PACTE

The Pennsylvania Association
of Colleges and Teacher Educators

Pennsylvania Teacher Educator

Vol. 21, No. 2, Fall 2022

SLIPPERY ROCK UNIVERSITY IS

proud to *support* the PENNSYLVANIA TEACHER EDUCATOR

DOCTORAL PROGRAMS

- Educational Leadership and Administration
- Special Education

PENNSYLVANIA DEPARTMENT OF EDUCATION

A top-three producer of teachers in Pennsylvania since 2010-2011.

- **No. 2** Best Master's in K-12 Education Degree Programs
- **No. 2** Best Master's in Math Education Degree Programs
- **No. 2** Best Master's in Social Studies Degree Programs
- **No. 4** Best Master's in Elementary Education Degree Programs
- **No. 4** Best Master's in Reading and Literacy Degree Programs
- **No. 4** Best Master's in Secondary Education Degree Programs
- **No. 6** Best Master's in Education Degree Programs
- **No. 8** Best Online Master's in Reading and Literacy Programs

COLLEGES OF DISTINCTION

College of Education

6th Consecutive Year

2022–2023

Slippery Rock University of Pennsylvania

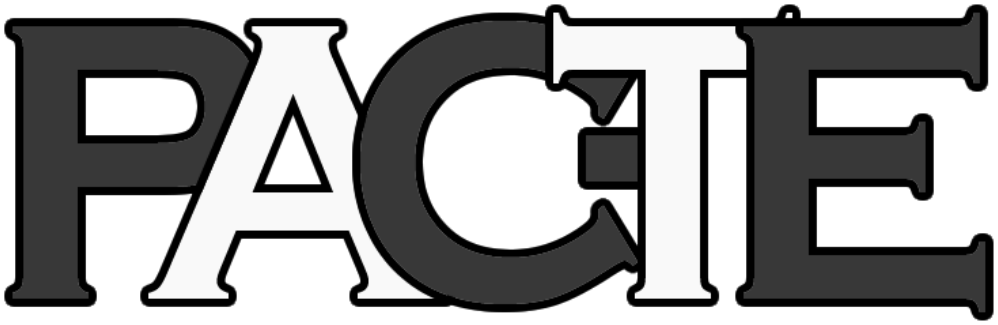
EXPERIENCE THE DIFFERENCE

www.sru.edu

A member of Pennsylvania's State System of Higher Education

#1623/9-2022

The Pennsylvania Association of Colleges and Teacher Educators



Pride • Advocacy • Commitment • Teacher • Excellence

Pennsylvania Teacher Educator

A Journal of the Pennsylvania Association of Colleges and Teacher Educators

Co-Editors
Thomas Conway, Cabrini University
Jason Hilton, Slippery Rock University of Pennsylvania

Managing Editor
James Preston, Slippery Rock University of Pennsylvania

Associate Editors
Jonathon Chitiyo, University of Pittsburgh, Bradford
Amy Hoyle, Neumann University
Janet McNellis, Holy Family University
Richard Mehrenberg, Millersville University of Pennsylvania
Beth Rogowsky, Bloomsburg University of Pennsylvania

Cover Design
Grace L. Donnelly, Slippery Rock University

Pennsylvania Teacher Educator

A Journal of the Pennsylvania Association of Colleges and Teacher Educators

Manuscript Reviewers

Brian	Berry	Holy Family University
Melinda	Burchard	Messiah University
Desiree	Caldwell	Gwynedd Mercy University
Daniel	Casebeer	Seton Hill University
William	Clark	University of Pittsburgh, Bradford
Juliet	Curci	Temple University
Daniela	DiGregorio	Wilson College
Kelly	Doyle	Immaculata University
Carol	Etlen	Gwynedd Mercy University
Leighann	Forbes	Gannon University
Karen	Frantz-Fry	Wilkes University
Laura	Kelley	Slippery Rock University of Pennsylvania
Jeffrey	Laferriere	Lebanon Valley College
Elizabeth	LaGamba	Slippery Rock University of Pennsylvania
Tracy	McNelly	St. Vincent University
Jamie	Raski	Indiana University of Pennsylvania
Carrie	Recla	Bloomsburg University
Greer	Richardson	La Salle University
Michelle	Sobolak	University of Pittsburgh
Madora	Soutter	Villanova University
Kathryn	Silvis	LaRoche University
Deborah	Tamakloe	Millersville University of Pennsylvania

Call for Manuscript Reviewers

The *Pennsylvania Teacher Educator* is looking for teacher educators who are interested in becoming reviewers for the journal. Each manuscript that is submitted to the journal undergoes a blind-review process from three peer reviewers. Consequently, we are always in need of good reviewers who return manuscripts to the editors in a timely fashion. **Members who are interested in becoming a reviewer should contact** pacte.journal@sru.edu.

Pennsylvania Teacher Educator

A Journal of the Pennsylvania Association of Colleges and Teacher Educators

Call for Papers

Fall Issue manuscripts due February 20
Spring Issue manuscripts due September 20

The Pennsylvania Association of Colleges and Teacher Educators publishes a peer-reviewed journal — the *Pennsylvania Teacher Educator*. Our journal is intended to provide PAC-TE members with a venue to capture current research that makes use of quantitative, qualitative, and/or mixed-methods approaches, as well as rigorous theoretical works that capture current research, advances, and changes in the emerging directions of teacher education. Publication decisions are made following a blind-review process. Starting in 2021, the *Pennsylvania Teacher Educator* will move to publishing two issues per year, allowing more flexibility for writers to conduct and to report their research throughout the academic year.

Submission Guidelines

· Manuscripts should be no more than 12 pages of narrative (exclusive of references, tables, and appendices), using the latest APA style, and double-spaced with one-inch margins.
· Manuscripts should be submitted as an e-mail attachment, sent to PA Teacher Educator at pacte.journal@sru.edu.
· A cover page should include the title of the article, a brief (no more than 50-word) abstract, the name, position, place of employment, mailing address, phone number, e-mail address, and a 2-3 sentence description of background and experience of each author.
· The title of the article should also appear on page 1 of the manuscript, but do not include the name(s) of the author(s) on page 1.
· Pages should be numbered consecutively, including the bibliography, but the author's name should not appear on the manuscript itself.
· Charts or illustrative material will be accepted if space permits. Such materials must be camera-ready. Photographs will usually not be used, unless they are black and white and of high quality.
· Authors are expected to take full responsibility for the accuracy of the content in their articles, including references, quotations, tables, and figures. The editorial board reserves the right to edit articles accepted for publication.
· Authors of manuscripts accepted for publication are asked to sign a copyright release to PAC-TE. This allows PAC-TE to publish the information in the *Pennsylvania Teacher Educator*, to publish the information in future PAC-TE publications, and to grant permission to persons or organizations that formally request the right to reprint the material in whole or in part.
· Authors of manuscripts accepted for publication are also expected to make a presentation about their article at the PAC-TE Teacher Education Assembly in the fall or spring.
There is no remuneration for articles accepted for publication, but a complimentary copy of the journal will be mailed to each author. There is no fee for the review of the manuscript.

Pennsylvania Teacher Educator

A Journal of the Pennsylvania Association of Colleges and Teacher Educators

Call for Papers..... iv

Challenges in Learning Phonics and Phonemic Awareness: Case Studies of Pre-Service Elementary Teachers 1
Stacey L. Bose

Exploring Technology Competencies of Field-Based Teacher Educators..... 16
Abdulsalami Ibrahim & Oliver Dreon, Jr.

Realistic vs. Effective: An Analysis of Educators' Perceptions of Traditional and Co-teaching Models of Student Teaching 30
Patricia Jorgensen & Jennifer L. Fisler

We Strive: Enhancing Implementation of Socioscientific Issues in STEM Classrooms Through Professional Development 41
Joseph Johnson, Augusto Macalalag, Becky Mathers-Lowery & Gabrielle Ialacci

Teacher Candidates Working with Digital Technologies to Support Multilingual Students in Asset-Based Ways 59
Megan E. Lynch, Frances Nebus Bose & May Lee

The Introduction of Global Collaboration to Pre-Service Teachers: Training Future Global Change-Agents 71
Aaron J. Sams, Lee Kenneth Jones & Walter Smith

Listening to Teacher Candidates of Color..... 82
Emily Wender, Roger Briscoe, Jt Helsop & Kaitlyn Brennan

Undergraduate Research Experiences for Pre-Service Teacher Candidates: Necessary Conditions for Productive Projects 93
Mark Wolfmeyer, David Mohamad & Michael Mistler

Interactions and Gains in Cultural Responsiveness in Pre-Service Educators..... 104
Melinda Burchard

Pennsylvania Teacher Educator

A Journal of the Pennsylvania Association of Colleges and Teacher Educators

***PAC-TE** is dedicated to providing strong advocacy for teacher education within the Commonwealth by promoting quality programs of teacher education and providing a variety of forums for discussion of issues that are of concern to all who are engaged in teacher education.*

***Pennsylvania Teacher Educator** articles are provided digitally on the PAC-TE website. The fall issue is also available in hardcopy through pre-ordering prior to the fall PAC-TE Teacher Education Assembly.*

Joel Geary
PAC-TE Executive Director
Pennsylvania Association of Colleges and Teacher Educators
(717) 516-8893 | pacte.exec@gmail.com

Pennsylvania Teacher Educator is an official publication of the Pennsylvania Association of Colleges and Teacher Educators. The journal is published as a service to the members of the organization and others concerned with teacher education.

Pennsylvania Teacher Educator serves as a forum for the open exchange of ideas and information related to the improvement of teacher education at all levels. Points of view and opinions are those of the authors of the articles and do not necessarily represent the views of the organization.

Pennsylvania Teacher Educator is a peer-reviewed journal that depends on both potential authors and reviewers to produce a high-quality publication each year. We are always in need of reviewers with a wide variety of perspectives and expertise to help us with the biannual review process. Becoming a reviewer is a helpful way to give back to the profession of teacher education and to PAC-TE as an organization. If you would like to be a reviewer, email pacte.journal@sru.edu. Reviewers must be PAC-TE members.

Pennsylvania Teacher Educator

A Journal of the Pennsylvania Association of Colleges and Teacher Educators

The popular proverb, it takes a village to raise a child is often quoted whenever it seems there is a collective effort needed to support a child's matriculation to adulthood. The proverb has been attributed to African culture, but a 2016 National Public Radio (NPR) piece suggested that finding a definitive answer to where it originated seems nearly impossible. The NPR piece reinforced that the proverb, if not originating from Africa, certainly embodies how many villages on the continent view childcare. The reason I mention this proverb is because it seems appropriate to paraphrase in the context of teacher education today. It takes a village to prepare a teacher. The articles in this issue of the *Pennsylvania Teacher Educator* represent many facets of teacher education and many reflect the idea that preparing a teacher in the current milieu requires the collective effort of our village. Higher education has, as long as I can recall, known and acknowledged the importance of our PK – 12 partners in this endeavor of preparing teachers. However, the village has vastly expanded to student support services, health care providers, offices of diversity, equity and inclusion, technology experts, and politicians, just to name a few. As our village expands, so does our need to pay extra attention to our relationships with those in our village and to express a sincere thank you to both our obvious partners and those seemingly on the fringe.

Speaking of expressions of gratitude, a great deal needs to be extended to the co-editors of this journal, Jason Hilton and Tom Conway and to our associate editors listed in the pages prior. Thank you to all of our manuscript reviewers as well. Congratulations to the authors whose work is presented in this issue of *Pennsylvania Teacher Educator* and thank you to all who submitted manuscripts. I would like to thank Grace Donnelly, a sophomore education major at Slippery Rock University, who used her seemingly unlimited talents to produce the cover for this issue. Kimberly Norris, our previous graphic designer, who has been a member of our village for many years deserves our sincere appreciation as well. Once a member, always a member.

Yours in education,
Jim Preston, Managing Editor

Challenges in Learning Phonics and Phonemic Awareness: Case Studies of Pre-Service Elementary Teachers

Stacey L. Bose

Abstract: This qualitative multi-case research study explored the experiences of pre-service teachers learning phonics and phonemic awareness (PPA) in a literacy methods course. Data were collected from pre- and post-test scores, literacy life maps, semi-structured interviews, and course questionnaires. Findings suggest pre-service teachers with limited prior knowledge struggled with learning PPA but were able to overcome the challenges. Participants perceived their preparedness and confidence in teaching PPA had grown through the course. Participants noted the benefits of hands-on practice with PPA.

About the Author: *Stacey L. Bose, Ed.D. is an Associate Professor of Education at Cairn University.*

Introduction

In 1999, Congress convened the National Reading Panel to synthesize the research on the most effective components of literacy instruction. The findings of the study document five key components of the reading process, namely phonics, phonemic awareness, fluency, vocabulary, and comprehension (National Institute of Child Health and Human Development, 2001). The five components continue to be essential not only for students to learn to read but also for pre-service teachers to learn as part of teacher preparation programs (Hudson et al., 2021).

While each of the five components are essential, phonics and phonemic awareness (PPA) are particularly important for pre-service teachers who will instruct emergent or struggling readers (Moats, 2014). Learning to read is a complex process; students need direct instruction in understanding how spoken sounds transfer to written text (Castles et al., 2018). Through phonemic awareness instruction, beginning readers learn to isolate speech sounds in spoken words (Ehri, 2022; Mesmer & Kambach, 2022). Through phonics instruction, students learn to map speech sounds to letters to read and spell words (Ehri, 2021; Mesmer & Kambach,2022). Pre-service teachers need to understand how to teach these critical parts of literacy.

Literacy methods courses in teacher preparation programs incorporate instruction in phonics and phonemic awareness. However, many pre-service teachers struggle with learning PPA, graduating with limited content knowledge (Cheesman et al., 2009; Washburn et al., 2011). Pre-service and in-service teachers can grow in their understanding of PPA when given the opportunity (McCutchen et al., 2002; Washburn et al., 2016). Thus, literacy methods courses must continue to enhance PPA instruction for pre-service teachers (Ehri & Flugman, 2018).

Pre-service teachers in literacy methods classes possess differing levels of content knowledge and experience with PPA. Some pre-service teachers learned to read from a phonetic approach. Others learned to read through whole language without explicit phonics instruction. Still others may have learned to read through a phonetic approach but have forgotten basic language constructs. While learning PPA is a challenge for all pre-service teachers, the difficulty may be exacerbated by limited prior knowledge. Pre-service teachers not only need to understand the content but also must be able to teach it to others. According to the Peter Effect, teachers are unable to teach what they themselves have not learned (Applegate & Applegate, 2004; Binks-Cantrell et al., 2012).

Review of the Literature

The Necessity of PPA for Pre-Field Teachers

Teachers need to have a deep understanding of PPA for students to experience literacy success (Moats, 2009; Wong-Fillmore & Snow, 2000). A teacher's knowledge of phonics-related concepts can impact students' success in reading (Al Otaiba & Lake, 2007; Carlise et al., 2011; McCutchen et al. 2009; Piasta et al, 2009). Pre-field and in-service teachers can learn the needed content through university training and professional development (Bose, 2018; Washburn et al., 2016; Washburn et al., 2011). Pre-service teachers feel their course work emphasizes PPA (Salinger et al., 2010), but studies on textbooks and syllabi reveal that college literacy classes may not use the most effective literacy strategies (Joshi et al.,

2009). Given the importance of PPA for beginning and struggling readers, it is critical that teacher preparation programs provide a strong foundation for pre-service teachers in PPA (Ehri & Flugman, 2018).

Pre-Field Teachers Struggle with Learning PPA

Numerous studies over the past two decades show that pre-field teachers lack proficiency in basic language constructs (Washburn et al., 2016). Salinger et al. (2010) found pre-field teachers (n=2237) correctly answered only half of the questions on alphabetics. Washburn et al. (2011) found that two-thirds of the pre-field teachers scored below 60% on an assessment of phonological, phonemic and morphemic awareness. Bose (2018) found that while pre-service teachers grew in their knowledge of PPA, they only answered 72% of questions correctly on the course post-test.

The Importance of Prior Knowledge

According to the constructivist theory, humans learn new information by building on existing knowledge (Unrau & Alvermann, 2013). The activation of prior knowledge facilitates the learning process (Ambrose et al., 2010). Activating prior knowledge can be problematic in higher education when students need to learn content for which they have no prior knowledge; thus, students' levels of prior knowledge should be considered as part of the instructional process (Hailikari et al., 2008).

Purpose

The main purpose of this study was to explore the impact of limited prior knowledge in PPA on the success of pre-field elementary teachers learning PPA in a literacy methods course. Secondarily, this study also sought to understand the factors which help or hinder the successful acquisition of PPA. Finally, the study analyzed the perceptions of pre-field elementary teachers toward the importance of PPA and their preparedness to teach it.

Methodology

As this study aimed to explore the experiences of pre-service teachers with limited background knowledge in PPA, Yin's (2014) multiple-case study procedure was selected. Following this model, each case, or pre-service teacher, served as an individual unit. After the data was collected for each case, single reports were written to summarize the findings of the individual cases. A multi-case summary report was generated to allow for cross-case analysis and the identification of themes. This final step provided a holistic analysis (Yin, 2014).

Participants

The participants in the study were purposefully selected from a literacy methods course at a large, private university in the mid-Atlantic region. Each semester approximately seventy pre-service elementary education teachers enrolled in one of three identical sections of a literacy methods course. The course had a PPA proficiency requirement to pass the class.

Study participants were chosen based on two criteria. The first selection criterion was a low pre-test score. Students who scored at the bottom range across all three sections were tagged as possible participants. The second selection criterion was the pre-service teacher's willingness to sign an IRB-approved consent form to participate in the study. Individuals tagged with a low pre-test score were sent letters of

invitation to participate. Those that responded were sent a consent form. Seven individuals agreed to participate by signing the consent form. All seven were white females whose first language was English. All were elementary education majors, with two majoring in both elementary education and special education. Five were juniors, and two were sophomores. Each participant was assigned a number and pseudonym.

Data Collection

The data were collected over a period of fifteen weeks. Four data sources were utilized for each individual case. A modified version of the Survey of Basic Language Constructs (Binks-Cantrell et al., 2012) was administered as a pre-test on the first day of class and as a post-test on the last day. This survey contained multiple-choice and fill-in-the-blank questions related to PPA, such as how many phonemes or how many syllables were in a word. Results of the pre- and post-test are presented in Table 1. The second source of data came from the literacy life maps created in the second week of the course. In this assignment, pre-service teachers reflected on their own experiences with reading and writing (See Appendix A). Pre-service teachers drew an icon and wrote a paragraph about five different time periods in their lives, namely first memories, early childhood, elementary, middle/high school, and college years. This assignment allowed pre-service teachers to consider how their own literacy development contributed to their beliefs about literacy instruction. The third instrument of data collection was semi-structured interviews. The interviews loosely followed an interview protocol with 12 questions (see Appendix B) and were conducted by a student worker during the last three weeks of the semester. The interviews were recorded and transcribed. Transcriptions were returned to participants for member-checking. The fourth data source was the end of course questionnaire. The questionnaire was distributed to students as a Google form on the last day of class. The questionnaire contained demographic questions and questions related to the pre-service teacher's experience with PPA in the course.

Table 1: *Pre- and Post-Test Scores*

Participant	Pre-Test	Post-Test	Point Growth
Jane	27	44	17
Mary	28	38	10
Susan	28	51	23
Diane	31	39	8
Kim	32	58	26
Lisa	34	59	25
Karen	36	45	9

Data Analysis

The four data sources for the individual participants were compiled into a written case report. The reports were reviewed by three coders, namely a university professor, a PK-12 practitioner, and a student worker. The coders read the case reports noting repeated themes across the data sources and unique features of the cases. The coders created a multi-case summary chart with the findings from each case (see sample in Appendix C). The coders used the summary chart for the cross-case analysis and identification of cross-case themes.

Results

Case #1: Jane

The results of Jane's pre-test and post-test scores showed a 17-point growth from the beginning of the semester to the end. This was above the mean point growth of 11 points for the course. In Jane's literacy life map, she shared that her parents read to her as a child. She also remembered playing vocabulary games and having a genuine love for reading. During the interview, Jane reported that she didn't learn phonics as a child, but she believes phonics is essential to help children learn to read. She shared that phonics is more in-depth than she knew, commenting that it is hard to acquire if you haven't learned it before. She felt it was important to study PPA and benefited from the professor reviewing the material in class. She felt prepared to teach PPA in the future. On the questionnaire, Jane wrote that the phonics content was challenging. On average, she spent 30-60 minutes studying PPA each week.

Case #2: Mary

Mary had a 10-point growth from the pre-test to the post-test, slightly less than the average point growth for the course. On her literacy life map, Mary shared that her mom read to her as a child. She remembered playing with magnetic letters and having an interest in books. Mary had difficulty learning to read. Due to the help she received from a reading specialist, she now wants to help struggling readers. During the interview, Mary again shared that she struggled to put reading together as a child. She remembered learning rhyming words but not phonics. At the beginning of the course, she felt lost with so many new terms. She believes PPA is very important for children and should be taught with kinesthetic, hands-on activities. Personally, she feels she needs more time to review PPA before teaching as the pace of the course was fast. On the questionnaire, she noted learning phonics required a lot of time as she studied 30-60 minutes per week.

Case #3: Susan

Susan grew 23 points. In her literacy life map, she wrote she was homeschooled and taught to read by her mother. She hated reading until she got to middle school; then, she began to love it. During her interview, she explained she never learned explicit phonics. She remembered reading was word by word not sound by sound. She was taught to point to the words and go across, first words, then sentences. She shared that the course was difficult at first. PPA was not complicated, but it took time to learn. She felt visuals and class activities helped her. She believes it is important for children to learn PPA to understand how language works. On the questionnaire, she noted that the course was challenging, but she learned a lot. She spent approximately 60-90 minutes studying a week but will need additional practice before teaching PPA.

Case #4: Diane

Diane showed an eight-point growth, less than the average point growth for the class. Through her literacy life map, she shared that her parents read to her as a child and she remembered reading groups in school. She didn't like reading as a child but loves reading in college. During the interview, Diane shared memories from her childhood such as literature circles, sight words, syllables and making words. She indicated that the course helped her as she thought she already knew phonics but realized she had forgotten it. She continued to struggle with concepts such as diphthongs and digraphs. She believes phonics is important for life. On the questionnaire, she shared learning phonics was a positive experience. She spent two hours a week studying and feels prepared to teach PPA, but she needs to continue practicing.

Case #5: Kim

Kim had a 26-point growth, well above the course mean growth of 11 points. On her literacy life map, she wrote about her parents reading to her as a child and her enjoyment of stories. By third grade, she struggled with comprehension and no longer enjoyed reading. In tenth grade, she had a great teacher and began to enjoy reading again. In the interview, Kim shared that she attended a private school which placed a heavy emphasis on phonics instruction. At the beginning of the course, she thought she knew phonics but discovered there was much she did not know. She learned a lot and has seen the importance of phonics. She began implementing phonics strategies with her siblings. She feels teachers need to be able to explain how language works. On the questionnaire, Kim indicated that learning PPA was a positive but challenging experience as she spent 30-60 minutes a week studying. She felt the course prepared her to teach PPA in the future.

Case #6: Lisa

Lisa had a 25-point growth. On her literacy life map she described how her parents read to her. She remembered her teacher loved reading so she did too. During her field experience in freshman year, she observed how a teacher's excitement for reading caused children to love reading. At the interview, Lisa shared memories of learning to read by memorizing the alphabet, sounding out words, singing phonics charts, and playing letter games. She learned a lot in the course, especially about phonemes and morphemes. She benefited from hands-on practice activities. She believes PPA is an important life skill. On the questionnaire, Lisa shared that learning phonics was a positive but challenging experience as she spent one and a half to two hours a week studying. She feels prepared to teach PPA in the future.

Case #7: Karen

Karen gained nine points, scoring below the mean point growth. On her literacy life map, she wrote about her mom reading to her and playing with magnetic letters on the refrigerator. She struggled with reading in middle school and received extra support. She started to enjoy reading in college. During the interview, she shared she attended an extra program in school which focused on phonics. She didn't remember much except for letter cards with sounds and vowels. She felt she learned a lot in the course, but it was harder for her since she didn't learn the material in her childhood. She believes phonics is important. The hands-on activities were helpful, but she would benefit from more practice. Learning PPA in college has been challenging as she

spent 30-60 minutes studying each week, but she feels prepared to teach it.

Cross-Case Themes

Following Yin's (2014) multiple case design, the seven cases were examined across cases to identify themes. Each coder identified the top five themes from the data (see Table 2). The themes from each coder were reviewed and color-coded to identify repeating themes. Themes that were mentioned by two or more coders were retained. Using the list of retained themes, the university professor returned to the data to determine the frequency of each theme (see Table 3).

Two themes were mentioned by all participants. First, all participants shared that learning PPA was challenging for them. Mary stated during her interview, "The first assessment was hard. I was clueless." Susan commented that "it is overwhelming at first because I had to stop thinking of words as whole pictures and break it down into individual parts." Jane shared, "The quizzes were kind of hard, but I think that not having any background before this was definitely a struggle too." Second, despite struggling with the content, all participants felt they had grown and were prepared to teach PPA at the end of the course. This was evidenced by the growth each participant made from the pre- to post-test, but it was also mentioned in the interviews. For example, Karen shared "I do feel prepared because we went over it a lot and practiced it so much." Later in the interview, she said, "If you don't know it, you won't be able to teach it well." The students realized that learning PPA was not only about content knowledge but also about practical application in the classroom. Diane shared, "I learned a lot….I am better prepared to explain to a student who might wonder why these sounds go together." Susan was excited that she got to see what she was learning in class about PPA being taught in her practicum and in the daycare where she worked.

Another two themes were mentioned by six of the seven participants. Participants shared that they found hands-on practice of PPA very beneficial to their success in learning the material. For example, Mary stated in her interview, "I am a kinesthetic learner, so I need hands-on." Diane mentioned that the "little activities" in class helped her. Lisa shared that practicing PPA "like we are teaching it to a kindergartener" was beneficial for her. While not directly connected to learning PPA, six of the seven participants also shared their parents read to them as part of their literacy development. This was evidenced both in the literacy life maps and the interview transcriptions. Participants had memories of special times spent together enjoying books.

Five of the participants expressed that they had limited background knowledge in PPA. Some made explicit statements about the disadvantage they felt due to not having prior knowledge. For example, in the interview Karen shared, "If I had a better understanding of PPA, it would have been easier for me." Later she said, "Because I didn't remember it as a child, it was harder for me to learn." Similarly, Mary stated, "I don't remember learning phonics at all." In regards to the course pre-test, Susan said, "The pre-test was like a foreign language."

Table 2: *Themes by Coder*

Coder	Theme
Coder #1: University Professor	#1 Despite PPA being challenging, pre-service teachers can grow in their understanding of PPA. #2 Many struggled with reading as a child but had parents or others to help them. #3 Pre-service teachers mentioned they had limited background knowledge. #4 Pre-service teachers appreciated the hands-on experiences. #5 After the course, most pre-service teachers felt prepared to teach PPA.
Coder #2: PK-12 Practitioner	#1 Parents and teachers play an important role in the literacy development of young children. #2 Many pre-service teachers expressed that they did not like reading initially, but learned to enjoy it. Now, they are excited to teach it. #3 Many pre-service teachers do not remember learning phonics in elementary school and so they struggled with learning the course content. #4 The course content was helpful in learning PPA. They feel prepared to teach it. #5 The course discussion, quizzes, and practice activities were essential in comprehending the PPA concepts.
Coder #3: Student Worker	#1 Pre-service teachers struggled with PPA and morphemic analysis. #2 Pre-service teachers enjoyed the hands-on activities done in class. These activities helped prepare them to teach in a classroom. #3 A majority of the pre-service teachers felt more confident in PPA after this course. #4 Pre-service teachers feel like phonics should have a greater focus when students are learning to read. #5 There was some correlation between time spent studying and higher post-test scores.

Table 3: *Theme Frequency Counts*

Theme	Coder Frequency	Participant Frequency
The participants found PPA challenging and struggled with learning it.	3	7
The participants felt more prepared/more confident/had grown in PPA after the course.	3	7
The participants found hands-on practice of PPA beneficial.	3	6
The participants had parents who read to them/were part of their literacy development.	2	6
The participants had limited prior knowledge about PPA.	2	5
The participants struggled with reading growing up.	2	3

Key Findings

This study explored the impact of limited prior knowledge in PPA on the success of pre-field elementary teachers in a literacy methods course. All of the participants felt that learning PPA was challenging as evidenced in the interviews and end-of-course questionnaire. Some demonstrated greater gains than others on the post-test as the point growth ranged from eight to twenty-six. All participants demonstrated growth despite entering the course with limited background knowledge.

The study sought to determine what factors helped or hindered pre-service teachers with limited prior knowledge from successfully acquiring proficiency in PPA. Several participants mentioned in the interview and questionnaire that they were hindered because they did not learn phonics as a child. Participants also shared it was difficult to learn PPA as an adult who already knows how to read. The participants felt that in-class review and hands-on PPA activities assisted their learning.

This study sought to understand the perceptions of pre-field elementary teachers with limited prior knowledge toward the importance of PPA and their preparedness to teach it. Despite their own limited background in PPA, the participants perceived that PPA was very important for all children to learn as shared in the interviews. Participants felt prepared to teach PPA after the course as indicated on the end of course questionnaire. Some participants noted they would need additional practice before teaching; however, several had already begun using the concepts learned in class in practicum settings and in tutoring sessions.

Limitations

There are several limitations to this study. The participants in this study were purposefully selected from one university. Although multiple data sources were used to triangulate data, there is the potential for researcher bias. The use of three coders and participant checks of transcriptions served to mitigate this limitation. There is also potential bias due to the professor-student relationship that existed in this study. To reduce bias, all communication regarding the study was conducted by a student worker. The professor had no direct communication about the study with the participants.

Discussion

A primary theme from the study was the difficulty participants had in learning PPA. This aligns with other research in which pre-service teachers struggled with learning phonics (Bose, 2018; Salinger et al., 2010; Washburn et al., 2016; Washburn et al., 2011). The participants in this study grew in their understanding of PPA as evidenced by the interview, questionnaire, and test scores. This finding also compares with the findings of Bose (2018) and Salinger et al. (2010) which documented pre-service teacher growth in PPA through literacy methods courses. The pre-service teachers in this study reported feeling prepared to teach PPA at the end of the course. This finding is to be received with caution as some research shows pre-service teachers' self-perceptions regarding preparedness may be higher than their actual performance ability (Washburn et al., 2016; Washburn et al., 2011).

The findings of this study highlight the importance of PPA in literacy methods courses for elementary education pre-service teachers. The participants did not learn or

did not remember learning to read with phonics. Since learning PPA is essential for pre-service teachers (Enhri & Flugman, 2018; Hudson et al., 2021), direct instruction in PPA is needed in literacy methods courses. In addition to content knowledge, pre-service teachers need instructional experiences with PPA. Participants in this study emphasized the importance of coupling content knowledge with hands-on activities to practice teaching the concepts to students. Englert et al. (2020) found that pre-service teachers were more confident in their phonics knowledge when literacy coursework included field experience.

Finally, the findings of this study confirm the difficulty higher education students have in mastering concepts for which they have no prior knowledge. Similar to the findings of Hailikari et al. (2008), the use of pre-assessments can provide beneficial information at the beginning of a course for both professor and students. The professor can use the information to understand the needs of the students while the students can self-assess their own knowledge to determine the effort needed to succeed in the course.

Recommendations for Practice

Based on the findings discussed above, the following recommendations are provided for teacher educators designing literacy methods courses:

1. Incorporate pre-assessments or surveys at the beginning of the course to identify students who may need additional support with PPA.
2. Provide rich instruction in PPA with amble opportunities to practice challenging concepts in and out of class.
3. Utilize manipulatives and hands-on learning activities which simulate how to teach PPA to children.
4. Plan field experiences concurrent with PPA instruction.

Conclusion

Today's elementary students need teachers who are well-prepared in teaching reading. Teacher education programs must ensure the foundational components of reading are incorporated into literacy methods courses. The results of this study confirm that pre-service teachers struggle with learning phonics and phonemic awareness, but even those with limited prior knowledge can learn PPA with support and practice.

References

Al Otaiba, S., & Lake, V. (2007). Preparing special educators to teach reading: Using classroom-based assessments to judge response to intervention. *Reading and Writing: An Interdisciplinary Journal, 20,* 591-617.

Ambrose, S. A., Bridges, M. W., DiPietro, M., Lovett, M. C., & Normal, M. K. (2010). *How learning works: 7 research-based principles for smart teaching*. Jossey-Bass.

Applegate, A. J., & Applegate, M. D. (2004). The Peter effect: Reading habits and attitudes of teacher candidates. *The Reading Teacher, 57*, 554-563.

Binks-Cantrell, E., Washburn, E. K., Joshi, R. M., & Hougen, M. (2012). Peter effect in the preparation of reading teachers. *Scientific Studies of Reading, 16*, 526-536.

Bose. S. (2018). Phonics and phonemic awareness in a teacher preparation program: An analysis of the achievement and perceptions of pre-service teachers. *Association of Literacy Educators and Researchers Yearbook, 40*, 347-365.

Carlise, J., Kelcey, B., Rowan, B., & Phelps, G. (2011). Teachers' knowledge about early reading: Effects on students' gains in reading achievement. *Journal of Research on Educational Effectiveness, 4*, 289-321.

Castles, A., Rastle, K, & Nation, K. (2018). Ending the reading wars: Reading acquisition from novice to expert. *Psychological Science in the Public Interest, 19*(1), 5-51.

Cheesman, E. A., McGuire, J. M., Shankweiler, D., & Coyne, M. (2009). First-year teacher knowledge of phonemic awareness and its instruction. *Teacher Education & Special Education, 32*(3), 270-289.

Ehri, L. C., & Flugman, B. (2018). Mentoring teachers in systematic phonics instruction: effectiveness of an intensive year-long program for kindergarten through 3rd grade teachers and their students. *Reading and Writing, 31*, 425–456.

Ehri, L. C. (2022). What teachers need to know and do to teach letter-sounds, phonemic awareness, word reading, and phonics. *Reading Teacher,* 1-9.

Englert, C. S., Mariage, T. V., Truckenmiller, A. J., Brehmer, J., Hicks, K., & Chamberlain, C. (2020). Preparing special education preservice teachers to teach phonics to struggling readers: Reducing the gap between expert and novice performance. *Teacher Education and Special Education, 43*(5), 235-256.

Hailikari, T., Katajavuori, N., & Lindblom-Ylanne, S. (2008). The relevance of prior knowledge in learning and instructional design. *American Journal of Pharmaceutical Education, 72*(5), 1-8.

Hudson, A. K., Moore, K. A., Han, B., Koh, P. W., Binks-Cantrell, E., & Joshi, R. M. (2021). Elementary teachers' knowledge of foundational literacy skills: A critical piece of the puzzle in the science of reading. *Reading Research Quarterly, 56*(S1), 287-315.

Joshi, R. M., Binks, E., Hougen, M., Dahlgren, M. E., Ocker-Dean, E., & Smith, D. (2009). Why elementary teachers might be inadequately prepared to teach reading. *Journal of Learning Disabilities, 42*(5), 392-402.

Piasta, S. B., Connor McDonald, C., Fishman, B. J., & Morrison, F. J. (2009) Teachers' knowledge of literacy concepts, classroom practices, and student reading growth. *Scientific Studies of Reading, 13*, 224-248.

McCutchen, D., Abbott, R. D., Green, L. B., Beretvas, S. N., Cox, S., Potter, N. S., Quiroga, T., & Gray, A. L.(2002). Beginning literacy: Links among teacher knowledge, teacher practice, and student learning. *Journal of Learning Disabilities, 35*, 69-86.

Mesmer, H. A., & Kambach, A. (2022). Beyond labels and agendas: Research teachers need to know about phonics and phonological awareness. *Reading Teacher*, 1-11.

Moats, L. C. (2009). Knowledge foundations for teaching reading and spelling. *Reading and Writing: An Interdisciplinary Journal, 22*, 379-399.

Moats, L. (2014). What teachers don't know and why they aren't learning it: addressing the need for content and pedagogy in teacher education. *Australian Journal of Learning Difficulties, 19,* 75-91.

National Institute of Child Health and Human Development, NIH, DHHS. (2001). *Put reading first: The research building blocks for teaching children to read*. Washington, DC: U.S. Government Printing Office.

Salinger, T., Mueller, L., Song, M., Jin, Y., Zmach, C., Toplitz, M., Partridge, M., & Bickford, A. (2010). *Study of teacher preparation in early reading instruction* (NCEE 2010-4036). Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education.

Washburn, E., Binks-Cantrell, E., Joshi, R. M., Martin-Chang, S., & Arrow, A. (2016) Preservice teacher knowledge of basic language constructs in Canada, England, New Zealand, and the USA. *Annals of Dyslexia*, *66*(1), 7-26.

Washburn, E., Joshi, R. M, & Binks-Cantrell, E. (2011) Are preservice teachers prepared to teach struggling readers? *Annals of Dyslexia, 61*, 21-43.

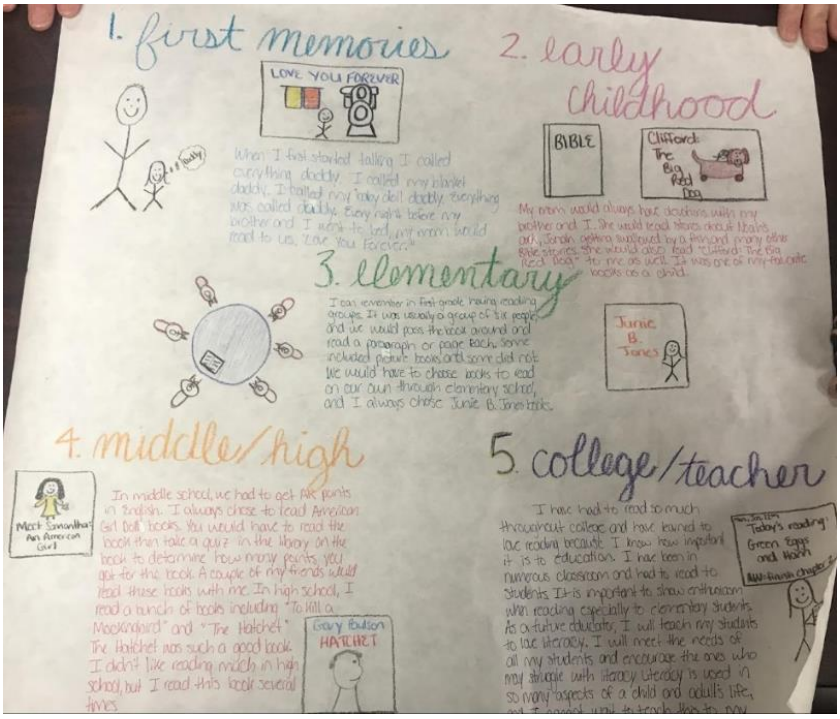
Wong-Fillmore, L., & Snow, C. (2000). What teachers need to know about language. In C. T. Adger, C. E. Snow, & D. Christian (Eds). *What teachers need to know about language* (pp. 7-54). Washington D.C.: Center for Applied Linguistics.

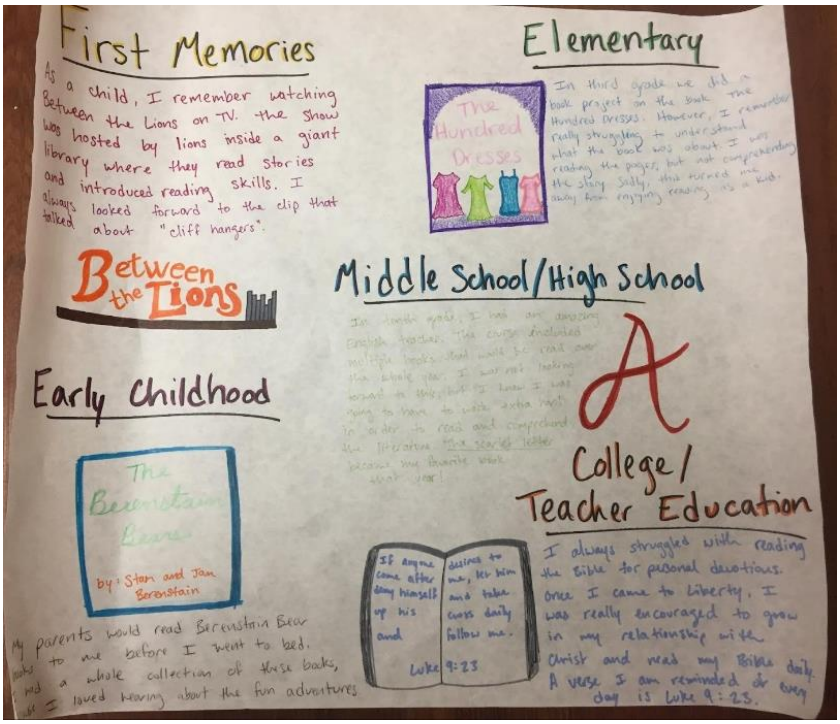
Unrau, N. J., & Alvermann, D. E. (2013). Literacies and their investigation through theories and models. In D. E. Alvermann, N. J. Unrau, & R. Ruddell (Eds.), *Theoretical models and process of reading* (6th ed., pp. 47-90). International Reading Association.

Yin, R. K. (2014). *Case study research design and methods* (5th ed.). Sage.

Appendix A

Literacy Life Map Samples





Appendix B

Interview Questions

1. Describe memories of how you learned to read.
2. What role did phonics play in your learning to read?
3. Do you remember learning phonics? If so, what do you remember?
4. Describe your experience with learning phonics, phonological awareness, and phonemic awareness as a pre-field teacher? Describe your experience with learning phonics, phonological awareness, and phonemic awareness this semester.
5. How important do you think it is for children to learn phonics, phonological awareness, or phonemic awareness?
6. What have been some of the struggles you have faced with learning phonics, phonological awareness, or phonemic awareness this semester?
7. What have been some of the positive aspects about learning phonics, phonological awareness, or phonemic awareness this semester?
8. Why do you think the concepts of phonics, phonological awareness, or phonemic awareness are often difficult for pre-service teachers to grasp?
9. What factors do you believe contribute to the success or difficulty of pre-service teachers in learning phonics, phonological awareness, and phonemic awareness?
10. What recommendations do you, as a pre-service teacher, have for improving the instruction of phonics, phonological awareness, and phonemic awareness in a university literacy methods course?
11. At the end of the course, did you feel prepared (or will you feel prepared) to teach phonics, phonemic awareness, and phonological awareness. Why or why not? Explain your answer in detail.
12. Name two things that you feel would have helped you to be more successful in learning phonics, phonological awareness, or phonemic awareness.

Appendix C

Multi-Case Summary Chart Sample
Coder: PK-12 Practitioner

	Case #1: Jane	Case #2: Mary	Case #3: Susan	Case #4: Diane	Case #5: Kim	Case #6: Lisa	Case #7: Karen
Repeated themes across 4 data sources	-Adults read to her -Enjoyed reading and phonics in school -No longer remembers a lot of the phonics -Won a vocab contest -Loves reading -Feels confident to teach phonics -Learned a lot in the class that she didn't know -Excited to teach reading	-Adults read to her -Read to self -Difficult time reading as a young person -Clueless at beginning of class -Wants to help others learn -Pace of the class is fast	-Adults read to her -Did not like reading -Reading was a family activity -Didn't really learn phonics; just learned words -Wants to be a good reading teacher -Class material very helpful -Not confident yet to teach reading	-Adults read to her -Enjoy reading somewhat -Learned a lot from class -Valued the quizzes/class activities -Ready to teach others	-Adults read to her -Learned a lot from class -Bad experience in 3rd grade -Enjoyed class activities -Learning to enjoy reading again -Enjoyed the class but was challenging -Ready to teach others	-Adults read to her -Remembers picking books to read -Second grade was a special time; enjoyed reading -Enjoys learning how to teach reading/phonics -Learned a lot in the class -Enjoyed class activities and practical application	-Read to self -Memories from 4th grade -Struggled with reading -Enjoys reading more now -Learned a lot from class activities -Learning terms and meanings can be very confusing -Class material difficult -Confident to teach others
Unusual/unique features	-Very little phonics in school	-Requested second chance of quizzes -Wants to learn to help others who struggle	-Very little phonics if any in school	-Skills learned are applicable to life -Easy to confuse terms	-Early memories of learning phonics from TV shows -Bad experience in 3rd grade turned her off to reading	-Enjoyed reading as a young person	-Enjoys reading more now -Learned a lot from class -Confident to help others
Other Notes	-Point Growth of 17 - Junior -1/2 to 1 hour	-Point Growth of 10 - Junior -1/2 to 1 hour	-Point Growth of 23 - Junior -1/2 to 1 hour	-Point Growth of 8 - Junior -2 to 2.5 hours	-Point Growth of 26 - Sophomore -1/2 to 1 hour	-Point Growth of 25 - Sophomore - Adding SPED -1.5 to 2 hours	-Point Growth of 9 - Junior - Adding SPED -1/2 to 1 hour

Exploring Technology Competencies of Field-Based Teacher Educators

Abdulsalami Ibrahim
Oliver Dreon, Jr.

Abstract: Drawing on a sample of 124 cooperating teachers in four school districts, this study examined the Teacher Educator Technology Competencies (TETCs) of field-based teacher educators. While the study showed no significant differences in the TETCs possessed by participating cooperating teachers, it offers important considerations and implications for continuing research.

About the Authors: *Abdulsalami Ibrahim, D.Ed. is an Assistant Professor in the Department of Educational Foundations at Millersville University of Pennsylvania. Oliver Dreon, Jr., Ph.D. is a Professor in the Department of Educational Foundations at Millersville University of Pennsylvania.*

Introduction and Background

Field experiences are an essential component of teacher preparation programs (Darling-Hammond & Lieberman, 2013). During their field experience, teacher candidates learn to teach and interact with students, teachers, and staff within the school setting (Jaspers et al., 2014). As they navigate these field experiences, teacher candidates learn from cooperating teachers when they modeled and continued to challenge their thoughts about the process of teaching from the tremendous feedback they receive during their time in the classroom (Kang, 2016). While cooperating teachers are veteran teachers who are knowledgeable in their areas of expertise and experienced in the school settings and culture (Mckingley, 2021), the evolution of physical and virtual learning environments has expanded the practices and strategies that cooperating teachers must know and model. Considering the developments in educational technology and the impacts on teaching and learning, there has been a growing need for cooperating teachers to be knowledgeable in instructional technology and integration practices (Zhao et al., 2015). While cooperating teachers play a critical role in supporting teacher candidates' growth, little is known about their technological knowledge base or their abilities to model effective technology integration.

Statement of the Problem

Teacher preparation programs thrive through the interplay of collegiate curriculum and field-based clinical experiences (Zeichner, 2010). As teacher candidates navigate their campus education courses, they develop an understanding of pedagogy, content area, and instructional technology. While teacher candidates often learn about the nature and utility of educational technologies through campus course work, they rely on field experiences to fully understand how educational technologies can be used effectively with classroom students. Examining the impact of field experiences on teacher candidates' technology use, Meagher et al. (2011) write about the need for cooperating teachers' modeling of "exemplary practice to convince (teacher candidates) of the benefits of working to incorporate technology in their own teaching" (p. 245). Despite this need, little research has examined the technological competencies possessed by cooperating teachers.

Purpose

Through the field-based experiences they facilitate, cooperating teachers provide critical training to teacher candidates. In a way, cooperating teachers serve as de facto teacher educators, modeling effective pedagogy that integrates technology in real classroom environments. While these field-based experiences are critical to new teachers' understanding of technology integration, little is known about cooperating teachers' technological backgrounds or their self-efficacy with using technology to support student learning. This research seeks to examine these constructs.

This research builds on the recently released Teacher Educator Technology Competencies (TETCs). Drawing on the United States Department of Education's 2017 National Educational Technology Plan, Foulger et al. (2017) identified a list of 12 technology-based competencies so that teacher educators could provide consistent and appropriate experiences with technology for teacher candidates. Knezek et al. (2019) developed and validated a 12-item Likert-style survey which can be used to examine teacher educators' technology competencies. Ultimately, the research seeks to deliver on the stated hope of Knezek et

al. where "teacher education programs could use the instrument as a tool to guide teacher educator professional development focused on enhancing the integration of technology to prepare future teachers" (2019, p. 466). Through the use of this survey, we hope to gain a broader understanding of the technology competencies possessed by cooperating teachers.

Research Questions

This study is guided by the following research questions:

1. How do cooperating teachers self-assess their TETCs?
2. How do cooperating teachers' content area, level of education, experience and knowledge influence their TETCs?

Since the TETCs survey relies heavily on cooperating teachers' self-reported assessments, the results in this study may be influenced by participants' experiences and perceptions.

Review of Related Literature

Cooperating teachers are at the core of providing teacher candidates with the necessary mentoring to develop as effective teachers. While different institutions of higher education use different terminology to describe these roles (e.g., "cooperating teachers," "mentor teachers," "field-based teacher educators"), a supportive, experienced mentor during a field experience is critical to a teacher candidate's development. Butler and Cuenca (2012) recognize this important role by describing the cooperating teacher as an instructional coach, as an emotional support system, and as a socializing agent within the school community. Beyond these roles, however, research shows that the training and experience of cooperating teachers can have a positive impact on teacher candidates' success and growth during a field experience (Garies & Grant, 2014).

Mentoring teacher candidates to integrate technology requires a technology savvy cooperating teacher during a field experience. Here, developing student-teacher technology self-efficacy would play a critical role. Krause (2017) conducted a study to explore teacher candidates' technology integration self-efficacy. Findings revealed that "(teacher candidates') self-efficacy to integrate technology into physical education significantly improved over the course of student teaching" (p. 476). The researcher credited this improvement to the mentoring from the cooperating teacher.

Cooperating Teachers Technology Competencies

The National Education Technology Plan sets some profound expectations for educators that will enable them to be competent in technology integration for teaching (U. S. Department of Education, 2010). In our classrooms today, "teachers not only need to use technology effectively in their teaching, but they also need to guide students in using those tools to enhance their learning" (Smaldino, et al., 2019; p. 29). This charge means that educators must stay current with their technological knowledge and continuously update their technological competencies (Smaldino et al., 2019).

Stakeholders in education, especially in educational technology, prescribe some set of technology standards that will guide the practice of educators and students in a technology mediated learning environment. For example, the Association for Educational Communications and Technology (AECT) and the International Society for Technology in Education (ISTE) have developed technology standards for

practice (Lever-Duffy & McDonald, 2018; Smaldino et al., 2019). While the AECT presented "five standards that guide the field in ensuring candidates in the education profession possess the competencies necessary to create high-quality, systematic instructional design that effectively includes technology" (Lever-Duffy & McDonald, 2018, p. 7). The ISTE standards identify essential skills and knowledge for students in the contemporary digital age and assume that "teachers are able to model and apply the standards articulated for students" (Lever-Duffy & McDonald, 2018, p. 5). From ISTE's perspective, a teacher candidate assumes two roles, as a mentee (student) learning from a mentor teacher, and as a teacher, leveraging technology as they instruct learners. Thus, ensuring effective modeling of teaching in a digital age classroom.

Overall, the development of the Teacher Educator Technology Competencies (TETCs) was supported by many organizations including The United States Department of Education Office of Educational Technology (US DoE), International Society of Technology in Education (ISTE), Society for Information Technology and Teacher Education (SITE), Council for the Accreditation of Educator Preparation (CAEP), National Technology Leadership Coalition (NTLC), and American Association of Colleges of Teacher Education (AACTE). Foulger et al. (2017) explain that TETCs "were developed to support the redesign of teaching in teacher education programs so that all teacher educators are prepared to model and integrate technology in their teaching" (p. 253). Table 1 presents a summary of TETCs as presented by Foulger et al. (2017).

Table 1: *Technology Competencies for Teacher Educators (TETCs)*

TETCs
1. Teacher educators will design instruction that utilizes content-specific technologies to enhance teaching and learning.
2. Teacher educators will incorporate pedagogical approaches that prepare teacher candidates to effectively use technology.
3. Teacher educators will support the development of the knowledge, skills, and attitudes of teacher candidates as related to teaching with technology in their content area.
4. Teacher educators will use online tools to enhance teaching and learning.
5. Teacher educators will use technology to differentiate instruction to meet diverse learning needs.
6. Teacher educators will use appropriate technology tools for assessment.
7. Teacher educators will use effective strategies for teaching online and/or blended/hybrid learning environment.
8. Teacher educators will use technology to connect globally with a variety of regions and cultures.
9. Techer educators will address the legal, ethical, and socially responsible use of technology in education.
10. Teacher educators will engage in ongoing professional development and networking activities to improve the integration of technology in teaching.
11. Teacher educators will engage in leadership and advocacy for using technology.
12. Teacher educators will apply basic troubleshooting skills to resolve technology issues.

TETCs adopted from https://site.aace.org/tetc

The application of technology competencies requires a high level of commitment from teacher educators. Foulger et al. (2017) emphasize that, "teacher educators can and should not ignore their responsibility and commitment to the ever-changing nature of technology and its role in society and PK-12 schools" (p. 252). In many ways, the TETCs represent the Technological Pedagogical Content Knowledge (TPACK) which teacher educators must possess and model both in collegiate classrooms and in field experiences. TPACK encompasses a teacher's understanding of the pedagogical techniques that allow technologies to be integrated appropriately into classroom environments in order to teach content in unique and differentiated manners.

TPACK as a body of knowledge is not a single entity. It is formed through the development and intersection of other bodies of knowledge (content knowledge, pedagogical knowledge, technological knowledge) critical for a teacher's success. Looking across these knowledge types and their intersections, it becomes apparent that teachers need to know more than just how to use computers to effectively incorporate technology into classroom environments. Instead, successful technology integration requires that teachers "go beyond their knowledge of particular disciplines, technologies, and pedagogical techniques in isolation" and draw on "a contingent, flexible kind of knowledge that lies at the intersection of all three of these knowledge bases" (Mishra & Koehler, 2009, p.16)

Typically, stand-alone educational technology courses for teacher candidates focus on the development of technological knowledge. While the development of TPACK requires that teacher candidates acquire technological knowledge, it also requires a shift in focus from simply learning a baseline list of technologies to developing an understanding of how technology "can be integrated successfully into content-based learning at different levels" (Harris, et al., 2009). TPACK development, Mishra and Koehler argue, requires "a deep experiential understanding, developed through training and deliberate practice, of all the aspects of the TPACK framework and how they interact with each other" (2009). To do this effectively, technology-rich field experiences where exemplary practices can be modeled are paramount (Mouza, 2016). The modeling that teacher candidates receive during a field experience, however, depends heavily on cooperating teachers and the TETCs they possess.

Since the TETCs were released in 2017, there has been a dearth of research that explores teacher educators' technology competencies and how cooperating teachers apply them in their classroom technology integration practices. This research examines how cooperating teachers assess their technology competencies and how they draw on this knowledge base in their work with the teacher candidates they support.

Methodology

This study employs a descriptive approach in conjunction with survey design (Creswell, 2013). A descriptive approach is used to "describe a phenomenon and its characteristics" (Nassaji, 2015, p. 1). It enables researchers to obtain information about the phenomenon which will enable them to describe the event in respect to the situation under study. In terms of generalization, surveys are an important data collection instrument in a descriptive study. This is because, "surveys have a particular strength with regard to objectivity because of the use of easily examined and reproduced questionnaires to generate data" (Morgan, 2014, p. 55). Researchers adopted

this approach because the study involves the collection of numerical data through surveys to explore educator technology competencies.

Population and Sample

The population for this study comprised cooperating teachers from partner districts who mentored a teacher candidate from a regional comprehensive university in the northeastern United States during the fall 2020 and spring 2021 semesters. Researchers adopted a convenience sampling method (Creswell, 2012) which allows researchers to collect data within partner school districts with the permission of the district superintendents. The researchers chose this sample due to the district's ongoing partnerships with the university and their continued support of university teacher candidates.

In April 2021, 124 cooperating teachers from the four partner districts were contacted through email and were invited to complete the TETCs survey (Knezek et al., 2019). The partner districts included: Carter Valley, Hillview, Lincoln, and Prairie Mount (pseudonyms). All four districts reside in suburban areas and range in size, with Lincoln School District being the smallest (200 teachers, 3000 students) and Hillview School District being the largest (500 teachers, 6800 students). The invitation recorded a high response of n = 70 (86.8% response rate) and participation spanned across all four partner school districts: Carter Valley (25 respondents, 35.7% of sample), Hillview (14, 20.0%), Lincoln (11, 15.7%), and Prairie Mount (20, 28.6%)

Examining the demographics of the responding cooperating teachers, it was clear that the invitation drew a diverse population of individuals in terms of years of experience, content area taught, and mentoring experience. While 64.3% of the respondents reported more than 16 years of teaching experience, the survey also included teachers with 0 – 5 years of experience (2.8%), 6-10 years of experience (12.8%), and 11-15 years of experience (18.5 %). The respondents identified as English/language arts teachers (22.8%), social studies teachers (11.4%), technology education teachers (8.5%), science teachers (5.7%), mathematics teachers (5.7%), and art teachers (4.2%). When completing the survey, roughly 38% of the responding cooperating teachers selected "Other" as their content area, possibly reflecting the interdisciplinary nature of their teaching roles within their district. The survey also elicited responses from an experienced group of cooperating teachers. The majority (62.8%) of respondents had mentored more than 6 teacher candidates over their teaching careers.

Data Collection and Analysis

The primary instrument used for this study was the TETCs Survey (Knezek et al., 2019). The TETCs Survey (see Table 2) consists of 12 Likert-type questions that examine teacher educators' perceptions of their technology competencies. Each of the 12 Likert-type questions corresponds to one of the Teacher Educator Technology Competencies (see Table 1) and asks participants to self-assess their abilities. The survey was initially validated through the participation of 223 participants from North America, Europe and the Asia/Pacific Region and found to be a highly reliable instrument (alpha = .95) (Knezek et al., 2019).

In addition to the 12 Likert-type questions, several demographic questions (district, grade level, content area, years of teaching experience, education level, etc.) were included to help identify influencing

factors that may impact participants' technology competencies. The survey also included one open-ended survey question which examines the technological challenges participants encountered while mentoring teacher candidates during the pandemic. Responses were exported from Qualtrics to SPSS for data analysis to identify critical trends that influence cooperating teachers' TETCs knowledge. Both descriptive and inferential statistical analysis were conducted to determine the pattern and relationships that exist within data collected. To analyze the responses to the open-ended questions, participants' responses were grouped into thematic clusters and examined for emergent trends (Creswell, 2012).

Results

In this section, we present results from the two research questions explored in this study – 1) How do cooperating teachers self-assess their TETCs? 2) How do cooperating teachers' level of education, experience and knowledge influence their TETCs? While presenting and discussing results, school district names will not be used, and the data will be reported in aggregate.

Cooperating teachers' self-assessment of their technology competency

This research included all 12 questions from TETCs survey that was validated by Knezek et al. (2019). Findings revealed cooperating teachers reported a high degree of technology competency with a high percentage of educators' responses within agree and strongly agree in almost all areas. Some degree of variation, however, was observed in three items: i) use of technology to connect globally with a variety of regions and cultures (majority of respondents n = 24; 34.3% maintained a neutral position on this item); ii) address the legal, ethical, and socially responsible use of technology in education (n = 18, 25.7% of respondents were neutral), and iii) engage in leadership and advocacy for using technology (n = 22; 31.4% were neutral on this item). Table 2 shows detailed responses generated from cooperating teachers' self-assessment of their technology competence.

Table 2: *Cooperating Teachers Technology Self-Assessment*

I feel confident that I could….	Strongly disagree n(%)	Some-what disagree n(%)	Neither agree nor disagree n(%)	Some-what agree n(%)	Strongly agree n(%)
Use online tools to enhance teaching and learning	1(1.4)	-	1(1.4)	16(22.9)	52(74.3)
Use technology to differentiate instruction to meet diverse learning needs	1(1.4)	-	1(1.4)	28(40.0)	39(55.7)
Use appropriate technology tools for assessment	1(1.4)	2(2.9)	2(2.9)	28(40.0)	37(52.9)
Use effective strategies for teaching online and/or	-	2(2.9)	2(2.9)	28(40.0)	37(52.9)

blended/hybrid learning environments					
Use technology to connect globally with a variety of regions and cultures	4(5.7)	7(10.0)	24(34.3)	18(25.7)	16(22.9)
Address the legal, ethical, and socially responsible use of technology in education	1(1.4)	3(4.3)	18(25.7)	35(50.0)	13(18.6)
Engage in ongoing professional development and networking activities to improve the integration of technology in teaching	1(1.4)	1(1.4)	4(5.7)	34(48.6)	30(42.9)
Engage in leadership and advocacy for using technology	1(1.4)	3(4.3)	22(31.4)	31(44.3)	13(18.6)
Apply basic troubleshooting skills to resolve technology issues	1(1.4)	1(1.4)	6(8.6)	36(51.4)	26(37.1)
Design instruction that utilizes content specific technologies to enhance teaching and learning	1(1.4)	1(1.4)	4(5.7)	33(47.1)	31(44.3)
Incorporate pedagogical approaches that prepare teacher candidates to effectively use technology	-	2(2.9)	10(14.3)	30(42.9)	28(40.0)
Support the development of the knowledge, skills, and attitudes of teacher candidates related to teaching with technology in their content area	-	2(2.9)	3(4.3)	31(44.3)	34(48.6)

While participating cooperating teachers assessed their TETCs relatively high, they identified several challenges in drawing on this knowledge base to support their teacher candidates. Since the survey was sent during the COVID-19 pandemic, the survey included an open-ended question that explored challenges faced by cooperating teachers during the pandemic. Table 3 presents a summary of the challenges discussed and the number references made by cooperating teachers.

Table 3: *Challenges faced by Cooperating Teachers*

Challenges	f	Sample Quote
Lack of knowledge of LMS	9	"Regardless of the pandemic, I had to teach (the teacher candidate) the basic functionality of Schoology."
Lack of full access to school's LMS	6	"They don't have the same level of access to our LMS, so it makes things tricky with providing them an authentic teaching experience with developing lessons within the LMS."
Internet connection	7	"Inconsistent internet connection for students working from home."
Teacher candidates lack technology knowledge	6	"(The teacher candidate's) lack of understanding of how to teach using technology resources."
Communication	8	"When working in the virtual world, communication can be an issue. So much is lost in expression and body language. There are always times when the technology does not work, and we are forced to make changes on the spot."

Cooperating teachers' content area, level of education, experience and knowledge and application of TETCs

For this item, researchers examined the influence of demographic factors on cooperating teachers' technology competency. These factors included content area (primary teaching subject), years of teaching experience, and level of education. To analyze data generated for this item, researchers ran Pearson correlation coefficient on each of these factors against teachers' self-assessment of their technology competency. Findings revealed that there was no significant correlation between cooperating teachers' self-assessment of their technology competency and any of the demographic factors identified.

Discussion of Findings

While this study garnered strong participation from cooperating teachers in partner schools, the results did not yield any significant differences across cooperating teachers' self-assessment of their technology competencies. Findings from this study revealed that cooperating teachers reported a high degree of technology competency across almost all areas identified in TETCs, except in a few areas. While some technology competency areas (global use, ethical use and advocacy) showed more neutral positions from participating cooperating teachers, these did not prove to be significant. These findings corroborated several research findings in this area. For example, Burrows et al. (2021) studied educators' technology competencies in a secondary education program at Mountain West university. Findings suggest that educators' to be "meta-experts" where they can integrate technology and align it so well with content-specific interactions. Conversely, Herro et al. (2021) explored educators' perspectives and practices towards technology education TETCs. Findings revealed that educators exhibit a high degree of technology competencies, however, were weak in their application of these competencies in teaching. Results from our current study and the findings from

Herro et al's (2021) studies may still communicate several important findings.

First, while the TETCs survey developed by Knezek et al. (2019) was validated with teacher educators from a dozen universities in the United States, Europe, and the Asian/Pacific Region, it was not used previously with cooperating teachers. Since the survey did not show any broad variability in cooperating teachers' assessment of their TETCs, it could prompt an examination of the applicability of the survey to this population. Since the TETCs survey relies heavily on participants' self-assessment of their technology competency, it may not fully capture cooperating teachers' ability regarding technology integration and use. In line with this, Carpenter, et al. (2019) also explored teacher educators' perceptions of their TETCs. Findings revealed teachers' high degree of TETCs across all the items and reported high mean scores for all items except for "*teacher educators will use technology to connect globally with a variety of regions and cultures"* (M = 3.057, SD = 1.311), which obtained a considerably lower mean score compared to scores obtained for other items. This corroborates with findings in this current study, where the majority of respondents (n = 24, 34.3) maintained a neutral position. Findings from both studies indicated that this is an area of concern in educators' TETCs application. Additional research including observations and interviews would provide a more holistic picture of cooperating teachers' technology competency.

When examining the results from this study, the influence of the pandemic should not be discounted. Since the survey was administered almost 12 months into the COVID-19 pandemic, cooperating teachers had much broader access to technology. Examining the surge of technology use during the pandemic, an Education Next report (2020) reported on the EdTech300, an index of the use and engagement of the 300 most used educational technologies daily. Analyzing data from thousands of schools and district with over 2 million students and teachers, LearnPlatform calculated the EdTech300 and saw that it increased from 141.668 on March 5th, 2020, prior to COVID-19 pandemic to +18.021 (18.72%) during the third week of global pandemic and the school closure – April 2nd, 2020 (Rectanus, 2020). As online and remote teaching became more prevalent nationwide, cooperating teachers grew more accustomed to using technology to interact with their students and teacher candidates through synchronous and asynchronous means. The expansion in access and use of technology during this time could have a strong influence on the cooperating teachers' assessment of their technological competency.

While the true impact is unknown, the results identify that all cooperating teachers report possessing a high level of technology competency regardless of years of experience, content area, grade level or other demographic qualifiers. This is important information for teacher education programs that have increased field experiences to better bridge theory and practice for teacher candidates. For example, the participating university uses a Professional Development School model where the majority of teacher candidates spend an extended amount of time in the classroom through the partnership (Parker, et al. 2016). With the high level of technology competencies that cooperating teachers reported, universities may be confident that technology integration is being effectively modeled for teacher candidates during their internships. The findings from this study also strongly suggest that cooperating teachers' demographic factors-level of education,

experience and knowledge has no significant on their application of TETCs while mentoring teacher candidates. Future research including other forms of data (observations, interviews, etc.) may confirm whether these self-reported assessments are reflected in cooperating teachers' classroom practices.

Implications for Practice

This research offers significant implications for schools and institutions of higher education. Through robust analysis of the survey data, this research can inform professional development opportunities and guide programming for cooperating teachers and teacher candidates. Since cooperating teachers play such a critical role in modeling technology practices to beginning teachers, this research can provide important information about the technology competencies and how they are reflected in the field experiences teacher candidates encounter. The research also pointed to a strong partnership that exists between the university's teacher preparation programs and partner school districts. During this critical time, the university provided a technology professional development in the form of a virtual conference to the partner school districts during the summer of 2020 and 2021. Both these conferences recorded a high participation rate across partner school districts and received a positive review from participants. Moving forward to continue to strengthen this partnership, the university will continue to work with school districts and find avenues to present the TETCs and invite educators to fully integrate those competencies into teaching and learning.

Suggestions for Future Research

The study explored technology competencies of field-based teacher educators and it was conducted during COVID-19 pandemic where schools around the world have embarked on online/remote instruction across all grade levels. Based on findings generated from this study, researchers have more questions regarding cooperating teachers' TETCs than answers from this research. We provide the following suggestions for future research:

- Is the TETCs survey reliable for field-based teacher educators? The TETCs instrument used for this study was designed and validated with collegiate teacher educators working in university settings. Further research could identify whether the survey is a reliable instrument for field-based teacher educators or whether a different instrument is needed.
- Did the pandemic offer unprecedented opportunities for technology-related professional development? Since this research was conducted a year after the COVID-19 pandemic forced closure of many face-to-face classrooms, the results may be impacted districts' rapid move to remote and online instruction. To continue instruction amidst the pandemic, many districts purchased new equipment and offered expanded professional development opportunities to educate teachers on technology use and integration. The high levels of TETCs reported by the participating cooperating teachers could be the result of these factors. To uncover these impacts, qualitative research could better detail the professional development experienced by teachers in different schools.
- Are field-based teacher educators over-reporting their technology competency? Since the TETCs

survey relies heavily on cooperating teachers' self-reported assessments, the results in this study could be skewed due to participant over-reporting. Incorporating other forms of data such as interviews or classroom observations would offer a fuller picture of the technological competencies which cooperating teachers possess and model.

- Did the ongoing partnership help to offer "reverse mentoring" to cooperating teachers? The sample population for this study included only those teachers who had mentored a teacher candidate in the previous academic year. Due to the nature of the ongoing partnerships with the districts, the vast majority of participants had mentored more than six teacher candidates during their careers. Hosting and mentoring a teacher candidate could serve as professional development for the cooperating teachers, with teacher candidates acting as "reverse mentors" (Aydin, 2017). A comparative study that examined technological competencies of individuals who had mentored teacher candidates with those who had not could detail the impacts of these processes.

Conclusion

Field experience is an essential component of teacher preparation programs. Both traditional and alternative teacher preparation programs emphasize field-based experiences for the development of teacher candidates' teaching and technology competencies. Through the field-based experiences they facilitate, cooperating teachers provide critical training to teacher candidates. In a way, cooperating teachers serve as de facto teacher educators, modeling effective pedagogy that integrates technology in real classroom environments. While these field-based experiences are critical to new teachers' understanding of technology integration, this research sought to uncover the technological competencies that cooperating teachers possess. Despite a large pool of respondents, this research found no significant differences between the competencies of the participating cooperating teachers. Although this could communicate a high level of technological ability of the participating cooperating teachers, it also suggests the need for further research into this population of teacher educators.

References

Aydin, B. (2017). Three birds with a stone: Technology integration in language education with reverse mentoring model. *Journal of Teacher Education and Educators*, *6*(2), 177-190.

Butler, B. M., & Cuenca, A. (2012). Conceptualizing the roles of mentor teachers during student teaching. *Action in Teacher Education*, *34*(4), 296-308.

Burrows, A. C., Swarts, G. P., Hutchison, L., Katzmann, J. M., Thompson, R., Freeman, L., ... & Reynolds, T. (2021). Finding spaces: Teacher education technology competencies (TETCs). *Education Sciences*, *11*(11), 733.

Carpenter, J., Rosenberg, J., Dousay, T., Romero-Hall, E., Kessler, A., Phillips, M., ... & Krutka, D. (2019, March). *What do teacher educators think of teacher education*

technology competencies? In Society for Information Technology & Teacher Education International Conference (pp. 796-801). Association for the Advancement of Computing in Education (AACE).

Creswell, J. W. (2012). *Educational research: Planning, conducting, and evaluating quantitative and Qualitative research* (4thEd.). Pearson.

Creswell, J. W. (2013). Steps in conducting a scholarly mixed methods study. DBER speaker series. Paper 48. https://digitalcommons.unl.edu/dberspeakers/48/

Darling-Hammond, L., & Lieberman, A. (Eds.). (2013). *Teacher education around the world: Changing policies and practices*. Routledge.

Foulger, T.S., Graziano, K.J., Slykhuis, D., Schmidt-Crawford, D., & Trust, T. (2016). Invited commentary: The time is now! Creating technology competencies for teacher educators. *Journal of Technology and Teacher Education, 24*(3), 249-256.

Gareis, C. R., & Grant, L. W. (2014). The efficacy of training cooperating teachers. *Teaching and Teacher Education, 39*, 77-88.

Herro, D., Visser, R., & Qian, M. (2021). Teacher educators' perspectives and practices towards the Technology Education Technology Competencies (TETCs). *Technology, Pedagogy and Education, 30*(5), 623-641.

Jaspers, W. M., Meijer, P. C., Prins, F., & Wubbels, T. (2014). Mentor teachers: Their perceived possibilities and challenges as mentor and teacher. *Teaching and Teacher Education, 44*, 106-116.

Kang, H. (2016). The role of mentor-student teacher relationships in building standards-based elementary mathematics teaching pedagogy. *Journal of Educational Research and Innovation, 5*(2), 1-21.

Knezek, G., Christensen, R., & Furuta, T. (2019). Validation of a teacher educator technology competencies survey. *Journal of Technology and Teacher Education, 27*(4), 465-498.

Koehler, M., & Mishra, P. (2009). What is technological pedagogical content knowledge (TPACK)? *Contemporary Issues in Technology and Teacher Education, 9*(1), 60-70. https://www.learntechlib.org/primary/p/29544/.

Krause, J. M. (2017). Physical education student teachers' technology integration self-efficacy. *Physical Educator, 74*(3), 476 – 496.

Lever-Duffy, J., & McDonald, J. B. (2018). *Teaching and learning with technology*. Pearson

Meagher, M., Ozgun-Koca, A., & Edwards, M. T. (2011). Pre-service teachers' experiences with advanced digital technologies: The interplay between technology in a pre-service classroom and in field placements. *Contemporary Issues in Technology and Teacher Education, 11*(3), 243-270.

McKingley, D. (2021). The importance of mentoring new teachers. *INcompassing Education*. http://incompassinged.com/2017/07/14/the-importance-of-mentoring-new-teachers/

Morgan, L. D. (2014) Integrating qualitative and quantitative methods: A pragmatic approach. Sage

Nassaji, H., (2015). Qualitative and descriptive research: Data types versus data analysis. *Language Learning Research, 19*(2), 129-132.

Parker, A. K., Parsons, S. A., Groth, L., & Brown, E. L. (2016). Pathways to partnership: A developmental framework for building PDS relationships. *School-University Partnerships, 9*(3), 34-48.

Rectanus, K. (2020). *Access to education technology is not enough: Three key steps states can take to make sure remote learning works for everyone.* https://www.educationnext.org/access-education-technology-not-enough-three-steps-remote-learning-works/

Smaldino, S. E., Lowther, D. L., Russell, J. D., & Mims, C. (2019). *Instructional technology and media for learning.* Pearson

U. S. Department of Education (2010). National education technology plans. www.ed.gov/technology/netp-2010

Zhao, Y., Zhang, G., Lei, J., & Qiu, W. (2015). *Never send a human to do a machine's job: Correcting the top 5 edtech mistakes*. Corwin Press

Realistic vs. Effective: An Analysis of Educators' Perceptions of Traditional and Co-teaching Models of Student Teaching

Patricia Joergensen
Jennifer L. Fisler

Abstract: Using the Danielson Framework for Teaching, we compare educators' perceptions of the effectiveness of traditional and co-teaching student teaching models. This study frames student teaching as a community of practice with Vygotsky's Zone of Proximal Development as a key feature of the experience. This study uses a mixed methods sequential design. Our data indicate the co-teaching model outperforms the traditional student teaching model on all Danielson components and was preferred by the majority of our participants. Recommendations for teacher preparation and further study of student teaching are discussed.

About the Authors: *Patricia Joergensen is a Professor of Education at Holy Family University. Jennifer Fisler is Professor of Education and Dean of the School of Graduate and Professional Studies at Messiah University.*

Introduction

The student teaching experience serves as the capstone element of a teacher preparation program. As the bridge between theory and practice, student teaching is the culminating opportunity for careful mentoring and supervised teaching prior to induction as a new teacher. Through analysis of data collected via survey and interview with cooperating teachers and university supervisors, this study seeks to assess educators' perceptions of the effectiveness of a co-teaching versus a traditional model for student teaching. As it is used widely in our state and region, we use the Danielson Framework for Teaching to guide our definition of effectiveness.

For the purposes of this study, we are defining the two models as follows. Both models of student teaching place one student teacher with one cooperating teacher in the respective content and grade band certification area for an extended period of time, typically in a student's last year in a teacher preparation program. In the traditional model, the student teacher observes in the classroom early on and then gradually takes on classroom responsibilities while the cooperating teacher reduces his/her involvement in the classroom. The goal is for the student teacher to acquire and maintain responsibility for as many of the cooperating teacher's tasks as possible. The cooperating teacher provides support and feedback before and after teaching episodes with the support being gradually diminished as the student teacher gains experience. Near the end of the experience, the student teacher hands back responsibilities to the teacher.

In the co-teaching model, the student teacher is actively involved in the classroom from the first day of the experience and continuing through the field placement. Both the student teacher and the cooperating teacher are actively involved in planning, delivery, assessment and evaluation of the teaching responsibilities throughout most of the experience. Modeling and feedback are provided before, *during*, and after instruction. The student teacher is provided with some opportunities for solo teaching, but the main shift happens when the student teacher begins taking the lead with the student teacher directing the work of the cooperating teacher. "While collaboration may occur in the traditional model, it is not the principle organizing [the] approach and some argue that the complexity of learning to teach in the current context demands collaboration" (Rabin, 2020, p. 135). It is this assumption that led the current researchers to implement and then study the co-teaching model of student teaching in our teacher education programs.

While some researchers and practitioners have shifted to using the term "apprentice teaching" (Friend, et. al., 2015) rather than "co-teaching" to describe the scenario in which a licensed teaching is working with a pre-service teacher, we continue to use "co-teaching" as it is the term still used by the initiators of the model in which our teacher preparation programs were trained, and it is still used in much of the research literature to highlight the goal of a truly shared classroom even with a non-licensed co-teacher (Rabin, 2020; Sebald et al., 2021).

Research Literature

The co-teaching model for professional educators is not new to K-12 education. It has become more popular as schools seek to address the broad needs of children with special educational and/or English language learning needs (Sacks, 2014). Typically, in the K-12 environment, co-teaching involves a licensed general education teacher collaborating with a licensed educational specialist such as a special education teacher, speech therapist,

ESL (English as a Second Language) teacher or a paraprofessional or parent volunteer. Seeing the applications of co-teaching with two licensed teachers (Cook & Friend, 1995), St. Cloud State University was among the first universities in the United States to begin implementing and researching co-teaching as a model for preparing new teachers. Through a multi-year study of student teachers in the co-teaching model, researchers at St. Cloud State demonstrated that this model holds great potential for positive outcomes for student teachers, cooperating teachers, and K-12 students. Their data on benefits and positive outcomes for student teachers, K-12 learners, and cooperating teachers is compelling (Washut-Heck, & Bacharach, 2015/2016). Because of their success, their model of teacher preparation using the co-teaching model has expanded to many teacher preparation programs across the country (Sebald, et. al, 2021).

Co-teaching contexts provide opportunities for teachers to collaborate with colleagues, provide social and professional support for one another, and more effectively meet student learning and behavioral needs (Murawski & Bernhardt, 2015/2016; Sebald et al., 2021). Wassell and LaVan (2009) found that co-teaching during student teaching may impact beginning teachers' operating schema for being a teacher. Gallo-Fox (2009) responded to Wassell and LaVan's work (2009) by positioning co-teaching as a driver of a classroom culture informed by a belief in the shared responsibility for teaching and learning and the actions needed to support such a learning classroom environment. Moreover, Washut-Heck and Bacharach (2012) found that co-teaching in the student teaching context led to enhanced professional dispositions (enthusiasm, reliability, responsibility, initiative, and sensitivity and responsiveness to the needs of students and staff) for the student teachers compared to non-co-teaching student teachers. In terms of transferability of skills, co-teaching allows teachers to develop reflective practices they will use in their future teaching careers (Murphy,et al., 2009).

Theoretical Framework

Communities of practice are powerful means of learning and development (Lave & Wenger, 1991). "As a locus of engagement in action, interpersonal relations, shared knowledge and negotiation of enterprises, such communities hold the key to real transformation - the kind that has real effects on people's lives" (Wenger, 1998, p. 85). Communities of practice are characterized by three dimensions: mutual engagement, a joint enterprise, and a shared repertoire (Wenger, 1998) that can all be seen in the student teaching experience. The primary purpose of the student teaching experience is to prepare the student teacher to take on the future role of a classroom teacher. To accomplish this, the cooperating teacher, student teacher, and university supervisor are all actively involved in the student teacher's professional development (NCATE, 2010). A joint enterprise "is their (the participants') negotiated response to their situation and thus belongs to them in a profound sense" (Wenger, 1998, p. 77). In student teaching, a shared understanding of what constitutes a lesson plan, specific vocabulary, and classroom routines are all examples of a shared repertoire.

Within a community of practice, the zone of proximal development (ZPD) is a key feature in the development of the identity, beliefs, and practices of student teachers. The ZPD lens is important in examining the distinctive characteristics of the co-teaching model. Links between

Vygotsky's zone of proximal development (ZPD) and co-teaching are documented in the research literature (Ash & Levitt, 2003; Jones et al., 1998; Murphy et al., 2015).

Co-teaching is a means of scaffolding and is closely aligned with ZPD. Scaffolding is made explicit in the co-teaching model through co-planning, real-time feedback on lessons, and joint reflection on the classroom experience. Through co-teaching, the cooperating teacher becomes aware of the student teacher's "dynamic developmental state" (Vygotsky, 1978, p. 87), those areas that are in the process of formation within the student teacher, the "internal, subterranean, developmental network" (Vygotsky, 1978, p. 91), that is the student teacher's zone of proximal development.

The student teacher also becomes aware of the cooperating teacher's thinking about planning, instruction, and assessment through co-teaching (Sebald, et.al, 2021). According to Vygotsky (1978), "the process of internalization consists of a series of transformations" (pp. 56-57). In the student teaching setting, the higher mental processes targeted for internalization are those that characterize an effective teacher. Key to this process is the transformation of external activities that are "reconstructed and begins to occur internally" (Vygotsky, 1978, p.57). The higher mental processes are not limited to the student teacher. Co-teaching has been shown to have positive effects for cooperating teachers, serving as a source of new insights related to their practice, curriculum development interest and opportunity and willingness to take on new or expanded leadership roles (Gallo-Fox & Scantlebury, 2016).

Another key transformation identified by Vygotsky is the transition between interpersonal processes and intrapersonal processes. In Vygotskian terms, during the co-teaching experience, the cooperating teacher's intrapersonal processes for thinking about instruction become part of the interpersonal (social) process between the cooperating teacher and teacher candidate as they discuss lessons during co-planning or even during instruction. These dialogues supply the conditions for an interpersonal (social) process to become an intrapersonal thinking process for the student teacher (Murphy et al., 2015).

This close alignment of co-teaching at the student teaching level with the definitions of a community of practice and the zone of proximal development suggests a different experience from a more traditional student teaching. Since cooperating teachers and supervisors are in the unique position to have multiple student teaching experiences throughout their careers, it seemed appropriate to turn to these educational professionals to garner their perceptions about whether a co-teaching student teaching experience is qualitatively different from what we have called the "traditional" approach to student teaching.

Research Questions

The research questions are:

1. Do cooperating teachers and university supervisors who have mentored/supervised student teachers under both a traditional model and a co-teaching model of student teaching report perceived differences in these models with respect to pre-service teacher preparation?
2. What advantages or disadvantages, if any, do cooperating teachers and university supervisors perceive for the student teacher in either a traditional or co-teaching model?

Method

Research Design

This study used a mixed methods sequential design. The purpose of the study was to compare participants' perceptions related to two models for student teaching. This study used an online survey that included both selected-response and open-ended questions. The questions asking participants to rate the two forms of student teaching using the Danielson Framework were analyzed quantitatively. Qualitative responses allowed us insight into the possible explanations for any differences identified in the quantitative data. These data were analyzed simultaneously to see if the ratings of the student teaching methods and the open-ended questions yielded congruent data (Cresswell et al., 2003). Following the preliminary analysis of the survey data, we developed a set of interview questions to more deeply explore the findings of the survey.

Participants

The current researchers are faculty members in two different teacher preparation programs at private institutions of higher education. All cooperating teachers and university supervisors from our two institutions who had mentored/supervised student teachers in both a traditional model and the co-teaching model of student teaching were invited to participate. All teachers had a minimum of three years of teaching experience and were certified in their content/grade area. University supervisors, who are retired educational professionals, serve as adjunct faculty and were trained by our respective institutions to supervise student teachers. All of the cooperating teachers and university supervisors participated in a co-teaching training using the training modules from St. Cloud State University. This training included data from previous research studies demonstrating the value of co-teaching for K-12 student learning, student teacher development, and the experience of the cooperating teacher. Training also included definitions and examples of specific co-teaching strategies and best practices for co-planning as a key component of effective co-teaching (Cayton, 2016). Participants were given expectations regarding co-teaching implementation such as frequency of use, guidelines for observations/evaluations, and documenting co-planning.

Data Collection and Analysis

We created and distributed an anonymous online survey with 28 questions. Potential participants were contacted by email with an explanation of the study, the informed consent document, and a link to the online survey. After an initial review of survey data, we followed up with interviews of a select number of participants. Reports from the survey were generated and exported into MS Word for qualitative analysis and in Excel for quantitative analysis. Open-ended responses from the survey and interviews were initially coded by each of the researchers independently. Some codes were induced from the data; some were created after the literature review. After this initial round of coding, the researchers shared our codes and discussed and resolved any differences. We then identified themes related to perceptions of how or why respondents favored one model or the other.

Results

A total of 90 educational professionals (55 cooperating teachers and 35 university student teaching supervisors) were invited via email to complete the survey. Thirty-six of those invited

completed the survey indicating an overall 40% response rate. The respondents include 17 cooperating teachers and nineteen university supervisors. In applying the statistical tests, the respondents were treated as one group. In the survey, the respondents were asked to rate the traditional model of student teaching and the co-teaching model on the 22 components of the Danielson Framework for Teaching. The ratings were Exceptional, Good, Fair and Minimal. When analyzing the responses, the researchers converted these nominal data to numerical values: Exceptional = 4; Good = 3; Fair = 2; and Minimal = 1.

Tables 1,2,3,4 show the results of paired t-tests for each of the components of the Framework for our participants. Significant differences between the traditional model and co-teaching model for each of the components in all four Danielson Domains exist.

Table 1: *A Comparison of Traditional and Co-Teaching Student Teaching Models using the Danielson Framework for Teaching for Domain 1: Planning and Preparation*

Domain 1: Planning & Preparation	Mean Traditional	Mean Co-Teaching	t statistic	p value one-tailed
Knowledge of Content and Pedagogy	3.19	3.53	-3.16	0.002
Knowledge of Students	3.11	3.58	-4.33	p<0.001
Setting Instructional Outcomes	2.97	3.56	-5.06	p<0.001
Knowledge of Resources	3.06	3.64	-7	P<0.001
Designing Coherent Instruction	2.94	3.67	-7.65	p<0.001
Designing Student Assessments	2.78	3.44	-5.58	p<0.001

Table 2: *A Comparison of Traditional and Co-Teaching Student Teaching Models using the Danielson Framework for Teaching for Domain 2: Classroom Environment*

Domain 2: Classroom Environment	Mean Traditional	Mean Co-Teaching	t statistic	p value one-tailed
Creating an Environment of Respect & Rapport	3.17	3.61	-3.3	0.001
Establishing a Culture for Learning	3.03	3.58	-5.49	p<0.001
Managing Routines & Procedures	2.97	3.5	-3.17	0.002
Managing Student Behavior	2.83	3.5	-4.64	p<0.001
Organizing Physical Space	2.92	3.31	-3.39	p<0.001

Table 3: *A Comparison of Traditional and Co-Teaching Student Teaching Models using the Danielson Framework for Teaching for Domain 3: Instructional Delivery*

Domain 3: Instructional Delivery	Mean Traditional	Mean Co-Teaching	t statistic	p value one-tailed
Communicating with Students	3.17	3.69	-4.55	p<0.001
Using Questioning & Discussion Techniques	2.75	3.5	-6.5	p<0.001
Engaging Students	3	3.75	-6.93	p<0.001
Using Student Assessments	2.89	3.42	-3.91	p<0.001
Demonstrating Flexibility & Responsiveness	2.78	3.64	-5.55	p<0.001

Table 4: *A Comparison of Traditional and Co-Teaching Student Teaching Models using the Danielson Framework for Teaching for Domain 4: Professionalism*

Domain 4: Professionalism	Mean Traditional	Mean Co-Teaching	t statistic	p value one-tailed
Reflecting on Teaching	3.08	3.64	-3.44	p<0.001
Maintaining Accurate Records	2.97	3.31	-3.16	0.002
Communicating with Families	2.53	2.94	-3.25	0.001
Participating in a Professional Community	3.03	3.58	-4.8	p<0.001
Growing & Developing Professionally	3.08	3.64	-4.12	p<0.001
Showing Professionalism	3.25	3.58	-2.65	0.006

The survey also included several open-ended questions to allow respondents to add comments about the two student teaching models with respect to each of the Danielson Domains. Additionally, respondents were asked: "If you were to have another student teacher in your classroom/supervise another student teacher what student teaching model would you prefer: co-teaching or traditional? Please explain your choice." Co-teaching was overwhelmingly favored by both groups (cooperating teachers 82.35%; university supervisors 73.68%; combined group 77.78%). The researchers will expand on these qualitative findings and link them to the quantitative results.

Discussion

With both university supervisors and cooperating teachers, Domains 1 and 3 are most notably positive for co-teaching. For Domain 1: Planning and Preparation, both university supervisors and cooperating teachers rated all components as Exceptional or Good in the co-teaching model. A hallmark of the co-teaching model is the opportunity to co-plan to better understand a teacher's thinking process. These findings corroborate earlier research on co-teaching outcomes (Bacharach et al., 2010; Tschida et al., 2015).

The educators in the study rated all of the components of Danielson's Domain 2

(Classroom Environment) higher for co-teaching. This difference was significant for three of the five components: Establishing a Culture for Learning, Managing Student Behavior and Organizing Physical Space. These findings seem to align with Keeley's findings (2015) where co-teachers perceived that classroom management was significantly impacted by all of the co-teaching models used in their study.

In all components of Domain 3, the co-teaching model significantly outperformed the traditional model. In Domain 3, we see three components where co-teaching received noticeably more positive ratings than the traditional model from participants: Using Questioning and Discussion Techniques, Using Assessment in Instruction, and Demonstrating Flexibility and Responsiveness. Learning to teach with an effective mentor rather than working and delivering instruction as a solo teacher may provide an explanation for improved ratings in instructional delivery for teachers prepared in co-teaching (Guise & Thiessen, 2016).

In Domain 4, we see strong agreement among our respondents in terms of their positive ratings for co-teaching and also in their appraisal of a weakness of both models. Collaboration has been shown to be a notable feature of new teachers who have experienced co-teaching in student teaching (Guise, M., & Thiessen, 2016; Wassell & LaVan, 2009). Our data support these findings. Our participants rated Communicating with Families as the lowest scoring component for either model. While the co-teaching model surpassed the traditional model, only 75% of the educators in this study gave co-teaching an Exceptional or Good rating on this component. Based on these lower ratings, developing prospective teachers' ability to work well with families is a challenge that teacher preparation programs will have to address regardless of the student teaching model they implement.

While the co-teaching model received appreciably more positive ratings overall, a small number of open-ended responses indicated some concerns with co-teaching. One concern that showed up in Domain 1 was that co-teaching may camouflage a student teacher's weaknesses. In support of the traditional model, one stated, "In the traditional model, all of the parts of Domain 1 are HIGHLY VISIBLE! There is no ability to 'hide' shortcomings." Additionally, in their open-ended comments, three respondents indicated that the traditional model provides a more realistic and therefore better picture of what teaching will look like after student teaching. While some favored co-teaching as preparation for working with other professionals and paraprofessionals, these respondents do not see many opportunities for co-teaching on the horizon for new teachers and therefore question its value.

Another response repeated by more than one participant is that the student teaching model does not matter as much as other context variables and overall quality control. Several participants talked about the compatibility and commitment of the teacher and student teacher. For example, one respondent said, "I think both models develop student teacher skills when the cooperating teacher is supportive of the student teacher and gives consistent, helpful feedback." Finally, some participants qualified their support for co-teaching for example by stating that more "preparation for engagement with the [co-teaching] model" was needed in order to maximize co-teaching's effectiveness.

Interestingly, participants would sometimes look at the same aspect of a model and rate it differently. For example, the issue of developing independence and holding the student teacher individually

accountable for the work of a teacher came up repeatedly with conflicting interpretations. One teacher saw co-teaching as giving the teacher candidate "elevated responsibilities" as they are viewed as a teacher from the beginning of the experience and are expected to lead planning later in the semester. Another teacher, however, interpreted working as a partner as a potential way of skirting accountability.

Limitations

The main limitation of this study is that we rely on perceptions of effectiveness of the models rather than a particular set of outcome measures that more directly assesses a new teacher's preparation for the field. We have, however, limited our participants to educational professionals with significant experience in the teaching field.

We also have a fairly small sample of respondents. The strength of the differences they noted between the models, however, gives us confidence in our findings. Finally, fidelity to the critical aspects of any model is essential to evaluating the effectiveness of the model. Since we did not observe in the classrooms of the teachers we surveyed, we do not know how closely they implemented the respective models. Recognizing potential issues of fidelity, future implementation and evaluation efforts will employ the recommendations of other researchers who have identified strategies to support co-teaching pairs in more fully implementing co-teaching practices (Guise, et.al., 2017).

Future Questions

A larger sample size and intentionally crafted questions may allow for connections between university supervisors' and cooperating teachers' beliefs about the primary purpose for the student teaching (e.g., simulate the first-year experience or provide opportunities for deep learning) and preference for a particular model. Additionally, the co-teaching model could be further studied to identify best practices for developing the difficult skills of classroom management and communication with families. Since the compatibility between the cooperating teacher and student teacher was raised as a factor, examining co-teaching pairs may yield insight into the contextual variables that add or detract from the student teaching experience. Further research may also look at direct measures of student teacher performance beyond participant perceptions. Finally, longitudinal study of the early-career teachers who have been prepared in the co-teaching and traditional models would allow these teachers' experiences to inform teacher preparation about the salient features of their student teaching experience and the impact on their current practice.

Implications for Practice

Based on our experience in observing classroom teachers and student teachers, we assert that in many ways the co-teaching model normalizes best practice for the student teaching experience. By emphasizing particular aspects of the model (e.g., co-planning, ongoing feedback and modeling, shared leadership, collaborative reflection), the co-teaching model is simply codifying the strategies that exemplary cooperating teachers have been using and expanding their use to a broader audience.

Based on the particularly strong support for co-teaching in Domains 1 and 3, in the direct comparison of the traditional and co-teaching, and the favorable but somewhat mixed support for co-teaching in Domains 2 and 4, we conclude that a co-teaching model is a preferred model for

teacher preparation. This model could be further improved by addressing specific areas such as clear definition and fidelity in implementation of the co-teaching model and targeted attention for the more universally challenging areas of Domains 2 and 4, classroom management and communication with families.

While it is true that new teachers may not enter the teaching force as part of a co-teaching pair, we posit that the experience of co-teaching as part of an intentional community of practice may have a lasting effect (Sebald, et. al., 2021). The co-planning, co-instruction and co-reflection that are essential to co-teaching may be instilled in the student teachers who experience this normalization of best practice. The opportunity to reflect on teaching practice during teaching practice and through co-planning and co-instruction provides an opportunity for Vygotsky's key transformations from interpersonal processes to intrapersonal processes (Vygotsky, 1978).

If Wassell and LaVan's proposition (2009) is true that co-teaching may impact beginning teachers' conception of what it means to teach, then these novice teachers may seek out collaborators in teaching. Experiencing teaching as a shared responsibility during a co-teaching student teaching can translate into seeking out others such as fellow teachers and students as partners in the teaching and learning process. Our data corroborates the research literature (Duran, et. al., 2020) suggesting that the co-teaching experience helped to build the student teachers' skills for teaching. Perhaps this skill development will also inform the student teachers' schema for being a teacher.

Conclusion

Our findings indicate that a co-teaching model is perceived by some as less realistic for teaching, but it may also provide better support and preparation for prospective teachers in the student teaching experience. Based on the perceptions of experienced cooperating teachers and university supervisors, the co-teaching model outperforms the traditional model across a number of critical professional development areas. However, the model is not without its drawbacks, and as with any model fidelity in implementation, supportive context, and strong preparation of the participants are key to success.

References

Bacharach, N., Heck, T., & Dahlberg, K. (2010). Changing the face of student teaching through co-teaching. *Action in Teacher Education. 32*(1), 3-14.

Bullough, R., Young, J., Birrell, J. R., Clark, D., Egan, M., Erickson, L., Frankovich, M., Brunetti, J., & Welling, M.(2003). Teaching with a peer: a comparison of two models of student teaching. *Teaching & Teacher Education, 19*(1), 57-73.

Cayton, C. (2016, October). *Co-planning strategies to support co-teaching* [Conference Session]. National Conference on Co-Teaching, Minneapolis, MN, United States.

Cook, L., & Friend, M. (1995). Co-Teaching: Guidelines for creating effective practices. *Focus on Exceptional Children, 28*(3), 1-17.

Darling-Hammond, L. (2006). Constructing 21st-century teacher education. *Journal of Teacher Education, 57*(10), 1-15.

Duran, D., Flores, M., Ribas, T., & Ribosa, J. (2020). Student teachers' perceptions and evidence of peer

learning through co-teaching: improving attitudes and willingness towards co-teaching. *European Journal of Psychology of Education, 36*(2), 495–510.

Gallo-Fox, J. (2009). Transferring schema or transforming cultures? *Cultural Studies of Science Education, 4*,449–460.

Guise, M., & Thiessen, K. (2016). From pre-service to employed teacher: Examining one year later the benefits and challenges of a co-teaching clinical experience. *Educational Renaissance*, *5*(1), 37–51.

Guise. M., Habib, M., Thiessen, K., & Robbins, A. (2017). Continuum of co-teaching implementation: Moving from traditional student teaching to co-teaching. *Teaching and Teacher Education*, *66*, 370–382.

Murawski, W., & Bernhardt, P. (December 2015/January 2016). An administrator's guide to co-teaching. *Educational Leadership, 73*(4), 30-34.

Murphy, C., Carlisle, K., & Beggs, J. (2009). Can they go it alone? Addressing criticisms of co-teaching. *Cultural Studies of Science Education, 4*, 461–475

National Council for Accreditation of Teacher Education, (2010). *Transforming teacher education through clinical practice: A national strategy to prepare effective teachers.* Report of the Blue Ribbon Panel on Clinical Preparation and Partnerships for Improved Student Learning. Washington, D.C., NCATE

Rabin. (2020). Co-Teaching: Collaborative and caring teacher preparation. *Journal of Teacher Education, 71*(1), 135–147.

Sacks, A. (2014, October 15). *Eight tips for making the most of co-teaching*. Retrieved from http://www.edweek.org/tm/articles/2014/10/15/ctq_sacks_coteaching.html

Sebald, Myers, A., Frederiksen, H., & Pike, E. (2021). Collaborative co-teaching during student teaching pilot project: What difference does context make? *Journal of Education,*

Tschida, C. M., Smith, J. J., & Fogarty, E. A. (2015). "It Just Works Better": Introducing the 2:1 Model of Co-Teaching in Teacher Preparation. *Rural Educator*, *36*(2)11-26.

Torrez, C. A., & Krebs, M. M. (2012). Expert voices: What Cooperating Teachers and Teacher Candidates say about Quality Student Teaching Placements and Experiences. *Action in Teacher Education, 34*, 485-499.

Washut Heck, T., & Bacharach, N. (December 2015/January 2016). A better model for student teaching. *Educational Leadership, 73*(4), 24-29.

Wassell, B., & LaVan, S. K. (2009). Tough transitions? Mediating beginning urban teachers' practices through co-teaching. *Cultural Studies of Science Education, 4*, 409–432

Zeichner, K. (2002). Beyond traditional structures of student teaching. *Teacher Education Quarterly, 29*(2), 64

We Strive: Enhancing Implementation of Socioscientific Issues in STEM Classrooms Through Professional Development

Joseph Johnson
Augusto Macalalag
Becky Mathers-Lowery
Gabrielle Ialacci

Abstract: This study explores the experiences of two teachers participating in professional development workshops focused on supporting implementation of SocioScientific Issues (SSI) and aspects of social justice into STEM classrooms. SSI are ill-defined problems, with a basis in science, but necessarily include moral and ethical decisions that cannot be resolved through science alone. These debatable issues can enhance learning of STEM by engaging students in real-world and authentic problems. The *USTRIVE project* was developed to foster STEM learning through integrated professional development workshops and the development of professional learning communities to support teachers in the use of SSI and incorporation of aspects of social justice in their STEM classrooms. Two research questions were investigated: (a) To what extent did teachers implement SSI into their lesson planning during the project and (b) In what ways did teachers' designed lessons change from the beginning of the workshop?

About the Authors: *Dr. Joseph Johnson is an Associate Professor and Chair of the Physics Department at Mercyhurst University. Dr. Augusto Z. Macalalag, Jr is an Associate Professor of Science, Technology, Engineering, and Mathematics (STEM) Education. Dr. Becky Mathers-Lowery is a postdoctoral researcher in the USTRIVE project at Arcadia University. Gabrielle Ialacci is an Undergraduate Research Assistant at Mercyhurst University majoring in Biochemistry.*

Introduction

Current education reform movements in science and mathematics advocate for teaching science, technology, engineering, and mathematics (STEM) disciplines by solving real-world problems (National Research Council [NRC], 2013; Sadler et al., 2007). Incorporation of socioscientific issues (SSI) into STEM classrooms can provide meaningful contexts for students to learn concepts and practices in these disciplines (Zeidler et al., 2005) and powerful avenues for engaging traditionally marginalized student groups in STEM content (Johnson et al., 2022A; Johnson et al. 2022B). Yet common STEM teaching practices rarely allow students, especially low-income students of color (Marco-Bujosa et al., 2020), to connect STEM lessons with their own lives (Zeidler, 2016). While this may not be a result of purposeful resistance to teaching for diversity, teachers may lack the awareness, support, confidence, knowledge, or skills to implement socially relevant curriculum and culturally responsive strategies (Rodriguez, 2005). Moreover, teachers may be hesitant or struggle with some fundamental components of the SSI framework such as inquiry, problem-based learning, argumentation, and authenticity (Johnson et al., 2020). Fortunately, directed coursework and professional development can provide prospective teachers with the knowledge, resources, and experience to develop the necessary skills for effective SSI implementation (Johnson et al., 2020).

The SSI framework consists of debatable issues that can enhance learning of STEM concepts as students engage in real-world and authentic problems (Zeidler, 2014). SSIs are ill-defined problems that have their basis in science, but necessarily include moral and ethical decisions that cannot be resolved through science alone (Ratcliffe & Grace, 2003). As such, SSI can provide meaningful and relevant contexts for students to learn science concepts and practices across STEM fields (Zeidler et al., 2005). Students engage in STEM content to address moral and ethical problems through reflection on their personal experiences, prior knowledge, and cultural background, promoting students' STEM learning and scientific skill development (Ziedler, 2014), especially when engaging in those issues that have a disproportionate, negative impact on their lives. SSI implementation can provide avenues for teachers to enhance their students' scientific knowledge and literacy skills, such as evidence-based reasoning, consideration of multiple perspectives, and reflective scientific skepticism (Minken et al., 2021). However, most teachers are unfamiliar with SSI and require coursework or professional development in order to learn how to effectively plan instructional activities by engaging their students on its components (Macalalag et al., 2017).

The USTRIVE Project (*Understanding STEM Teaching Through Integrated Contexts in Everyday Life),* funded through a large National Science Foundation Discovery Research in K-12 federal grant, was developed to foster STEM learning for close to 3,000 students in grades 6–12 over four years through integrated professional development workshops and the development of professional learning communities focused on supporting teachers in the use of SSI and incorporation of aspects of social justice in their STEM classrooms.

In implementing SSI in the classroom and addressing controversial issues, teachers must be knowledgeable in several key areas within the SSI framework, including logical reasoning, recognizing fallacious reasoning, comparing, and contrasting multiple perspectives, engaging

in scientific modeling, and more (Zeidler et al., 2002). Successful implementation of SSIs strongly depends on the scientific content knowledge of the teacher, and the pedagogical knowledge that they bring to bear. By developing understandings of SSIs, particularly those involving local problems, and linking them to effective pedagogical practices, students are given opportunities to analyze and resolve situations that relate directly to them and their lives (Hernández-Ramos, 2021). Shulman (1987) defined the intersection of pedagogical knowledge and content knowledge, situated within teachers' knowledge of the learning context, as Pedagogical Content Knowledge (PCK), a powerful framework for understanding teacher growth and development. As such, PCK was chosen as the conceptual framework for the current study. Goals of the USTRIVE project included (1) development of teacher PCK to support their capacity to develop, implement and reflect on instructional units that use SSI to promote students' scientific literacy, cultural competence, and sociopolitical consciousness; (2) development of teacher dispositions toward social justice and SSI; (3) fostering of teacher PCK to develop, write and implement units of study with lesson plans, assessments, and classroom resources.

For the current study, the PCK framework was applied with a qualitative case study methodology to analyze initial findings regarding teacher development after the first semester of implementation of the USTRIVE project. The authors of this study are all researchers on the USTRIVE project who worked on the design and implementation of the project professional development workshops. The first and second authors were co-principal investigators for the USTRIVE grant. The following research questions guided this study: (a) To what extent did teachers implement SSI and its components in lesson plans designed through USTRIVE workshops and (b) In what ways did teacher lessons and planning change from the beginning of the workshop?

Conceptual Framework

According to Shulman (1987), PCK is the knowledge teachers require that is essential for them to effectively plan and implement teaching methods to help learners of various levels and backgrounds learn concepts and skills during instruction. PCK exists at the intersection of areas of teacher knowledge that facilitate effective pedagogical decision making. It is a special amalgamation of knowledge and teaching practices that directs teachers' actions while planning and implementing their lessons (Shulman, 1987). PCK in general, and PCK for teaching SSI, includes several subdomains. It includes knowledge about the content and curriculum, such as teachers' awareness of the curriculum goals, objectives, and the vertical alignment and progressions of students' learning (Magnusson *et al.*, 1999; Bayram-Jacobs *et al.*, 2019). PCK for teaching SSI also requires instructional strategies to craft and engage students in debatable issues or questions, to support students in their inquiry experiences, and to develop their reflective scientific skepticism as they compare and contrast multiple perspectives (Johnson et al., 2020). A teacher's knowledge of instructional strategies includes the teacher's ability to make appropriate choices about pedagogical strategies available in incorporating SSI (Magnusson et al., 1999). This is closely intertwined with the teacher's knowledge of student understanding and assessment. A teacher of SSI must have the versatility to incorporate a variety of teaching strategies that allow students to explore the underlying

scientific phenomena, employ reflective skepticism, engage in scientific modeling, compare multiple perspectives, and elucidate their own position, all of which are key components of SSI (Sadler et al., 2019). All of this knowledge is situated within a knowledge of the teaching and learning context. Teaching SSI effectively requires understanding the learning contexts in terms of background knowledge of the experiences, culture, and interests of students, while considering issues that are grounded in their community (Johnson et al., 2020).

Methodology

This study employed the PCK framework to guide a qualitative case study methodology to address the stated research questions. Case study research involves the exploration of a bounded "case" or "cases" within clearly defined, real life contexts (Cresswell & Poth, 2016). This methodology allows researchers to delve deeply into complex aspects within the bounded system defined by the selected case (Johnson & Christensen, 2019). According to Cresswell and Poth (2016) cases may be concrete, as in small groups, individuals, or an organization. They may also be more abstract entities like a relationship, a community, or a project. The case for the current study includes two teachers participating in a large-scale U.S. government funded grant that involved weekly workshops focused on integration of SSI into STEM subject areas. Pseudonyms were used for the two participants in this study. At the time of the study, Ms. Rodriguez held a B.S. in Mathematics and a M.A. Secondary Education and Teaching. She had 19 years of teaching experience and was teaching grades 11 and 12 precalculus in a large urban kindergarten through grade 12 school in Philadelphia, PA. The second participant, Ms. Anderson, held a Master's of Education and had been teaching for 22 years. At the time of the study, Ms. Anderson taught 6th grade science in a large urban middle school in Philadelphia. These two participants were selected for the case because they demonstrated sophistication in creating SSI Unit Plans based on the rubric requirements defined by the research team. This allowed for analysis of the differences in improvement from the participants' baseline lesson plans collected early in the workshops to their most recent lessons.

The professional development (PD) program included about 100 hours of the following activities from September 2021 to June 2022: (a) 19 three-hour Tuesday evening workshops, (b) 6 three-hour Professional Learning Community (PLC) sessions, (c) 4 two-hour one-on-one lesson planning meetings and teacher classroom support visits, (d) 2 six-hour Saturday workshops and field trips, and (e) 1 six-hour end-of-year conference. The Tuesday evening workshops focused on introducing teachers to SSI in the context of STEM lessons. Example topics included how to define a socioscientific issue and make it relevant to students; what it means to take multiple perspectives; how to effectively use debates to engage students in SSIs; what it means to be scientifically skeptical; possible topics for debates and contexts for SSI units of study; the ways in which culture influences our individual decisions and indirectly affects our environment and health; how to identify debatable issues from scientific phenomena and develop lessons using debatable issues and scientific phenomena; and how to engage students in STEM modeling in the context of SSI; how to engage students in culturally relevant STEM projects; and how to connect debatable issues to the local community.

The PLCs were developed to provide teachers an extensive professional network,

to develop trust among colleagues, and to build deeper content knowledge. Topics focused on the aspects of effective SSI lessons, debatable issues, how dynamic systems can frame a debate, and how stakeholders clarify an issue. Discussions addressed how STEM modeling can foster deep scientific knowledge construction, what the word justice means, and how to collect student data to measure growth.

Classroom support visits provided teachers with guidance as they developed and implemented their units of study and helped grant coaches to monitor teachers' challenges both in the classroom and within the school. They also provided a level of teacher accountability to implement SSI lessons. These visits were intended to increase teachers' confidence as they investigated and implemented new content and practices in their classrooms. Saturday workshops and field trips clearly framed academic and scientific discourse in the classroom and modeled the discursive nature of SSI complemented by discussions of STEM in the community.

The purpose of the end of year conference was to cultivate teacher leadership toward SSI. Participating teachers had the opportunity to present mini-lessons from their units of study. This conference was intended to foster dialogue among teachers, students, school leaders and community members, allow teachers to reflect on learning experiences, provide an avenue for local community involvement, disseminate project work, and celebrate classroom successes.

Case study research is further defined as "a qualitative approach in which the investigator explores a real life, contemporary bounded system (a case) or multiple bounded systems (cases) overtime, through detailed, in-depth data collection involving multiple sources of information" (Cresswell & Poth, 2016, p. 96). Data analyzed for the current study included information from a baseline questionnaire administered at the beginning of the grant experience and lesson plans developed by the participants. Lesson plan data was analyzed using a rubric developed by the research team and provided to participating teachers. Feedback from teacher focus groups conducted by project external evaluators, Public Health Management Corporation (PHMC), Division of Teaching & Learning, Research & Evaluation Group was also used to inform claims. While this data was aggregated from the entire body of project teachers, it provided important contextual information regarding the attitudes and reactions of the group to inform our analysis of our specific case. These data sources were used for triangulation to enhance the reliability and trustworthiness of our findings. Triangulation involves the use of multiple data sources during the analysis of data (Denzin, 2009).

Inductive analysis of baseline questionnaire data, outlined below, provided an initial set of codes that informed the analysis of lesson plan data. Specifically, we wished to understand if teachers were incorporating debatable issues and/or real-world problems into their STEM lessons before beginning our PD program and if after PD workshops on the development of lessons with an SSI focus, teachers felt comfortable creating and implementing these types of lessons. Themes were developed from the initial lesson plan analysis, triangulated across participants and focus group feedback, and compared with lesson plan data to illuminate areas of growth as well as challenges faced by participants.

Baseline Questionnaire Data

During the first Professional Development (PD) workshop, the teachers were asked to describe a lesson they taught that exemplifies ideal STEM instruction and to recount the ways, if any, they engaged and motivated their students to learn STEM with a focus on debatable issues and/or real-world problems. Finally, the teachers expressed any challenges they have encountered in the past when trying to implement a STEM lesson anchored on a debatable issue and/or real-world problem. The baseline questions were chosen to gauge the teachers' perceptions of ideal STEM instruction and to understand what they believed made a STEM lesson exemplary. Second, their answers provided an avenue to get a sense of the teachers' knowledge related to SSI before engaging in the project. Finally, we strived to understand why the teachers may not have attempted or have been unsuccessful in implementing lessons with a focus on debatable issues and/or real-world problems in the past.

For the baseline data, we used an inductive approach to data analysis to allow the data to speak for itself rather than assigning themes derived from the literature. We created a coding guide based on the initial questions asked at the beginning of the workshop, specifically on implementation of STEM lessons and lessons with a debatable and/or real-world issue.

Lesson Plan Data

As part of the professional development workshops from September to December 2021 (3 hours per week, 45 hours total), time was allotted for teachers to develop and write lesson plans by integrating the SSI components in the 5Es framework – e*ngage, explore, explain,* *elaborate,* and *evaluate* (Bybee et al., 2006). Specifically, as part of *engage*, teachers planned and wrote how they would help their students establish relevance by identifying an SSI issue and by exploring the underlying scientific phenomena that are relevant to their students' lived experiences. In *explore*, they indicated their plan on how to engage students in scientific modeling through development, use, evaluation, and revision of scientific models. In *explain*, teachers wrote how to help their students express new learning by considering issue system dynamics that social, political, economic, ethical, and religious considerations associated with their SSI debate. As part of *elaborate*, teachers wrote a plan to help students apply their prior learning and acquire new learning experiences by asking them to employ reflective skepticism and compare and contrast multiple perspectives as part of SSI. Finally, in *evaluat*e, they wrote how to help their students measure their learning by elucidating their own position or solution at the end of the SSI debate or statement.

The two lesson plans that were submitted by Ms. Rodriguez and Ms. Anderson in December 2021 were coded guided by the SSI framework (Boyatzis, 1998) and the project developed lesson plan rubric (see Appendix A). We used these codes to find themes and analyze the extent to which the teachers incorporated SSI components in their lesson plans and describe ways their lessons changed from the beginning to the midterm point of the first year of the professional development workshops.

Findings

Initially, Ms. Rodriguez described two lessons which she felt exemplified ideal STEM instruction. In a derivatives unit, her students determined the maximum area of a

protesting space while considering a six-foot distance between each protestor. In the second lesson she described, Ms. Rodriguez also challenged students to collect data related to the extinction of a subspecies of a rhino. Students identified a regression model to best fit the data, used the model to make predictions, decided if the chosen model was the best fit by providing supportive evidence, and created an alternative model if needed. Ms. Anderson shared an ideal STEM lesson from the Waterworks curriculum called Rain to Drain. Students need to construct a situation out of the materials and explain what is happening to the amount of water used in the experiment and how they can save more water.

Neither teacher had previously taught a STEM lesson with a debatable issue focus; however, Ms. Rodriguez had implemented discussions in the past regarding pollution in which she had students take sides. Both teachers described past challenges with incorporating a debatable issue and/or real-world problem into STEM lessons. Ms. Rodriguez stated that it was a challenge to find real and relevant data to use in her lessons, while Ms. Anderson conveyed her challenges included time, behavior, and the reading levels.

Analysis revealed evident growth in participants' ability to implement specific aspects of SSI into their lessons. Rubric data is presented in Table 1.

Table 1: *Score by SSI Elements; Rubric Data*

	Ms. Anderson (Pseudonym)	**Ms. Rodriguez (Pseudonym)**
A) Identify the Issue	3	3
B-1) Knowledge: Sci. Phenom.	2	3
B-2) PCK: Sci. Phenom.	3	3
C) STEM Modeling	3	3
D) Issue System Dynamics	0	2
E) Reflective Scientific Skepticism	0	0
F) Multiple Perspectives	0	3
G) Elucidate Own Position/Solution	0	1
H) Reflexivity	0	1
I) Authentic Activity	3	3
J) Dialogic Conversation	2	3
K) Metacognition	2	1

The lesson plans developed by Ms. Rodriguez and Ms. Anderson promote real-world and STEM-based issues that are relevant to students' lives and their community. In particular, the SSI debatable questions in Ms. Rodriguez's lessons are, "Should the government regulate housing prices?" and "Should there be a limit on housing prices?" She hoped to engage her students in the following real-world problem: "Property prices are inclining and forcing people to abandon the idea of

becoming homeowners, [which] impact homeowners and renters." She continued by explaining that this problem of unfair cost of housing promotes inequality to those who can and can't afford to buy and rent houses. At the end of her lessons, Ms. Rodriguez hopes her students will be able to: (a) "Explain the fundamental concepts of time value of money," (b) "Calculate present and future value of a single and a series of cash flows," and (c) "Apply the concepts and calculations of time value of money in personal financial management." Similar to Ms. Rodriguez, Ms. Anderson's lesson engages students in an SSI and a real-world problem of "whose job is to provide clean water to our community?" According to the description of her lesson, "We assume that we can turn on our faucet in Philadelphia and water that is acceptable for living will exist." She continued by saying that "families rely on bottled water to accomplish daily living," which implicitly suggests possible impact to the environment (use and recycling of plastics) and the added cost of buying them. At the end of her lessons, Ms. Anderson hopes her students will be able to "explain the need, usage, and importance of water as a person, community, and global community."

In addition to identifying an SSI issue, participant teachers presented two different approaches on how to engage their students in exploring the underlying scientific or mathematical phenomenon. Ms. Rodriguez planned to show a short video from MTV Cribs and ask the questions to elicit her students' initial ideas and interests with regards to buying or renting a house. Then, she will ask her students to go to Zillow.com to choose two homes in the region and to analyze the cost of these homes with annual salary per profession and cost of education. Ms. Anderson will use an activity to discuss why water is important and how humans use water. The difference between the two pedagogical approaches is that Ms. Rodriguez plans to elicit her students' initial ideas and dispositions on SSI, while Ms. Anderson plans to use an activity without eliciting her students' prior knowledge or beliefs.

In terms of engaging students in scientific modeling through development, use, evaluation, and revision of scientific models as part of SSI, we found that both lessons describe ways students can participate in discussions and investigations. For instance, Ms. Rodriguez has several questions to guide her students' inquiry: "(a) What is the standard of living in certain areas? (b) What is the median wage in certain areas? (c) Compare crime rates and poverty in those areas? (d) What is the population in Philadelphia and surrounding areas? (e) Is there a correlation between population and standard of living? and (f) How do population and standard of living relate to crime rates/poverty?" On the other hand, Ms. Anderson describes a series of investigations: "Task card 1- Water Usage Chart- How do we use water? Task card 2- Water Descriptive Words- How is water essential (define in your own words what this word means) to life and culture? Task Card 3- Global Awareness Fact Sheet- How do you relate to the facts provided on the Global Awareness Fact Sheet? Task Card 4- Power of Water - an article regarding Tsunamis and Hurricanes - Explain how water behaves?"

Unfortunately, we found that both lessons provided little or no evidence in considering issue system dynamics of social, political, economic, ethical, and religious considerations associated with their SSI debate. For example, in Ms. Rodriguez's lesson, she plans to show a video on the housing crisis in the U.S. and the growing movement to end single family housing zones. She also plans to provide reading material about the housing market over the

last 20 years and invite a guest speaker on financing homes. However, it is implicit how her planned activities could promote discussions with regards to social, political and economic aspects of the cost of buying homes. Similarly, Ms. Anderson's plan does not include explicit consideration of system dynamics: "Students will present their findings from the Task card with the class."

In addition to system dynamics, we also found little or no evidence of employing reflective skepticism and comparing multiple perspectives in their lesson plans. Although Ms. Rodriguez's activities will promote problem solving, it is unclear if and how students will question and critique the different information they find or were presented to them. Instead, students were tasked to analyze different variables before answering if they can afford their dream home: "Given three mortgage rates from different banks, they have to calculate the mortgage payments using the future/present value formulas and the total amount paid over 15- and 30- years. They have to consider any student loans, bills, and other debts." On the other hand, she plans to ask her students to do a role play: "Who are the stakeholders in housing prices?" that could potentially promote the examination of multiple perspectives from realtors, buyers, tenants, investors, banks, government, and others. Ms. Anderson plans to ask her students to reflect on "What happens as a result (as an individual, community, society) of actions we take towards water?" Note that this question will examine results from multiple sources, which is different from comparing and contrasting multiple perspectives.

We found that both lessons allowed students to reflect and state their own position or solution at the end of the SSI debate or statement. Specifically, Ms. Rodriguez will ask her students to "make a decision based on evidence; create presentation slides and script for student presentation." While Ms. Anderson will provide an exit ticket question: "how do I show I value water?"

The findings from teacher focus groups feedback, collected by project external evaluators, PHMC, support our findings by demonstrating the success of professional development efforts to support teachers in the use of SSI and the incorporation of aspects of social justice in their STEM classrooms. Teachers' knowledge of SSI/sTc topics increased as a result of the PD workshops offered during the first fifteen weeks of the project. Similarly, teachers felt better equipped to implement engaging lessons using presentations and classroom discussions. Teachers also documented growth in their ability to create debatable questions related to their unit topics. Through the PD workshops and fall field trips, teachers were introduced to hands-on, authentic learning opportunities that serve as a model for the types of activities they can incorporate into their units of study.

Discussion

The following research questions guided this study: (a) To what extent did teachers implement SSI and its components in lesson plans designed through USTRIVE workshops and (b) In what ways did their lessons and planning change from the beginning of the workshop? Findings suggest that although Ms. Rodriguez and Ms. Anderson had science and math contexts in mind in the beginning, neither teacher had attempted to implement an SSI component prior to the PD. Both teachers recounted challenges with incorporating a debatable issue and/or real-world problem into STEM lessons in the past. For example, Ms. Rodriguez stated that it was a challenge to find real and relevant data to use in her

lessons, while Ms. Anderson conveyed challenges with time, student behavior, and the reading levels of the students. These initial challenges of our teachers are similar to those challenges experienced by teachers in other projects who start to implement SSI and inquiry-based learning (Zeidler, 2016; Johnson et al., 2020).

Our PD provided teachers with about 100 hours of activities for them to learn SSI and implement them in their classrooms. These PD included Tuesday evening workshops, PLCs, classroom support visits, Saturday field trips, and end-of-year conference from September 2021 to June 2022. After engaging in PD activities focused on SSI, it was found that teachers provided better real-world and SSI contexts in their lessons than in the beginning of the PD workshops. In response to the call of Zeidler (2014) to make STEM learning authentic and relevant, the lesson plans developed by Ms. Rodriguez and Ms. Anderson both promote real-world and STEM-based issues relevant to their students' lives and their community. Moreover, as Rodriguez (2005) argued for socially relevant curriculum and culturally relevant strategies, Ms. Rodriguez aimed to introduce her students to the inequality that those who can and can't afford to buy or rent houses because of the unfair cost of housing. Similarly, Ms. Anderson focused on the importance of freshwater for people, communities, and the world.

Interestingly, teachers presented two different approaches to engage their students in exploring the underlying scientific or mathematical phenomenon. We found that both lessons provided little or no evidence in considering issue system dynamics of social, political, economic, ethical, and religious considerations associated with their SSI debate. They also showed little or no evidence of employing reflective skepticism and comparing multiple perspectives in their lesson plans. These challenges are common to those who are unfamiliar with SSI and who are starting to develop their PCK toward SSI (Zeidler, 2014; Lee, 2016). Finally, we found that both lessons allowed students to reflect and state their own position or solution at the end of the SSI debate.

Conclusion and Recommendations

This study employed the PCK framework to guide a qualitative case study methodology to address our research questions. Our PD program included about 100 hours of workshops, PLC sessions, one-on-one lesson planning meetings and teacher classroom support visits, Saturday workshops and field trips, and an end-of-year conference that supported the development of our teachers' PCK. In particular, the lesson plans developed by Ms. Rodriguez and Ms. Anderson promoted real-world and STEM-based issues that are relevant to their students and community. This suggests that the development of teachers' PCK in teaching SSI requires understanding of the learning contexts that are grounded in background knowledge, experiences, culture, and interests of students, a finding consistent with prior research (Johnson et al., 2020). In addition to SSI contexts, our teachers presented multiple approaches on how to engage their students in exploring the underlying scientific or mathematical phenomenon. They mentioned ways to elicit their students' initial ideas and interests with regards to their chosen SSI context, which indicates the development of the teachers' PCK with regards to content, curriculum, and progressions of students' learning (Bayram-Jacobs et al., 2019). Moreover, we found that both lessons describe ways to engage students in scientific modeling through development, use, evaluation, and

revision of models as part of SSI that points to the development of teachers' PCK of instructional strategies in incorporating SSI in lesson plans (Magnusson et al., 1999).

However, similar to previous research that showed teachers' successes and challenges of incorporating argumentation in SSI (Johnson et al., 2020), this study suggests that our teachers struggled to incorporate some components of SSI such as employing reflective skepticism and comparing multiple perspectives. It is important that these challenges be addressed in future PD workshops. Finally, participant teachers demonstrated development of their PCK of student understanding of assessment as a key component of SSI (Sadler et al., 2019) by asking their students to reflect and state their own position or solution at the end of the SSI debate. Through engaging in PD activities, experiencing SSI lessons as modeled by PD facilitators and guest speakers, and through guided lesson development, participant teachers expanded their PCK towards SSI.

While these findings are promising, reflecting the initial success of the USTRIVE project for developing teacher PCK towards SSI, additional research is needed. Recommendations for future research include: (a) the development and utilization of an SSI classroom observation protocol to observe and study teachers' PCK in action during instruction, (b) direct analysis of teacher PCK with regards to students' thinking of SSI, and (c) analysis of PD effectiveness through observation of students as they engage and solve SSIs in the classroom.

Acknowledgements

This material is based upon work supported by the National Science Foundation under Grant No. 2101395. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation. We would like to thank our teachers for volunteering to participate in this study. We are also grateful to our USTRIVE project staff including Zachary Minken, Dr. Greer Richardson, Dr. Lisa Marco-Bujosa, Dr. Ling Liang, Marlin Marte, Peter Koetting, and Rachel Stannard. Additionally, we would like to give our gratitude to our external evaluators, Dr. Kelly Feighan and Megan Richardson of the Public Health Management Corporation, Division of Teaching & Learning, Research & Evaluation Group.

References

Bayram-Jacobs, D., Henze, I., Schwartz, Y., Aschim, E. L., Alcaraz-Dominguez, S., Barajas, M., & Dagan, E. (2019). Science teachers' pedagogical content knowledge development during enactment of socioscientific curriculum materials. *Journal of Research in Science Teaching, 56,* 1206–1233.

Boyatzis, R. E. (1998). *Transforming qualitative information: Thematic analysis and code development.* Sage.

Bybee, R. W., Taylor, J. A., Gardner, A., Vanscotter, P., Powell, J. C., Westbrook, A., & Landes, N. (2006). *The BSCS 5E instructional model: Origins, effectiveness, and applications*. BSCS.

Creswell, J. W., & Poth, C. N. (2016). *Qualitative inquiry and research design: Choosing among five approaches*. Sage.

Denzin, N. K. (2009). *The research act: A*

theoretical introduction to sociological methods. Adline Transaction.

Hernández-Ramos, J., Pernaa, J., Cáceres-Jensen, L., & Rodríguez-Becerra, J. (2021). The effects of using socio-scientific issues and technology in problem-based learning: A systematic review. *Education Sciences, 11*(10), 640.

Johnson, R. B., & Christensen, L. (2019). *Educational research: Quantitative, qualitative, and mixed approaches*. Sage.

Johnson, J., Batkie, R., Macalalag, A., Dunphy, J., & Titus, S. (2022A). The Rise of STEM education: Social scientific issues and STEM learning. *International Encyclopedia of Education.*

Johnson, J., Macalalag, A., & Dunphy, J. (2020). Incorporating Socioscientific Issues into a STEM Education Course: Exploring teacher use of argumentation in SSI and plans for classroom implementation. *Disciplinary and Interdisciplinary Science Education Research.*

Johnson, J., Zielinski, M., Essary, J. N., Dean, K., Bartynski, K., & Macalalag, A. Z. (2022B). Encouraging STEMpathy: A review of literature addressing STEM learning for students with special education services in inclusive learning environments. In A. Z. Macalalag, I. Sahin, J. Johnson, & A. Bicer (Eds.), *Internalization of STEM Education* (pp. 1-40). ISTES Organization.

Lee, H. (2016). Conceptualization of an SSI-PCK framework for teaching socioscientifc issues. *Journal of the Korean Association for Science Education, 36*(4), 539–550.

Macalalag, A., Johnson, J., & Lai, M. (2019). How do we do this: Learning how to teach socioscientific issues. *Cultural Studies of Science Education, 3*(8), 1–25.

Macalalag, A., Johnson, J., & Lai, M. (2017). STEM education course: Enhancing k-12 teachers' cultural awareness through reflections of socioscientific issues. *Pennsylvania Teacher Educator, 16*, 76–92.

Magnusson, S., Krajcik, J., & Borko, H. (1999). Nature, sources, and development of pedagogical content knowledge for science teaching. In J. Gess-Newsome & N. G. Lederman (Eds.), *Examining Pedagogical Content Knowledge* (pp. 95-132). Kluwer Academic Publishers.

Marco-Bujosa, L. M., McNeill, K. L., & Friedman, A. A. (2020). Becoming an urban science teacher: How beginning teachers negotiate contradictory school contexts. *Journal of research in science teaching, 57*(1), 3–32.

Minken, Z., Macalalag, A., Clarke, A., Marco-Bujaso, L., & Rulli, C. (2021). Development of teachers' pedagogical content knowledge during lesson planning of socioscientific issues. *International Journal of Technology in Education* , *4*(2), 113–165.

National Research Council. (2013). *Next generation science standards: For states, by states*. The National Academies Press.

Ratcliffe, M., & Grace, M. (2003) *Science education for citizenship: Teaching socio-scientific issues*. McGraw-Hill Education.

Rodriguez, A.J. (2005). Teachers' resistance to ideological and pedagogical change: Definitions, theoretical framework, and significance. In A. J. Rodríguez & R. S. Kitchen (Eds.), *Preparing mathematics and science teachers for diverse classrooms: Promising strategies for transformative pedagogy* (pp. 17–32). Lawrence Erlbaum Associates.

Sadler, T. D., Barab, S. A., & Scott, B. (2007). What do students gain by engaging in socioscientific inquiry? *Research in Science Education, 37*(4), 371–391.

Sadler, T. D., Friedrichsen, P., & Zangori, L. (2019). A framework for teaching for socio-scientific issue and model based learning (SIMBL). *Journal Educação e Fronteiras, 9*(25), 8–26.

Shulman, L. S. (1987). Knowledge and teaching: Foundations of new reform. *Harvard Educational Review, 57*(1), 1–21.

Zeidler, D. L. (2014). Socioscientific issues as a curriculum emphasis: Theory, research, and practice. In N. G. Lederman & S. K. Abell (Eds.), *Handbook of Research on Science Education* (2nd ed., Vol. 2, pp. 697–726). Routledge.

Zeidler, D. L. (2016). STEM education: A deficit framework for the twenty first century? A sociocultural socioscientific response. *Cultural Studies of Science Education, 11*(1), 11–26.

Zeidler, D. L., Walker, K. A., Ackett, W. A., & Simmons, M. L. (2002). Tangled up in views: Beliefs in the nature of science and responses to socioscientific dilemmas. *Science Education, 86*(3), 343–367.

Zeidler, D. L., Sadler, T. D., Simmons, M. L., & Howes, E. V. (2005). Beyond STS: A research based framework for socioscientific issues education. *Science Education, 89*(3), 357–377.

Appendix A: Lesson Plan Rubric

NOTE: Failing to meet the minimum criteria for a Level 1 code results in a code of Level 0

A) Identify the Issue: Identify the socioscientific issue by reviewing "newspapers, books, Internet sources, professional science education-related journals and television/movies for current issues related to your subject matter and course objectives. There are local and global controversies related to almost any science topic. As you explore topics, consider students' interests and selected topics with relevance to their lives and the [school's] curriculum" (Zeidler & Kahn, 2014, p. 31).		
Level 3	**Level 2**	**Level 1**
Lesson plan contains: a) **Debatable SSI explicitly stated** and translated in the lesson **AND** b) Students are engaged in SSI by reviewing primary sources and/or real-world examples **OR** c) Debatable SSI is connected to students' lives	Lesson plan contains: a) **Debatable SSI implicitly stated** and translated in the lesson **AND** b) Students are engaged in SSI by reviewing primary sources and/or real-world examples **OR** c) Debatable SSI is connected to students' lives	Lesson plan contains: a) **Debatable SSI explicitly or implicitly stated** and translated in the lesson

B-1) Knowledge: Explore and explain the underlying scientific phenomena: Think of opportunities for students to explore and explain the scientific phenomenon associated with the focal issue. This anchor phenomenon must be relevant to students' everyday experiences, observable, complex, have associated data, text and images, and part of the school's curriculum (Sadler et al., 2019). If anchor phenomenon is not present or unclear, then this element is scored as a zero		
Level 3	**Level 2**	**Level 1**
All <u>three</u> components: a) Explicit **naming** of the anchor phenomenon b) **Mechanisms and systems/functions** (in science or **mathematics)** described c) **Connections** of **science** or **mathematical** topics to SSI	Only <u>two</u> components: a) Explicit **naming** of the anchor phenomenon b) **Mechanisms and systems/functions** (in science or **mathematics)** described c) **Connections** of **science** or **mathematical** topics to SSI	<u>One</u> component: a) Explicit **naming** of the anchor phenomenon

B-2) PCK: Explore and explain the underlying scientific phenomena: Think of opportunities for students to explore and explain the scientific phenomenon associated with the focal issue. This anchor phenomenon must be relevant to students' everyday experiences, observable, complex, have associated data, text and images, and part of the school's curriculum (Sadler et al., 2019). If anchor phenomenon is not present or unclear, then this element is scored as a zero		
Level 3	**Level 2**	**Level 1**
All <u>three</u> components: a) teacher relates anchor scientific phenomenon or mathematical system to students' everyday experiences b) teacher provides opportunity for students to observe the anchor scientific phenomenon or mathematical system c) teacher provides opportunity for students to use data, text, and/or images to explore and explain the anchor scientific phenomenon or mathematical system	Only <u>two</u> components: a) teacher relates anchor scientific phenomenon or mathematical system to students' everyday experiences b) teacher provides opportunity for students to observe the anchor scientific phenomenon or mathematical system c) teacher provides opportunity for students to use data, text, and/or images to explore and explain the anchor scientific phenomenon or mathematical system	<u>One</u> component: a) teacher relates anchor scientific phenomenon or mathematical system to students' everyday experiences b) teacher provides opportunity for students to observe the anchor scientific phenomenon or mathematical system c) teacher provides opportunity for students to use data, text, and/or images to explore and explain the anchor scientific phenomenon or mathematical system

C) Engage in STEM modeling: Allow students to engage in scientific modeling and reasoning through development, use, evaluation, and revision of scientific models. Models are used to convey and explain information as well as to predict future events. Example classroom models include: conceptual (e.g. drawings and sketches), mathematical (e.g. graphs and equations), physical (e.g. stream table), engineering (e.g. designs and physical model of a bridge), and computer-oriented model (e.g. online simulation). (Macalalag, 2012)		
Level 3	**Level 2**	**Level 1**
<u>Three or four</u> components: a) **students** develop models b) **students** evaluate **and/or** revise models c) **students** use models to convey information d) **students** use models to make predictions	<u>Two</u> components: a) **students** develop models b) **students** evaluate **and/or** revise models c) **students** use models to convey information d) **students** use models to make predictions	<u>One</u> Component: a) **students** develop models b) **students** evaluate **and/or** revise models c) **students** use models to convey information d) **students** use models to make predictions

D) Consider issue system dynamics: Ask students to consider a system associated with their SSI. The system may include interactions of humans with nature as well as social elements such as political, economic, ethical, and religious considerations.		
Level 3	**Level 2**	**Level 1**
Four or more components: a) political b) cultural c) economic d) ethical e) religious f) health g) nature h) equity	Two or three components: a) political b) cultural c) economic d) ethical e) religious f) health g) nature h) equity	One component: a) political b) cultural c) economic d) ethical e) religious f) health g) nature h) equity

E) Employ reflective scientific skepticism: Teach students to consider the following questions while reviewing their data and sources of information (Sadler et al., 2019).		
Level 3	**Level 2**	**Level 1**
Asks students to question **THREE OR MORE**: a) Biases that could affect the presentation of the information **OR** b) The author or organization disseminating the information **OR** c) The purpose and/or methodology for obtaining information **OR** d) The expertise and/or relevant experiences the author has **OR** e) Those who are disadvantaged/advantaged with respect to the SSI	Asks students to question **TWO**: a) Biases that could affect the presentation of the information **OR** b) The author or organization disseminating the information **OR** c) The purpose and/or methodology for obtaining information **OR** d) The expertise and/or relevant experiences the author has **OR** e) Those who are disadvantaged/advantaged with respect to the SSI	Asks students to question **ONE**: a) Biases that could affect the presentation of the information **OR** b) The author or organization disseminating the information **OR** c) The purpose and/or methodology for obtaining information **OR** d) The expertise and/or relevant experiences the author has **OR** e) Those who are disadvantaged/advantaged with respect to the SSI

F) Compare and contrast multiple perspectives: Ask students to obtain and evaluate information from a range of stakeholders such as environmental activists, politicians, political groups, researchers, scientists, religious organizations, and media.		
Level 3	**Level 2**	**Level 1**
Four or more perspectives: a) media b) scientists c) businesses d) politicians e) researchers f) public opinion g) political groups h) religious organizations i) environmental activists	Two or three perspectives: a) media b) scientists c) businesses d) politicians e) researchers f) public opinion g) political groups h) religious organizations i) environmental activists	One perspective: a) media b) scientists c) businesses d) politicians e) researchers f) public opinion g) political groups h) religious organizations i) environmental activists

G) Elucidate own position/solution: Engage students to defend and explain their position and/or propose a solution to the SSI. Ask students to use their data to explain their position and/or solution, explain the strengths and weaknesses of their claims, and identify their personal biases and possible limitations.		
Level 3	**Level 2**	**Level 1**
All three components: a) use **their** data to explain **their** position and/or solution, b) explain the strengths and weaknesses of **their** claims, c) identify **their** personal biases and possible limitations.	Two components: a) use **their** data to explain **their** position and/or solution, b) explain the strengths and weaknesses of **their** claims, c) identify **their** personal biases and possible limitations.	One component: a) use **their** data to explain **their** position and/or solution, b) explain the strengths and weaknesses of **their** claims, c) identify **their** personal biases and possible limitations.

Sociotransformative Constructivism (sTc)

H) Reflexivity: Providing avenues to elicit and voice with respect to one's cultural background, moral and ethical stance, socioeconomic status, belief systems, values, education, and skills influence what we consider is important to teach/learn (Calabrese, 2003 in Rodriguez, A.J., Morrison, D., 2019; Zeidler, 2014)		
Level 3	**Level 2**	**Level 1**
All three components: a) Students provided avenue to elicit and voice their perspective on the SSI b) Students reflect on how their opinions changed over time with the unit of study c) Students are able to discuss the SSI's value to them in terms of cultural significance, social importance, and level of interest	Two out of three components: a) Students provided avenue to elicit and voice their perspective on the SSI b) Students reflect on how their opinions changed over time with the unit of study c) Students are able to discuss the SSI's value to them in terms of cultural significance, social importance, and level of interest	One out of three components: a) Students provided avenue to elicit and voice their perspective on the SSI b) Students reflect on how their opinions changed over time with the unit of study c) Students are able to discuss the SSI's value to them in terms of cultural significance, social importance, and level of interest

I) Authentic Activity: sTc is authentic activity that involves inquiry-based, hands-on, minds-on activities that are also socio-culturally relevant and tied to the everyday life of the learner.		
Level 3	**Level 2**	**Level 1**
Students are engaged in learning activities that meet all of the following criteria: a) Tied to the everyday life of the learner b) Inquiry-based, hands-on, minds-on c) Socioculturally relevant	Students are engaged in learning activities that meet 2 of the following criteria: a) Tied to the everyday life of the learner b) Inquiry-based, hands-on, minds-on c) Socioculturally relevant	Students are engaged in learning activities that meet 1 of the following criteria: a) Tied to the everyday life of the learner b) Inquiry-based, hands-on, minds-on c) Socioculturally relevant

J) Dialogic Conversation: Provides opportunities for students to voice their own reasons (emotional tone, ideological, and conceptual positions) the speaker chooses in a specific context		
Level 3	**Level 2**	**Level 1**
Three or more opportunities for students to co-construct knowledge through different forms of dialogue with classmates, teachers/other adults, experts, etc.	Two opportunities for some students to co-construct knowledge through different forms of dialogue with classmates, teachers/other adults, experts, etc.	One opportunity for some students to co-construct knowledge through different forms of dialogue with classmates, teachers/other adults, experts, etc.

K) Metacognition: Provides opportunities for students to use their learning experiences to transform (actions) themselves and others		
Level 3	**Level 2**	**Level 1**
a) Two or more opportunities for students to reflect on their learning experiences with regard to its impacts on themselves and others **AND** b) Reflects on what their role is in influencing this SSI (agency)	a) One opportunity for students to reflect on their learning experiences with regard to its impacts on themselves and others **AND** b) Reflects on what their role is in influencing this SSI (agency) **OR** c) Multiple opportunities for students to reflect on their learning experiences with regard to its impacts on themselves and others	a) One opportunity for students to reflect on their learning experiences with regard to its impacts on themselves and others **OR** b) Reflects on what their role is in influencing this SSI (agency)

Teacher Candidates Working with Digital Technologies to Support Multilingual Students in Asset-Based Ways

Megan E. Lynch
Frances Nebus Bose
May Lee

Abstract: This article demonstrates how the digital technologies of video recordings and webcams in a virtual learning after school program made it possible for teacher candidates to practice and reflect on asset-based pedagogies for multilingual students. Implications to engage teacher candidates in asset-based pedagogies in virtual science and engineering programming are discussed. The authors invite teacher educators to consider how the potentials of video recordings and webcams can be extended to other content areas and in-person teaching.

About the Authors: *Megan E. Lynch, Postdoctoral Fellow, University of North Florida; Frances Nebus Bose, Postdoctoral Research Associate, The Pennsylvania State University; May Lee, Instructor, World Campus M.Ed. Program Coordinator; The Pennsylvania State University*

Introduction

Even prior to the COVID-19 pandemic, P-12 multilingual students, children and students classified by the school district as "English Learners", were not consistently provided equitable, culturally sustaining learning practices in the classroom (Kleyn & García, 2019; López, 2017; Paris & Alim, 2014). The COVID-19 pandemic has exacerbated the inequities multilingual children face and has underscored the need for engaging, equitable learning opportunities. During the height of the COVID-19 pandemic, there was thus an enhanced need for teacher education programs to offer teacher candidates (TCs) high quality field experiences to practice supporting and engaging multilinguals. Responding to this need, during the 2020-2021 academic year, the authors pivoted toward virtual internships for TCs that were interdisciplinary and focused on language-integrated science and engineering practices.

With the assumption that virtual P-12 learning opportunities will continue to be prevalent (Singer, 2021), we asked, "*How do virtual teaching interactions afford opportunities for TCs to foster asset-based pedagogies* (López, 2017; Paris & Alim, 2014*) with multilingual students through science and engineering practices?*" Our analysis revealed how digital technologies (e.g., webcams and video recordings) made it possible for TCs to enhance communication and social connections with multilingual students through movement, video images, and working with materials (Kress, 2010; Lemke, 2004), as well as facilitate reflective teaching practices (Gibbons & Farley, 2021). Through webcams and video recordings, we found that TCs were enacting and reflecting on equitable learning opportunities for multilingual students throughout their virtual internship.

Conceptual Framework

Prior to the recent need for P-12 teachers to teach virtually given the COVID-19 pandemic, a call for teacher education programs to prepare TCs to teach online had been established. While the number of online learning opportunities for P-12 students was growing, it was without proportionate teacher preparation for teaching in an online environment (Kennedy & Archambault, 2012). Additionally, there was concern that teacher education programs tended to give more value to in-person clinical experiences despite a growing trend toward virtual and hybrid P-12 learning (Larson & Archambault, 2019).

Preparing TCs to differentiate content and advocate for multilinguals who are learning English in a virtual space requires additional considerations. Multilingual students learning English must be provided with learning experiences in which they can engage and express through multiple modes in addition to words (Wright, 2015). At the same time, there is concern that virtual teaching and online clinical experiences may constrain such ways of engaging since teachers and students are physically separate and unable to work collectively with the same materials. An additional concern that has garnered attention during online learning in response to the COVID-19 pandemic is that many multilingual students and their families have unequal access to a high-speed internet connection, hardware, and materials required for digital learning (Ferren, 2021; Zehler et al., 2019). These digital infrastructure challenges may also be similarly experienced by TCs (Howell et al., 2021). Although pedagogical and infrastructure concerns can present a significant hurdle for equitable digital learning and teaching, we argue that there are indeed overlooked possibilities, such as facilitating the ability to reflect on asset-

based pedagogies and preparing TCs to cultivate equitable learning opportunities for multilingual students.

Our stance is that for TCs to support multilingual students learning English in science and engineering practices, their pedagogies must be culturally sustaining (Paris & Alim, 2014). That is, TCs must develop asset-based pedagogies, which see "students' culture as a strength, countering the more widespread view that inordinate achievement disparities stem from deficiencies in the child and/or child's culture" (López, 2017, p. 193). This requires TCs to flexibly orient to students' dynamic funds of knowledge (Moll et al., 1992). They must also create spaces for students to draw on their existing and evolving semiotic resources to express their thinking and knowing by hybridly mixing gestures, images, and working with materials in tandem with multilingual talk and writing (Canagarajah, 2013; García & Kleifgen, 2020).

For both TCs and students, considerations for teaching science and engineering virtually are distinct from other content areas. For one, science sensemaking (Lee et al., 2013), the material and visual-oriented communication of science practices (Lemke, 2004), and the uniqueness of communication in digital interactions (Androutsopoulos, 2021) provide expansive discourse opportunities for multilingual students to share their understandings of the natural and designed world that are not historically privileged in schools (Haverly et al., 2020). Through such complex ways of communicating in a virtual science and engineering space, a fertile ground for advancing equity pedagogies for TCs is created as they begin to know the multilingual students they interact with, learning more about *what* they know and can do, as well as *how* they come to know in expanded ways. Furthermore, because TCs have less formal training in science and engineering teaching (Cunningham et al., 2014), not to mention the linguistic practices of science and engineering (Shaw et al., 2014), if positioned from an asset orientation, this sentiment of 'not knowing' can create a space of curiosity and exploration where TCs may be more open to pedagogical inquiry. We show how in this virtual science and engineering teaching and learning space, webcams and video recordings became the means by which multilingual students shared their different ways of knowing and TCs practiced equity pedagogies.

Methodology

Context and Program Description

The virtual internship was situated within an interdisciplinary professional development partnership that had brought together stakeholders from a university, a community center after-school program, and a school district in a Mid-Atlantic state for the past five years. The data for this study comes from a 10-week virtual internship offered to TCs in the university's college of education.

The goals of the internship were two-fold: 1) provide the students in a partnering after-school program at a community center with equitable science and engineering experiences, and 2) provide TCs with an opportunity to foster relationships with students and develop asset-based pedagogies that draw on the myriad of multilingual students' cultural and linguistic knowledge. The students in the after-school program were in grades two through six and attended various nearby public schools. They were multilingual students who were part of a predominantly English/Spanish bilingual community that has faced political upheaval after a demographic shift resulted in Dominican and Puerto Rican communities

now representing the majority. All TCs had differing linguistic backgrounds from the students they taught, with the majority being English-dominant. The TCs were divided into two cohorts of 13 TCs with 12 students each. Teacher candidate cohorts met with their respective teacher educator on a weekly basis to plan, prepare, and reflect on each week's lesson.

In both cohorts, TCs led students through the engineering design process of investigations that positioned students as creative engineers who designed, refined, tested, and manipulated various products using everyday materials. In Cohort A, they explored circuits and motors, and in Cohort B, they explored early coding through the use of a BBC "micro:bit", an exposed circuit board that pairs with an easy-to-use website to introduce block coding to beginners (The Micro:bit Educational Foundation, n.d.).

Data Collection and Analysis

This study employs case study methodology (Merriam, 1998). The case is bounded by the two cohorts of TCs participating in a 10-week online internship. Data include artifacts from weekly hour-long co-planning meetings and co-teaching sessions for each cohort over the course of the internship. Data from co-planning meetings include lesson plans, meeting agendas, other shared documents/resources, weekly written reflections, and video recordings of co-planning meetings and corresponding transcripts and chat logs. Data from co-teaching sessions include video and transcriptions of weekly co-teaching between TCs and students in the after-school program. This included video from the main room and "breakout rooms" (approximately 4-5 breakout rooms each week per cohort). Finally, exit interviews for all participating TCs were a source of data triangulation. For one TC, her verbal reflections delivered as part of a conference presentation where she spoke about her teaching experience in the virtual internship were additionally included as part of the data.

Data analysis began with an initial open coding of interactional moments across the data that broadly addressed one of the two main concepts guiding the study's inquiry: use of technology and evidence of the development of or attention to asset-based pedagogies. Some interactional moments were sought out based on what TCs shared in the exit interviews while others were found in re-watching the video and reading transcripts. Video analysis was more heavily relied on over transcript analysis because of the visual nature of the inquiry. After identifying interaction moments, additional, iterative cycles of analysis were conducted to move between content-coding and focused coding of the data. What resulted from the analysis was repeated use of webcams in a way that we had previously not seen theorized and the repeated use of co-teaching video for TCs to reflect upon.

Findings

By working with webcams and video recordings, TCs practiced asset-based pedagogies and fostered equitable communication and social connections supporting multilingual students in the digital teaching environment. First, we focus on how webcams created possibilities for TCs to make space for students to have choices about their learning, how they display their learning processes, and expand their ways of sharing their ideas in virtual science and engineering interactions. Webcams also created ways for TCs and students to facilitate social connections. Subsequently, we consider how the plentiful, high-quality video made possible by the webcams, served as rich material for TCs to reflect on teaching

interactions to promote asset-based pedagogies.

Equitable Possibilities Through Working with Webcams

During the COVID-19 pandemic, learning incorporating webcams became a controversial topic, suggesting that requiring teachers, students, and TCs to use a webcam when online risked serving as a discriminatory practice of surveillance (Will, 2020), particularly when students' home practices and/or environment are not valued by the educational institution, teachers, or peers. In this study, however, the students TCs worked with were all physically located at an after-school community center, minimizing the concern about revealing one's home environment to others. Furthermore, there were intentional conversations about webcam use as a form of surveillance with TCs drawing on their current lived realities of also being students taking online classes.

Across the fields of language learning and early childhood education, webcams are impactful for multilingual learning interactions (Guichon & Cohen, 2014; Magnusson, 2021; Waldmann & Sullivan, 2019) primarily because they allow *students* to communicate visually, showing an object or indicating an idea with the camera rather than communicating with words. However, little is known about how *TCs'* pedagogies and interactions with students are influenced by webcams, and how *TCs* might also engage with such visual communication. In our analysis, we found that webcams changed ways of teaching for TCs, providing ways of promoting more equitable teaching and learning interactions.

With in-person video recordings of classrooms, video is often restricted to a camera positioned by an adult teacher or researcher rather than by students. In contrast, by removing and repositioning the angle of the external webcams that rested on top of each computer at the after-school center, students were able to show TCs multiple angles and perspectives of their designing and learning processes. For example, when students moved the camera downward to focus on their hands and materials as they built, TCs were able to view a zoomed-in play-by-play of students' design process. This perspective, often less visible in an in-person classroom, allowed us as teacher educators to foreground in our conversations with TCs the significance of the engineering design process rather than the final product that students created. Additionally, students could manipulate the webcam to choose what to show, or what *not* to show to create suspense, thus providing students a larger stake in how each learning interaction could unfold. For TCs negotiating their new roles as teachers in the classroom, such interactions emphasized the importance of a teacher as a cultivator, working *with* students and the material characteristics of technology rather than managing/controlling students, objects, and/or phenomenon. Lastly, in learning with webcams, TCs and students frequently held up materials to the camera and performed gestures in conjunction with and in lieu of words (Bose et al., 2021). This visual sharing made possible by the webcams provided opportunities for multimodal teaching and expanded options for communication between students and TCs beyond the spoken and written words, which was critical given TCs' and students' different linguistic backgrounds.

To illustrate these findings, we offer an example from week seven when a TC worked with two students in a breakout room to build a motor-based car. Despite the moment being virtual, it was defined by multimodality, being movement-oriented and tactile (Kress, 2010). As described by the TC, students could, "get into it, get on the ground, even though we're over Zoom". Throughout

the hour-long session, both the TC and students could be seen holding up the components of their design to the webcam at various stages of building. In doing so, TCs and students visually communicated information about their designs in conjunction with and in lieu of spoken words.

At one point, rather than holding up materials at eye-level, one student moved his webcam to face downward so that the TC and his peers could see his hands and materials while he was building rather than the previous moment when his face was positioned at the center of the screen. This move made it possible for the TC to carefully notice the process of the students' car building that would later inform the final design. A few minutes later, both students moved their webcams, this time pointing the camera toward the floor to show the TC their designed cars racing on the carpet. When reflecting on this moment, the TC noted, "the students were able to manipulate the camera, which ultimately invited me to experience and observe the moment with them. Being able to observe this process with them brought me into their perspective even thought I was through the screen." Although virtual, the TC felt that by moving the camera, the students could "really make sure like we were included because they [students] could have just said…like it (the car) ran … NO! they were like— 'look, like look what you helped me make.'"

In addition to including the webcam in ways that gave students choices, to the TC, the webcam was a way to build social connections between herself and students such that she perceived being included and being acknowledged as part of making the car. The TC and others in her cohort shared the concern that they felt uneasy about forming social connections with the students because they were virtual and felt that human relationships in the virtual setting felt "less personal" (as shared in an interview). Yet, the TC felt that she and her students were indeed able to connect through the invitation the students made through the camera. She theorized that the multilingual students she worked with were perhaps less comfortable and/or confident with connecting with her through spoken English, and thus believed they reciprocated and responded to her interest in them and their process of making through their visual invitation with the webcam and by allowing her to "participate" in the testing of the car (virtually). The TC suggested students made a social connection not by talking, which she reported was her means of developing a relationship of care, but by moving the camera lens. To the TC, if the webcams had remained stationary without the students moving them, she would not be able to see the action happening on the floor of the community center and would have been unable to participate with them at this critical moment.

Curated Teaching Videos for Teacher Candidates' Reflective Practice Toward Asset-Based Pedagogies

The beneficial uses of video of teaching practice as a source of reflection during clinical experiences are not new (Baecher et al., 2014; Gibbons & Farley, 2020). However, for many TCs, watching classroom videos can be daunting; there is a lot to process at one time, and they do not always have specific lenses to focus their attention. This process is further compromised by, in our experiences as teacher educators, low-quality audio captured in in-person classrooms with young students given movement and background noise, as well as recordings that may be focused on pre-determined moments of formal instruction, resulting in missed opportunities.

The digital space created a quantity and quality of teaching video that allowed for robust possibilities for TC reflection toward

developing asset-based pedagogies. Regarding quantity, the large volume of recordings from the virtual context provided TCs with a readily available, sizable library of video and still images to analyze. TCs had access to all the recordings, including video from breakout rooms they were not part of, to which they were able to refer. Moreover, the quantity of video provided a wider range of video for the authors, as teacher educators, to use in guiding TCs' reflection during co-planning meetings. This volume and range of video included what might seem like mundane or taken-for-granted interactions that are not typically recorded by TCs, their mentor teachers, or their university supervisors. Additionally, because students were wearing headsets with microphones, high-quality audio of student's voices was captured. Without this audio, students' words and ideas would not have been able to be recorded so completely, a critical component to what made co-planning sessions successful, as explored in the example below.

In co-planning sessions, transcript elicitation coupled with extensive recorded video created more in-depth, nuanced opportunities for formative assessment of TCs' pedagogical moves leading to shifts in asset-based pedagogies. In week five, some of the TCs had the opportunity to meet with students individually to check-in on the progress of their current design. An excerpt from three brief conversations between three TCs and three elementary-aged multilingual students during these meetings were selected for discussion the next week. These conversations were selected because nearly all the TCs' initiating questions were close-ended questions and mirrored the limited, yet often-default school discourse structure – IRE (teacher *initiates*, student *responds*, teacher *evaluates*) (Cazden, 2001). The types of initiating questions asked to one multilingual child included: "*Can we see your microbit? Did you put your code into it? Do you need help with anything? You're pretty good at this; do you like building? Do you want to be an engineer when you grow up?* and *What would you make?"* As a result, the multilingual students were limited to giving short, one-word or yes/no responses.

When the transcript was brought into the co-planning session, the TCs spent time in breakout rooms participating in a modified "notice and wonder" activity (Zembal-Saul et al., 2013) eliciting TCs' understandings on what they observed from the conversation. TCs' responses indicated that they noticed the short utterances through comments like "he replied 'no' a lot; she responds with 'yeah' a lot; he seems to give short answers and does not explain beyond what is directly asked; her responses got longer as the conversation went on." Then TCs "wondered" (i.e., posed meaningful questions about the transcript) in their breakout rooms. They wondered whether the students were just shy, if they understood the questions, or if there was a "language barrier." As evident in these wonderings, the TCs were not yet reflecting in an asset-based way.

When shifting from their breakout rooms to the whole group, the teacher educator used the TCs' "noticings" from their "notice and wonder" activity to highlight the linguistic structure of the questions being asked. TCs were ultimately able to see how their method of question-asking restricted the students' responses, providing space for TCs to critique their initial deficit framing of students' ways of responding.

Furthermore, during the conversation, one TC referenced the current transcript and a previous breakout room video to further develop asset-based pedagogies. She noted, "At one point when [other TCs] asked 'oh, do you think you'd want to be an engineer when you're older?' and [the child's] like 'yeah,' and they were like 'what would you make?' and [the child] said 'bunnies.'" While her colleagues had been puzzled by "bunnies" as

an answer, the TC referenced breakout room video she had watched during previous week to suggest that the child's response of "bunnies" was not a misunderstanding of the question. Rather, because of the unrestricted access she had to extensive video from her and other groups' breakout rooms across multiple weeks, she understood that when the child said "bunnies," he was referencing the combination of multiple events from prior weeks. Based on video analysis over time, the TC was able to exemplify how TCs can have a more nuanced interpretation of a child's response and not dismiss the "bunnies" response as a misunderstanding or attributing the response to the perception of limited English-speaking abilities.

The focused video and transcript noticing of co-teaching moments provided the opportunity for TCs to recognize changes they wanted to make to their own practice to better support multilingual students while also recommending changes their fellow TCs might want to consider. In a second illustration from a co-planning meeting, while watching video that included the practice of taking attendance from other TCs' breakout room, one TC expressed the concern that the approach was awkward and confusing. She suggested that instead of the TCs reading the students' names aloud continuously and asking students to confirm/correct the pronunciation, "that maybe to avoid calling the students the wrong names in the beginning, instead of being 'is your name Demerius,' we just go around and say our names. Like avoid saying- or calling them by- the wrong names." She later enacted this practice in her own breakout room. While this suggestion could be perceived as a very minor shift, it demonstrated the TC's ability to imagine, suggest, and ultimately enact a more culturally sustaining practice of honoring students' names (Kohli & Solórzano, 2012), a practice propelled by video she was not part of but able to watch and reflect on. Further, because taking attendance could be overlooked as an inconsequential interactional moment in the classroom, this moment might not have been captured on video in a traditional, in-person teaching placement. Although TCs wrote weekly reflections, it was in the conversations around the videos and transcripts that incrementally showed the TCs' emerging and shifting of beliefs and practices for more equitably supporting multilingual students.

Conclusion

The potential of virtual teaching has been historically overlooked in favor of in-person instruction (Larson & Archambault, 2019). Yet, we are suggesting two characteristics prevalent with virtual teaching, webcams, and video recordings, can invite opportunities to provide equitable, culturally sustaining learning opportunities for multilingual learners. One pedagogical possibility realized through virtual teaching is how the visual and moveable nature of external webcams was critical for students and TCs of different linguistic backgrounds and experiences to build relationships and communicate. While webcams can pose a threat to equitable teaching through monitoring and control (Will, 2020), we show more equitable possibilities of webcam use when students are given a choice as to how and when to bring webcams into their learning interactions.

Similar to previous scholarship, our findings suggest the material characteristics of webcams impact the process of learning in a multilingual environment (Waldmann & Sullivan, 2019). Extending this work, the current study suggests webcams impact learning interactions between TCs and students, not only by permitting the visual presence of a teacher and student (Guichon & Cohen, 2014), but by students revealing to

TCs their perspectives about their learning as they position, turn the webcam on/off, and work with materials. Doing so provided TCs with insights (based on evidence beyond words) as to what students know and can do. By recognizing multiple ways of communicating and expressing ideas, TCs see the multiple assets that students bring to the interactions rather than fixating on perceived deficits. We further suggest that webcams provided students multiple avenues for choice that altered the positioning of the TCs in the interactions to be on more equal footing. All of these phenomena additionally provided possibilities for social connections between TCs and students from different linguistic and cultural backgrounds.

Furthermore, the quantity and quality of video data provided TCs a more complete picture of their interactions during the sessions and the ways in which they interacted with students. Data captured via online digital technologies allowed for TCs to collectively reflect on detailed interactions of targeted moments across time leading to more evidence-based explanations/insights into the interactions. As one TC summarized, "collectively, in planning, we figure out something." This collective figuring out served as a powerful form of formative assessment of the TCs' development of asset-based pedagogies towards multilingual students each week and additionally highlights the need for focused analysis of teaching video in traditional, in-person coursework. One way this might be achieved is to reconceptualize how video analysis occurs. For example, if several TCs have video of a read-aloud, they could collectively watch their videos of read-alouds over time with a fine-grained analysis of their interactions with multilingual students to discuss where they see culturally sustaining practices with support from a teacher educator. Additionally, seemingly inconsequential moments could be the focus of analysis, like viewing videos from multiple rooms of students lining or setting up, transitioning, etc. (In)equity is always present and always relevant; by integrating equity talk in all reflections on teaching, not as an "add-on," (Dyches & Boyd, 2017) TCs can see students' assets and see more opportunities to engage in culturally sustaining pedagogies in all aspects of the day.

To conclude, though separated physically, the digital technologies of webcams and video recordings during a virtual science and engineering internship with multilingual students and TCs created possibilities for previously overlooked and new ways of learning together – be it TCs and students engaging in a shared, iterative process of engineering design and re-design or TCs collaboratively reflecting on each other's breakout room videos. We suggest that these synergistic possibilities brought together between webcams and video recordings in a virtual science and engineering space may also offer opportunities to engage TCs in equity pedagogies in *other* content areas in addition to in-person teaching.

References

Androutsopoulos, J. (2021). Investigating digital language/media practices, awareness, and pedagogy: Introduction. *Linguistics and Education*, *62*, 1-4.

Baecher, L., McCormack, B., & Kung, S. C. (2014). Supervisor use of video as a tool in teacher reflection. *TESL-EJ 18*(3).

Bose, F. N., Lynch, M. E., & Zembal-Saul, C. (2021). STEM education needs STEM talk: Lessons learned from an after-school enrichment program with

multilingual children, *Science & Children, 59*(2), 38-44

Canagarajah, A. S. (2013). *Translingual practice: Global Englishes and cosmopolitan relations*. Routledge.

Cazden, C. B. (2001). *Classroom discourse: The language of learning and teaching* (2nd ed.) Heinemann.

Cunningham, C. M., & Carlsen, W. S. (2014). Teaching engineering practices. *Journal of Science Teacher Education, 25*(2), 197-210.

Dyches, J., & Boyd, A. (2017). Foregrounding equity in teacher education: Toward a model of social justice pedagogical and content knowledge. *Journal of Teacher Education, 68*(5), 476-490.

Ferren, M. (2021). *Remote learning and school reopenings: What worked and what didn't.* The Center for American Progress. https://www.americanprogress.org/issues/education-k-12/reports/2021/07/06/501221/remote-learning-school-reopenings-worked-didnt/

García, O., & Kleigfen, J. (2020). Translanguaging and literacies. *Reading Research Quarterly*, *55*(4), 1-19.

Gibbons, S., & Farley, A.N. (2021) Learning to think like a teacher: Effects of video reflection on preservice teachers' practice and pedagogy. *Action in Teacher Education, 43*(3), 250-267.

Guichon, N., & Cohen, C. (2014). The impact of the webcam on an online L2 interaction. *The Canadian Modern Language Review / La revue canadienne des langues vivantes, 70*(3), 331-354.

Haverly, C., Calabrese Barton, A., Schwarz, C. V., & Braaten, M. (2020). "Making space": How novice teachers create opportunities for equitable sense-making in elementary science. *Journal of Teacher Education, 71*(1), 63-79.

Howell, P. B., Gnau, A., Peavley, L., & Workman, C. (2021). Field experiences in the ether: The pandemic-induced realities of learning to teach. *Current Issues in Middle Level Education, 25*(2), 72-79.

Kennedy, K., & Archambault, L. (2012). Offering preservice teachers field experiences in K-12 online learning: A national survey of teacher education programs. *Journal of Teacher Education*, *63*(3), 185-200.

Kleyn, T. & García, O. (2019). Translanguaging as an act of transformation: Restructuring teaching and learning for emergent bilingual students. In L.C. de Oliveira (Ed.) *The Handbook of TESOL in K-12* (pp. 69-82). John Wiley & Sons Ltd.

Kohli, R. & Solórzano, D. G. (2012) Teachers, please learn our names!: Racial microaggressions and the K-12 classroom. *Race Ethnicity and Education, 15*(4), 441-462.

Kress, G. R. (2010). *Multimodality: A social semiotic approach to contemporary communication*. Routledge.

Larson, J.S., & Archambault, L. (2019). The extent of K-12 online teacher development: A disconnect between preparation and practice. In Heafner, T. L., Hartshorne, R., & Thripp, R. (Eds.). *Handbook of research on emerging practices and methods of K-12 online and blended learning* (pp. 57-55). IGI Global.

Lee, O., Quinn, H., & Valdés, G. (2013). Science and language for English language learners in relation to Next Generation Science Standards wand with implications for Common Core State Standards for English language arts and mathematics. *Educational Researcher, 42*(4), 223-233.

Lemke, J. L. (2004). The literacies of science. In Saul, E. W. (Ed.). *Crossing borders in literacy and science instruction: perspectives on theory and practice* (pp. 33–47). International Literacy Association.

López, F. (2017). Altering the trajectory of the self-fulfilling prophecy: Asset-based pedagogy and classroom dynamics. *Journal of Teacher Education, 68*(2), 193-212.

Magnusson, L. O. (2021). Digital technology and the subjects of literacy and mathematics in the preschool atelier. *Contemporary Issues in Early Childhood*, 1-13.

Merriam, S. B. (1998). *Qualitative research and case study applications in education*. Jossey-Bass Publishers.

Moll, L., Amanti, C., Neffe, C., & Gonzalez, N. (1992). Funds of knowledge for teaching: Using a qualitative approach to connect homes and classrooms. *Theory into Practice, 32*(2), 132–141.

Paris, D., & Alim, H.S. (2014). What are we seeking to sustain through culturally sustaining pedagogy? A loving critique forward. *Harvard Educational Review*, *84*(1), 85-100.

Shaw, J. M., Lyon, E. G., Stoddart, T., Mosqueda, E., & Menon, P. (2014). Improving science and literacy learning for English language learners: Evidence from a pre-service teacher preparation intervention. *Journal of Science Teacher Education, 25*(5), 621-643.

Singer, N. (2021, April 11). Online schools are here to stay, even after the pandemic. *The New York Times*. https://www.nytimes.com/2021/04/11/technology/remote-learning-online-school.html

The Micro:bit Educational Foundation. (n.d.) BBC Micro:bit. https://www.microbit.org

Waldmann, C., & Sullivan, K. P. H. (2019). How the Materiality of Mobile Video Chats Shapes Emergent Language Learning Practices in Early Childhood. In Pargman, T.C. & Jahnke, I. (Eds.) *Emergent Practices and Material Conditions in Learning and Teaching with Technologies* (pp.217-229). Springer.

Will, M. (2020, October 20). Most educators require kids to turn cameras on in virtual class, despite equity concerns. *Education Week*.

https://www.edweek.org/teaching-learning/most-educators-require-kids-to-turn-cameras-on-in-virtual-class-despite-equity-concerns/2020/10

Wright, W. E. (2015). *Foundations for teaching English language learners: research, theory, policy, and practice*. (2nd ed.) Caslon Publishing.

Zehler, A. M., Miyaoka, A., Chaney, B., Orellana, V., Vahey, P., Torre Gibney, D., Yee, K., & Yilmazel-Sahin, Y. (2019). *Supporting English learners through technology: What districts and teachers say about digital learning resources for English learners.* U.S. Department of Education.

Zembal-Saul, C., McNeill, K.L., & Hershberger, K. (2013). *What's your evidence? Engaging K-5 students in constructing explanations in science.* Pearson.

The Introduction of Global Collaboration to Pre-Service Teachers: Training Future Global Change-Agents

Aaron J. Sams
Lee Kenneth Jones
Walter Smith

Abstract
By participating in global projects, students learn to communicate, asynchronously or synchronously, through digital tools and media. The project in this article paired pre-service teachers in the United States with primary students, ages 8 to 10, in South Korea. The intent was to expose pre-service teachers to global collaboration projects, and to give them experience with the challenges that come with global collaboration so they can later support their own students in such endeavors. The project was evaluated through an open-ended survey for pre-service teachers (N=19) and results were coded according to the constructs of TPACK (technology, pedagogy, and content knowledge). Results showed that the most impactful aspects of the project were in the pedagogy and technology constructs. Surveys showed mostly positive (n=9) and mixed experiences (n=8) for pre-service teachers. Negative experiences were largely related to challenges with asynchronous collaboration. Future recommendations include developing companion lessons to precede this project, training teachers and students in techniques, expectations, and norms during non-face-to-face collaboration.

About the Authors: *Aaron J. Sams is an Assistant Professor in the Education Department at Saint Vincent College. Lee Kenneth Jones is a STEM Teacher at St Johnsbury Academy in South Korea. Walter Smith is a Retired Professor of Education from Texas Tech University.*

Introduction

Bringing about change in an established institution is extremely difficult. Much has been written about how to best effect change in organizations, and these prescriptions take on various forms. Some rely on a top-down leader-driven approach to bringing about change through a transactional model (Weber, 1947), and others take more of a grass-roots approach bringing change from the bottom up through a transformational model (Bass & Riggio, 2006). Some works focus on relationships within the organization, and others attempt to bring change from outside the group. Although books containing all these leadership styles provide a variety of examples and approaches to change, few seem to try to anticipate and address the need for change before the need arises.

Schools are no exception when it comes to change management, but how to evoke lasting and effective change in schools remains an issue. Any of the aforementioned approaches are reasonable, and most are probably effective to some extent. In fact, the transactional model (Weber, 1947) has been a successful model of change in past generations but has recently been questioned as to whether it remains effective in the development of future leaders (Sarros & Santora, 2001). But what if change agents could be planted in an institution before the need for change actually arises? To truly bring about lasting change in an organization the "next generation of leaders must be trained" (Spiro, 2011, p. 129) and "empowered" (Couros, 2015, p. 99). This study accepts this challenge to bring up the next generation out of a single organization and into a broad community by training and empowering undergraduate pre-service teachers. The tactic described herein approximates values-based leadership put forth by Kraemer (2011). By training pre-service teachers who will ultimately become classroom instructors, the goal is that they will become the agents of change necessary to address needs of the future, and recent studies have confirmed that teachers do function as change agents (van der Heijden et al., 2018) specifically with regard to collaboration (Bush & Grotjohann, 2020) and designing learning experiences at a distance (Lee & Kim, 2021). The hope is that pre-service teachers can be primed and ready to positively alter the culture of their future institution, the school.

Another change that has taken place over the last two decades is both the emergence and integration of technology into both society and the classroom. The sudden influx of such tools has developed a need for training teachers, both pre- and in-service, on how to use those tools to enhance both classroom content and pedagogy. This demand and need for cohesive integration of technology, pedagogy, and content knowledge is now known and referred to as TPACK (Koehler & Mishra, 2009).

Anticipating the need for global collaboration in the rising generation and seeing the opportunity to build and develop TPACK skills through a practical application, this study attempted to train pre-service teachers to become adept at teaching and learning through global collaboration. Once the pre-service teachers become teachers in their own classrooms, they will have the experience and skills necessary to model for their students and their colleagues what effective global collaboration looks like. These exemplars can then serve as the trigger to bring about the institutionalization of global collaboration, not just in one organization, but in any of the organizations where the pre-service teachers find themselves in the future.

Conceptual Framework

The project to be described below was not designed to address specific learning targets or standards (although they were addressed and met in each location). Rather, the authors developed the project and recruited participants with the idea of creating an experience for pre-service teachers, in-service teachers, and students that would provide them with increased capacity in the growing world of digital, asynchronous collaboration and communication. The fact that it simultaneously addressed classroom standards and needs, while not the focus of the project, was also intentional as it gave teachers (both pre- and in-service) an opportunity to overlay what they are already doing in their classrooms with modern, 21st century skill development. For the project development, three research-based frameworks were used: the need for developing TPACK (Mishra & Koehler, 2006), the importance of promoting change in education through the training of pre-service teachers (Erdogan & Ciftci, 2017), and the modern idea of global collaboration in the classroom (Nugent et al., 2015).

Technological Pedagogical Content Knowledge

In recent history there has been a sharp shift in how teachers approach their classrooms, and this has initiated calls for rethinking the way new teachers are trained. In the early years of education, much of the focus was placed on teacher content knowledge; the more facts a teacher knew, the better they would perform in their career (Shulman, 1986). However, in more recent decades, the focus moved to pedagogical knowledge with the idea that classroom practices in general were more important than content knowledge (Ball & McDiarmid, 1990). However, concentrating exclusively on either content or pedagogy was unsuccessful, as focusing on only one weakened the other, thus diminishing classroom teaching. Shulman (1986) proposed the idea of strengthening both content knowledge and pedagogical knowledge and acknowledging their codependence on one another and training teachers to use one concept to support the other; and thus, was born the idea of pedagogical content knowledge (PCK). Fast forward two decades to find the addition of many new technologies to both society in general and the classroom in particular; and suddenly technology assumed a significant place in the development of a better classroom. At this time, the idea of TPCK (later TPACK) was introduced; a combination of Shulman's (1986) PCK and teaching technology (Koehler & Mishra, 2009). Mishra and Koehler (2006) stressed the idea that the best classroom practice is not simply using technology in the classroom; rather, best practice integrates technology in a way that expands both content and pedagogy. For example, lecturing in front of a PowerPoint presentation is pedagogically no different than standing and lecturing in front of a chalkboard; but having student teams from two countries collaboratively solve an engineering challenge applies technology's power to go beyond content learning to improve students' so-called soft skills like communication (between cultures) and creativity. This improved classroom use of technology is similar to how modern doctors, police officers, and auto mechanics use technology to *improve* their performance, not simply to make their job easier (Ertmer & Ottenbreit-Leftwich, 2010).

Importance of Change through Pre-service Teacher Education

Although change can be brought about in many ways, one means by which an entire community can be impacted is through the educational system. Governments have recognized this fact and use this opportunity as various policy initiatives are enacted through the schools (Marsh & Wohlstetter, 2013; Schneider & Ingram, 1993; Stone, 1989). Although policy is often enacted through schools, the long-term impact of policies effected through pre-service teacher training is only studied occasionally. One such study found that pre-service teacher training is an effective way to impact the skills and mindsets of a future workforce (Erdogan & Ciftci, 2017), hereby demonstrating the impact of change through pre-service teacher training programs. Another study examined how field immersion during the pre-service years can impact the future teacher's cultural awareness (Wiggins, et al., 2007) showing how predominantly suburban white females may be able to reach students more effectively in urban settings. In addition to effecting change in the community, others suggest that projects conducted during a pre-service teacher program and collected in an e-portfolio can easily transition into a professional portfolio once employed (Boulton, 2014), seamlessly carrying over the work done as a pre-service teacher into the in-service professional environment.

Figure 1: *Three step process for preservice teachers to become change agents helping other teachers engage their students in global education.*

While none of these examples directly relates to the project conducted in this study, they all demonstrate the potential impact that robust pre-service teacher training can have on individuals, schools, and communities. They do so by creating "relatively non-threatening conditions" (Fullan, 2011, p. 53) in which the students can freely learn to become global collaborators before embarking on their own global collaboration projects. The goal of this project is studying the first step shown in Figure 1, which is the development of teachers ready to use global collaboration in their classrooms when they become in-service teachers. The long-term goal, though not within the scope of this initial project, is to develop teachers who will later become agents of change in their respective districts and communities by expanding the reach of global collaboration beyond their own classroom walls. This structure is what Fullan calls a "peer culture to achieve deep change" (Fullan, 2011, p. 53) in which improvement is brought about through the development of a collaborative culture, in the case of this study, within a classroom. Fullan goes on to state that motivating change is "practice based, not theory based" (Fullan, 2011, p. 82) implying that for an individual to know how to bring about change they must first experience it in practice.

Global Collaboration

In a time in which all social, economic, political, and environmental

concerns are becoming increasingly global, the idea of embedding global collaboration in the mindset of educators continues to become more and more relevant. One model of global collaboration is presented as a continuum through which various levels of interaction and collaboration between global partners in Nugent et al. (2015). The collaborative project presented in this paper falls under Limited Communication as defined in this continuum as "some form of direct communication that can be asynchronous, such as via e-mail or a letter; or synchronous, such as a Skype session (interactive audio or video), and typically involves students from a variety of locations reporting their authentic science data, coupled with a communication exchange of some sort" (Nugent et al., 2015, p. 36).

The structure of the project is based on the collaborative process in Lindsay and Davis (2012). This process was implicitly facilitated with the pre-service teachers; however, this project was intended to expose the pre-service teachers to the experience of global collaboration with the intent of collecting their reflections on the process. Consequently, the details of the process were not revealed to the pre-service teachers beforehand. Additionally, the project they worked on was somewhat competitive in nature in that a viable product that could complete a task was the desired end. This approach was adopted to emulate an approach called collaborative competition by Fullan (2011), which is believed to be an essential component of success.

Methodology

This project was developed to provide teachers with what we see as a practical and effective use of TPACK. Along with addressing TPACK skills, the project was developed to seamlessly integrate with current content in the target classrooms. To achieve the goal of efficacy in TPACK discussed previously, the authors did not want to overburden the in-service teachers with something new with which they were uncomfortable. Rather, the overarching goal was to deliver the message that this is just a new way of doing what you are already doing. However, as was pointed out by other authors (Cuban et al., 2001; Ertmer & Ottenbreit-Leftwich, 2010; Lawless & Pelligrino, 2007), the technology component needed to be used to support the PCK.

The authors of this paper are a pre-service teacher educator in Pennsylvania, United States, a STEM instructor at an international school in Seoul, South Korea, and a university professor in Texas. Using the conceptual framework described above, the first two authors collaborated to develop a project that would simultaneously give global collaboration experience to a cohort of pre-service elementary teachers in the United States, two in-service elementary teachers in Seoul, and grade three (nine and ten years old) and grade four (10 - 11 years old) students also in Seoul. This group allowed us to provide proper TPACK training for both pre- and in-service teachers, while simultaneously giving modern global collaboration experiences to a group of elementary students. The following sections describe the designed collaboration.

Settings

This project took place at two separate locations on opposite ends of the globe. One group (the pre-service teachers) were in Pennsylvania, United States, and the other group (the in-service teachers and their students) were in Seoul, South Korea.

South Korea

In South Korea, two experienced elementary school teachers were recruited to

participate in this project along with their students. The two classrooms were a third-grade class with nine students in total, five girls and four boys, and a fourth-grade class with eight students, four boys and four girls. Although their participation was important, none of the in-service teachers or elementary students were part of the actual research and analysis. The school is a private, K-12 international school in a relatively less populated area of Seoul. The students, however, are not just from the nearby neighborhood, but come from all around Seoul, some traveling more than an hour to attend school. The goal of many students enrolled at this school is to attend University in the United States, and so the exposure to Western-style curriculum and to practice with English language is important.

United States

The Pennsylvania participants consisted of 19 undergraduate pre-service teachers at a small private, Catholic, liberal arts college. All the participating pre-service teachers were pursuing a Bachelor of Science degree in Early Childhood Education along with teacher certification in the Commonwealth of Pennsylvania. All the pre-service teachers were white females between the ages of 20 and 26. The undergraduate students participated in the project as part of their elementary science methods course which is required for their major and which is taken in one of their last two years of their academic program. This course was taught off campus at a STEM center housed in a local educational service unit.

Project description

For this project the students in the third and fourth grade classes began working with the preservice teachers in the United States to design, build, and test rubber band launchers that would shoot ping-pong balls into containers at a predetermined distance. The elementary students were in groups of three to four students working with two to three preservice teachers. Each grouping of students/pre-service teachers was referred to as a *team*. Since the project was completed by the end of November, the theme of an international toy company designing a launcher to sell at Christmas was used. The teams were engineers from Korea and the United States, each building a launcher that could be made and sold in both locations. Proper safety training and rules for working with projectiles were provided and followed at each location. This project was modeled after a similar one done by Davey, et al. (2009) in which preservice teachers from the United States worked with elementary students in Australia to design and build edible lunar vehicles.

The parameters of the project were intentionally kept simple and open-ended so as to give teams the opportunity to design their own unique launchers. The first requirement was that each team build identical launchers in both the United States and Korea. This required teams to discuss and then select only materials that were readily available in both locations and kept with the theme of an international toy company that is looking to build and sell the same device in two locations. The remaining two requirements were that teams had to use size #32 rubber bands (maximum of 20 per device) and needed to be able to launch into a bucket on ground level 3.0 meters away.

After teams had been formed, the preservice teachers created a kick-off video that introduced the project to the students in Korea, highlighting the goals, the rules, and the target outcome. Next a single shared Google Doc was created for each team (and shared with the classroom teachers and authors) and each group began with an exchange of biographies of each team member and their sharing initial ideas. Then

over the course of about three weeks the teams communicated via a combination of their Google Doc and Google Hangouts (video chatting) to share ideas, progress, problems, and solutions. The school in Korea used G-Suite for education and all teachers and students had Google accounts. The college where the pre-service teachers were enrolled used Office365, so each of them used a pre-existing Google account or created a new one so they could more easily communicate with the students in Korea. Although it is not always possible with global collaboration projects like this, despite the 13-hour time difference since the course in the United States was an evening class, video conferencing was also an option since the morning session of the elementary school aligned with the evening class in the United States. At the end of the project, each team had two identical launchers, one in the US and one in Korea. To conclude the project, the entire group (pre-service and in-service teachers and all students, as well as the authors) met via video conference to simultaneously show off and test their launchers.

Results

Upon completion of the project the pre-service teachers were administered a survey containing 20 open-ended questions in which they were asked to reflect upon their experience and respond to the open-ended questions. The open-ended questions were then coded, and emergent themes were created. After the initial themes were categorized, each theme was coded based on TPACK categories: technology (TK), pedagogy (PK), and content (CK); along with all combinations thereof: TPK, TCK, and PCK. Codes that did not fall into any of the TPACK categories were noted as X. The TPACK codes were then counted based on responses coded per category. Once coded, the results were assessed to determine which themes were most common in the responses. All pre-service teachers (N = 19) responded to the survey. See Table 1 for total counts in each category. A Chi-square analysis of adjacent knowledge categories shows each category is significantly different than each adjacent category ($p < 0.005$)

Table 1: *Categories of pre-service teachers' TPACK responses*

Knowledge Categories	N
Pedagogical	252
Technology	114
Technology/Pedagogical	85
Content	61
Pedagogical/Content	17
Technology/Content	0

27 comments were counted as not addressing TPACK.

Successes with Collaboration and Construction

After the survey comments were coded and analyzed, the results indicated the students reported the most successful experiences as being the collaboration process and construction of the actual ping-pong ball launchers. The undergraduate students in Pennsylvania seemed to enjoy working with the primary students in Korea. Positive comments are listed in Table 2.

Table 2: **Positive comments about the collaborative experience**

"Working with and successfully completing a project with such wonderful children from across the globe!"
"The students in Korea brought me the most joy during this project. Each time they communicated with us they were so happy to be working on something that "older kids" were working on as well. It made me proud to know that young students can do something and struggle, the same way that college students can do something and struggle."
"The ability to work with students in another part of the world on a project because I never thought that would be possible."

Struggles with Collaboration and Communication

Review of the results demonstrated two main ways in which the pre-service teachers struggled with this project: collaboration and communication. Interestingly, collaboration was also one of the elements that was highest in the success category. Comments regarding these challenges are found in Table 3.

Table 3: **Comments about challenges faced in the collaborative experience**

"The lack of constant communication. Also, the difficulty of negotiating with the students on certain parts of the design and materials."
"I was most frustrated with the students not being willing to change their mind on how to create the ping-pong ball launcher. They assumed that we were going to make those changes and they did not seem eager to change theirs other than adding tape instead of glue."
"The inability to communicate via video every time."

Abilities as Change Agents

The final question the undergraduates were asked on their questionnaire was to evaluate the extent to which the pre-service teachers could serve as change agents in their future teaching roles. Specifically, they were asked whether they believed they could provide leadership in helping others coordinate a similar project that incorporated elements of TPACK and global collaboration. Of the 19 respondents, 13 agreed and 6 strongly agreed that they could do so. No respondents indicated that they disagreed or strongly disagreed with the statement.

Discussion

Based on the coded and categorized responses, most of the responses were technology and pedagogy related. This trend is confirmed by the responses that were categorized as being a combination of categories with TPK, which was a combination of the two highest incidence categories, being the highest. This result seems to indicate that the most impactful elements of the project related to technology and pedagogy. This analysis does not reflect whether those comments reflect positive or negative experiences, but additional sentiment analysis could be conducted to do so. One specific question did address student

perception of the overall experience, either positive, negative, or mixed. Of the 19 undergraduates who participated in this project nine reported the experience as being positive, two reported it as a negative experience, while eight noted a mixed experience of both positive and negative elements. Notably, the two students who reported the negative experience were also the same individuals who worked with the students mentioned above who were inflexible in their design ideas.

Training for Asynchronous Collaboration

Since collaboration was rated both as a success and as a struggle by the students, further analysis of the responses seemed necessary. Upon further examination, the comments seemed to indicate that the successful collaborative experience was related to the act of collaboration with primary students in another country. Whereas the negative experiences related to collaboration stemmed from frustration with the actual logistics of the collaborative process. Since this project was the first experience these students had ever encountered with asynchronous global collaboration, it comes as no surprise that they struggled to manage the logistics and their expectations of the realities of such a project. Some students even reported their desire for explicit training or instruction in how to best work in an asynchronous collaborative environment. Although the students requested explicit instruction, it could be argued that this project and reflective exercise did, in fact, function along these lines. If this is the case, then this project could serve as a training mechanism for future asynchronous global collaboration.

Future Research

If this project were to be repeated, a more rigorous study could accompany it. Specifically, a pre-test/post-test evaluation about teacher self-efficacy to be change agents in global collaboration could be administered to better measure the effect of the project on the pre-service teachers. Additionally, a TPACK evaluation measure could also be administered to measure changes in the three TPACK categories through a validated survey, rather than through qualitative measures used in this study. Finally, since communication seemed to be the greatest challenge for success in completing the task, additional research could include comparing two groups of undergraduates engaging in different communication protocols to determine which is most effective.

Further Recommendations

This study was a first attempt at institutionalizing global collaboration at an undergraduate institution in the teacher education program with the intent that the student teachers would implement global collaboration into their future classrooms. The results show that additional work is necessary at the front end of the project to establish communication techniques, expectations, and norms among both parties in the collaboration. This finding is consistent with the recommendations found in Lindsay and Davis (2012). Further attempts at institutionalizing global collaboration should include explicit instructions in communicating through a variety of digital means.

The second recommendation comes in establishing collaboration expectations that are agreed upon by both parties. In this study, the undergraduate students in Pennsylvania were tasked with introducing the project to the primary students in Korea. During this the pre-service teachers focused primarily on defining the task and agreeing upon using Google Docs as the primary

communication platform. By failing to establish how decisions would be made regarding the modification of any agreed upon plans for the ping-pong ball launchers, the undergraduate students became extremely frustrated when the primary students modified the project. Establishing criteria for agreeing upon modifications could help alleviate future challenges in this regard.

Finally, despite the undergraduate students' reported frustration, most of the students expressed interest in pursuing global collaboration in their own classrooms. This seems to indicate that projects like this, despite any challenges, are a positive experience for pre-service teachers and could result in similar global collaborations happening in their future classrooms. A follow up study with these students, or other students who have had a similar experience, could help determine the extent to which projects like this in an undergraduate class carry over into the future classrooms.

References

Ball, D. L., & McDiarmid, G. W. (1990). The subject matter preparation of teachers. In W. R. Houston (Ed.), *Handbook of research on teacher education* (pp. 437-449). New York: Macmillan.

Bass, B. M., & Riggio, R. E. (2006). *Transformational leadership* (2nd ed.). Mahwah, NJ: Lawrence Erlbaum Associates Publishers.

Boulton, H. (2014). ePortfolios beyond pre-service teacher education: A new dawn? *European Journal of Teacher Education, 37*(3), 374-389.

Bush, A., & Grotjohann, N. (2020). Collaboration in teacher education: A cross-sectional study on future teachers' attitudes towards collaboration, their intentions to collaborate and their performance of collaboration, *Teaching and Teacher Education, 88*.

Couros, G. (2015). *The innovator's mindset*. Dave Burgess Consulting, Inc.

Cuban, L., Kirkpatrick, H., & Peck, C. (2001). High access and low use of technologies in high school classrooms: Explaining an apparent paradox. *American Educational Research Journal, 38*(4), 813-834.

Davey, S., Smith, W. S., & Merrill, C. (2009). Internationalizing technology teaching with blogs and bananas. *The Technology Teacher, 69*(2), 22-27.

Erdogan, I., & Ciftci, A. (2017). Investigating the views of pre-service science teachers on STEM education practices. *International Journal of Environmental and Science Education, 12*(5), 1055-1065.

Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2010). Teacher technology change: How knowledge, confidence, beliefs, and culture intersect. *Journal of Research on Technology in Education, 42*(3), 255-284.

Fullan, M. (2011). *Change leader: Learning to do what matters most*. Jossey-Bass.

Koehler, M., & Mishra, P. (2009). What is technological pedagogical content knowledge (TPACK)? *Contemporary Issues in Technology and Teacher Education, 9*(1), 60-70.

Kraemer, H. M. J. (2011). *From values to action*. Jossey-Bass.

Lawless, K. A., & Pelligrino, J. W. (2007). Professional development in integrating technology into teaching and learning: Knowns, unknowns, and ways to pursue better answers. *Review of educational research, 77*(4), 575-614.

Lee, H., & Kim, H.-B. (2021). Exploring science teacher agency as agent of change: The case of distance learning practice due to COVID-19. *Journal of The Korean Association For Science Education, 41*(3), 237–250.

Lindsay, J., & Davis, V. A. (2012). *Flattening classrooms, engaging minds: Move to global collaboration one step at a time*. Pearson.

Marsh, J. A., & Wohlstetter, P. (2013). Recent trends in intergovernmental relations: The resurgence of local actors in education policy. *Educational Researcher, 42*(5), 276-283.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record, 108*(6), 1017-1054.

Nugent, J., Smith, W., Cook, L., & Bell, M. (2015). 21st-century citizen science: From global awareness to global contribution. *The Science Teacher, 82*(8), 34-38.

Sarros, J.C., & Santora, J.C. (2001), The transformational-transactional leadership model in practice. *Leadership & Organization Development Journal, 22*(8),383-394.

Schneider, A., & Ingram, H. (1993). Social construction of target populations: Implication for politics and policy. *American Political Science Review, 87*(2), 334-347.

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher, 15*(2), 4-14.

Spiro, J. (2011). The essentials of leading change step-by-step. *Leading Change: Step-by-Step*. Jossey-Bass.

Stone, D. A. (1989). Casual stories and the formation of policy agendas. *Political Science Quarterly, 104*(2), 281-300.

van der Heijden, H. R. M. A., Beijaard, D., Geldens, J. J. M., & Popeijus, H. L. (2018). Understanding teachers as change agents: An investigation of primary school teachers' self-perception. *Journal of Educational Change, 19*, 347–373.

Weber, M. (1947). *The theory of social and economic organization* (A. M. Henderson & Talcott Parsons, Trans.). The Free Press.

Wiggins, R. A., Follo, E. J., & Eberly, M. B. (2007). The impact of a field immersion program on pre-service teachers' attitudes toward teaching in culturally diverse classrooms. *Teaching and Teacher Education: An International Journal of Research and Studies, 23*(5), 653-66

Listening to Teacher Candidates of Color

Emily Wender
Roger Briscoe
Jt Heslop
Kaitlyn Brennan

Abstract: As part of one predominantly White institution's efforts to better support teacher candidates of Color (TCOCs), researchers held focus group discussions with TCOCs. Findings include TCOCs' diverse identities and shared experiences of "onlyness" in educational settings **(**Harper et al., 2011). Recommendations include racial affinity groups and highlighting teacher diversity in curricula. This work was supported by the McElhattan Foundation.

About the Authors: *Emily Wender, Professor of English, Indiana University of Pennsylvania. Roger Briscoe, Adjunct Faculty in Early Childhood Education and Instructor of Educational Technology for Fulbright DAI Fellows, Indiana University of Pennsylvania. Jt Heslop, Doctoral Candidate, Indiana University of Pennsylvania, & Instructor, Point Park University. Kaitlyn Brennan, Policy Advisor, and Adjunct Faculty, Indiana University of Pennsylvania.*

Introduction

The critical shortage of teachers of Color (TOCs) across the state of Pennsylvania is well documented (Fontana & Lapp, 2018). Recent data reflects a majority of Pennsylvania schools employ predominantly White teachers with 37% of districts across the Commonwealth employing only White teachers (Shaw-Amoah et al., 2020). The disproportionate rates between students of Color (SOCs) and TOCs is among the highest in the nation. Between 2013 and 2020 the percentage of SOCs across the commonwealth increased from 30.5% to 35.8% while TOCs increased from 5.4% to 6.0% (Shaw-Amoah et al., 2020). Strong evidence supports the notion that having a TOC is of significant benefit for students of all races, but most especially important for SOCs. A federal and statewide response to address the critical shortage of educators and lack of diversity in the field is needed more now than perhaps ever before.

Diversifying the Teacher Workforce

Arguments for a diverse teacher workforce include providing mirrors for SOCs, providing diverse role models for all students, and disrupting patterns of discrimination in schools (Goodwin & McIntosh, 2008; Villegas & Lucas, 2004). Empirical research has shown that race-congruent teachers can improve students' academic achievement in the short term and long term (Egalite et al., 2015), leading to, for example, increased probability for low-income students to attend a four-year college, or for Black male students, a reduced likelihood to drop out of high school (Gershenson et al., 2017). Gershenson et al. (2016) found that Black teachers' expectations for Black students are significantly higher than those of White teachers, and Cherng and Helpin (2016) found that all students perceived their Black teachers as having higher academic expectations.

The lack of diversity in the teacher workforce is a result of historical oppression and a cause of continued oppression. Historically, education has been used as a tool of cultural erasure and assimilation, such as in decades of government run American Indian Residential Schools (Goodwin & McIntosh, 2008). Arguing for reframing the narrative around an imbalanced White teacher workforce, Carter Andrews et al. (2018) described the discriminatory actions after Brown vs. Board of Education that "pushed out" many Black teachers and administrators, an organized workforce that had for decades advocated for and provided Black children's educations (Hale, 2018; Oakley, et al., 2009; Ramsey, 2022). Carter Andrews et al. (2018) go on to argue that both policymakers and teacher educators ought to study the effects of civil rights laws and education policies on the racial makeup of the educator workforce "so that history does not repeat itself" (p. 7). As states increasingly consider and pass laws limiting educators' freedoms to discuss race, sexuality, and identity in the classroom, this warning is not being heard (Przybyla & Edelman, 2022).

Although state and federal policies have and will continue to shape the teacher workforce, we argue that educator preparation programs (EPPs) also have a foundational role to play in rebuilding a diverse and culturally responsive teacher workforce. EPPs can commit to recruiting, retaining, and educating teacher candidates of Color (TCOCs) and developing culturally responsive and sustaining educators (Carter Andrews et al., 2018; Goodloe et al., 2020; Grooms et al., 2021). Curricular interventions designed to develop teacher candidates' (TCs) awareness of social justice, however, often end up relying on

and fueling "deficit stances" towards people of Color (Carter Andrews et al., 2019, p. 12). Carter Andrews et al. (2019), drawing from Tuck's theory of damage-centered research (2009), catalogs such approaches as "damage centered"; although designed to develop White TCs' critical consciousness around identity and equity, focusing on "people's pain and brokenness" (Tuck, 2009, as cited in Carter Andrews et al., 2019, p. 7) can instead reinforce deficit perspectives. Such orientations do not just emphasize damage—in their focus on developing White TCs' critical consciousness, they can do damage to TCOCs. Within the contexts of predominantly White institutions (PWIs), this damage contributes to overarching program cultures that center Whiteness, othering people of Color (Carter Andrews et al., 2018).

An important component of "disrupting . . . dominant culture ideologies" (Haddix, 2017, p. 144) within EPPs includes researching the experiences of both TCOCs and TOCs (Endo, 2015; Griffin, 2018; Grooms et al., 2021; Ingersoll et al., 2017; Kohli, 2019). Research has shown that TCOCs and TOCs navigate a host of racialized challenges within EPPs, in the field, and in their jobs as teachers, including racism, microaggressions, damage-centered teaching, and racial isolation (Carter Andrews et al., 2018; Endo, 2015; Griffin, 2018; Kohli, 2019). We position this study as part of efforts to 1) better understand our TCOCs' experiences within our local context, a mid-sized PWI state institution in Western Pennsylvania and to 2) recommend ways similar EPPs can support TCOCs, disrupting structures of Whiteness within their programs.

Methodology

Adopting an asset-based approach, this study aimed to further understand the experiences of TCOCs in a PWI in Western Pennsylvania (Carter Andrews et al., 2019). Utilizing the recruitment toolkit published by the Pennsylvania Education Diversity Consortium's (PEDC) (2021), our team designed a culturally informed protocol for focus group discussions with TCOCs. We replicated the focus group discussions 5 times, with anywhere from 2-9 participants at a time. PEDC's (2021) recruitment toolkit was created to help individuals and institutions across Pennsylvania recruit high school SOCs to the teaching profession by providing conversation entry points; it includes in-depth descriptions of recruitment strategies along with case studies and implementation recommendations. The toolkit highlights five culturally responsive recruitment statements, which served as our organizing structure for the discussions:

1. People like me can become a teacher.
2. Students need a teacher like me.
3. Teaching is a form of social justice and community liberation.
4. I know what it takes to become a teacher and feel supported to achieve it.
5. Teaching is a stable, respectable profession. (PEDC, 2021, p. 9)

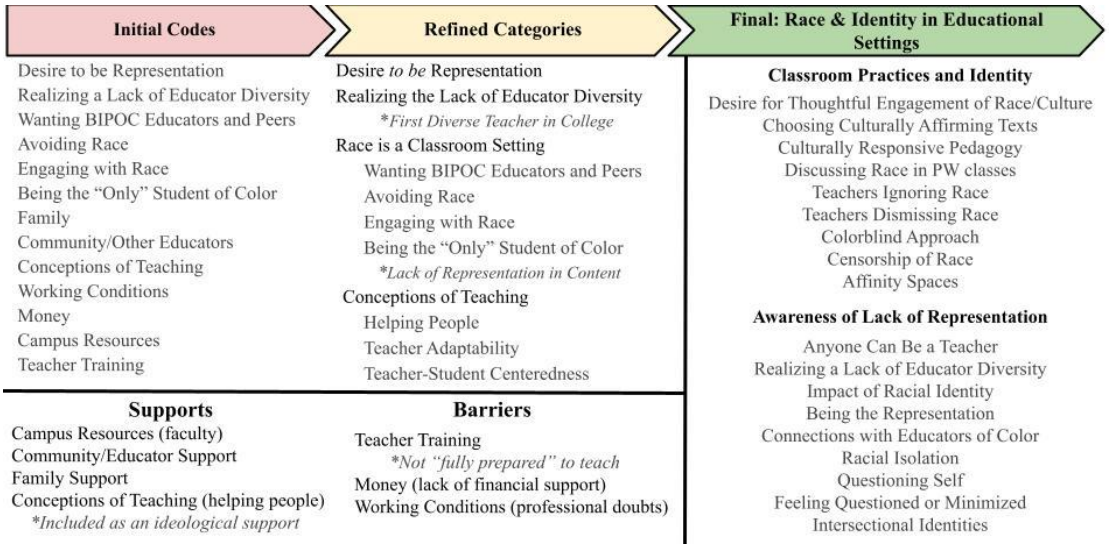
After being presented with each statement, TCOCs discussed their reactions: whether or not they agreed, disagreed, felt unsure, and why. PEDC's (2021) culturally informed statements allowed TCOCs to articulate their strengths and visions for teaching while also sharing barriers they had encountered on their journeys thus far, including the negative impacts of a predominantly White teacher workforce.

PEDC's (2021) recruitment toolkit offers guidance on who will most effectively deliver each recruitment statement to SOCs, which led us to conclude the focus groups would be most culturally responsive if

facilitated by a person of Color. Roger, an African American man, facilitated 4 of the 5 focus groups, and Emily, a White woman, facilitated the fifth. Data were collected from a total 21 participants during the Fall 2021 semester. These 45-minute discussions took place both face-to-face (2) on campus and remotely (3) through a video conferencing service. In the recruitment stage, 95 TCOC undergraduates were emailed across our university's multiple Educator Preparation Programs**.** Participants' racial identities were based on self-selected labels reported to the university: Black Non-Hispanic (8), Hispanic (5), Asian or Pacific Islander (4), Multiracial (3), and American Indian (1).

All identifying data were removed from the transcriptions before analysis. After the initial two workshops, both face-to-face, we used grounded theory to identity repeated themes among participants' experiences. Once all workshops were transcribed and initially coded, resulting in a number of initial codes, (see Figure 1), we then labeled each code as "barrier" or "support," determined by a negative or positive expression from participants. Initial codes included a range of similar statements. For example, "Money" was labeled as a "barrier" and included statements like, "I'm paying my own tuition," "I'm not financially supported by my parents," and "And if that means working like two or three jobs, I will." Once we had a list of barriers and supports, we grouped codes into larger subcategories and then narrowed our data to moments dealing with race and identity in educational settings. Once narrowed, we recoded the data line by line, adding more precise codes to our initial list and solidifying conceptually congruent categories. This stage led us to two overarching categories and a final list of codes: (1) Classroom Practices and Identity and (2) Awareness of Lack of Representation.

Figure 1: *Coding Process*



Findings

Critical Consciousness

TCOCs understood the lack of teacher diversity in their lives on various levels—some knew it as a sociopolitical problem, and some categorized it only by their personal experiences. In responding to the statement, "I could have used a teacher like me," some candidates described the deleterious effects of a largely White teacher workforce, including decreased academic achievement, lower expectations, and decreased connections and support for SOCs. Similarly, in response to "People like me can become a teacher," some candidates pointed to a lack of representation as a barrier in fully embracing that statement for themselves: "I agree to a certain extent . . . I just don't see a lot of Asian American teachers so . . . it's just not a common thing across the nation." Several candidates shared that they had their first teacher of Color in college. For one candidate, having her first teacher of Color was impactful because the instructor was more able and willing to explore race within their classroom context. Another candidate shared how one of her college professors of Color explicitly taught her culturally responsive pedagogy, something she had been "yelling about for years," as her all-girls high school had been "predominantly African American," yet they "read books about White girls or White people."

In one focus group, both candidates chose not to talk about race in response to the statement "People like me can become a teacher," adopting a colorblind approach. Participant 1 shared, "I don't want to sound like *people like me*," and Participant 2 agreed: "It doesn't really matter. Like what race you are, what your ethnicity is or what background you come from." Participant 1 eventually did acknowledge that race could play a positive role, but only by positing its effects on assumed White children: "It's good for people like us to be teachers because then children are seeing that there's people different from them."

Later in the discussion, the same two candidates shared that neither of them had had a teacher of Color, which led them to think more deeply about teacher representation:

> Participant 1: White women was pretty much all I had as my teachers. And there's nothing wrong with that. But I never thought about my race going into it. But then as I got older, I was like, I've never had a teacher of Color.

As Participant 1 continued to think out loud, she realized multiple ways having a TOC could have impacted her or other SOCs: SOCs could "feel more comfortable," instead of feeling like they "stick out like a sore thumb." On top of that, she added, more SOCs might even think about becoming teachers themselves. Participant 2 began to share how she, too, had never had a teacher of Color, also reconsidering how TOCs could potentially inspire SOCs to imagine themselves as teachers: "So they're [SOCs] not being able to notice like what it involves to be . . . this . . . I don't even know how to explain it . . . that's why in a way it would have been nice to have like a different teacher."

Complex Identities

Candidates in more than one focus group responded to the standing statement, "People like me can become a teacher," by emphasizing that their racial identities were just one aspect of who they are, often pointing to personality traits that have led them to pursue teaching: "I didn't just think of it in terms of like Black people can be teachers and minorities can be teachers, but more so like people passionate about certain things, like very excited people, very

talkative." Other candidates mentioned "patience" or "drive." One participant offered that it's a "mindset that pushes you into teaching rather than what you are."

At the same time, candidates also responded to the statement "People like me can become a teacher" by connecting their racial identity to other marginalized identities, such as in the following exchange about gender and sexual orientation:

> Participant 6: But I think also like when I think about race or like for me, I'm also thinking about sexuality a lot, like, um, I'm a queer.
>
> Participant 7: I agree with the statement because I identify as gay slash nonbinary, and I've never had any teachers who were out and open in that way.

Candidates also referenced the importance of teachers seeing them as whole people. One candidate connected the idea of recognizing students' lives beyond the classroom to a pivotal memory of being punished in school:

> My little sister was just born like a newborn, crying. We shared a room like my mom, my mom was in the period, where she was just letting her cry. And I was like, cool. So I'm up all night. And I fell asleep in class and my teacher made me stand against [the wall]. And then I fell asleep on the wall and I got in trouble and I was like, I was like, you gotta just let me sleep. Like, I'm not a bad student.

In this case, the teacher dehumanized the participant; we read this situation as emblematic of the way cultural bias and implicit assumptions fuel harmful and punitive measures in schools (Castro Atwater, 2008).

Structures of Whiteness in Schools

Although all candidates discussed feeling supported by professors and many shared the support of their mentor teachers, multiple candidates brought up racial isolation, microaggressions, and racism in school spaces, including both past schooling and current field experiences as teacher candidates or in paid positions: for example, "I was always the only Black child in the classroom," "It's hard to feel support kind of in the schools for me just because there's not many African Americans," or "I worked in a school . . . I do get the stares." One candidate tied her experience of being racially isolated in her own schooling to the empathy she felt for the one student of Color in her field experience: "I feel for you, like, I understand where you're coming from."

Other candidates shared stories of their racial identities being dismissed and ignored by teachers, such as the prior example of being in a predominantly African American school yet reading books about White people. One candidate shared that although she went to a racially diverse school, she remembered the experience of being dismissed when asking about Black History Month: "She [the teacher] was like, you can do that in your other classes, we're doing [the] Holocaust, and like at the time I was like, okay, but now that I'm older I'm like—that was messed up . . . her to just be like . . . we're not worried about that right now." During one focus group discussion, candidates shared their fear to talk about Black Lives Matter in the classroom because of censorship by administrators, schools, or parent groups.

Discussion and Recommendations

"This is good to have, you know?": Providing Racial Affinity Group Settings

Racial isolation emerged as a major part of many candidates' educational experiences, and at a PWI, that isolation continues for TCOCs in most of their classes. Two candidates mentioned conversations about race being harder when White professors led them, and one candidate shared that it was difficult to talk about race "with a classroom of White people." This same candidate went on to comment on the focus group as a racial affinity space itself: "This is good to have, you know?" The focus group discussions provided a space to center the experiences of TCOCs and also offered connections across program divisions.

Harper et al. (2011) characterize the "psychoemotional burden of having to strategically navigate a racially politicized space occupied by few peers, role models, and guardians from one's same racial or ethnic group as 'onlyness'" (p. 190). Most candidates shared some educational experience of "onlyness." One candidate described microaggressions from the students in her current school placement: "They don't understand. They'll see like another African American [and] will ask me if that's like my sibling, so it's hard to feel supported in the school." Kohli (2019) found that racial affinity groups helped mitigate against the "hostile racial climates" of schools for TOCs (p. 40). For her participants, "Being in exclusively teacher of Color spaces offered a sanctuary from the exhausting experience of being a minority in a predominantly White profession" (p. 48). Kohli (2019) recommends not only providing racial affinity spaces for TCOC but "legitimizing" them through course credit, recognizing the work TCOC do as active participants in those spaces (p. 48). The work of developing racial literacy—or "the ability to see, name, and unpack the enduring racism embedded in our society" (Kohli, 2019, p. 40)—needs to be woven throughout EPPs for all TCs, yet racial affinity spaces could also serve as one way for TCOCs to share experiences navigating Whiteness in schools.

We also see the potential for the racial affinity group model to support TCOCs' ongoing visions for themselves as teachers. Teacher identity research suggests that teachers' vision and purpose leads to greater resiliency in the field (Beltman et al., 2015; Mascarenhas et al., 2010). As TCs move through their preparation journeys and they are exposed to the systems of schools and the demands of the profession, including impacts of White supremacy, their identities and motivations shift. This study suggests that TCOCs would benefit from opportunities to develop and revise their visions of themselves as teachers within racial affinity group settings, especially in ways that draw both on their strengths as individuals and as a collective. Determining how best to start and sustain racial affinity spaces for TCOCs in PWIs goes beyond this study, but we suggest working with campus resources and leaders of Color beyond teacher education as well as building partnerships with organizations committed to teacher diversity.

"Unfortunately, I never had a teacher like me": Diversifying Teacher Education

Just as we need more racially diverse teachers in our schools, we also need more racially diverse teacher educators. Several of our participants shared that college was the first time they had a teacher of Color, describing the positive impacts of that experience—learning about culturally responsive pedagogy from a same-race teacher, for example, or talking about race in meaningful ways in the classroom. Yet some candidates shared that they had still never had a TOC. Candidates who had had TOCs acknowledged that that representation was still few and far between: "I mean I'm not

satisfied with not seeing enough, yes, that looks like me, but I'm satisfied that I at least had three," shared one candidate. We recognize that a racially diverse teacher workforce is deeply intertwined with a racially diverse teacher education faculty. Many institutions of higher education have made diversity, equity, and inclusion a priority in hiring, recognizing the dramatic imbalance between the number of postsecondary faculty of Color and the undergraduate students of Color that they teach (Davis & Fry, 2019; Huff, 2021), but discussions of the pipeline and retention of TCOCs should also include the significance of a diverse teacher education faculty for recruiting, retaining, and graduating TCOCs. EPPs ought to consider how, where, and when their TCOCs' racial identities are represented within their programs.

EPPs also ought to consider curricular moments for highlighting historical causes of a predominantly White teacher workforce and why teacher diversity matters for students. Some candidates came to these discussions with an understanding that teacher diversity is a studied and systemic problem, but others lacked that critical awareness. Although this study did not include White TCs, they would also benefit from developing a critical understanding of the significance of teacher diversity, including how they can support educator diversity in their future roles as colleagues. Courses or units of study on the history of education, theories of learning, educational research, and education's role in a multicultural society are just some of the possible places to address the impact of Brown vs. Board of Education or the effects of representation on learning. Building in opportunities for all TCs to reflect on moments in their lives when representation of one or more of their identities impacted them positively can help introduce and underscore how TOCs have increased academic outcomes for SOCs.

"Your students are not just students": Recognizing Intersectionality

TCOCs are diverse, and any programmatic or curricular changes designed to support TCOCs should recognize and invite forward candidates' many identities and contexts. In this study, candidates expressed their identities in varied ways. In focus group conversations, candidates defined themselves as teachers through personality attributes: "I'm a talker," "I'm good at explaining things. And that's what being a teacher is about," or "I'm doing it because I love children, and I want to make a difference in their life." With a wide range of schooling experiences, hometowns, and racial identities, TCOCs also had diverse socioeconomic backgrounds and families. Several candidates spoke about their families' struggles to support them financially, while one candidate shared that everyone in her family was a "psychologist" or a "lawyer." Of the 21 participants in the study, 2 verbally volunteered their queer identities, noting that their gender or sexuality was also marginalized.

Our focus group conversations demonstrated that people have multiple identities, some in tension with each other, and some layered in ways that deeply connect them. but all part of a candidate's whole sense of self. Through an intersectional lens, individuals can be both socially and historically empowered and disempowered, experiencing simultaneous privilege and oppression. Individuals can also be marginalized in multiple ways, such as the two TCOCs who shared their queer identities and noted the absence of queer teachers. Yet research has shown that both teacher education research (Pugach et al., 2018) and curriculum often approach students as monolithic groups, reinforcing

deficit stances that fail to recognize "whole students" (Carter Andrews et al., 2019, p. 6) or to consider the ways all TCs have "multiple social identities" (Gaither, 2018, p. 447). Although we are recommending a racial affinity group space for TCOCs, it is imperative that TCOCs are seen as diverse individuals within these spaces and EPP's broader curricula. EPP coursework should disrupt monolithic assumptions of any student group, recognizing and inviting TCs to reflect on their multiple shared and diverging identities as well as those of their current and future students.

Conclusion

This research is one example of how a PWI might investigate the strengths, needs, and experiences of TCOCs as part of programmatic efforts to diversify the teacher pipeline. Our findings stress TCOCs' diverse backgrounds and identities, but they also highlight significant shared experiences, namely the weight of "onlyness" in educational settings (Harper et al., 2011) and having few or no TOCs. Not all TCOCs came to the focus group discussions with the sociopolitical awareness of why teacher diversity matters. For TCOCs in particular, we see this critical awareness as a crucial step in integrating their racial identities into their visions for themselves as teachers (something we believe all TCs should do while in their EPP). Ultimately, we recommend identifying curricular moments to highlight teacher diversity as a historical and pressing issue, providing racial affinity group spaces for TCOCs, increasing teacher educator diversity within EPPs, and adopting asset-based approaches in social justice curricula.

References

Beltman, S., Glass, C., Dinham, J., Chalk, B. & Nguyen, B.H.N. (2015). Drawing identity: Beginning pre-service teachers' professional identities. *Issues in Education Research, 25*(3), 225-245.

Carter Andrews, D., Castro, E., Cho, C. L., Petchauer, E., Richmond, G., & Floden, R. (2018). Changing the narrative on diversifying the teaching workforce: A look at historical and contemporary factors that inform recruitment and retention of teachers of color. *Journal of Teacher Education, 70*(1), 6-12.

Carter Andrews, D. J., Brown, T., Castillo, B. M., Jackson, D., & Vellanki, V. (2019). Beyond damage-centered teacher education: Humanizing pedagogy for teacher educators and preservice teachers. *Teachers College Record, 121*(4), 1-28.

Castro Atwater, S.A. (2008). Waking up to difference: Teachers, color-blindness, and the effects on students of color. *Journal of Instructional Psychology, 35*(3), 246-253.

Cherng, H. S., & Halpin, P. F. (2016). The importance of minority teachers: Student perceptions of minority versus white teachers. *Educational Researcher, 45*(7), 407-420.

Davis, L., & Fry, R. (2019, July 31). *College faculty have become more racially and ethnically diverse, but remain far less so than students.* Pew Research Center, https://www.pewresearch.org/fact-tank/2019/07/31/us-college-faculty-student-diversity/

Egalite, A. J., Kisida, B., & Winters, M. A.

(2015). Representation in the classroom: The effect of own-race teachers on student achievement. *Economics of Education Review, 45*, 44-52.

Endo, R. (2015). How Asian American female teachers experience racial microaggressions from pre-service preparation to their professional careers. *Urban Review: Issues and Ideas in Public Education, 47*(4), 601-625.

Fontana, J., & Lapp, D. (2018, September). *Patching the leaky pipeline: Recruiting and retaining teachers of color in Pennsylvania.* A Pennsylvania Clearinghouse for Education Research Policy Brief. https://www.researchforaction.org/publications/patching-the-leaky-pipeline/

Gaither, S. E. (2018). The multiplicity of belonging: Pushing identity research beyond binary thinking. *Self and Identity, 17*(4), 443-454.

Gershenson, S., Hart, C. D., Lindsay, C. A., & Papageorge, N. W. (2017). The long-run impacts of same-race teachers. IZA Institute of Labor Economics, https://ftp.iza.org/dp10630.pdf

Gershenson, S., Holt, S.B., & Papageorge, N.W. (2016). Who believes in me? The effect of student-teacher demographic match on teacher expectations. *Economics of Education Review, 52,* 209–224.

Goodloe, A., Kerns, K., & Ardley, J. (2020). Building capacity in the successful preparation of teachers of Color: Effective recruitment strategies. *Kappa Delta Pi Record, 56*(3), 112-115.

Goodwin, A.L., & McIntosh, K. (2008). Diversifying the teaching force. In Good, T. L. (Ed.), *21st century education: A Reference handbook* (pp. 23-32). SAGE Publications.

Griffin, A. (2018). Our stories, our struggles, our strengths: Perspectives and reflections from Latino teachers. *The Education Trust*. https://edtrust.org/resource/our-stories-our-struggles-our-strengths/

Grooms, A. A., Mahatmya, D., & Johnson, E. T. (2021). The retention of educators of color amidst institutionalized racism. *Educational Policy, 35*(2), 180-212.

Haddix, M. M. (2017). Diversifying teaching and teacher education: Beyond rhetoric and toward real change. *Journal of Literacy Research, 49*(1), 141-149.

Hale, J. (2018). "The development of power is the main business of the school": The agency of southern Black teachers associations from Jim Crow through desegregation. *The Journal of Negro Education, 87*(4), 444-459.

Harper, S.R., Davis, R.J., Jones, D.E., McGowan, B.L., Ingram, T.N., & Platt, C.S. (2011). Race and racism in the experiences of black male resident assistants at predominantly white universities. *Journal of College Student Development 52*(2), 180-

Huff, C. (2021, November 1). *Building a better, more diverse faculty.* American Psychological Association. https://www.apa.org/monitor/2021/11/news-diverse-faculty

Ingersoll, R., May, H., & Collins, G. (2017). *Minority teacher recruitment, employment, and retention: 1987 to 2013*. Learning Policy Institute. https://learningpolicyinstitute.org/sites/default/files/product-files/Minority_Teacher_Recruitment REPORT.pdf

Kohli, R. (2019). Lessons for teacher education: The role of critical professional development in teacher of Color retention. *Journal of Teacher Education, 70*(1), 39-50.

Mascarenhas, A., Parsons, S., & Burrowbridge, S. C. (2010). Preparing teachers for high-need schools: A focus on thoughtfully adaptive teaching. *Occasional Paper Series, 25*(4), 1-25.

Oakley, D., Stowell, J., & Logan, J. R. (2009). The impact of desegregation on black teachers in the metropolis, 1970-2000. *Ethnic and racial studies, 39*(9), 1576–1598.

Pennsylvania Educator Diversity Consortium (PEDC). (2021). *Diversifying the teacher pipeline: A toolkit for recruiting more high school SOCs into Pennsylvania teacher prep programs and schools.* PEDC.

Przybyla, H., & Edelman, A. (2022, Jan. 28). *State weigh a raft of proposed laws to limit race, sexuality lesson in schools.* NBC News. https://www.nbcnews.com/politics/politics-news/states-weigh-raft-proposed-laws-limit-race-sexuality-lessons-schools-n1288108

Pugach, M. C., Gomez-Najarro, J., & Matewos, A. M. (2018). A review of identity in research on social justice in teacher education: What role for intersectionality? *Journal of Teacher Education, 70*(3), 206-218.

Ramsey, S. (2022). *The troubled history of American education after the brown decision.* The American Historian. https://www.oah.org/tah/issues/2017/february/the-troubled-history-of-american-education-after-the-brown-decision/

Shaw-Amoah, A., Lapp, D., & Kim, D.Y. (2020, December). *Teacher diversity in Pennsylvania from 2013-2014 to 2019-2020.* Research for Action. https://www.researchforaction.org/research-resources/k-12/teacher-diversity-in-pennsylvania-from-2013-14-to-2019-20/

Souto-Manning, M. (2019). Transforming university-based teacher education: Preparing asset-, equity-, and justice-oriented teachers within the contemporary political context. *Teachers College Record, 121*(6), 1-26.

Villegas, A. M., & Lucas, T. F. (2004). Diversifying the teacher workforce: A retrospective and prospective analysis. *Teachers College Record, 106*(13), 70–104.

Undergraduate Research Experiences for Pre-Service Teacher Candidates: Necessary Conditions for Productive Projects

Mark Wolfmeyer
David Mohamad
Michael Mistler

Abstract: Institutions of higher education have increasingly motivated faculty to involve undergraduates in their research. These can be excellent opportunities for education researchers interested in working with pre-service teacher candidates (PSTCs). This article demonstrates the necessary conditions required for successful research experiences and includes two sample projects involving PSTCs.

About the authors: *Mark Wolfmeyer is Department Chair and Associate Professor of Secondary Education at Kutztown University. David Mohamad and Michael Mistler are teacher candidates in Secondary Education at Kutztown University.*

Introduction

Since the early 2000's, institutions of higher education have increasingly motivated their faculty to provide research experiences to undergraduate students. Beginning in STEM disciplines and expanding to all areas of research, these opportunities are exciting potentials for undergraduates to grow and can also further faculty research and teaching goals. Teacher educators work with pre-service teacher candidates as their primary body of students, most of whom are near the beginning of their careers with limited or emerging field experience in classrooms. Thus, for education researchers, we can find it difficult to think about how to involved our undergraduate students in our research projects. This paper reflects on one teacher educator who successfully involves undergraduates in high-level research and reveals a particular set of necessary conditions for teacher education faculty who would like to complete research with their pre-service teacher candidates. After sharing these, the article provides two sample research projects completed with undergraduates; thus, this paper is coauthored by an educational researcher and two undergraduate teacher candidates.

The article begins with a review of the emergence of involving undergraduates in research and what benefits are clearly known. Next, the benefits to the unique considerations of education research are detailed, out of which emerges a suggested set of "necessary conditions." These conditions are intended to be useful for teacher educators who would like to try the experience for the first time and for the many who have already involved undergraduates in their research projects but would like to reflect on their prior experiences. In the section that follows, two example projects are shared. The first is an action research project in the researcher's teacher education classroom that scaffolds the learning of instructional delivery practices with the use of improv theatre. The second is a media analysis project using critical discourse analysis that reveals understandings about national news coverage of mathematics education. The two projects differ in method and sub-discipline of education research, demonstrating the breadth of possibilities for involving undergraduates. After the project descriptions, the students' reflections complement the lead author's reflections on the productivity of undergraduate education research.

Undergraduates in research: From STEM to all disciplines, including education

There is much research and activity in undergraduate research experiences, including organizations that support this across institutions of higher education. Beginning with the early research, Russell et al. (2007) provide both the key benefits and suggestions for best practices. They note that undergraduate STEM majors who were involved with research projects, and especially ones funded by the National Science Foundation and other funding bodies, had an increased interest in pursuing a STEM career as well as plans for a PhD in STEM. Moreover, students benefited when they "became involved in the culture of research" and mentors should "combine enthusiasm with interpersonal, organizational, and research skills" (p. 549).

Over time the American Association of Colleges and Universities (AACU) has developed their set of "high impact practices" for institutions to include, with undergraduate research as a prominent item on the list. Currently, they specify how this must be much broader than research occurring in the science labs: "The goal is to

involve students with actively contested questions, empirical observation, cutting-edge technologies, and the sense of excitement that comes from working to answer important questions" (AACU, 2022, n.p.). The AACU supports and publishes research in leveraging the most out of undergraduate research, e.g., with Brownell & Swaner (2010).

Since these earlier studies many articles declare the benefits and best practices of undergraduate research. One of these, Fischer et al. (2021) provides an excellent review of what is known from among these contributions and explicitly moves the conversations about best practices in undergraduate research beyond STEM fields. As researchers across disciplines (two in STEM, one in performing arts, and one in social sciences), they review much of the literature's suggestions of the benefits: including gaining experience in the techniques of research, appreciating the discipline of study much more deeply, working on project teams, greater retention in their major and postgraduate pursuits in the discipline. They also note that these benefits occur across student identity and are especially beneficial for those underrepresented in academic disciplines: women, BIPOC, and lower socioeconomic status students specifically.

Fischer et al. (2021) also contribute a very helpful taxonomy for "high-impact" projects involving undergraduates because the undergraduate research experience can be rather varied:

> Student immersion into a disciplinary problem with a research mentor lends itself to a highly engaging-learning experience. However, mentors do not always know how to fit the work that needs to be done on their own research to the skills and knowledge of students who want to get involved. The actual tasks assigned to a student will vary across disciplines and even students with prior research experience may not be well prepared to fit into a new project. In addition to a wide range of possible tasks is variability in the level of autonomy afforded to the student. Looking holistically, undergraduates experience inconsistency in the range of opportunities and skills gained from undergraduate research. Thus, what is missing from prior studies of undergraduate research as a +IP is a clear delineation of the components and dimensions of the research experience and what make it high impact. (p. 89)

Their taxonomy includes the following indicators: "Originality of research; Systematic disciplinary inquiry; Evaluated research process work; Activities emphasize research; Required project; Mentoring" (p. 91). Each component is detailed with examples and further guidelines. For example, for originality of research, the authors push research mentors to consider research questions for which both the mentor and the student do not know the answer. As another example, the required project suggests that mentors define target projects for the undergraduate, such as presentations at research conferences or publications. Their taxonomy's elements provided inspiration as I developed my own necessary conditions for productive education research involving pre-service teacher candidates.

Along with the research, several institutes and organizations work across institutions of higher education to support undergraduate research experiences. One of these is the Council on Undergraduate Research whose board members are comprised of academic leaders across US colleges and universities. Their mission supports and promotes "high-quality mentored undergraduate research, scholarship, and creative inquiry" (CUR,

2021). They provide consultations for universities to promote undergraduate research, professional development for research mentors, and recognition for institutions that are good at providing high impact undergraduate research experiences. CUR includes divisions associated with academic disciplines, including a division specifically for Education. One Education Division activity is providing small funding for mentor-student research collaboratives as well as awards for mentor-student projects. The Division's biannual newsletters, located on their website, prove inspirational reading to see the types of projects education researchers have enacted with their undergraduate students.

Each institution promotes undergraduate research experiences differently and it is important to note how the examples described in this article relate to the particular context, specifically Kutztown University. This regional public university has embraced the call for undergraduate research for several years. We have one faculty member who coordinates the Undergraduate Research and Creativity program for the university. The program disseminates research opportunities for our undergraduates and holds an annual conference for undergraduates to share their research and creative projects. The program works closely with the university's Office of Grants and Supported Projects, who annually run the KU BEARS (Kutztown University Bringing Experiences About Research in Summer) grant opportunity. The KU BEARS program is a competitive grant opportunity for faculty summer research. Faculty can apply for up to $2000 and all funds for the grant are to be used to pay a salary stipend for undergraduates involved in research. Faculty members select the undergraduates they want to work with for the summer. Additionally, the undergraduates involved in the project are offered free on campus housing for the duration of the summer project.

Necessary Conditions for PSTC Research

Taking together what is known about undergraduate research experiences, the researcher sought to adapt these as a set of necessary conditions for a successful experience involving pre-service teacher candidates. These grew out of the general literature on undergraduate research experiences but specifically target the unique circumstances that our undergraduates are pre-service teacher candidates. The five tenets developed are: Pre-service teacher prior knowledge; Faculty motivation; Pre-service teacher responsibilities; Rigorous methodology; and Satisfying finding." Each of these is described as follows, relating them to the literature and practices of undergraduate research more generally.

Pre-service teacher prior knowledge

Because undergraduates are pre-service teachers, it becomes important to develop projects that relate to prior experiential knowledge and carefully negotiate their research responsibilities with their career experience. For example, it may be hard to find a way to involve undergraduates in any projects related to empirical study of teachers because they are only beginning to have classroom teaching experiences. As another example, when involving an undergraduate in a project that studies the researcher's own classroom practices and its effects on the students, this should only occur when the undergraduate student has already completed the course that is being studied. Most important to this consideration, the researcher must identify projects that the undergraduate has experience with and knowledge about,

perhaps to complement that of the lead researcher. This may relate to an interest or activity that the student has significantly more knowledge about than the teacher educator. This balances what the mentor and student bring to the table and increases motivation to work and learn together mutually.

Faculty motivation

Furthering the motivation for the faculty mentor, they need to feel confident and excited about how to relate the student's prior knowledge to an area of inquiry within their own educational research sub-domain. A handful of possibilities exist. One is research that can improve our teaching. Thus, an opportunity to relate the student's prior knowledge to an action research project in your own teaching might be a good approach. Another option is to think about previous publications and areas of inquiry as they relate to the student's interest: How can this merge into a definable project? This necessary condition relates to Fischer et al's tenet of "originality of research:" Faculty mentors will be highly motivated when they define a project whose area of inquiry is relevant to their own work and the answers to research questions posed are not yet known by the faculty member.

Rigorous methodology

As the review of research on undergraduate research experiences revealed, students have varied experiences and some literature suggests that undergraduates working on NSF or other large-scale funding body leads to better outcomes. One interpretation of this conclusion is that the project has better outcomes for students when it is legitimate, high-level research. A project's methodology should be something that the mentor has experience and training using and is able to train an undergraduate to be responsible for specific components of its execution. Many times, undergraduates come into a research experience with their background knowledge of the term "research" in the colloquial, as if they are going to research a topic and bring together some ideas that they learned into an essay or presentation. Mentors should not fall prey to this expectation, merely thinking of their collaborative projects as simply a literature review. In suggesting a rigorous methodology, this comes in quite a variety of forms for education research, not limited to empirical studies using quantitative or qualitative methods, but also the inclusion of projects that use rigorous policy analysis methods, philosophical or theoretical methods, etc.

Pre-service teacher candidate responsibilities

A typical education research project includes, roughly speaking, a problem statement, a conceptual framework, literature review, a methodology, data and analysis, and conclusion. These vary according to sub-discipline and methodology, they are a bit different for conceptual projects, but there are a variety of components to any research project. The faculty mentor needs to determine what are reasonable responsibilities to delegate to the undergraduate student given the timeframe of the project and their background knowledge. For example, limited timing may allow an undergraduate to only complete the literature review. A rigorous literature review requires training to locate peer-reviewed resources, use multiple keywords to exhaust all literature, write annotated bibliographies, and turn these into a narrative literature review for use in a manuscript. Another area of responsibility

could be coding data. To do so, the undergraduate needs to complete ethics in human research training (if applicable to the data collected) and be trained by the mentor on coding methods. Whether or not a student is involved in one or multiple steps of the project, they should be taught the full scope of the project, so they see how their responsibilities fit into the whole project.

Satisfying findings

The final necessary condition for successful projects is less something that can be determined in advance but something that should follow if all other parts are in place. To acculturate undergraduates most effectively to research life, the project needs to come to satisfying research findings. The joy of discovering something that is of mutual interest to the faculty and student will be especially memorable for the student and will validate the experience and challenging work. A satisfying finding could either bring together questions posed by the research project and its data, could fill holes in the existing literature, and, in my view the most exciting, could address conceptual issues related to the theoretical framework. With strong motivation and a rigorous methodology, the goal of a satisfying finding can be set up to sustain the project. In my experience, the mentor sees the satisfaction first and should elaborate on its development and resolution a few different ways to make sure it is clear for the student.

Two examples of education research involving pre-service teachers

With these necessary conditions for inviting undergraduates into the world of education research at hand, next are two examples of research projects that were completed at our university's summer undergraduate research program. David Mohamad worked on the first, an action research project for my Principles of Teaching class that used improv theatre to develop best practices in instructional delivery. Another undergraduate at my institution participated in this project but was unable to contribute to providing reflections for this article. Michael Mistler worked with me on the second project that used critical discourse analysis to understand the national news media coverage of mathematics education policy. To share more details on each project, we offer a very abbreviated version of each project including references to existing literature and write with a narrative, active voice to describe how the project emerged.

For the improv theatre project, the initial problem of practice was to develop new interventions for teaching students how to best deliver instruction in the classroom. Mark explained how there was an idea about "teaching as performing" and David came to the project team with a lot of experience in improv theatre. We set about focusing on Mark's teaching intervention on how to use improv to improve my teaching practices. The project team identified several resources related to teaching as a performative activity, including Rubin's (1995) comprehensive exposition on teaching as performance and Pineau's (2004) consideration of the metaphor's problems. With this more refined focus, the most relevant literature for our project became Falter's (2015) feminist critique of the teaching of performance metaphor. She declared that, when left untroubled, the metaphor lent itself to the gendered nature of teachers as the inferior, the feminine, following the "script" of explicit curriculum that society has handed to them. Our project team found hope in the opportunity of using improv as a rejection of this scripting of teaching.

As the teaching intervention developed, David presented several improv theatre game options for Mark to relate to the professional standards of teaching. As one example, one goal we have as teacher educators is to develop our candidates' ability to use active question and discussion in their classrooms. This requires the ability to ask good questions spontaneously and to have the mindset of "ask questions" rather than "tell answers" both in whole class, small group, and individual settings. To develop this mindset and habit, our project team identified the improv theatre game called "Questions Only" in which a pair of players tells a story by asking only questions. Although the types of questions used in the classroom are different than the game's questions, playing the game pushed the teacher candidates into a mindset and habit of asking questions more frequently.

Several additional improv theatre games were related to effective teaching practices. Extending their work beyond the summer project, my undergraduate student researchers attended class during the academic year to help facilitate these games. This was especially useful because of David's experience with improv theatre. In the following summer, the project team coded the data from the classroom and discovered several significant findings. First, the teaching intervention developed the teacher candidate's confidence in front of a classroom and with a range of teaching practices. Second, the intervention over time developed in candidates a sense of the performativity of teaching and, excitingly, qualitative data was coded to reveal a striking finding: participants felt more that teaching was spontaneous and unscripted, thus the teaching intervention appeared to engage directly through the conceptual question's posed by Falter's (2015) feminist critique of teaching as performance. The research findings, especially this last moment that engaged with theory, were a memorable highlight for the project team. These research findings were incredibly helpful for Mark's teaching practice, and he continues to refine these tools for use in my classroom.

The second research project was completed by Mark and Michael. As a secondary mathematics teacher candidate, Michael expressed a significant interest in knowing more about the politics of mathematics education and had prior experience in the performing arts and news media. Mark considered how this might integrate with his own research trajectory in mathematics policy analysis, e.g., Wolfmeyer (2013). He knew that mathematics education topics were increasingly being covered on national news networks and with some interesting discussions that would advance Michael's understanding of mathematics teaching. So, we selected this coverage as our unit of analysis and drew upon rigorous methodological examples that use critical discourse analysis methods to explicate meaning from news events. Our literature review included several newer pieces on news media coverage of mathematics education such as Abtahi & Barwell (2019) and Andersson et al (2021). These and other contributions outside of mathematics education, e.g., Goldstein (2010), generated a concise methodology using both frame and content analysis for the news events we identified.

An initial, interesting finding set us on a satisfying path early on. We realized that in selecting events from among the last 6 years (2015-2021), mathematics education was a topic covered inequitably across national news networks. We only identified a small number of news stories about mathematics education on CNN and MSNBC programs but several on Fox News. As we worked through both frame and

media analysis, we developed other striking findings. Although the news coverage contained the topic of mathematics education, other points beyond mathematics education seemed to be the priority. For example, one news media story spent more time discussing racial politics than it did mathematics teaching and learning. We do not suggest that racial politics has nothing to do with mathematics teaching, it certainly does! Our analysis of the news media indicated that racial politics, in favor of a continuation of things "as they are" and dismissal of advancements of equity, were the primary goals of the coverage rather than a discussion about mathematics classrooms.

Our primary conclusion, another satisfying result, was that mathematics education typically covered in national news stories advanced controversial policy discourses broader than mathematics education. In other words, we viewed the coverage of mathematics education as a tool for advancing particular ideologies, usually related to continued systems of power and oppression. As one clear example, we located a 2018 mathematics news event that ended up discussing at length the concept of meritocracy. As teacher educator and teacher candidate, we both knew well that public education functions in the mythology of meritocracy by providing a false sense of equal opportunity for all when we know that opportunity gaps (Milner, 2020) exist in public education. One counter-discourse that often appears in conversation suggests that meritocracy does function and everyone, regardless of their race, has equal opportunity even when the data does not support that conclusion. These conversations, as it did in the 2018 news event, go even further with declarations like "saying that meritocracy is embedded in societal racism" is a racist concept itself. Most recently, this twist on the concept of meritocracy appears also in the 2021 Pennsylvania House Bill No. 1532 (still in active legislation at the time of manuscript publication), also known as PA's Anti-CRT bill. One of their defined "racist concepts" that should be banned from teaching in higher education includes that "Meritocracy or merit-based systems are either racist or sexist." For Michael and Mark, our striking finding was seeing how the mathematics education news coverage three years prior had advanced a political discourse that now shows up directly in active legislative documents in our home state. More generally, during the data coding process we engaged in significant discussions about policies and practices of mathematics teaching including anti-racist pedagogies, traditional versus reform teaching, and detracking mathematics classrooms. Through the coding process Michael deepened both his understanding of mathematics pedagogies and the policy discourse landscape of public education.

Table 1 further indicates the ways that these two projects correspond to the necessary conditions for involving pre-service teacher candidates in education research.

Table 1: *Two examples of projects with necessary conditions*

	Improv and Instructional Delivery	Mathematics Ed in the National News
PSTC prior knowledge	-experience in improv theatre	-experience in performing arts, film, and media
Faculty motivation	-integrates feminist and performance theories into teaching -action research to improve classroom instruction	-continues project of national mathematics ed policy studies
Rigorous methodology	-classroom action research including IRB	-critical discourse analysis
PSTC responsibilities	-literature review -intervention development -enactment of protocol -transcribing -coding of data	-literature review -development of methodology -transcribing -coding of data
Satisfying finding	-improv reveals the performative yet spontaneous nature of teaching -use of improv increases ability to deliver instruction -disrupting gendered expectations of teaching profession	-coverage of mathematics ed in the news is not consistent across news platforms -coverage is less about math, more about politics -coverage uses mathematics ed to advance other policy discourses to continue systems of power and oppression

Student Reflections and Conclusion

Throughout the process, Mark made clear to both David and Mark that the research must accord with the necessary conditions. To continue their experience, Mark invited each to contribute their own reflections in this article and asked that they write through these reflections using the language of the necessary conditions.

From David: From my research experiences, I now aim to become a professor later in life. The project we worked on taught me the rigorous methodology involved in action-based research and I will now be better prepared in completing projects like it in the future. I learned how to appropriately obtain data from students and how to effectively look at it when compiled. Although the results we obtained were not exactly what I expected, they were very satisfying to find. In many ways teaching is a performance art. The purpose of this research was to examine Danielson's Framework of Teaching and to see how effective the students took in the information, mostly by connecting my background in improv theatre, and see how well the students were able to perform as teachers in the classroom as a result. Specifically, to my own goals as a future teacher and researcher, I strengthened my

observational skills in research and my performance skills in teaching, especially since I was unaware of Danielson's Framework before the research. This allowed me to gain a deeper understanding my junior year when I was using the framework myself.

From Michael: One of the main things I grew to appreciate was the rigorous methodologies that researchers must use. Before this project, I thought research was conducted in the manner most 10th graders "research" a topic for a paper. However, now I understand that research is about identifying a problem, looking at previous publications to identify a strategy to solve the problem, developing your method, and retrieving the data. Now I can describe what research is and be able to read publications accurately. Second, I grew as an educator, and this relates specifically to our project's focus and my prior knowledge. With my background in news media and interest in politics, I was excited to dig into an investigation about how mathematics education was covered. Our satisfying finding was surprising, it caused me to now know that sometimes people's views about education stem from these news networks. Our job as educators is to properly inform and advocate for the best possible education for our students. This research project has encouraged me to be a voice that uses ideas created by researchers. Therefore, this project has easily exceeded my expectations because I now have a new educator purpose.

David and Michael's reflections provide a glimpse into the possibilities for other education researchers to harness the excitement and productivity of undergraduate research experiences. We encourage education researchers to involve undergraduates in their research projects and to consider these necessary conditions as a starting point. For those who have done this before, we invite you to reimagine your work using these necessary conditions. The possibilities of research topics are endless given the broad range of interests that teacher candidates have and to which education researchers can connect research topics. If done with attention to rigor, successful projects will lead to a deepening of knowledge about teaching in the short term, the deeper appreciation of education research in the short and long term as a means for teacher development, and for the development of more education researchers in the long term. Whether an undergraduate pursues research full time later or prioritizes teaching for most of their career, clearly their approach to teaching will be much more research-minded in practice and that they will use action research methods to deepen practice. Further research, as longitudinal studies, can codify the specifics of these long-term effects of undergraduate research experiences in education. This approach and others are necessary future projects to fully explore the ways that undergraduate research experiences are a good fit for pursuit by teacher education faculty.

References

Abtahi, Y., & Barwell, R. (2019). Mathematical morality tales: Mathematics education in Canadian newspapers. *Canadian Journal of Science, Mathematics and Technology Education, 19*(1), 48–60.

Andersson, A., Ryan, U., Herbel-Eisenmann, B., Huru, H., & Wagner, D. (2021). Storylines in news media texts: A focus on mathematics education and minoritized groups. In *Proceedings of the 43rd annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*.

American Association of Colleges and Universities. (2022). High impact practices. https://Aacu.org/trending-topics/high-impact

Brownell, J.E., & Swaner, L.E. (2010). *Five high-impact practices: Research on learning outcomes, completion, and quality*. American Association of Colleges and Universities.

Council on Undergraduate Research. (2021). Mission and vision. https://www.cur.org/

Falter, M. M. (2016). Threatening the patriarchy: Teaching as performance. Gender and Education, 28(1), 20--36.

Fischer, A.E., Immel, K.R., Wilkum, K., & Lee, L. (2021). *A taxonomy for developing undergraduate research experiences as high-impact* practices. *Journal of the Scholarship of Teaching and Learning 21*(1), 84-106.

Goldstein, R. A. (2010). Imaging the frame: Media representations of teachers, their unions, NCLB, and education reform. *Educational Policy, 25*(4), 543–576.

Milner, R. (2020). *Start where you are, but don't stay there.* Harvard Education Press.

Pineau, E. (1994). Teaching Is performance: Reconceptualizing a problematic metaphor. *American Educational Research Journal* 31 (1), 3-25.

Rubin, L. (1985). *Artistry in teaching*. Random House.

Russell, S.H., Hancock, M.P., & McCullough, J. (2007). Benefits of undergraduate research experiences. 316, 548-549.

Wolfmeyer, M. (2013). *Math education for America? Policy networks, big business, pedagogy wars.* Routledge.

Interactions and Gains in Cultural Responsiveness in Pre-Service Educators

Melinda Burchard

Abstract: All teachers, special educators included, need to build competencies to honor and respond to the cultures of the students in their classrooms and school communities. This study of 64 pre-service teachers investigated interactions between their culturally responsive experiences specific to teaching children with disabilities and their self-efficacy for culturally responsive teaching of diverse children who qualify for special education. Participants self-rated their experiences and self-efficacy using the *Culturally Responsive Special Education Experiences and Efficacy Scale* which worked as a measure of self-efficacy. Variance in culturally responsive experiences explained nearly half of the variance in culturally responsive self-efficacy. Participants made very large effect size gains in both culturally responsive experiences and culturally responsive self-efficacy, though post-assessment self-efficacy remained merely moderate, indicating a next step for program improvement to increase culturally responsive experiences.

***About the Author*:** *Melinda Burchard, Ph.D,, is an Associate Professor of Special Education at Messiah University.*

Introduction

To meet the unique needs of all learners, teachers and future teachers must employ culturally responsive practices. This is especially true when supporting the learning of students with disabilities.

Competencies in Cultural Responsiveness

The Council for Exceptional Children is the leading international organization in the field of special education, setting standards for initial practice, advanced practice, and teacher preparation. One key emphasis in their Initial Practice-Based Professional Preparation Standards for Special Educators (Berlinger & McLaughlin, 2022), is development of cultural responsiveness. Special educators should pursue "…improved outcomes for individuals with exceptionalities.. with diverse social, cultural and linguistic backgrounds" as well as improved outcomes for their families (standard 1.2). Special Educators should "…plan and implement learning experiences and environments" that are culturally responsive (standard 2.2). Special educators should also learn to design and use "…culturally and linguistically appropriate…" assessments (standard 4.2). This means that teacher education for future special educators must explicitly teach such competencies of cultural responsiveness while teaching skills and competencies of planning, interventions, assessments, and collaborations with families.

What about future teachers who are not pursuing teacher certification in special education? *The Framework for Teaching Evaluation Instrument* (Danielson, 2013) is an instrument useful for setting goals and assessing teaching performance of both in-service and pre-service teachers. Used by certification programs, school districts, and even states, that framework values cultural responsiveness throughout. Examples from that framework include: anticipating how a student's home culture or language proficiency might interact with content learning (subdomain 1b); setting instructional outcomes appropriate for ALL students, including those of various diversities (subdomain 1c); creating a learning environment respectful of every learner, including those of diverse backgrounds (subdomain 2a); responding to student behaviors with sensitivity to culture and dignity (subdomain 2d); employing an extensive tool box of teaching strategies to flexibly adapt to meet the unique needs of learners, including those with disabilities or diverse cultures (subdomain 3e); and respectful communication with families (subdomain 4c). Clearly, such a framework shows that cultural responsiveness is an important competency in preparation of teachers in all fields.

Intersections of Disability and Diversity

Why prepare teachers to consider how disabilities interact with other factors of diversity? Educational research has long revealed evidence of discrepancies in special education services and learning outcomes. In 2018 synthesis research, McFarland and fellow researchers revealed that disproportionality continues in special education eligibility as well as learning outcomes. For example, they revealed that 13% of total student populations are found eligible for specific learning disabilities, but 16% of students who are black, and 17% of students who are American Indian or Alaskan Natives are found eligible for special education with learning disabilities. Of students served in special education only 62% of those students who are black graduate from high school, while 74% of students in special education who are white

graduate from high school. With such discrepancies continuing, teachers must reflect upon personal bias in both assessment and expectations of learning outcomes.

Self-Efficacy for Teachers

Self-efficacy is one's confidence to achieve outcomes that can either be broad such as self-efficacy for earning strong grades in math or very specific such as self-efficacy for solving word problems in geometry. (Woolfolk Hoy, 2007). For teachers, research has shown self-efficacy to be an important predictor for success in early career teaching and especially toward retention in the field of teaching. Sensitive to timely specific feedback, self-efficacy can grow in response to training, experience, and especially feedback (Erdem & Demirel, 2007).

Research shows that growth in self-efficacy for teaching interventions interacts with important skills in special education. Within teacher preparation for special education, research demonstrated interactions between self-efficacy and finding and judging evidence-based teaching practices (Burchard & Myers, 2019), writing quality IEPs (Burchard & Vargas, 2020), and designing math intervention lessons (Burchard, et al., 2022).

Promoting cultural responsiveness in teachers

Researchers demonstrated that teachers grow in efficacy when prompted to think about their thinking, specifically applied to shared vocabulary, persistence, and listening with empathy (Costa, et al., 2021). Specifically focused on building self-efficacy for cultural responsiveness, teachers need safe relationships to process bias, need to share motivation to solve problems, and need ways to encourage growth and celebrate growth (Jones, 2021). Teacher growth in cultural responsiveness specific to special education requires support with repeated routines of regular targeted reflection (Kelly & Barrio, 2021).

Improving Teacher Preparation for Cultural Responsiveness

Responding to an emphasis in cultural responsiveness in teacher competencies and standards, various teacher preparation programs implemented program improvements specific to cultural responsiveness. Research by McCall, et al. (2014) revealed the importance of teacher attitudes specifically about diverse students with disabilities. They emphasized the importance for teachers to engage authentically in wrestling with such issues. More recently, Williams, et al. (2021) recommended applying a culturally responsive lens as a framework for course development.

Assessing Cultural Responsiveness in Teacher Preparation

A clear gap exists in instrumentation to assess cultural responsiveness of teachers serving children eligible for special education. After gathering results of this study, a similar study (Williams, et al., 2021) reported development of similar instrumentation for pre-service teachers to self-rate cultural responsiveness using a checklist within the context of a special education course specifically about cultural responsiveness. The researcher compares the instrumentation from this study with the instrumentation from that study in the later discussion of results.

Purpose of this Study

The purposes of this study are twofold. First, this study required development of instrumentation to measure needs of teachers specifically related to serving diverse students with disabilities. Secondly, the researcher designed this study to investigate interactions between culturally responsive experiences and self-efficacy for cultural responsiveness specific to serving diverse students with disabilities.

Procedures

Participants

The researcher recruited participants for this study from one mid-sized private co-educational university in the northeastern region of the United States. That university offers bachelors, masters and doctoral degrees, with just over 2,300 students registered as degree seeking undergraduates in the fall semester of 2021.

During a pandemic, this university emphasized in-person learning with very few students approved for fully remote learning. Other students temporarily participated remotely when safety protocols required. Therefore, course instruction occurred in-person with some students simultaneously participating remotely.

Participants included juniors in a teacher preparation program enrolled in junior fall pre-student teaching field experiences with a concurrent special education course. Most participants' concurrent course emphasized inclusion of students with disabilities in the regular education curriculum and setting. Participants pursuing teacher certification in special education enrolled in a concurrent high incidence special education course that also emphasized inclusion with additional training in academic interventions. Participation criteria excluded those who took the course as an elective, or those who did not complete all instruments.

Application of inclusion and exclusion criteria resulted in data use from 64 participants, 19 pursuing teacher certification in special education, 45 pursuing certification in other teaching fields. Those participants included 53 females and 11 males, 16 individuals who disclosed a disability, and 3 individuals of an underrepresented race. Study results revealed no statistically significant difference between participants in the two special education courses, discussed later in results, allowing the researcher to combine results for participants in both courses.

Instrumentation

The researcher used two instruments in investigation of interactions and gains in cultural responsiveness, the *Culturally Responsive Special Education Experiences and Efficacy Scale, CRSEEES,* and the *Multi-Tiered Instruction Self-Efficacy Scale, MTISES.* For instructional purposes, the researcher used one additional instrument, the *Finding Belonging through Children's Books Scale.*

Culturally Responsive Special Education Experiences and Efficacy Scale, CRSEEES.

The researcher found no existing scale to assess cultural responsiveness specific to special education practices or serving students with disabilities. Using the DeVillis model for scale development (2017), the researcher developed and refined a self-reporting instrument with two subscales, one to self-rate frequency of culturally responsive experiences specific to serving students in special education, the second to self-rate one's need for

professional development in broad constructs of self-efficacy for culturally responsive practices specific to teaching in special education or serving students with disabilities. That work resulted in the *Culturally Responsive Special Education Experiences and Efficacy Scale, CRSEEES* (Appendix A) (Burchard, 2021a).

The CRSEEES is a 29-item instrument. Because some educators may lack full awareness of culturally responsive knowledge or skills, the first 24 items ask respondents to self-rate their frequency of engagement with specific teaching actions. Items on the experiences subscale represent those in common competencies of special education, such as IEP writing or behavior interventions, as well as common experiences of culturally responsive practices, such as supporting navigation of Medicaid Waiver processes or accessing translation services. The next five items ask respondents to self-rate the amount of professional development needed in broad categories of cultural responsiveness in serving students with disabilities who identify with additional identities of marginalization, under-represented race, poverty, etc. Such questions about professional development needs worked as a measure of self-efficacy in development of previous scales for use with teachers (Barnes & Burchard, 2016).

For program evaluation, students completed the CRSEEES during class on the second day of junior fall semester and then again in the last week of junior fall semester. One question with that survey allowed students to consent whether or not they wanted to participate in this study.

Finding Belonging through Children's Books Scale.

The researcher developed an instrument supporting teachers' instructional decisions about children's books, the *Finding Belonging through Children's Books Scale* (Burchard, 2021b) (Appendix B). That instrument is a 24-item questionnaire. The first item asks which book is rated. The second item asks teachers to identify any topics covered in the book that require sensitivity, such as death of a parent. The next two questions are a checklist of identities and experiences addressed. Then respondents use 20 Likert-Scaled items to rate degree of agreement or disagreement with statements, 6 items each in subscales of identity and catharsis with 8 items in the subscale of solutions. Within each of those constructs, some items support critiquing helpfulness for promoting children's awareness of marginalization, empathy for other's experiences, or pursuing reconciliation.

During in-class engagement with selected children's books, course participants critiqued wording and illustrations of books in three categories of identity, catharsis and solutions, including cultural responsiveness within those categories. The researcher computed overall means, as well as mean scores for each subscale of identity, catharsis and solutions. The instructor/research reported mean scores to course participants as they then engaged in group discussion of the texts. While the researcher used this instrument in instruction, the researcher did not use those results in analysis of interactions.

Multi-Tiered Instruction Self-Efficacy Scale, MTISES.

All participants completed a pre- and post- survey of self-efficacy, the *Multi-Tiered Instruction Self-Efficacy Scale, MTISES*. The MTISES is a 28-item survey with responses on a scale of how much professional development is needed in each specific teaching action. The MTISES works

to assess professional development needs of teachers and/or pre-service teachers for practices in multi-tiered interventions. The MTISES also works to measure gains in response to professional development. Previous research demonstrated that instrument works with strong internal consistency, validity and reliability (Barnes & Burchard, 2011; Barnes & Burchard, 2016). With strong consistency with other scales of teacher self-efficacy, results of such self-reported need for professional development work as a measure of self-efficacy (Barnes & Burchard, 2011; Barnes & Burchard, 2016). Self-efficacy as measured by the MTISES interacts with such competencies as math interventions (Burchard, et al., 2021), IEP quality (Burchard & Vargas, 2020), and finding and judging evidence-based teaching practices (Burchard & Myers, 2019). The MTISES is published for free use in teacher professional development or pre-service teacher program evaluation (Barnes & Burchard, 2016).

For program evaluation purposes, participants self-rated their needs for professional development on the items of the MTISES, (Barnes & Burchard, 2016) at the beginning and at the end of the junior fall semester.

Methods

At the beginning and end of fall junior special education courses, pre-service teachers completed both the MTISES, (Barnes & Burchard, 2011; Barnes & Burchard, 2016) and the CRSEEES (Burchard, 2021a).

During the fall semester of junior year, all participants enrolled in pre-student teaching field placements. That included common group training by the field experience program coordinator, and field supervision by a mentor teacher and university supervisor. All participants learned to design lessons and unit plans, practiced authentically in those junior fall field placements. Through participation in one of the two junior fall special education courses, students all learned how to find and judge evidence-based teaching practices, applications of high leverage practices (such as mnemonics and teaching with interactive materials), how to write measurable IEP goals, and how to adapt for unique needs of learners.

While topics of cultural responsiveness were explicitly discussed in course content, course participants also participated in some activities designed specifically to promote culturally responsive perspectives. Course participants observed such days as Indigenous People's Day, a United States holiday to commemorate history and experiences of Native Americans. Course participants also critiqued a selection of books for bibliotherapeutic purposes in special education, layered with critique of how the words and illustrations of each book work for identities such as disabilities, race, ethnicity, gender, poverty, nationality of origin, religion, and interactions of such identities. In those book critiques, students used the *Finding Belonging Through Children's Books Rating Scale* first, then using those ratings to inform small group discussion critiques.

The study used within-group pre to post methods. To analyze quantitative data, the researcher used the Statistical Package for Social Sciences, SPSS. The researcher calculated interactions through analysis of frequencies, group t-scores, correlations, and co-variance of individuals' paired data. The researcher then calculated effectiveness of gains using the Cohen's *d* formula comparing the pre-assessment group mean to the post-assessment group mean with the pooled standard deviation. Cohen's *d* is a standard measure of effect size. This statistic

allows the researcher to evaluate the size of effectiveness of gains from the group means at the beginning of the semester to the group means at the end of the semester. The researcher then interpreted effectiveness using effect size ranges for education.

Results

No differences between groups

The researcher used the pre-assessment experiences subscale scores to check for differences between groups of participants. The researcher conducted two-tailed *Mann-Whitney U tests* on participants' ratings of from the start of the junior fall semester for both culturally responsive experiences and culturally responsive self-efficacy. At the beginning of the semester, students pursuing special education certification (19) scored mean culturally responsive experiences with a mean score of 1.05 (SD .75) (See Table 1). At the beginning of the semester, students pursuing all other types of teacher certifications (45) reported culturally responsive experiences with a mean score of .73 (SD .75). Comparing those samples with two-tailed Mann-Whitney U tests at a significance level of .05, results showed that U= 316.5, z= -1.62, p =.10524, which means there were no statistically significant differences between the two groups in starting culturally responsive experiences.

Table 1: *No Differences between Group Scores on Culturally Responsive Experiences and Self-Efficacy*

Group	Culturally Responsive Experiences Mean (STD)	Culturally Responsive Self Efficacy Mean (STD)
Special Education	1.05 (.75)	2.34 (.69)
Other Certifications	.73 (.75)	2.02 (.70)

At the beginning of the semester, students pursuing special education certification (19) reported culturally responsive self-efficacy with a mean score of 2.34 (SD .69). At the beginning of the semester, students pursuing all other types of teacher certifications (45) reported culturally responsive self-efficacy with a mean score of 2.02 (SD .70). Comparing those samples with two-tailed Mann-Whitney U tests at a significance level of .05, results showed that U=303, z= -1.8221, p=.06. That means there is no significant differences between the two groups in starting culturally responsive self-efficacy.

Results demonstrated no significant differences in either starting culturally responsive experiences or starting culturally responsive self-efficacy. Therefore results from both cohorts (those in each of the two junior fall special education courses) could be combined for statistical analysis of this construct.

Correlations between Measures of Self-Efficacy

The experiences subscale of the CRSEEES worked as a measure of self-efficacy, with strong correlation with the proven self-efficacy scale of MTISES. Culturally responsive experiences correlated with self-efficacy for multi-tiered interventions, r=.541, p <.01. The self-efficacy subscale of the CRSEEES also worked as a measure of self-efficacy, with strong correlation with the MTISES. Culturally responsive self-efficacy

correlated with self-efficacy for multi-tiered interventions, r=.689, p <.01. (See Table 2.) That means that either subscale of the CRSEEES works as an assessment of self-efficacy.

Table 2: *Correlations between Pre-Assessment Scores for Culturally Responsive Experiences and Self-Efficacy in Special Education and Scores for Self-Efficacy for Multi-Tiered Instruction*

	Correlation with Self-Efficacy for Multi-Tiered Instruction MTISES
Culturally Responsive Experiences CRSEEES – Experiences Subscale	.541**
Culturally Responsive Self-Efficacy CRSEEES – Experiences Subscale	.689**

* means p <.05 ** means p <.01

Correlation and Co-variance of Culturally Responsive Experiences and Culturally Responsive Self-Efficacy

Within the CRSEEES, mean scores on the subscale of experiences correlated to mean scores on the subscale of self-efficacy r=.71, p<.01. Of greater significance, results further revealed significant co-variance with 47% of variance in self-efficacy explained by variance in experiences, F(1,62)=54.80, p<.001. R^2=.47. While co-variance is not an indicator of cause and effect relationships, it works as a more predictive type of correlation showing how variance in one factor interacts with variance in a second factor. In this case, results mean that the variance in culturally responsive experiences predict almost half of the variance in self-efficacy for culturally responsive teaching practice for students with disabilities.

Effectiveness of Gains in Culturally Responsive Experiences

Computing statistical results into effect sizes allows researchers, and in this case educators, to compare results. An effect size explains strength of difference between two groups or degree of change across standard deviation. The researcher used Cohen's *d* to compute effectiveness of pre to post gains within this group. This study resulted in large effect sizes for educational research (Cohen, 1988; Hedges, 2008; Kraft, 2019) though limited by within group study design.

Survey responses resulted in a pre-assessment mean score for culturally responsive experiences of .83 (.77 STD) on a scale of 0- 4 and a post-assessment mean of 1.59 (.85 STD), with mean gains of .77 (.78 STD). Student responses showed a very large effect size gain in culturally responsive experiences of Cohen's d= .95 (See Table 3). This means that across one semester, students encountered significantly newer culturally responsive experiences or increasing frequency in culturally responsive experiences that were specific to children with disabilities.

Table 3: *Effectiveness of Gains in Culturally Responsive Experiences and Self-Efficacy for Special Education Across One Semester*

	Pre-Assessment Mean (STD)	Post-Assessment Mean (STD)	Gains Mean (STD)	Effects Cohen's *d*
Culturally Responsive Experiences	.83 (.77)	.83 (.77)	.77 (.78)	.95
Culturally Responsive Self-Efficacy	2.11 (.71)	3.03 (.78)	3.03 (.78)	1.23

Effectiveness of Gains in Culturally Responsive Self-Efficacy

Survey responses resulted in a pre-assessment mean score for culturally responsive self-efficacy of 2.11 (.71 STD) on scale of 1-5, and a post-assessment mean of 3.03 (.78 STD), with mean gains of .92 (.74 STD). Student responses showed a very large effect size gain in culturally responsive experiences of Cohen's *d*= 1.23 (See Table 3). This means that across one semester, students demonstrated significant growth in self-efficacy for culturally responsive practices specific to children with disabilities.

Discussion

Addressing Intersections of Disability and Diversity

Guided by international standards and teacher certification guidelines, and more importantly propelled by values, teacher preparation for future special educators must prioritize development of cultural responsiveness. Specifically, future special educators need preparation to address needs of diverse students with disabilities. Beyond this present study, teacher preparation faculty, will navigate how to support development of such competencies in future teachers.

One value of this study is development of an instrument to guide self-reflection and to assess growth over time. Use of such an instrument in this study revealed helpful priorities for program improvements. This study also demonstrated helpful information about the connection between culturally responsive experiences and the development of culturally responsive self-efficacy for teaching diverse children who are eligible for special education.

Utility of the *Culturally Responsive Special Education Experiences and Efficacy Scale*

The Culturally Responsive Special Education Experiences and Efficacy Scale worked to rate self-efficacy in culturally responsive practices for diverse students with disabilities. That's certainly helpful. Still, practitioners must acknowledge that self-rating of such an important competency as cultural responsiveness in the context of special education is not the same as measuring authentic demonstrations of such competencies in pre-service classroom field experiences. The researcher acknowledges

that use of this sort of instrument is limited to promoting self-reflection toward more authentic growth in actual practice.

After this data was gathered, researchers Williams, et al. (2021) published a framework for implementing cultural responsiveness in curriculum and course revisions. That framework included a self-efficacy checklist scale. Similar to that scale, the CRSEEES supported student reflection upon their own self-efficacy for culturally responsive practices. Unlike the instrument in that study, this instrument asked students to first consider their frequency of engagement in culturally responsive experiences, before self-assessing self-efficacy for culturally responsive practices.

With this emphasis on cultural responsiveness, teacher educators should expect development of similar scales. Such anticipated options in instrumentation will offer a choice of what works for the priorities of each teacher preparation program.

Implications of Interactions between Culturally Responsive Experiences and Self-Efficacy

What does it mean that this study revealed covariance between culturally responsive experiences and culturally responsive self-efficacy? This result seems so logical, but the strong covariance result gives hope for the future of advancing cultural responsiveness for teachers of diverse students with disabilities. These results suggest that increasing culturally responsive experiences should then support growth in self-efficacy specific to teaching diverse students with disabilities.

School administrators and teacher educators alike can prioritize professional development opportunities to actively engage in the classroom, school and larger community targeting cultural responsiveness. What would that look like in a teacher preparation program? To raise awareness of poverty, such might involve promoting student participation in a poverty simulation training. Libraries can intentionally build collections of culturally responsive juvenile literature, and actively support professional development with those collections. School districts and teacher preparation programs can collaborate in professional development for specific competencies of cultural responsiveness, such as building sensitivity for a specific immigrant population of a geographic region.

Implications of Gains in Culturally Responsive Experiences and Culturally Responsive Self-Efficacy

This study revealed strong effectiveness in gains in self-efficacy for culturally responsive teaching practices for diverse students with disabilities. What does it mean? Encouragingly, even in a teacher preparation program with very limited diversity, cultural responsiveness did grow across one semester. Teacher educators can make a difference through curriculum and learning experiences, hopefully to a greater degree across several semesters. Logically, one should expect such gains to be even greater in more diverse teacher preparation programs or in schools and school districts with great diversity.

Implications of Post-Assessment Mean Scores in Culturally Responsive Self-Efficacy

Even with strong gains in self-efficacy for cultural responsiveness across one semester, mean post-assessment scores still fell in the mid-range of self-efficacy. That means students did not demonstrate strong post-self-efficacy for cultural

responsiveness, an inadequate learning outcome. Despite the growth, the researcher acknowledges much room for continued growth.

Limitations

The researcher notes important limitations of this study. All participants were enrolled in one mid-sized university, one with significantly low diversity. Students participated across one semester. The researcher conducted this study during a semester impacted by a pandemic, and though students engaged with in-person teaching field experiences, the pandemic did limit community engagement activities such as poverty simulation events or other collaborative professional development opportunities beyond field experiences.

Both self-efficacy instruments used in this study allowed participants to self-rate their need for professional development. This study did not use instrumentation to rate authentic demonstrations of cultural responsiveness in teaching field placements.

Next Directions and Importance

Results suggest the value of replicating such a study at a teacher preparation program with greater diversity, or with new teachers in a school district. Scaling such a study across multiple universities with varied demographic diversity and situated in varied settings (urban versus rural, etc.) would expand the utility of instrumentation.

At this same university, this researcher is extending this study across multiple semesters specifically for future teachers pursuing certification in special education. Such an extension across multiple semesters will support evaluation of more meaningful program effectiveness toward development of cultural responsiveness among pre-service teachers.

Clearly, this study points to one obvious next step. The variance in culturally responsive experiences so significantly explains the variance in culturally responsive self-efficacy. That points to intentional promotion of multi-cultural experiences both on the campus and engaging with the surrounding community. The researcher is collaborating with diversity advisors to pursue such enriching experiences for future academic years.

What do these results mean for the preparation of future educators?

Especially, what do these results mean for the preparation of future special educators? All teachers must be prepared to engage with cultural responsiveness to those students in classrooms and schools and districts, even as they engage with families in the community. This study gives hope that pre-service teachers benefit from training and field practice to grow in both culturally responsive experiences and self-efficacy. This study also provides clear direction that to grow the self-efficacy of pre-service teachers specific to culturally responsive practices, teacher educators must intentionally design and promote culturally responsive experiences in courses, on campuses, and in collaboration with nearby communities.

References

Barnes, S.K. & Burchard, M.S. (2011). Quality and utility of the multi-tiered instruction self-efficacy scale. *Research and Practice in Assessment, 6,* 22-42. http://www.virginiaassessment.org/rpa/5_wntr2011/RPA_winter2011.pdf

Barnes, S.K. & Burchard, M.S. (2016). Utility of the Multi-tiered Instruction Self-Efficacy Scale in assessing needs and short-term gains of pre-service teachers for multi-tiered instruction. *Teacher Education and Practice, 29*(1).

Berlinghoff, D., & McLaughlin, V.L. (Eds.) (2022). *Practice-Based Standards for the Preparation of Special Educators*. Council for Exceptional Children.

Burchard, M.S. (2021a). *Culturally Responsive Special Education Experiences and Efficacy Scale*. https://mosaic.messiah.edu/

Burchard, M.S. (2021b). *Finding Belonging through Children's Books Rating Scale*. https://mosaic.messiah.edu/

Burchard, M.S., & Myers, S. (2019). Early information literacy experience matters to self-efficacy and performance outcomes in teacher education. *Journal of College Reading and Learning, 49*(2), 115-128.

Burchard, M., & Vargas, K.H. (2020). Interactions of IEP quality and intervention self-efficacy for pre-service teachers. *Pennsylvania Teacher Educator.*

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral* Sciences (2nd Ed.). Lawrence Erlbaum.

Costa, A.L., Kallick, B., & Zmuda, A.G. (2021). Building a culture of efficacy with habits of mind. *Educational Leadership, 79*(3).

Danielson, C. (2013). *The Framework for Teaching Evaluation Instrument, 2013 Edition*. Danielson Group. www.danielsongroup.org

DeVellis, R. F. (2017). *Scale Development Theory and Applications,* (4th Ed.). Sage Publications.

Erdem, E., & Demirel, O. (2007). Teacher self-efficacy belief. *Social Behavior and Personality, 35*(5), 573-586.

Hedges, L. V. (2008). What are effect sizes and why do we need them? *Child Development Perspectives, 2*(3), 167-171.

Jones, K. H. (2021). Building a faculty's skills in culturally relevant teaching. *Educational Leadership, 79*(3), 38-43.

Kelly, J., & Barrio, B. (2021). Disability at the intersections: Expanding reflective practices within special education teacher preparation. *Journal of Special Education Preparation, 1*(2), 6-15.

Kraft, M. (2019). Interpreting effect sizes of education interventions. Retrieved from http://www.edworkingpapers.com/ai19-10

McCall, Z., McHatton, P.A., & Shealey, M.W. (2014). Special education teacher candidate assessment: A review. *Teacher Education and Special Education, 37*(1), 51-70.

McFarland, J., Hussar, B., Wang, X., Zhang, J., Wang, K., Rathbun, A., Barmer, A., Forrest Cataldi, E., & Bullock Mann, F. (2018). *The Condition of*

Education 2018 (NCES 2018-144). U.S. Department of Education. Washington, DC: National Center for Education Statistics.

Williams, K. R., Weiss, M.P., & Baker, P.H. (2021). Using a culturally responsive lens in the revision of a core preparation course. *Journal of Special Education Preparation, 1*(2), 36-47.

Woolfolk Hoy, A. (2007). *Educational Psychology* (10th Ed.). Allyn & Bacon.

Appendix A

Culturally Responsive Special Education Experiences and Efficacy Scale, CRSEEES

This instrument may be used at your discretion. Find a printer ready copy at https://mosaic.messiah.edu/

Please reference the following citation:

Burchard, M.S. (2021). *Culturally Responsive Special Education Experiences and Efficacy Scale.* https://mosaic.messiah.edu/

This survey asks a total of 29 questions and should take about 10 minutes to complete. 24 questions ask about your experiences. The last 5 ask you to identify professional development needs. There are no right or wrong answers.

Part One Directions: For each of these statements, please select the response that BEST matches your current experience with this skill. If you don't know the meaning of a term or don't know if you can do the skill, choose "Have not YET tried this/ OR CANNOT YET do this."

Response options for Part One Items:

I have not YET done this/ OR I CANNOT YET do this. = 0	I have done this once. = 1	I have done this a few times using support. = 2	I have done this a few times without support. = 3	I do this regularly without support. = 4

1. I **read articles** or chapters by experts on how **learning with a disability interacts with sociocultural factors** such as gender, race or ethnicity, English language learning, or economic status.

2. I **examine state and/or national** performance **data about how student disabilities interact with sociocultural factors** such as gender, race or ethnicity, English language learning, or economic status.

3. I **examine local progress monitoring data about how student disabilities interact with sociocultural factors** such as gender, race or ethnicity, English language learning, or economic status.

4. I use **students' comments** to understand **how learning with a disability interacts with sociocultural factors** such as gender, race or ethnicity, culture or faith, English language learning, or economic status.

5. I use students' **nonverbal behaviors** to understand **how learning with a disability interacts with sociocultural factors** such as gender, race or ethnicity, culture or faith, English language learning, or economic status.

6. I design my **classroom environment** with materials that welcome children with **disabilities** with additional interacting **sociocultural factors** such as gender, race or ethnicity, culture or faith, English language learning, or economic status (IE Strategy posters showing learners with varied skin colors).
7. I build my **classroom library** with books that are inclusive of children with **disabilities** with additional interacting **sociocultural factors** such as gender, race or ethnicity, culture or faith, English language learning, or economic status (IE book illustrations depicting a child with both a disability and garments specific to a particular ethnicity).

8. I **adapt vocabulary of texts** to meet the unique needs of children with **disabilities** with additional interacting **sociocultural factors** such as race or ethnicity, culture or faith, English language learning, or economic status (IE reading level of text, or names used in word problems).

9. I **adapt instruction** to meet the unique needs of children with **disabilities** with additional interacting **sociocultural factors** such as gender, race or ethnicity, culture or faith, English language learning, or economic status (IE avoiding idioms or geographically specific terminology in examples).

10. I **adapt assessments** for children with **disabilities** with additional interacting **sociocultural factors** such as gender, race or ethnicity, culture or faith, English language learning, or economic status (IE adjusting a rubric for group collaboration grade to acknowledge culturally expected gender roles).

11. I implement **class routines and rules that are culturally respectful** of **sociocultural factors** such as gender, race or ethnicity, culture or faith, English language learning, or economic status (IE rules about how to dress or wear hair during physical education do not clash with culture or religion of my students).

12. I **adapt proactive behavior practices** for children with **disabilities** with additional interacting **sociocultural factors** such as gender, race or ethnicity, culture or faith, English language learning, or economic status (IE respecting faith-based dietary restrictions for positive behavior events).

13. I **adapt behavior intervention practices** for children with **disabilities** with additional interacting **sociocultural factors** such as gender, race or ethnicity, culture or faith, English language learning, or economic status (IE explicitly teaching code switching from a home culture to the social expectations in school culture).

14. I **honor cultures** of my children with disabilities in our class events (IE how we celebrate holidays, OR whether a child's face shows in photos used in class newsletters).

15. I **flex** how to **engage families** of my **students with disabilities** who also **struggle financially** (IE flexing timing of meetings when parents lose pay to miss work for meetings, OR communicating through paper instead of digitally).

16. In my **visual communications with families, I vary illustrations** showing varied **types of families** (IE showing families with foster or adopted children with varied skin tones).

17. In my **written communications with families**, I use **culturally sensitive vocabulary** (IE describing a teaching unit using the name of a specific Native American tribe).

18. I actively engage **parent priorities in planning** for a child's special education (IE incorporating IEP goals that honor the parent's hopes for their child's future).

19. I **provide translated documents** for **families** of children with **disabilities** who are **English language learners** (IE providing a copy of parent rights in Special Education translated into Spanish).

20. I **use interpreters** or interpreting services to make **communication accessible** for **families** of children with **disabilities** who are **English language learners or who use American Sign Language** (IE holding an IEP meeting using video sign language interpreting).

21. I **advocate** for unique needs children with **disabilities** with additional interacting **sociocultural factors** such as gender, race or ethnicity, culture or faith, English language learning, or economic status (IE organizing community Wi-Fi hot spots for access to on-line learning).

22. I **problem-solve** for unique needs of children with **disabilities** respecting additional interacting **sociocultural factors** such as gender, race or ethnicity, culture or faith, English language learning, or economic status (IE collaborating with a neighborhood homework support program).

23. I **critique** how my own special education practices may be **biased** concerning **sociocultural factors** such as gender, race or ethnicity, culture or faith, English language learning, or economic status (IE expecting less of students of one gender or race, OR interpreting cultural expressions as inappropriate behaviors).

24. I **change my special education practices** as I learn about how disability interacts with **sociocultural factors** such as gender, race or ethnicity, culture or faith, English language learning, or economic status.

Part Two Directions: For each of these statements, please select the response that BEST matches your current need for professional development with this skill. If you do not know if you can do the skill, choose "I'll take anything."

Response options for Part Two Items:

I'll take anything = 1	I'm starting to get it, but I want lots more = 2	I do this, but I could benefit from more = 3	I don't feel the need for more = 4	I feel ready to help others =5

25. How much professional development do you need to **inform yourself how learning of a student with a disability interacts with sociocultural factors** such as gender, race or ethnicity, culture or faith, English language learning, or economic status?

26. How much professional development do you need to **design a positive environment** to support unique needs of **a student with a disability with** additional **sociocultural factors** such as gender, race or ethnicity, culture or faith, English language learning, or economic status?

27. How much professional development do you need to **adapt practices** to support unique needs of **a student with a disability with** additional **sociocultural factors** such as gender, race or ethnicity, culture or faith, English language learning, or economic status?

28. How much professional development do you need to **engage with families** of **students with a disability** with additional **sociocultural factors** such as gender, race or ethnicity, culture or faith, English language learning, or economic status?

29. How much professional development do you need to **problem-solve** to support unique needs of **a student with a disability with** additional **sociocultural factors** such as gender, race or ethnicity, culture or faith, English language learning, or economic status?

Appendix B

Finding Belonging through Children's Books Rating Scale

This instrument may be used at your discretion. Please reference the following citation: Burchard, M.S. (2021). *Finding Belonging through Children's Books Rating Scale*. https://mosaic.messiah.edu/

This scale is developed to guide selections of children's books to support children finding belonging through various identities or challenges.

Directions: Read through the book. Identify characters and topics, including topics requiring care. Then rate.

Book critiqued: _____

List Topics Requiring Care: List events or emotions that require care in use (IE death, suicide, abuse, trauma):

CHARACTERS and TOPICS

Identity of Characters: Who is represented in primary characters/illustrations? Check ALL that apply.

- □ Disability or Learning Difficulty
- □ Marginalized Ethnicity or Race
- □ Language Learner
- □ Immigrant or Refugee
- □ Low Socio-economic Status
- □ Marginalized Gender (IE girls in STEM.)
- □ Marginalized Age (IE child with adults)
- □ Differences (IE language, accent, clothing, weight, height, skin color, eye shape)
- □ Experience (IE adoption, foster care, hunger, bullying, trauma)
- □ Other: _____

Challenges Addressed: What challenges or struggles are directly addressed? Check ALL that apply.

- □ Racial or Ethnic Barriers to Access or Inclusion
- □ Disability Barriers to Access or Inclusion
- □ Historical or Personal Events
- □ Rights, Privilege or Lack of Privilege
- □ Academics: A Struggle or Frustration
- □ Communication: Disorders or Barriers
- □ Relationships: Barriers, Hurt, Healing
- □ Behaviors: in Trouble or Self-Regulation
- □ Emotions: Identifying, or Struggling
- □ Processing Trauma
- □ Processing a Demographic Factor or Difference
- □ Other: _____

Response options for the following items:

Strongly Agree =4	Agree =3	Disagree =2	Strongly Disagree =1	N/A =no score

Critique use of this book for IDENTITY

The **wording** in this book provides opportunity for children of one marginalized group to ***see themselves*** *in a character*.

The **vocabulary** is both ***appropriate and sensitive*** *to the identity* of a specific population.

The **wording** in this book provides opportunity for children who are NOT of one marginalized group to ***grow in awareness*** *of peers or community members of one marginalized group*.

The **illustrations** in this book provide opportunity for children of one marginalized group to ***see themselves*** *in a character*.

The **illustrations** are both ***appropriate and sensitive*** *to the identity* of a specific population.

The **illustrations** in this book provide opportunity for children who are NOT of one marginalized group to ***grow in awareness of*** *peers or community members of one marginalized group*.

Critique use of this book for CATHARSIS

This book **supports** children to ***identify emotions***.

This book **invites** readers to ***process emotions***, or emote with and through the story.

This book provides a ***healthy model*** **for processing emotions**.

This book **provides opportunity** for individual children to ***connect with a challenge*** in the story.

The **vocabulary** is both ***appropriate and sensitive*** *to the challenge* addressed.

The **challenge(s)** in this book **provides opportunity** for children who are NOT of one marginalized group to ***grow in empathy*** *for challenges experienced by peers or community members*.

Critique use of this book for SOLUTIONS

This book **promotes *inclusion*** of a marginalized group ***or reconciliation*** in social justice.

This book **supports discussion** of 2 or more **intersecting issues of marginalization *or* social justice**.

This book ***models accessing a supportive individual or community support*** through a challenge.

This book ***promotes perseverance or resilience*** through a challenge.

This book ***promotes self-efficacy*** (belief in self-worth and capability) OR ***self-regulation*** (self-awareness or using strategies) OR ***self-determination*** (goal setting, decision-making).

For use with a classroom or group, this book ***promotes growth in disability awareness or cultural intelligence***.

Challenges in Learning Phonics and Phonemic Awareness: Case Studies of Pre-Service Elementary Teachers
Stacey L. Bose

Exploring Technology Competencies of Field-Based Teacher Educators
Abdulsalami Ibrahim
Oliver Dreon, Jr.

Realistic vs. Effective: An Analysis of Educators' Perceptions of Traditional and Co-teaching Models of Student Teaching
Patricia Joergensen
Jennifer L. Fisler

We Strive: Enhancing Implementation of Socioscientific Issues in STEM Classrooms Through Professional Development
Joseph Johnson
Augusto Macalalag
Becky Mathers-Lowery
Gabrielle Ialacci

Teacher Candidates Working with Digital Technologies to Support Multilingual Students in Asset-Based Ways
Megan E. Lynch
Frances Nebus Bose
May Lee

The Introduction of Global Collaboration to Pre-Service Teachers: Training Future Global Change-Agents
Aaron J. Sams
Lee Kenneth Jones
Walter Smith

Listening to Teacher Candidates of Color
Emily Wender
Roger Briscoe
Jt Heslop
Kaitlyn Brennan

Undergraduate Research Experiences for Pre-Service Teacher Candidates: Necessary Conditions for Productive Projects
Mark Wolfmeyer
David Mohamad
Michael Mistler

Interactions and Gains in Cultural Responsiveness in Pre-Service Educators
Melinda Burchard