenomenological analysis requires that participants be similar to one another, it is impossible to say whether teachers of different student populations (e.g. middle- or upper-class students, white students, etc.) hold similar beliefs about the purpose of education, so it is not possible to generalize the findings presented here to any other teachers. Future research should aim to further investigate the relationship between high-stakes testing and teachers’ beliefs about education, both on a larger scale and among teachers of varying student populations.

Recruitment for this study was a significant challenge. The New York City Department of Education prevents teachers from being paid to participate in research, and also creates a multi-layered system of consent,

where both principals and teachers must consent to participate. Combined, these two issues posed a major problem and caused multiple time delays. Because of its size and diversity, conducting research in the NYC DOE is vital to understanding educational practices, policies, and beliefs, but recruiting larger sample sizes will be time consuming. Future researchers should be aware of this issue and plan accordingly. Additionally, it is likely that participants who self-selected into this study were those who already held negative beliefs about standardized testing. Future research should aim to conduct interviews with a larger sample, perhaps, for instance, all teachers working at a particular school, in order to counteract this self-selection bias.

Though the limitations of qualitative research, and phenomenological research in particular, are readily

recognized here, it is this researcher's position that still more of this type of educational study is warranted. The overwhelming majority of educational research relies on quantitative analyses. Previous researchers have regularly examined national, state, district, and school level datasets, created scales to measure attitudes, behaviors, beliefs, and practices, and measured empirical outcomes such as test scores, while the lived experiences of those involved in the educational system are often overlooked. Considering the policy focus on measurable, objective, and quantifiable outcomes, it is no surprise that much of the research has followed suit. In order to change this potentially harmful perception of quantitative data as the only valid source of information about education, researchers must conduct rigorous qualitative research to add to the body of knowledge on the important educational issues of our society.

NOTES

¹Science testing takes place in 4th grade. However, for the purposes of this research, teachers who teach 4th grade Science were not included, unless they also taught Math and/or ELA. Since Science testing does not take place every year, is often taught by someone other than the regular classroom teacher, and does not hold the same weight in accountability systems, the experiences of Science teachers are likely very different from Math/ELA classroom teachers and would not contribute appropriately to a phenomenological study.

²English Language Learners. These are students whose primary language is a language other than English. These students receive language services in school to help them become fluent in English.

³New York State English as a Second Language Achievement Test. ELL students must pass this test to test out of the ELL designation. This test includes listening, speaking, reading, and writing, and ELLs take it every year until they earn a score of "commanding." The NYSESLAT is usually given at the very end of the year, after both the state ELA and math tests.

⁴Integrated Co-Teaching. This is a classroom that includes both Special Education and General Education students, and is taught by both a certified General Education teacher and a certified Special Education teacher.

⁵ Individualized Education Program. This is a document for a Special Education student that includes a Special Education designation, an evaluation of the student's learning needs, specifies the services that the school is required to provide, and provides guidance for how a student's progress will be measured. IEPs also provide students with educational accommodations, such as extended time for testing.

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“Preach it Girl! Preach it!”: Exploring Trauma through Memoir and Discussion in Two Case Studies

Melissa Wrenn
Christine Christianson

Abstract: This qualitative study compares key findings from two case studies. We explain how two teachers, Laura and Rose, provided contexts for students to share and respond to stories of trauma. Author 1’s case study focused on exploring discussion practices in Laura’s elementary classroom, and Author 2’s case study investigated memoir writing in Rose’s high school classroom. Together, these studies provide a snapshot into the discursive practices through which marginalized youth share their experiences of trauma in school settings and answer the research questions, 1) What pedagogical decisions lead students to share traumatic experiences at school? 2) What happens when students share experiences of trauma in their language arts classrooms? The two researchers identified trauma as a common theme across the two cases then conducted joint analysis using Boyatzis’ (1998) thematic approach and determined three common types of trauma students expressed--death and dying, physical abuse, and poverty.

About the Authors: *Dr. Melissa Wrenn is an assistant professor of elementary education at East Carolina University. Her research interests include discussion, critical literacy, and teacher preparation. Dr. Christine Christianson is an assistant professor of teacher education at Ferrum College. Her research interests include trauma and expressive writing.*

Keywords: trauma, memoir, discussion

A large number of students in America are silenced by formalized curricula, school structure, or even classroom relationships. While calculating the exact number of students whose school experiences are shrouded in silence is impossible, evidence repeatedly suggests that students in poverty and who identify as racial minorities have access to an inequitable curriculum often resulting in silenced voices and ideologies. All students are at risk of becoming participants in *culture of silence* (Rubin, 1990), and marginalized young people are often separated from their personal experiences and subjected to practices more closely aligned with White, middle-class primary discourse (Delpit, 1995/2006; Heath, 1983; McCollum, 1989). In this article, we examine how two teachers purposefully challenged these perceptions in their classrooms and provided a space for students to explore and create meaningful texts. This led us to two specific questions: 1) *What pedagogical decisions lead students to share traumatic experiences at school?* 2) *What happens when students share experiences of trauma in their language arts classrooms?*

As students struggle with adult issues in classroom settings, teachers find themselves presented with the

dilemma of when and to what extent students’ stories of trauma should become part of classroom discourse. This article explains how two teachers, Laura and Rose, provided a context for students to share and respond to stories of trauma. Laura, a fifth-grade teacher, and self-described “humanitarian at heart” (interview, May 5, 2014) adopted a social justice agenda in her classroom and sought ways to encourage her students to consider texts about social issues (i.e., immigration, genetic engineering, racial discrimination, gender-biases, poverty, foster care). She believed, “Topics that are very difficult can sometimes be brushed under the rug or nerve wracking for people to teach...even in conversation, those kinds of topics can be taboo or somewhat harder for people to discuss” (interview, May 5, 2014).

Rose, a high school English teacher, adopted a similar philosophy as she taught students how to write memoirs. Her approach to social justice issues echoed those discussed in Laura’s fifth grade classroom; however, Rose’s students also discussed lesbian, gay, bisexual, transgender, and queer or questioning (LGBTQ) issues. She stated that some adolescents in her classroom had

difficulty seeing how their life experiences fit into schooling (interview, September 13, 2014). Therefore, she made intentional pedagogical decisions to blend expository with expressive writing, the result being a memoir-writing curriculum that allowed her to “teach difference and literary devices” (interview, August, 13, 2014). Rose noticed over time that students were “emboldened” and “compelled” to write about more complex, deeply personal topics (interview, September 27, 2014). In both classrooms, text opened the door for students to explore the impact of trauma on their lived experiences.

Critical sociocultural theory explores how individuals interact and build meaning together within multiple social and cultural contexts. Street (2007) explained approaching sociocultural theory with a heavier emphasis on broader social contexts affords researchers the opportunity to promote social justice and “social transformation” (ix) for traditionally marginalized groups. Critical sociocultural theorists seek to understand how issues of identity, agency, and power influence students’ learning (Moje & Lewis, 2007). They consider how teachers position themselves during classroom learning and question how the interactions between teachers and students may influence students’ identities and abilities to make decisions about their own learning.

Humans have a fundamental need for organizing lived experiences into stories (Britton, 1970; Bruner, 2004; Coles, 1989; Dyson & Genishi, 1994). Narrative serves children and adults alike in myriad ways: to construct a life through the organization of memory (Bruner, 1993, 2004); to become situated in the sociocultural landscape (Bakhtin, 1981); and to test relationships, form bonds, and compare experiences with others (Heath, 1994). Personal narratives give us a fuller understanding of our experiences and the experiences of others (Coles, 1989). Our self-narratives are culturally, relationally, and linguistically influenced, giving us the means to organize, to build, and to self-select the events of a life (Bruner, 2004). In effect, our personal stories have “the power to shape and reshape our perceptions of everyday experiences of the past and of what we believe is possible in the future” (Dyson & Genishi, 1994).

Educational researchers have identified literacy as an entry point into studying the lives of children and adolescents (e.g., Taylor, 2006; Taylor & Dorsey-Gains, 1988). In a world of poverty, racism, violence, and indifference, expressive discourse allows teachers to more deeply understand the complex and often troubled lives of their students (Noddings, 1988). MacGillivray,

Ardell, and Curwen (2010) emphasize that when teachers take time to learn about the lives of all students in their classrooms, they are better positioned to assist them in working through challenging times. Pedagogical practices combined with the unique aspects of the school curriculum can create a bridge between students’ unofficial worlds (i.e., home, community, peers) and the official world of formal schooling (Dyson, 1989, 1993).

Jones (2004) contends that classroom teachers can begin the dismantling of the systematic inequities marginalized youth face in school by acknowledging topics embedded in their lives. Bullying, for example, has become an acceptable topic to address in school because of widespread anti-bullying campaigns (see Jones, 2004), but topics like homelessness or domestic abuse are still shrouded in shame and silence. Humphrey (2013), a rare exception, describes the experience of an 18-year-old Afghan refugee who reveals her traumatic experiences, while also assuming the role of activist. This level of sharing echoes the struggle of the lived experiences for so many students around the world. Still, “well-meaning teachers” (Jones, 2004, p. 464) may silence students by using practices that privilege beliefs interwoven with their own social class positioning. Jones (2012) has maintained that addressing difficult lived experiences of characters in literature in a distanced way has become more acceptable in some classrooms than addressing issues experienced by real humans.

Dutro (2008, 2009, 2010) is the first scholar in literacy studies and poverty studies to combine trauma studies with critical theories of literacy, which examine the role of challenging life experiences in children’s literacy practices as well as in their relationship to schooling. According to the American Psychiatric Association (2014), *trauma* is the result of emotional responses to a distressing event such as death, an accident, rape, or natural disaster and may result in shock, denial, uncontrollable emotions, and physical symptoms. Trauma studies (Felman & Laub, 1992) is an interdisciplinary field wherein scholars examine trauma and memory and how these are represented (Caruth, 1995). In literacy research on trauma narratives, scholars seek to understand how students’ personal stories of trauma are elicited and what functions these serve. Dutro (2008) defines trauma narratives as those true stories of trauma that occur as a response to literature in classroom contexts as well as discussions of experiences related to highly visible disasters or less visible trauma that “lurks in the everyday lives of children and youth who suffer from private, personal difficulties” (p. 424).

In Dutro’s (2009, 2010, 2011) research on trauma

narratives, she borrowed the metaphors *testimony* and *critical witness* from literary trauma studies (Felman & Laub, 1992) to describe the acts of sharing and hearing stories of trauma. Laub (1992) stated that *testimony* is the process by which the survivor of trauma reclaims a position as a *witness*. Testifying to a story of trauma can lead to healing (e.g., Pennebaker, 1989, 1990, 1991, 1997; Pennebaker & Beall, 1986; Pennebaker, Mayne, & Francis, 1997; Pennebaker, Kiecolt-Glaser, & Glaser 1988; Pennebaker & Seagal, 1999), and a contributing factor to the healing process is how others receive or *witness* this testimony. If others ignore or reject the testimony, it can cause a recurrence of the difficult emotions experienced during the original traumatic event (Felman & Laub, 1992; Johnson, 2014; McKinney, 2007). If the testimony is acknowledged (witnessed), the survivor may continue the healing process (Laub, 1992). In classroom contexts, “a circle of testimony and witness” (Dutro, 2008, p. 428) may be necessary to ensure that difficult stories are acknowledged rather than met with silence or steered to safer ground.

Even in classrooms where teachers think they are selecting neutral assignments, some students will share personal stories without provocation (Dutro, 2008, 2009, 2011; MacCurdy, 2007). Moreover, certain curriculum materials, such as the study of poetry or the Holocaust, may explicitly draw upon students’ lived experiences. In other instances, district-mandated curriculum materials may elicit unintended personal responses by asking youth to define and personalize concepts such as *hard times* (Dutro, 2010). Dutro’s (2009, 2010) research on trauma narratives explores the challenges educators face in determining how to best support students who have experienced traumas while also not blurring the line between teacher and therapist. Dutro (2008) advocates that educators should “think carefully about how students’ hard stories are welcomed or silenced in classrooms and that we consider what it even means to take students’ difficult responses seriously in our work” (p. 433).

Research has shown that when teachers and students address sensitive topics openly and in developmentally-appropriate contexts, they take measures to avoid the perpetuation of shame, secrecy, or stigma associated with such topics (Becker-Blease & Freyd, 2007; Jolly, 2011). In order to construct communities where students feel safe to share their opinions and experiences and build on personal identities (Paley, 2001), teachers need to understand how to respond sensitively and genuinely when students share personal topics. Educators are trained in child development at relevant grade levels and learn to draw upon their professional judgment

regarding texts and written assignments selected for classroom use, yet they may be ill-prepared to address students’ difficult lived experiences.

However, implicit practices that value the unspoken rules privilege “middle-classed polite ways of interacting in the classroom” (Jones, 2012, p. 134) reinforce normalizing structures that control the nature and depth of classroom interactions and activities (e.g., Sumara, et al., 2006).

Lack of teacher preparation for the occurrence of sensitive topics in students’ responses may result in a teacher’s confusion, inappropriate responses, or silence (Dutro, 2008, 2010; Jones, 2004, 2012; Paley, 2001; Wiseman & Wissman, 2012; Wissman & Wiseman, 2011). With the exception of guidance from a handful of empirical studies (most notably, Dutro, 2008, 2010; Jones, 2004, 2012; Paley, 2001; Wiseman & Wissman, 2012; Wissman & Wiseman, 2011), unanswered questions remain regarding ways teachers can reify issues related to students’ self-disclosure of such sensitive, personal topics.

Method

This article compares research from two case studies. Melissa’s case study focused on exploring discussion practices in an elementary classroom, and Christine’s case study investigated memoir writing in a high school classroom. Through a rigorous and lengthy peer debriefing process (approximately 20 sessions) during the initial studies, each researcher noted the theme of trauma was present. The present study is the result of our further analysis of these trauma themes. What follows is a description of two larger, independent studies conducted about students’ discourse practices in one fifth grade and one ninth grade language arts classroom, as well as our method for analyzing data for this article.

Melissa’s Study

In the spring of 2014, Melissa conducted a three-month investigation using case study methodology (Stake, 1995; Yin, 2009) with Laura, a purposefully selected fifth grade teacher, and 11 of her students at Greenwood Elementary School, a rural, Title I school (see Pendleton, 2015). The racially diverse school population included 528 students who identified in the following ways: 43% Black, 27% White, 27% Hispanic, 2% multiracial, and .5% Asian. Approximately 82% of the students received

free or reduced lunch, and the school had a history of scoring below the district average on standardized tests in reading and math, with fewer than 34% of students scored at or above proficient in reading. This case study answered two research questions: 1) In a racially diverse, lower-tracked fifth grade classroom, what happens when a teacher and her students participate in text-based discussions? 2) How do students exhibit identity through discussion in their fifth grade language arts classroom?

Participants.

Laura, a White female and a seven-year veteran teacher, selected texts that represented marginalized populations and encouraged conversations about issues related to gender, race, social class, and religion because she desired to be responsive to students' needs and interests while maintaining high expectations for them (see Appendix A for selected texts). She emphasized discussion and used whole and small group approaches to instruction. Eleven of Laura's students (4 males and 7 females) consented to participate in this study. Of the 11 students, 5 were Hispanic, 4 were Black, and 2 were White.

Data collection.

From February to May 2014, Melissa collected data from Laura's classroom (see Table 1), while remaining as quiet observer. Classroom visits ranged from 30 minutes to 120 minutes, with a mode of 90 minutes. At these times, Melissa focused on small and whole group discussions as part of Laura's ELA and integrated social studies/writing curricula. Data were collected using photographs of student work, field notes, audio-recordings of class discussions, and interviews.

Table 1: Summary of Data Sources Collected during Melissa's Study and Included in Analysis

Data Source	Quantity
Artifacts	98
Audio Recordings	39
Classroom Observations	26
Interviews (formal)	7
Interviews (informal)	4
Participant Reflections	2

Data analysis.

Data were analyzed using constant comparative analysis (Corbin & Strauss, 2008). Using an open, inductive process, data were carefully analyzed then a more deductive process of axial coding was conducted; this continued until data were collapsed into four themes. In addition to constant comparative analysis, which was the primary method for this study, Melissa used the Dialogic Inquiry Tool (DIT; Reznitskaya, 2012) as a way to more closely examine classroom discussions. As Melissa went deeper into analysis, analysis was validated by coding by scoring sample transcripts at the low, middle, and high levels of the dialogic continuum for all six dialogic indicators. Peer review, member checking, and triangulation were critical parts of the validation process.

Christine's Study

In the fall of 2014, Christine undertook a four-month investigation with Rose, a purposefully selected educator who taught experience-based writing in her ninth grade English classes at an urban arts magnet school. Rose implemented a memoir-writing curriculum in which a large number of her students elected to publish their personal stories in digital and hardcopy formats. At the beginning of each new school year, Rose taught a six-week unit on memoir using a writing process approach within a studio workshop framework (Kirby & Kirby, 2007). Rose provided her students with a variety of mentor readings (see Appendix B for selected mentor texts) and writing prompts, allowing them to experiment with writing using different strategies for idea generation. This case study answered three questions: 1) How does one high school English teacher describe her instructional practices for teaching a memoir-writing curriculum based on the personal experiences of ninth grade students? 2) How does one high school English teacher navigate the occurrence of sensitive topics in students' written work? 3) What themes emerged in these ninth grade ELA students' published memoirs?

Participant.

Rose is a White female in her late twenties who received her first full time appointment as a ninth grade English teacher in August 2009 at a racially diverse, urban magnet school for the arts where approximately 40% of the children received free or reduced lunch. Rose had just completed her fourth year teaching when the study commenced. Rose's regular practice was to employ

expressivist pedagogical techniques in the teaching of memoir by helping students make connections between students' experiences outside of school and their experiences in school. Students explored topics about their lives, which sometimes included experiences, thoughts, and feelings about issues important to them (see Christianson, 2015). Adept at using technology, Rose documented her daily lesson plans, activities, and curriculum materials by posting them to a public teaching blog. She believed that transparency was an important component of her work, and she frequently shared examples of her personal experiences on her teaching blog as well as asked parents to talk to their child about the day's writing or reading topic. At the end of the memoir unit, students who wished to publish their polished pieces of writing in a book submitted their graded and revised work to Rose for publication through an on-demand press that resulted in both online and hard-copy formats.

Data Collection.

This study involved collecting data about one English Language Arts teacher's memoir-writing curriculum and students' published memoirs from August 2009 to May 2012, representing three academic years of lesson plans and students' published memoirs. As a result, two types of data served to inform the research questions. The main corpus of data collected consisted of Rose's curricular materials, lesson plans, and published books of her students' work (see Table 2), all of which were publicly available on the World Wide Web and created prior to Rose's involvement in this research study. The three books of memoirs, comprised of a total of 1475 total pages, represented 241 students' individual submissions. The second type of data collected was six semi-structured, face-to-face interviews conducted between Christine and Rose between August and November 2014.

Table 2: Summary of Data Sources Collected during Christine's Study and Included in Analysis

Data Source	Quantity
Blog posts pertaining to memoir	90
Embedded or linked documents within blog posts	78
Teaching Philosophy Statements	2
Interviews (formal)	6
Interviews (informal)	3
Published books of students' memoir	3
Rose's educational conference presentation on memoir	1

Data Analysis.

Qualitative content analysis guided the examination of the corpus of texts and interview transcripts. First, Christine created a coding frame (Schreier, 2012) using a combination of concept-driven and data-driven strategies in order to determine what data were relevant. She then conducted open coding (Corbin & Strauss, 2008) to look for emerging themes, clustering the raw data into chunks of assigned concepts. Similar concepts were then grouped together into categories and defined based on their similarities and variations. In defining these categories, the coding frame was structured (Schreier, 2012) so that the main categories and subcategories could be built. The initial coding frame was tested by applying it to 20% of the total data in order to conduct a consistency check, first by comparing coding with another coder (i.e., blind coding) and then by engaging in double-coding. A slight adjustment to the coding frame was made based on the research questions (Schreier, 2012). Using the modified coding frame, the remaining data were closely analyzed and coded (see Appendix C for themes from individual studies). Interpretivist methods used in the study were evaluated for trustworthiness through four areas established by Lincoln and Guba (1985): credibility, transferability, dependability, and confirmability.

Joint Analysis

The two case studies presented provide a rich body of information about students' discourse practices in one fifth grade and one ninth grade language arts classrooms. While each study does have its own data and findings, the authors noted a thread of students sharing traumatic experiences. Through a rigorous and lengthy peer debriefing process (approximately 20 sessions) during the initial studies, each researcher noted the theme of trauma was present, which raised questions about 1) What pedagogical decisions lead students to share traumatic experiences at school? 2) What happens when students share experiences of trauma in their language arts classrooms?

For the current research, we adapted thematic analysis (Boyatzis, 1998) to analyze the data from the larger, independent studies. We sampled our data individually and pulled out types of trauma evident in students' discourse. We then reduced our data by targeting common themes of trauma, thus identifying three main areas--death and dying, physical abuse, and poverty. We agreed that each of these themes met the definition of trauma because they depict terrible events that

can cause major emotional upheaval (The American Psychiatric Association, 2014). After identifying these three common categories, each researcher analyzed her data for further examples of the three categories. We then shared examples from each category and verified that our codes fit the criteria (Miles & Huberman, 1994). Finally, we interpreted the results.

The parallels in these cases provide a snapshot into the discursive practices through which students share their experiences of trauma in school settings. We believe the stories of trauma that these strands tell need to be discussed. In the following sections, we describe data from Laura's and Rose's classrooms to explain how students in both studies shared their experiences with death and dying, physical abuse, and poverty. All names are pseudonyms.

Results

Discussions on Death and Dying

Laura's students raised concerns about death and dying in their community and beyond. Over the course of the study, Laura and her students mentioned the Malaysian aircraft crash of 2014, the Sandy Hook Elementary School shooting of 2013, and the war in Afghanistan. However, most of the students' comments related to death and dying were about their personal experiences. Diamond (Black female), a student in Laura's classroom, often mentioned the death of her teenaged cousin. In one instance, Laura mentioned a biography that she read about a girl named Alex who had Cystic Fibrosis and described the disease for students. At this time, Diamond shared, "My cousin wrote an autobiography about her disease. She died in October from cancer" (field notes, March 20, 2014). Diamond brought up her personal experience with death during a later discussion of *Bud, Not Buddy* (Curtis, 1999). She told her group, "It reminded me of when my uncle had died in a car wreck, and I miss my uncle" (field notes, April 29, 2014). Laura provided the space for Diamond to share her experience with death through conversations about text. Similarly, Laura shared the story of her best friend who died when they were in the 9th grade. She said, "It was my first funeral. . . Every year on July 1, we gather back at his gravesite and tell stories about him." When Laura shared this personal story in her class, students had many questions and wanted more information. However, Laura chose not to respond and ended the discussion. Her response sheds light on the natural curiosity that children exhibit about death and dying (e.g., Koocher, 1974) and the need some members of a class community may have to avoid divulging

additional details about their grief experiences.

Memoir Themes on Death and Dying

The texts that Rose's students produced revealed the range of topics valued in this ninth-grade classroom in an urban arts magnet school. Some of Rose's students reported that writing about a grandparent's or friend's death helped them process the loss (artifact, June 9, 2014). Others did not consider writing about death initially but found that they were compelled to write about such experiences. For example, Rose shared that her student Zev felt that he had no stories worth writing about, but when he discussed the death of his best friend with his writing group, they said, "You should try writing about that!" (interview, August 30, 2014).

Rose said that later that evening Zev emailed her nearly two pages of single spaced prose that was "incredibly written" (interview, August 30, 2014) and used all the literary devices they had recently studied: imagery, foreshadowing, and suspense. The next day in class, Rose said that Zev told her he was not even thinking about how to write the story--it was just the way it came out (interview, August 30, 2014). She felt that the story, a trauma narrative, showed insight, resilience, and grief-in-progress for the loss of a childhood friend:

Immediately after I read John's note, I sprinted into the house. I saw his body dangling, his arms and legs frozen in useless attempts to save himself. I worked frantically to take him down, but he was already gone. My voice broke, my body slumped, and my eyes blurred with tears. A dear friend is gone, and I'm left here to remember.

Beyond the academic aspects of the writing was the sensitive nature of Zev's personal experience. According to Rose, the emotional, introspective moments for students usually happen when they are not in class, such as when they are alone writing. When such information has been shared, Rose said she acknowledged the telling without making her comments personal and that the unstated rules for a teacher's response differ from that of a guidance counselor and therapist (interview, September 27, 2016). Rose explained that just as counselors and therapists do, teachers listen to students, actively participate in their process of constructing life narratives, and care about their well-being, but teachers are not trained to psychoanalyze or counsel students (interview, September 27, 2016). As MacCurdy (2007) stated about students sharing their personal stories, the

teacher's job is to "focus on the text, not the life, to help writers produce effective work" (6).

Discussions on Physical Abuse

After reading a passage about a child being bullied at a park, Laura told her students, "Think of a place where something bad happened. Partner up to talk about a place and if you would avoid it" (field notes, February 6, 2014). Students engaged in lively discussions in pairs then returned back to the whole class. At this time, Jai (Hispanic female) shared with the class that she hid in a private place in her house when her parents were fighting. She said, "My sister was trying to stop them, and I sat there and tried to close my ears." Watching Jai put her hand over her ears as she recounted the abuse in her home was a powerful experience; Jai returned to theme of domestic violence in the study.

Laura's class was discussing families as part of an integrated social studies unit when Jai initiated a change in the conversation away from the ideas in the social studies textbook and toward domestic violence by saying, "You have to trust your blood family too, but they have to earn it. You might not be able to trust everyone in your family because someone might hurt you or be mean to you" (April 29, 2014, field notes). Laura mentioned how families can fight and still respect one another, but sometimes there may be physical abuse. She asked the class, "What do you think?" Diamond was the first to respond by saying, "No, there was this play called *Madea's Happy Family*, and Shirley had passed away and they were telling their secrets." She continued to tell an extended summary of the play including physical abuse a young girl in the play experienced. She ended with, "She got the r-word by her uncle." Laura replied, "Let's not go there, but let's just say she got harmed by her uncle. So they don't get that privilege of being called family anymore." Jai jumped back into the discussion and said:

They are still technically your family, but you're in their care until the state takes you away, but you don't have to deal with that. You can call the police, and they will take you away. To our opinion, they are pretty much psychos that are trying to kill you. (field notes, April 29, 2014)

Julio (Hispanic male) raised his hand and added, "I think they're not your family. Like if they abuse you, they are not your family, but if they're just hitting you like that then they're trying to make you better" (field notes, April 29, 2014). Alex (Black male) was undecided

and said the following:

...DNA will show that no matter what you are still family. It's different about by being abused almost every day and nobody stops it. I think you have all rights to pull yourself away. You have the right to pull yourself away from her life, but you never have the right to say she's not your mom. No matter how you feel, it's still your mom and dad. (field notes, April 29, 2014)

Briana (Black female) mentioned that some people may have even more challenges when reporting domestic violence. She said, "Say, if you're like Hispanic and don't live with your mom. Like your mom lives in the US and your dad lives in Mexico" (field notes, April 29, 2014). She expressed concerns about deportation and questioned whether or not the police would send someone who filed a complaint to a different country. Laura concluded, "Yeah, so sometimes people might not say something because they're afraid of the consequences" (field notes, April 29, 2014).

Throughout these exchanges, Laura moderated the discussion, but the students led its direction, based in large part from Diamond's detailed explanation of the domestic violence described in a play by Tyler Perry. Each participant in the discussion added a new thread to the talk as they worked together to decide how family might be defined. Students wrestled with complex ideas such as reporting violence and interacting with abusive family members.

Memoir Themes on Physical Abuse

Rose said that for some students, choosing what to write about was difficult because they were unsure what was acceptable to write about. For others, they took Rose at her word that they could "write about anything" (interview, August 30, 2014) and, therefore, used the memoir assignment as a way to process difficult experiences. Each of the three memoir volumes included stories of abuse and neglect. Stories of abuse included self-abuse as well as physical abuse at the hands of a family member. The stories of self-abuse were dominated with expressions of shame and self-loathing associated with cutting:

A friend glimpsed my arm at lunch. She gasped, "What happened?" I immediately unrolled my sleeves and pulled them down past my fingers, stretching the fabric into misshapen tubes to hide the ugliness of the angry red lines I'd dug into my flesh over and over. I couldn't explain

what happened. I only knew that my hot face gave away my deepest shame.

Rose stated that she was careful not to overstep her role as educator by trying to psychoanalyze or counsel students. Stories such as this one have prompted her to send messages to school guidance counselors as a heads up (interview, September 27, 2014). She said, "I just tell guidance, 'Would you check in on this student and get to know them because this happened to them and they just need to talk about it?'" (interview, August 30, 2014). Rose shared that usually such conversations were brief but added a measure of assurance that issues would be addressed per the school's protocol and her professional and ethical responsibility.

Rose's regular practice was to talk to her students about "abusive relationships or whatever they need to talk about" in a professional and straight-forward manner (interview, August 30, 2014). She felt students took this as permission to write about bold or "high-risk" topics. The following vignette is representative of a high-risk topic depicting physical abuse, written by a student during Rose's third year teaching:

I could anticipate the next purse-slap before it hit, the fake leather's stinging sensation continuing as repeated punches and smacks came at me in the repetitive pacing that she had perfected. I had no choice but to believe her threats to "show me" how serious she was, and I just prayed that I would survive the onslaught. I felt so empty, and all I could do was stare at the cold tile floor while I waited her out. All I cared about was how to survive. I know now that none of this was my fault, but grief washes over me even though that part of my life is behind me.

Rose conveyed that students who were compelled to write about such traumatic, abusive experiences did so with the support of carefully assigned writing groups. She understood that writing workshop was an important part of a writing classroom, but also felt strongly that placing students with supportive peers would help them articulate their stories of struggle. However, Rose expressed concern that a student might experience repercussions regarding such a story being published in a volume of memoirs. She said, "Ultimately, I convince myself that it's actually a really good thing because now the parent and the child are forced to have a conversation or not have a conversation" (interview, August 30, 2014).

Discussions on Poverty

Laura's students shared their perspectives of poverty through classroom discussions. In a small group discussion about the novel, *Bud, Not Buddy* (Curtis, 1999) Nikki (White female) expressed outrage that her cousin received \$300 for her birthday, yet Nikki did not have enough food to eat at home.

Alex: That joker's rich.

Briana: I only got \$100 on my birthday.

Nikki: And I got up and told her that she needed to be happy because people like me. If you go in my house and check my cabinet, there's nothing but beans. And I don't eat beans.

Layla: You have beans?

Nikki: I have to go to my aunt's to eat there, so she needs to be thankful cause she has a bike, and she has TVs, and video games and stuff like that. She needs to be happy on what she gets because there are some people like me who can't get stuff like that.

Diamond: Your cousin is rich.

Nikki: She's a little brat. She needs to be happy with what she's got.

Alex: Preach it, girl! Preach it! (transcription, March 26, 2014)

Students' actions and comments demonstrated unity as they separated themselves from "rich" people and supported one another's perspectives when discussing their experiences with poverty. These students viewed "rich" people as spoiled and separate from themselves, and their discussion of the text led them to a real conversation about a classmate's intimate relationship with poverty. As Nikki's voice grew louder and shook with anger, she shared with the group that she did not have enough food to eat at home. Nikki's comments created separation between herself and her cousin, and interestingly, other students in the group joined Nikki in distancing themselves from her "rich" cousin. Both Alex and Diamond commented Nikki's cousin was rich, and Briana compared her own birthday money to Nikki's cousin's and found it to be lacking, as evidenced by her use of the word "only" and her tone when speaking (transcription, March 26, 2014). Notably, Layla (White female) did not make a statement that created separation between herself and Nikki's cousin; rather, her comment focused on Nikki's lack of food at home. She seemed surprised by this revelation, and asked, "You have beans?" (transcription, March 26, 2014). Alex encouraged Nikki with an emphatic, "Preach it, girl! Preach it!" as she neared the end of her talk (transcription, March 26, 2014). Throughout this

excerpt the students united against Nikki's cousin and explored their personal identities related to SES.

Memoir Themes on Poverty

Rose's students consisted of economically and racially diverse adolescents, and sensitive social issues such as poverty were prevalent in the memoir collections. Memoirs in this category included experiences about parents' long work hours, parents getting laid off work, families meeting with social services to receive public assistance, and the emotional stress that comes with poverty. More than half of the stories of poverty contained details about a lack of adequate food:

It was not until Dad started being home so much that I realized he had lost his job. He usually traveled a lot, but gradually he was hanging around the house more because the company he worked for was sold, and everyone who had been a loyal employee for all these years got pushed out. We were stuck to made ends meet on my mom's check from Dollar Tree, which was a fraction of what Dad made. It took a while for me to completely grasp what was happening because my parents tried to protect me from the things only grownups should worry about. I learned what charity means, and I learned about healthy food because we didn't have any. The Food Bank gave us boxes of supplies, and even though what we received seemed like someone else's pantry leftovers, I knew we could not be too picky.

This vignette is representative of several memoirs in which an adolescent learned of a parent's job loss or divorce, and in these stories, money to buy food invariably became an immediate concern. In these stories, even though one or both parents typically tried to shield their child from knowledge of the financial concerns, the teen always showed resilience in the resulting memoir. Expressions such as "I grew from this experience" and "It is still difficult to make ends meet, but we have each other" show the teens' attempts to describe situations of poverty through a positive lens.

In other memoirs depicting stories of poverty, students wrote of housing concerns. While no students wrote about being homeless, stories of missed house payments or the need to move to a different city to accommodate a parent's job search revealed the anxiety and shame these adolescents experienced during the recent economic downturn. In many cases, students expressed shock or anger that their parents had kept economic issues from

them:

My eyes filled with tears of disgust. I thought we had moved to be nearer Daddy's family, but Mom let the truth slip. We moved because we had been evicted. We left our home because we had no money to pay for it. Now we lived in this moldy apartment in some unknown town where a new job held promise. But I felt conned, cheated, and ashamed.

According to Rose, many students found it easier to share their experiences of poverty with peers through the process of writing and revising their work in close-knit writing groups. She perceived that the intimate stories allowed students to see each other differently, yet they could make connections through their common experiences of struggle (artifact, June 2011).

Discussion

1) *What pedagogical decisions lead students to share traumatic experiences at school?*

We found that Laura and Rose made purposeful decisions as they shaped the creation and sharing of personal stories during academic work. For Laura, her personal stories were a way to scaffold discussions and create a culture of sharing. She often used her personal examples to help students understand text. At these times, Laura noticed students struggling to engage with the text and would assume a storytelling posture and launch into fun tales of her childhood escapades or share her experiences with life lessons and family members. Laura firmly believed in the importance of leadership, and her sharing personal stories allowed her to lead by example.

Rose said she wanted to model and encourage students to process and articulate their lived experiences: "I'm not ashamed of what has been in my life, so I tell students that I just want to model being totally open and receptive to different ideas of what you can write about in your life" (interview, August 30, 2014). By highly valuing personal experiences and perspectives and by straightforwardly sharing some of her own sensitive topics, Rose, like Laura, modeled the reciprocal nature of testimony and witness (Dutro, 2011; Felman & Laub, 1992).

Another common feature of Laura's and Rose's curricula was the purposeful use of text to engage students in making connections between in-school and out-of-

school experiences. Laura purposefully selected texts that she believed would encourage discussion about sensitive topics and tried to relate them to students' lives. She was troubled that her students were often not represented in school-sanctioned texts; consequently, she secured a position on the library committee at her school, which allowed her agency with text selection.

Laura selected texts that represented children and families from diverse backgrounds. Some of the selected texts were more difficult than her colleagues believed her students should be reading. Laura explained, "Yeah, I'm sure they do struggle a little bit more with the book levels and whatnot, but they do it. And they do it well, in my opinion" (interview, May 5, 2014). The access that Laura provided opened the doors for her students to freely engage in conversations about complex topics that related to their experiences within and beyond the school walls (Dutro 2009, 2010; Dyson 1989, 1993; Jones 2004, 2012).

Each year that Rose taught the memoir unit, she consistently and intentionally used certain pieces of classic and contemporary literature as mentor texts to inspire and improve students' writings. Additionally, as each volume of student memoirs was published, Rose provided those works as mentor texts. She perceived that students were better inspired to understand how certain authors' treatments of memoir features could inform their own writing practices. When students read previously published students' memoirs, they became emboldened to draw upon their personal experiences in their own memoirs. By making these tough pedagogical decisions about text, both Laura and Rose exposed students to diverse topics, often related to controversial or social justice issues, which opened the pathways of communication to allow students to consider and express stories of trauma.

Laura's and Rose's classrooms operated under explicit and implicit rules and norms (e.g., state standards, culturally acceptable behaviors and practices). Researchers suggest that teachers should use discussion protocols to improve talk practices (e.g., Beck et al., 1996; Chinn et al., 2001), yet Laura did not always implement discussion guides or formats in conversations about texts. However, she did loosely follow accountable talk procedures (Michaels et al., 2008) and was knowledgeable about this approach to discussion, as evidenced by her comments to Melissa, her instructional posters, and her actions. Laura provided a classroom culture with established norms for interacting (McIntyre et al., 2006; Sipe, 1999), but explicit, procedural instructions for discussions were

not a common practice.

In contrast, while Rose frequently encouraged students to write about any topic that was important to them, during her second year teaching the memoir unit, she identified the need to add core values for writing and sharing, which she adapted from Kirby and Kirby (2007, 2010):

We focus on the writing, not the writer. We share our work boldly. Our classmates will respect us for being confident enough to tell about personal experiences. We respond to work boldly. Writers do not want to hear "Good job." They do not want to hear about typos at this point, either. We value work ethic. We craft our writing through many drafts into a final product. We are never satisfied with the first draft. The author has the final say. The pencil/pen/marker stays in the author's hand, not the editor's. (artifact, September 1, 2011)

By creating and implementing core values for writing groups, Rose indicated a need for students to understand the basis for ethical actions for sharing and supporting each other within their writing groups and the greater school community. Rose frequently modeled how to converse and receive feedback in writing groups, which signified that it was necessary to establish acceptable behaviors and practices for peer feedback during writing workshops. Despite differences in adherence to protocols, Rose and Laura made concerted efforts to create a warm, welcoming environment, and students responded by sharing their personal stories, including those related to death and dying, physical abuse, and poverty.

2) What happens when students share experiences of trauma in their language arts classrooms?

As students shared experiences of trauma in their language arts classrooms they fostered a supportive peer network. For example, when Nikki shared her struggles with food and talked about her "rich" cousin, the other group members validated her comments and encouraged her, as indicated by Alex's comment, "Preach it, girl! Preach it!"

Likewise, Rose's students encouraged each other when a member of their writing group was torn about whether to write about their darkest hour, such as when they supported Zev by saying, "You should write about that!" These opportunities to support one another are reflective of the class environment, but they also demonstrate that

when students shared about issues related to death, physical abuse, and trauma, they were not teased by their peers; rather, students embraced one another with the power of their words and echoed their teachers' spirits of advocacy through listening and encouraging.

Even when students were in supportive environments, they sometimes chose to *testify* their trauma in a form of surrounded isolation. Diamond talked about her cousin's death to students outside of group discussions—at one point, announcing it loudly to anyone who would listen. Despite sharing it within her classroom setting, Diamond was still very much alone, suggesting that students *witness* trauma differently within the micro-contexts of a classroom. Students tended to support and encourage stories of trauma that were shared when discussing text in small groups or with their teacher; however, isolated *testimonies*, while rare, reify the traditional notion that students do not know how to respond to students sharing trauma at school (Dutro, 2008; Jones, 2012). Rose's students *testified* in isolation when they opted not to publish their memoirs. While writing their personal stories may have provided an opportunity to organize and process their experiences, the isolation of not sharing beyond the classroom seemed the safe or preferred choice.

Limitations & Future Research

Due to the highly subjective issues related to the questions in this study (i.e., trauma), we may have made inaccurate assumptions about students' emotions and feelings based on our own experiences with trauma as children and adults. Traumatic events are raw and personal, and we were not intimate *witnesses* to the lived experiences of these participants' stories. However, we followed the advice of Willis and her colleagues (2008) and worked to refrain from assigning judgments to behaviors exhibited during discourse based on our personal identities and values. We believe that the rigorous methodology applied to each individual study and the one presented in this article justify our findings, and the individual stories shared in this study are to be celebrated.

We believe that children should feel welcome to share their stories of trauma in classroom settings, yet like Laura and Rose, we still wonder about the best practices for witnessing students' testimonies (Dutro, 2008, 2009, 2010; Jones, 2004, 2012). An accepting classroom culture is paramount for setting an inclusive atmosphere in which sharing is possible. Students, just as their teachers, may limit their testimonies of trauma (Dutro

2008; Jones, 2004, 2012). In both studies, Laura and Rose, shared their experiences with trauma but, like their students, they also made choices about limiting their stories.

Perhaps the untold stories are as troubling as the shared ones. Laura's and Rose's students explored topics related to death and dying, physical abuse, and poverty. For some students, the classroom may be the only outlet for sharing their personal feelings about serious issues. We are left wondering about the stories children chose not to tell. Is it better for students to silence their lived experiences with trauma in order to satiate expected norms in classroom discourse? It can be difficult for teachers to determine when to press students for more information, as part of regular classroom discourse, and when to stop and report the experiences to a guidance counselor or health care professional.

At a time when mental health issues have arisen from the shadows into national headlines, educators have a renewed responsibility to help students find ways to express themselves. Rose maintained a position of transparency, and we agree that open lines of communication between families and schools are critical components of responsible explorations of trauma in classrooms. We have a duty to communicate with parents, guidance counselors, school social workers, and psychologists when students' sharing of traumatic experiences suggests they need evaluation or mental health services.

Invoking strong emotional responses from children should not be entered into lightly; however, discussing texts about social issues and engaging in expressive writing provide contexts for students to thoughtfully consider their experiences with trauma.

What should educators do when students get real about the trauma they have experienced? While many questions remain, Laura and Rose have taught us that teachers should 1) be willing to share, 2) create a supportive environment, and 3) be intentional. Teachers seeking ways to encourage students to share their stories of trauma may benefit from implementing these three criteria.

Future research aimed at understanding the implications and processes of trauma exploration should investigate a) the usefulness of trigger warnings in P-12 classrooms, b) ways trauma is induced at school (e.g., bullying, school violence) influences students' classrooms interactions, and c) how we can prepare teachers for the emotional labor of teaching.

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APPENDIX A

Selected Texts from Melissa's Study

Title	Author
<i>Bud Not Buddy</i>	Curtis
<i>Star in the Forest</i>	Resau
<i>Runaway Twin</i>	Kehret
<i>Killer Species: Menace from the Deep</i>	Spradlin
<i>Zora and Me</i>	Bond & Simon

APPENDIX B

Selected mentor text excerpts from Christine's study

Title	Author
<i>My Name</i>	Cisneros
<i>Zen and the Art of Motorcycle Maintenance</i>	Pirsig
<i>The Color of Water</i>	McBride
<i>The Absolutely True Diary of a Part-Time Indian</i>	Alexie
"You Can't Kill the Rooster"	Sedaris
<i>Dreams from My Father</i>	Obama
"Living Al Chuco:	Gilb

