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The Texas Forum of Teacher Education, a publication of the Texas Association of Teacher Educators (TxATE), is a referred journal published once annually. Articles in the journal are directed to both campus-based and field-based Texas teacher educators. TxATE members, including graduate students, are encouraged to submit manuscripts. Authors must be active members as a condition for publication.

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EDITOR'S INTRODUCTION

What a year 2020 has been! To say the profession (in general) and we as educators (in particular) have been challenged is a gross understatement. The silver lining that struck me as I compiled this year's contributions to *The Texas Forum of Teacher Education* was, and continues to be, the amount of incredible grit and determination exhibited by educators across the PK-16 instructional spectrum. With little time to prepare parents and other stakeholders to take over an unsolicited portion of the instructional reigns, Texas teachers (in tandem with their national colleagues) worked tirelessly to ensure students were given opportunities to excel to the greatest extent possible in this "new normal".

It has been my pleasure to work with the TxATE Board members and reviewers through the creation of this year's TxATE *Forum*. It would take much more space than I am allowed here to thank each person individually. Know that no matter your role in this endeavor, I appreciate your guidance!

A common thread running through contributed manuscripts to this issue was the foundational principle that effective educators consistently strive to deliver effective research-based instruction (no matter the circumstances) in order to ensure student needs are met. A pandemic could not stop that goal as evidenced by educators who continued to:

- Show **C**are and **C**ompassion through the **C**ourageous **C**reation of **C**aptivating instruction while **C**onsistently **C**hallenged by **C**ontinuous **C**hange.
- Be **O**bservant and **O**ptimistic as they engaged students in **O**utstandingly **O**rganized **O**pportunities despite **O**ccasional moments when they themselves felt a bit **O**verwhelmed.
- **V**alidate student and parent **V**oices by being **V**igilant in the **V**irtual presentation of a **V**ariety of **V**alued and **V**ibrant instructional strategies.
- **I**mplement **I**ncredible **I**nstruction that was not only **I**nviting but **I**nclusive, **I**nnovative and **I**mpactful as well.
- Be **D**riven and **D**edicated in their **D**esired creation of **D**iverse yet **D**istinct tasks which focused on **D**iscovery and **D**ignified **D**ivergent thinking.

In this issue:

- Using the Technological Pedagogical Content Knowledge (TPACK) theory developed to explain knowledge teachers need to teach effectively and with technology, Dr. Karman Kurban looked at adding robust data including videos and teacher reflections to the lesson plans utilized in the assessment of teacher quality. Results outlined in *Characterizing Middle Grade Mathematics Teachers' Technological Pedagogical Content Knowledge (TPACK) Using a Robust Data Set* added to the knowledge base focused on translation of theory to practice.
- Recognizing the influx of locally certified teachers whose first career path was not education through Texas' District of Innovation designation, Dr. Brian Uriegas spoke to the importance of creating individualized, collaborative professional development programs to address their unique circumstances and needs in *identifying the Professional Development Needs for Teachers from Non-Educational Backgrounds.*
- Drs. Amy Barrios, Karen Kohler, & Lydia Gerzel-Short investigated the rapid shift in learning brought about by the pandemic that necessitated a change in school/family interactions. The authors provided strategies for teachers and teacher candidates to help parents/guardians and their children negotiate virtual learning spaces in their submission, *Shifting from Involvement to Engagement: Strategies for Supporting Families Virtually.*
- Academic calendar year 2020 saw standardized testing and accompanying accountability ratings waived for Texas schools. Indeed, Texas is currently discussing the possibility of a decrease in the number of standardized exams required for graduation. Dr. Erin Pierce followed the experiences of two secondary science teachers as they transitioned from teaching a state-tested subject to teaching a subject that was non-tested in *Now What? Teacher Perceptions of Their Instructional Practices in a Post-Standardized Tested World*.
- The pandemic forced teachers and teacher candidates to adapt quickly to constantly changing scenarios. In their article, *Teaching in Challenging Times: How Can Culturally Relevant Pedagogy Assist Teachers During COVID19?*

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Drs. Laura Trujillo-Jenks, Rebecca R. Fredrickson, Karen Dunlap, and Sarah McMahan described strategies which help pre-service educators understand that culturally relevant pedagogy is essential.

- In their article, *Meeting the Needs of Secondary Students: One Teacher Candidate at a Time*, Drs. Amber Wagnon & Heather Dean explored how teacher education programs may provide more active learning opportunities responsive to current trends in education; specifically targeting content literacy among secondary clinical student teacher candidates.
- Through solid pedagogical practices, Drs. Arren Swift, Robert Maninger, and Casey Creghan identified strategies preservice and in-service educators can use to increase confidence in both time management and classroom discipline when implementing project-based learning in the article, *Enacting PBL Without Fear.*
- Through their article, *The Impact of the Robert Noyce Mentoring Programs on Increased Teaching Effectiveness among Teacher Candidates,* Drs. Amber Wagnon, Keith Hubbard, & Chrissy Cross examined the impact the mentorship program from the National Science Foundation had on recruiting and retention efforts of teacher candidates in STEM fields at their university.
- Drs. Maria de Lourdes Viloria, Selina V.Mireles, Weam Al-Tameemi and Marcela Uribe in their submission, *Instructional Research-Based Practices Related to Agriculture Science,* investigated instructional practices that enhanced hands-on agricultural science lessons aligned to Texas curriculum standards.
- Finally, to enhance the writing skills of educator candidates, Dr. Thomas Hansen submitted a review of the book, *A Student's Guide to Academic and Professional Writing in Education* by Arostegy, Bright & Rinard.

Therefore, as 2020 winds down, perhaps upon reflection, articles within this issue will continue to serve as reminders that even though COVID 19 forced the shutdown of schools, universities, and university teacher preparation programs, several insights did negotiate their way to the forefront of educators' minds. Standards matter...Schools matter...Teachers matter.... Training matters...Stakeholders matter...How Change is Addressed matters. TxATE has a pivotal role to play.

As TxATE prepares for the next edition, the call for papers to be submitted to the *Texas Forum for Teacher Education* will go out in spring 2021 with the deadline for manuscripts set for **July 1, 2021.** Authors are asked to direct submissions to the 2021 Managing Editor, Dr. Daniella Varela (daniella.varela@tamuk.edu) .

Respectfully submitted,
Karen Dunlap
Managing Editor, *Forum* 2020

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CHARACTERIZING MIDDLE GRADE MATHEMATICS TEACHERS' TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE (TPACK) USING A ROBUST DATA SET

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Abstract

Teachers' combined knowledge of contents, technologies, and the pedagogical methods has become a focus of understanding and evaluating teachers' quality. Much of the research uses rubrics to assess technological pedagogical and content knowledge (TPACK) but are limited in that the data sources are oftentimes only lesson plans. The purpose of this study was to characterize mathematics teachers' TPACK using a robust data set that includes the lesson planning process (written lesson plan), implementation of the lesson as represented through video, and teacher reflection about the lesson. Fifteen middle grade mathematics teachers' Technology Lesson Cycles data (the robust data) were assessed and analyzed using a pretested rubric which is the first part of the study. Findings from the study illustrate that the in-service mathematics teachers' pedagogical knowledge (PK) and the knowledge components that contain PK are relatively weaker than other components. Among all seven TPACK components, the technological pedagogical knowledge (TPK) was the weakest knowledge component. This work brought forward a deeper understanding of how TPACK translates to practice. Recommendations were provided for teacher education programs and for future studies.

Keywords: Teacher Knowledge, TPACK, Teacher Education, Technology Integration

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Introduction

Theoretical Framework

Incorporating appropriate technologies in mathematics instruction is an expectation across national standards (National Council of Teachers of Mathematics, 2000). Effective teaching with technology requires a developed, nuanced understanding of the complex interplays between three key kinds of knowledge: content knowledge, pedagogical knowledge, and technological knowledge; and how they play out in specific contexts (Mishra & Koehler, 2006). Based on research, a framework commonly used to describe teacher knowledge as it relates to the incorporation of technology is referred to as technological pedagogical and content knowledge (TPACK) (Mishra & Koehler, 2006). Figure 1 illustrates TPACK as the intersection of the three primary forms of knowledge: Content Knowledge (CK), Pedagogical Knowledge (PK), and Technology Knowledge (TK).

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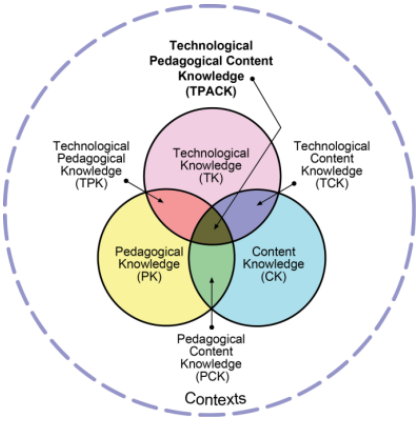
Figure 1
Graphic Representation of Technological Pedagogical Content Knowledge (TPACK)



Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, *108*(6), p. 1025.

This framework allows one to look into teacher's individual knowledge component such as technological pedagogical knowledge (TPK). The individual knowledge component such as TPK demonstrates the ways in which the knowledge of teaching practices combines with the knowledge of technology so that a teacher implements technology in a way that best impacts student learning. When all three knowledge areas are combined, it forms the framework, TPACK, in which teachers' knowledge is combined to produce effective teaching of content utilizing technology in a way that identifies, produces, and enhances student learning (Harris, Mishra, & Koehler, 2009; Koehler & Mishra, 2009; Koehler & Mishra, 2006).

Need for the Study

There is a wealth of research related to the use of TPACK as a framework for conceptualizing teachers' knowledge as it relates to pedagogy and technology. Much of the research about TPACK attends to pre-service and practicing teachers' beliefs and attitudes about technology and about self-efficacy beliefs regarding integrating technology in practice. (Archambault & Crippen, 2009; Doering, Scharber, & Miller, 2009; Graham et al., 2009; Harris, Mishra, & Koehler, 2009; Koehler & Mishra, 2006; Yurdakul et al., 2012). Since last decade, studies have focused more on how to assess TPACK using teacher created written lesson plans (Harris, Grandgenett, & Hofer, 2010; Kereliuk, Casperson, & Akcaoglu, 2010; Kim et al., 2015). These studies have helped to conceptualize teachers' TPACK, however, they have not included the actual implementation of the lesson. In other words, research centered on the use of teaching practice data which includes multiple components to characterize teachers' TPACK have rarely seeing in the literature.

Purpose of the Study

The purpose of this study was to characterize mathematics teachers' TPACK using written lesson plans, videotaped implementation of the lessons, and teachers' reflections about their lessons. To better understand the middle-grade mathematics teachers' TPACK characteristics, a new method was adopted in this researcher's study. The intent was to use a rubric to analyze lesson cycle data of fifteen middle-grade in-service mathematics teachers to learn how they use TPACK and how the study could infer TPACK from written documents and videos of instruction. Descriptive analysis, observation, and content analysis methods were used to analyze the practicing data of the mathematics teachers who were enrolled in a graduate course about using technology in instructional practices.

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This study used multiple data sources to assess in-service middle-grade mathematics teachers' TPACK, a procedure that has not been often used in the literature. The methodology developed in this study could potentially contribute to the literature for assessing teacher knowledge. The results of this study provided further evidence of how CK and PK, CK and TK, and PK and TK intersect in the TPACK framework described by Mishra and Koehler (2006). Characterizing in-service mathematics teachers' TPACK in practice can potentially expand the understanding of teachers' TPACK and how they use their TPACK in their classrooms. The characterization helps teacher educators in identifying teachers' specific TPACK (CK, PK, TK, PCK, TCK, TPK) levels, leading appropriate professional development programs for specific areas. Findings from a study such as this would also inform teacher educators in designing coursework and professional development regarding educational technology integration in teaching.

Literature Review

Teaching is a complex activity that requires teachers with multiple knowledge areas. Historically, the teachers' knowledge was focused on content knowledge and pedagogical knowledge only. Over the years, greater access to computer technologies has encouraged teachers to develop technology knowledge as well. More recently, the area that has received greater attention is the knowledge construct related to the integration of technology in instruction.

Shulman (1986) introduced a new way of thinking about one aspect of teacher knowledge which he called pedagogical content knowledge (PCK), acknowledging in part how content knowledge and pedagogical knowledge intersect. Based on Shulman's contribution to the field, Mishra and Koehler (2006) developed a framework for thinking about teacher knowledge as it relates to using technology. They called this construct technological pedagogical and content knowledge (TPACK). It represents the complex relationship and intersection of three primary forms of knowledge: Technology Knowledge (TK), Pedagogy Knowledge (PK), and Content Knowledge (CK) (see Figure 1, p. 2). Considerable research has been conducted using the framework of TPACK to conceptualize and to understand teachers' knowledge required for effective teaching and technology integration. This framework has been implemented in many studies to investigate and understand specific learning activities and environments (Abbitt, 2011; Archambault & Crippen, 2009; Doering, Scharber, & Miller, 2009; Graham et al., 2009; Harris, Mishra, & Koehler, 2009; Koehler & Mishra, 2006; Yurdakul et al., 2012). The TPACK concept has become a widely used framework in research that focused on understanding teacher knowledge and teaching practice.

Since last decade, scholarship addressing teachers' TPACK has focused increasingly on how this knowledge can be assessed. Several studies developed self-reported survey instruments for reliability and validity of TPACK assessment (Archambault & Crippen, 2009; Niess, M. L., van Zee, E., & Gillow-Wiles, H. 2010-11; Schmidt, Baran, Thompson, Koehler, Shin & Mishra, 2009). Several studies developed performance assessments (Angeli & Valanides, 2009; Groth, Spickler, Bergner & Bardzell, 2009). By 2015, at least ten more validated self-report survey instruments and rubrics had appeared in the literature (Burgoyne, Graham, & Sudweeks, 2010; Chuang & Ho, 2011; Figg & Jaipal, 2011; Landry, 2010; Lee & Tsai, 2010; Lux, 2010; Sahin, 2011; Yurdakul, et al., 2012), including four validated rubrics (Harris, Grandgenett, & Hofer, 2010; Hofer, Grandgenett, Harris & Swan, 2011; Kereluik et al., 2010; Kim et al., 2015) and different types of TPACK-based content analyses that had adequate levels of interrater reliability (Clement et al., 2003; Graham, Borup & Smith, 2012; Hechter & Phyfe, 2010; Koh & Divaharan, 2011; Mouza, 2011; Mouza & Wong, 2009). Researchers believe that because of the complexity of TPACK, scholarship that develops methods for TPACK measurement will probably continue (Harris, Grandgenett, & Hofer, 2010).

Schmidt et al. (2009) designed a TPACK survey instrument for preservice teachers. The instrument constructed contained seventy-five items for measuring preservice teachers' self-assessments of the seven TPACK domains. This instrument measured preservice teachers' self-assessments of the TPACK domains, not their attitudes toward TPACK. Koehler, Mishra, and Yahya (2007) developed a coding protocol related to TPACK analysis and used discourse analysis to track the development of TPACK. They analyzed the conversations of teachers working in design teams, tracking the

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development of each of the seven categories of TPACK over the course of a semester. Their research suggested that this approach only works when applied to specific methodology particular to unique contexts.

There have been studies that focused more on how to assess TPACK using teacher-created, written lesson plans (Harris, Grandgenett, & Hofer, 2010; Kereliuk, Casperson, & Akcaoglu, 2010; Kim et al., 2015). These studies helped to conceptualize teachers' TPACK but did not include the actual implementation of the lesson. In other words, using teacher practice data to characterize teachers' TPACK has not been often utilized. There is a need for characterizing in-service mathematics teachers' TPACK in practice to expand the current understanding of teachers' TPACK and how teachers use their TPACK in the classroom. This need especially includes middle-grade mathematics teachers' TPACK which plays a crucial role in children's learning at this important period in their education. This study examined teachers' TPACK through data that included a lesson plan, videotaped implementation of the lesson, and the teacher's reflection about the lesson. The characterization helps teacher educators identify teachers' TPACK levels, influencing the design of appropriate professional development programs aimed at increasing teachers' knowledge and skills necessary for integrated teaching.

Methodology

Context

The participants of this study were middle-grade mathematics teachers enrolled in an online graduate course, "Teaching Secondary Mathematics with Technology," which was a part of a M.Ed. program for in-service mathematics and science teachers at an urban university located in a south-central region of the United States. The course was designed to promote teachers' development of various TPACK components and was taught for four fall semesters over four years. This study used 15 mathematics teachers' archival data from fall 2012, 2013 and 2014 semesters.

A key assignment of this course was called the *Technology Lesson Cycle*. This assignment required the submission of a detailed, written lesson plan with multiple components. These included an evaluation plan, a brief paper describing research/literature about how the chosen technology supports student learning, evidence of learning outcomes provided by teachers, at least 20 minutes of video-taped instruction of the lesson, and teachers' reflection about the overall lesson. Teachers chose topics and technologies that were available to them at their respective schools and were encouraged to try technologies with which they were unfamiliar.

Data

The *Technology Lesson Cycle* assignment was archived data in Blackboard Learn, the course management system for the course. Teachers submitted the lesson plan, the literature review, and lesson reflection in a Word document. Video was submitted through a hyperlink or mailed to the instructor on a CD or USB stick. At the time of the study, some of the videos of practice were unavailable. For the purpose of this study, only complete Lesson Cycle submissions of mathematics teachers were used for analysis. Fifteen of the thirty-four mathematics teachers' Lesson Cycle submissions were complete and therefore utilized for the purposes of this study.

Rubric Development

A significant part of the methodology in this study was the development of a rubric that was used as a tool to characterize TPACK. Most of the available rubrics in the literature were designed to evaluate a specific task or an assessment, specific to the researchers' study, and therefore were not applicable to this study.

Pilot data were used to develop the rubric. The finalized rubric was tested for reliability. Interrater reliability was examined using Intraclass Correlation (0.734), and internal consistency within the rubric was computed using Cronbach's

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Alpha. The test result was significant ($p = 0.007$, $p < 0.05$). The result of the analysis indicated the rubric was a valued instrument for this study. The rubric is included as Appendix A.

Table 1
Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.734	.713	6

Table 2
Intraclass Correlation Coefficient

	Intraclass Correlation[b]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.315[a]	.049	.750	3.757	6	30	.007
Average Measures	.734	.237	.947	3.757	6	30	.007

Rubric Application

The fifteen middle-grade mathematics teachers' Technology Lesson Cycle data, which represents how teachers operationalize their TPACK in practice, was applied to the rubric using descriptive and video analysis methods. Each component of the TPACK was characterized as "Weak" "Marginal" "Proficient" and "Strong" based on the analysis. Descriptive, observation, video and content analysis methods were used to analyze the mathematics teachers' complex data during the process. Lesson plans provided the general sequence of the lessons, including the lesson objective, technologies to be used, engagements and students' activities, and evaluation plans. The technology research papers provided evidence of what the teachers knew about technologies that impact classroom teaching and the rationale of why they chose the particular technologies included in the lesson. The video data was used to capture lesson content and classroom events, and to determine if the teachers' plans were implemented in the actual instruction. Teacher reflections about their lessons provided evidence of teachers' abilities to learn to adapt to new technologies and to show the ways in which teachers' understandings of the content can be changed by the application of technologies.

Results

The results were organized in a TPACK characterization pattern chart and the percentages of each scale character—from weak to strong—for all teachers combined are listed in Table 3.

Table 3
The Percentage of Scale Character of the TPACK

TPACK Scale	Technological Pedagogical and Content Knowledge						
	CK	PK	TK	TCK	PCK	TPK	TPACK
Weak	0%	0%	0%	0%	0%	0%	0%
Marginal	0%	0%	0%	0%	7%	27%	13%
Proficient	0%	40%	7%	20%	33%	33%	40%
Strong	100%	60%	93%	80%	60%	40%	47%

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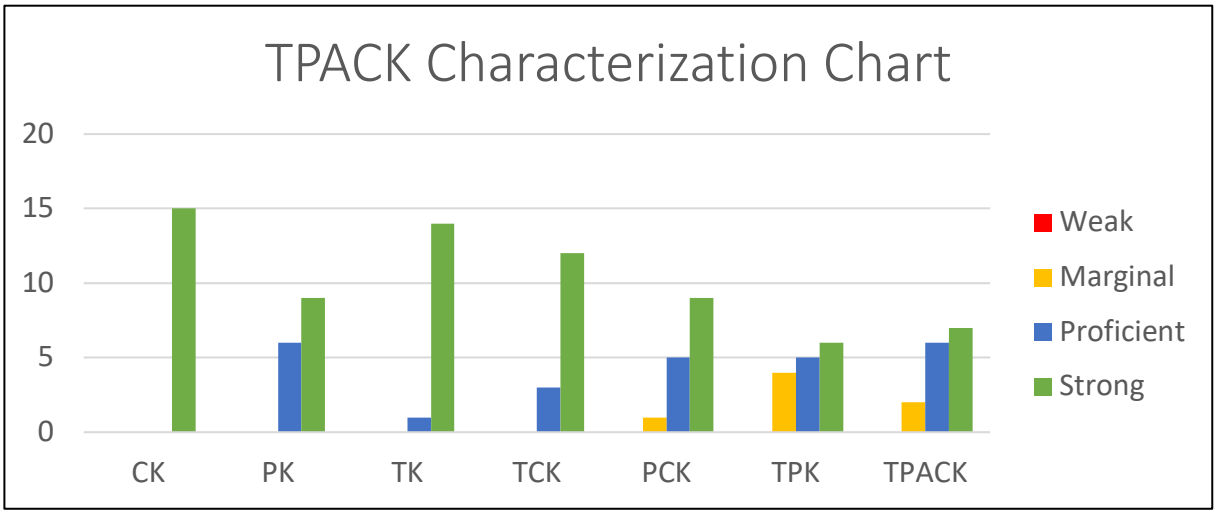
Characterization Results

The results were based on the analysis of each of the fifteen mathematics teachers' data that consisted of written lesson plans, technology research papers, video of lesson implementation, and teachers' written reflections about the lessons. Based on the data analysis, all teachers demonstrated strong content knowledge (CK). The data indicated that teachers had the ability to apply procedures accurately, efficiently, and flexibly. The teachers also showed strong understanding of concepts being taught and were able to use them strategically to solve problems. All teachers exhibited proficient mathematical language ability, using it strategically and frequently. Most of their lesson plans were carefully planned and included detailed information about engagement and activities, the content objectives, and the technologies used. In addition, most of their lesson plans were consistent with the implementation of their lessons. Sixty percent (60%) of teachers were characterized as strong in pedagogical knowledge (PK) and 40% were characterized as proficient. Ninety-three percent (93%) were strong and 7% were proficient in technology knowledge (TK). Eighty percent (80%) were strong and 20% were proficient in technological content knowledge (TCK). In regard to pedagogical content knowledge (PCK), sixty percent (60%) were characterized as strong, 33% were characterized as proficient, and 7% were characterized as marginal. For technological pedagogical knowledge (TPK), forty percent (40%) were strong, 33% were proficient, and 27% were marginal. Finally, in the area of technological pedagogical and content knowledge (TPACK), 47% of teachers were characterized as strong, 40% were as proficient, and 13% were as marginal.

Discussion

When looking at individual components separately (Figure 2 and Table 3), the teachers as a group demonstrated strong knowledge in three basic knowledge components of the TPACK. These were content knowledge (CK), technology knowledge (TK), and pedagogical knowledge (PK). The teachers' combined PK, however, was somewhat more proficient and less strong than the other two components. Another significant pattern that emerged in the chart analysis was that the teachers' knowledge strength decreased on three of the four combined knowledge components—pedagogical content knowledge (PCK), technological pedagogical knowledge (TPK), and the combination of the three components of their technological pedagogical and content knowledge (TPACK). The teachers' TPK demonstrated the most marginal and least strong levels among all components (Table 3 and Figure 2). Their technological content knowledge (TCK) was relatively the strongest among the combined knowledge components, with 80% of teachers rated strong and 20% proficient. The teachers' strong TCK was constant with their strong CK and TK.

Figure 2
TPACK Characterization Chart



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Summary Comments

Results of the study provided detailed characteristics of these fifteen mathematics teachers' knowledge. They appeared to have solid knowledge of CK, PK, and TK according to the analysis. Consistently, the CK, PK, and TK formed relatively weaker knowledge characteristics when combining these three knowledge components. These results provided further evidence of how CK and PK, CK and TK, and PK and TK intersect in the TPACK framework described by Mishra and Koehler (2006). Although the teachers' three single knowledge components were strong, the teachers' knowledge characteristics were weakened when these single knowledge components intersected with each other. Results also indicated that the PCK, TPK, and TPACK associated with PK demonstrated relatively weaker knowledge characteristics than TCK, which did not include the PK component. Additionally, this result further emphasized the importance of, and the difficulties in, acquiring pedagogical knowledge which requires an understanding of cognitive, social, and developmental theories of learning and how they apply to students in their classroom (Mishra, & Koehler, 2006; Shulman, 1986).

The rubric developed in this study demonstrated validity reliability in analyzing the practicing data and evaluation of teachers' TPACK levels. The TPACK characterization chart promoted the effective organization of the data analysis results. The findings helped to answer the guiding question of this study which was: In what ways can we characterize middle school mathematics teachers' TPACK? Utilizing a specific rubric that was developed using pilot data to analyze teachers' comprehensive practicing data (i.e., lesson cycle which represented how teachers operationalized their TPACK in practice) facilitated the characterization and understanding of the middle school in-service mathematics teachers' TPACK by characterizing each component into weak, marginal, proficient, and strong levels.

Recommendations

Several recommendations emerged from this study regarding teacher training, rubric development, and future research.

Teacher Training

One of the important findings in this study was that teachers' TPK proved to be the weakest component of all seven TPACK components. This finding could be used to inform the design of course work for pre-service and in-service teachers. Findings also suggested the need for teacher education or professional development programs to increase the focus on developing mathematics teachers' TPK, or more specifically, the strategies to engage and to guide students in using technologies to explore and learn content. In addition, the development of PK needs to be a continuous priority in teacher education programs. The results of this study suggested that mathematics teachers' lower PK could be one of the factors keeping other combined knowledge components (including TPACK) at a weaker level. It was not surprising, however, that PK, the knowledge of teaching strategies, was shown to be a difficult knowledge to acquire. For these reasons, those knowledge components of teachers' TPACK that contain PK (i.e., PCK, TPK, and TPACK) should be greatly emphasized when providing trainings for both pre- and in-service teachers. This supports a recommendation to reevaluate teaching methods courses for both university and alternative certification program (ACP) undergraduate students in order to improve pre-service teachers' PK that may affect other knowledge components of their TPACK.

Rubric Development

In regard to the rubric developed and utilized in this study, it is recommended that the rubric be further tested to improve its usability, reliability, and validity. For example, the interrater reliability of the rubric could be improved to its optimum level by further examining the rating descriptions of the rubric in order to more accurately characterize the different components of teacher knowledge. Additional testing of the rubric (applying the rubric to new sets of participants) would also improve rubric reliability and validity, and perhaps indicate modifications needed.

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Further Research

There are also several recommendations related to future research, the first of which deals with data quantity and collection. For the purpose of this study, only complete Lesson Cycle submissions data was used for analysis. The more Technology Lesson Cycle submission data can be used for analysis, the more precise pattern of teachers' TPACK characteristics may be generated.

For the next step, in-service mathematics teachers' TPK needs to be further studied to understand what makes this particular component weaker than CK, PK, TK, TCK, PCK, and TPACK. Further studies would potentially provide additional recommendations for what needs to be done to improve teachers' TPK, as well as other components of TPACK in general.

Limitations of the Study

In order to fully evaluate the relevance and impact of this study's findings, the limitations of the study were fully explored in regard to data, impact, and design. The first point considered regarding data was that the participants were a unique group of teachers enrolled in an online graduate course for the M.Ed. degree at the university. Since the data was used for a course grade (which could have contained potential sources of bias and exaggeration), the data may not have reflected the teachers' true ability or TPACK level. Another limitation was the use of archival data in regard to teacher interviews in that it prohibited this researcher's ability to conduct direct interviews with teachers which may have yielded a deeper understanding of their experiences in designing and implementing technology-integrated mathematics lessons.

There was also a possible impact limitation since all teachers in this study were middle-grade teachers. For this reason, the results may not have been applicable to all in-service mathematics teachers across grade levels from elementary to senior high school. Finally, although the rubric developed for this study reached an adequate level of the interrater reliability, it did not reach the optimum level 80% that is recommended by Clement et al. (2003) and by Harris, Grandgenett, and Hofer (2010), it demonstrated an internal consistency of 73.4% which is above the adequate level of 70%, according to Donner and Wells (1986). This result may have affected accurate data analysis.

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Appendix A

Rubric Use to Analyze Mathematics Teachers' TPACK in Practice
(CUIN 6346 Lesson Cycle Assignment)

Teacher name: _____ Grade level: _____
Class: _____ Lesson: _____

Data sources: The written lesson; teacher reflections about the lesson; evidence of learning outcomes provided by the teacher; video of implementation

TPACK Components	Criteria	Category (1 Weak – 4 Strong)					Overall Rating (circle one)
		1	2	3	4	Score	
Content Knowledge (CK)	A) Procedural understanding of content	Apply procedures poorly, or inefficiently;	Ability to apply procedures somewhat accurately and efficiently,	Proficient in applying procedures accurately and efficiently; transfer procedures to different problems and contexts	Strong ability to apply procedures accurately, efficiently, and flexibly; transfer procedures to different problems and contexts		**Weak** (111;121) (1 – 1.5) **Marginal** (122; 222; 223) (1.5 – 2.5) **Proficient** (233; 333; 334) (2.5 – 3.5) **Strong** (344; 444) (3.5 – 4)
	B) Conceptual understanding of content	Lack of ability to understand concepts being taught and encounter difficulties when use them to solve problems	Understanding concepts being taught and able to use them to solve problems with difficulty	Understanding concepts being taught and able to use them strategically to solve problems	Strong understanding of concepts being taught and able use them strategically to solve problems; strong ability to identify misconceptions		
	C) Mathematical languages	Minimum or no mathematical language	Appropriate use of mathematical language	Sufficient mathematical language and use them appropriately and frequently	Strong mathematical language ability and use the language strategically and frequently		
Pedagogical Knowledge (PK)	A) Appropriate assessments	Assessments are less or not relevant to the concepts being taught and do not reflect teachers' understanding of students' cognitive abilities	Assessments are somewhat relevant to the concepts being taught and they may not reflect teachers' understanding of students' cognitive abilities	Assessments are relevant to the concepts being taught and reflect teachers' understanding of students' cognitive abilities	Assessments are relevant to the concepts being taught in full extent and reflect teachers' strong understanding of students' cognitive abilities		**Weak** (111;121) (1 – 1.5) **Marginal** (122; 222; 223) (1.5 – 2.5) **Proficient** (233; 333; 334) (2.5 – 3.5) **Strong** (344; 444) (3.5 – 4)
	B) Organize and manage student behavior	Teachers are less or not able to use rules, procedures to engage students learning; students' misbehavior are ignored	Teachers are somewhat able to use rules, procedures to engage students learning; students' misbehavior sometimes are ignored	Teachers are able to use rules, procedures to engage students learning; students' misbehavior are corrected in a timely manner	Teachers use rules, procedures, and routines to ensure that students are actively involved in learning; students' misbehavior are prevented		
	C) Class activities reflect an understanding of developmental theory of learning and how students learn	Learning activities are less or not appropriate to students' cognitive abilities and students are having hard time in learning	Learning activities are somewhat appropriate to students' cognitive abilities and students are learning in someway	Learning activities are appropriate to students' cognitive abilities and students are engaged in learning	Learning activities are appropriate to students' cognitive abilities and students are actively engaged in learning		

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TPACK Components	Criteria	Category (1 Weak – 4 Strong)					Overall Rating (circle one)
		1	2	3	4	Score	
Technological Knowledge (TK)	A) Knowledge of the technology application	Teachers have less or no knowledge of the technology application used in teaching	Teachers somewhat understand the technology application used in teaching	Teachers have a sufficient knowledge of the technology application used in teaching	Teachers understand the technology application used in teaching proficiently		**Weak** (111;121) (1 – 1.5) **Marginal** (122; 222; 223) (1.5 – 2.5) **Proficient** (233; 333; 334) (2.5 – 3.5) **Strong** (344; 444) (3.5 – 4)
	B) Knowledge of operating particular technologies	Teachers are not able to use the technology application appropriately	Teachers are able to use the technology application with some degrees of difficulties	Teachers are able to use the technology application appropriately	Teachers are able to manipulate and use the technology application strategically		
	C) The ability to learn and adapt to new technology	Teachers show less or no ability to learn and adapt new technology and are not able to find solution when encounter technology issues	Teachers show somewhat ability to learn and adapt new technology and able to find solution with difficulty when encounter technology issues	Teachers show proficient ability to learn and adapt new technology and able to find solution when encounter technology issues	Teachers show strong ability to learn and adapt new technology and able to find solution quickly when encounter technology issues		
Technological Content Knowledge (TCK)	A) Link between technology and content is obvious or explicit	The technology choice not properly suits to contents and students may not be learning content objectives	The technology somewhat links to contents and it can be used in some ways to teach contents	The technology choice suits contents and it can be used to teach contents	The technology choice best address contents and it can be used in a variety of ways in teaching contents		**Weak** (111;121) (1 – 1.5) **Marginal** (122; 222; 223) (1.5 – 2.5) **Proficient** (233; 333; 334) (2.5 – 3.5) **Strong** (344; 444) (3.5 – 4)
	B) An understanding of the representation of concepts using technologies	Teachers have less or no ability to use technology representations to help students to understand the concept	Teachers somewhat have the ability to use technology representations to help students to understand the concept	Teachers have the ability to use technology representations to help students to understand the concept	Teachers have strong ability to use technology representations to teach contents and understand the effect of tech on the concept		
	C) An understanding of the content can be changed by the application of technology	Teachers are not able to use the same technology to link between different contents or concepts	Teachers are somewhat able to use the same technology to link between different contents or concepts rarely provide examples	Teachers are able to use the same technology to link between different contents or concepts and provide examples	Teachers have a strong ability to use same technology to link between different contents or concepts and able to teach and provide examples of different contents		
Pedagogical Content Knowledge (PCK)	A) Demonstrates awareness of possible student misconceptions	Teachers hardly recognize student misconceptions	Teachers recognize student misconceptions and correct them when they occur	Teachers use casual questions and post questions to uncover misconceptions and able to lead to conceptual change	Teachers use casual questions and post questions to uncover misconceptions strategically and promote continual positive conceptual change		**Weak** (111;121) (1 – 1.5) **Marginal** (122; 222; 223) (1.5 – 2.5) **Proficient** (233; 333; 334) (2.5 – 3.5) **Strong** (344; 444) (3.5 – 4)
	B) Knowing how elements of the content can be arranged for better teaching	Teachers have less or no understanding of rearranging contents for better teaching	Teachers have some understanding of contents can be rearrange for better teaching	Teachers are able to rearrange the contents necessary based on class progress, students' cognitive ability, and their prior knowledge	Teachers have strong ability to rearrange the contents necessary based on class progress, students' cognitive ability, and their prior knowledge effectively		

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TPACK Components	Criteria	Category (1 Weak – 4 Strong)					Overall Rating (circle one)
		1	2	3	4	Score	
	C) Knowledge of teaching strategies that incorporate appropriate conceptual representations of the content in order to guide student thinking and learning, and address learner difficulties and misconceptions.	Teachers have less or no ability to use effective teaching strategy such as using manipulative to guide student thinking and learning, and address learner difficulty and misconnections	Teachers have somewhat ability to use effective teaching strategy such as using manipulative to guide student thinking and learning, and address learner difficulty and misconnections	Teachers are able to use effective teaching strategy such as using manipulative to engage and guide student thinking and learning, and address learner difficulty and misconnections	Teachers have strong ability to use effective teaching strategy such as using manipulative or pictorial representations to engage and guide student thinking and learning, address learner difficulty and misconnections		
Technological Pedagogical Knowledge (TPK)	A) Evidence of appropriate technologies enhancing student learning. Students use technology to explore content and achieve learning goals	Teachers have less or no ability to use strategies to engage and guide students explore and learning contents with technology	Teachers somewhat able to use strategies to engage and guide students explore and learning contents with technology	Teachers are able to use strategies to engage and guide students explore and learning contents with technology	Teachers have strong ability to use strategies to engage and guide students explore and learning contents with technology		**Weak** (111;121) (1 – 1.5) **Marginal** (122; 222; 223) (1.5 – 2.5) **Proficient** (233; 333; 334) (2.5 – 3.5) **Strong** (344; 444) (3.5 – 4)
	B) Knowledge of how technologies can be used to build on existing knowledge and to develop new ones or strengthen old ones.	Teachers do not demonstrate understanding of using appropriate sequence of technology applications and pedagogical methods to help students to learn new knowledge based on existing ones	Teachers have somewhat ability of using appropriate sequence of technology applications and pedagogical methods to help students to build new knowledge based on existing ones	Teachers demonstrate understanding of using appropriate sequence of technology applications and pedagogical methods to help students to learn new knowledge based on existing ones	Teachers have strong ability of effectively using appropriate sequence of technology applications and pedagogical methods to help students to build new knowledge based on existing ones		
	C) Knowledge of pedagogical strategies and the ability to apply those strategies for use of technologies	Teachers have less or no ability to use technology with appropriate pedagogical strategy in teaching	Teachers are somewhat able to use technology with appropriate pedagogical strategy in teaching	Teachers are able to use technology with appropriate pedagogical strategy in teaching	Teachers demonstrate strong ability to use technology with appropriate pedagogical strategy in teaching		

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TPACK Components	Criteria	Category (1 Weak – 4 Strong)					Overall Rating (circle one)
		1	2	3	4	Score	
Technological Pedagogical and Content Knowledge (TPACK)	A) Appropriate technology enhances content objectives and instructional strategies	Teachers are not able to use appropriate technology enhance contents with appropriate teaching strategies	Teachers have somewhat ability to use appropriate technology enhances contents with appropriate teaching strategies	Teachers are able to use appropriate technology enhance contents with appropriate teaching strategies	Teachers demonstrate strong ability to use appropriate technology enhance contents with effective teaching strategies		**Weak** (111;121) (1 – 1.5) **Marginal** (122; 222; 223) (1.5 – 2.5) **Proficient** (233; 333; 334) (2.5 – 3.5) **Strong** (344; 444) (3.5 – 4)
	B) Demonstrate the knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face	Teachers have less or no knowledge of what makes concepts difficult or easy to learn and how technology can help	Teachers somewhat demonstrate knowledge of what makes concepts difficult or easy to learn and how technology can help	Teachers demonstrate knowledge of what makes concepts difficult or easy to learn and how technology can help	Teachers demonstrate strong knowledge of what makes concepts difficult or easy to learn and how technology can help		
	C) Pedagogical techniques that use technologies in constructive ways to teach content	Teachers are not able to use pedagogical techniques that use technology in constructive ways to teach contents	Teachers are somewhat able to use pedagogical techniques that use technology in constructive ways to teach contents	Teachers are able to use pedagogical techniques that use technology in constructive ways to teach contents	Teachers demonstrate strong ability of using pedagogical techniques that use technology in constructive ways to teach contents		

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IDENTIFYING THE PROFESSIONAL DEVELOPMENT NEEDS FOR TEACHERS FROM NON-EDUCATIONAL BACKGROUNDS

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Abstract

With the introduction of the District of Innovation designation, many Texas school districts have started the practice of locally certifying teachers/instructors to teach courses in areas such as career and technical education (CTE). Many of these new instructors have professional experience and training but not possess background knowledge in areas related to teaching in a school setting. In this qualitative research study, I surveyed and interviewed school principals and locally certified teachers to gain their perspective on areas where deficiencies may exist as it relates to classroom teaching. The results of this study identified areas of needed professional development for locally certified teachers and yielded potential ideas for smaller, rural school districts to create individualized, collaborative professional development programs.

Keywords: Professional development, District of Innovation, rural education, career and technical education

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Introduction: Districts of Innovation

The District of Innovation concept was passed by the 84th Legislative Session in House Bill 1842 in 2015, giving traditional school districts most of the flexibilities available to Texas' open enrollment charter schools and the ability to exempt parts of the Texas Education Code (Brantley, 2018). A District of Innovation may adopt a plan that includes exemptions from most of the same state laws that are not applicable to open enrollment school districts (Uriegas, 2020). Some districts opt to use the designation for single exemptions such as an earlier start date for the school year, while other districts use the designation in multiple areas such as teacher contracts, teacher appraisals, class size ratio and attendance rules. The Texas Education Agency (2017) states that among the areas of exemption through the District of Innovation Designation, school districts can locally certify teachers for employment. This function allows school districts to hire industry experts to teach courses related to career and technical education even though they lack traditional teaching credentials or a background in an educational field. To date, 898 school districts are designated as districts of innovation (Texas Education Agency, 2020).

Many districts in Texas have used the need for career and technical education (CTE) teachers as part of their rationale when applying for the District of Innovation designation (TCTA, 2017). This function has allowed small rural districts to offer an increased number of CTE programs and courses with the goal of providing students with career related knowledge, skills and experience. Being able to locally certify teachers, as a function of the District of Innovation designation, has allowed school districts to hire industry professionals to instruct CTE courses without holding a traditional teaching certificate or having a background in education. Districts have also utilized the ability to locally certify teachers to address shortages in other fields not related to career and technical education. For small, rural school districts being able to fill vacancies with locally certified teachers has created increased course offering opportunities for students.

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Literature Review

Professional Development

"Professional development (PD) is common in the teacher landscape and often takes the form of workshops arranged for and provided by schools, districts, and educational cooperatives" Wake & Mills, 2018, pg. 90). While industry professional instructors can provide expertise in training and experience, the majority do not come from an educational background as it relates to pedagogy and best practices. School districts, and specifically principals, are tasked with developing these instructors' abilities to teach in a manner that is conducive to learning while also capitalizing on the manner of training that is normally utilized on the job. While the primary form of professional development, most training sessions are typically only evaluated for attendee satisfaction (Gaumer-Erickson et al, 2017).

Ensuring that the training of teachers is effective is a key component of training programs. Low quality training can often be more detrimental to teachers than no training at all. Sawyer (2018) states that teachers do not find the professional development and instructional support provided to new teachers to be consistent, relevant, or effective. If this is the case for new teachers coming from teaching certification programs, then negative effects of bad professional development are even more significant for new teachers with no educational background, knowledge or training. The goal for principals and school leaders is to find or create professional development that builds on the instructors' knowledge to strengthen their ability to deliver that knowledge in a way that best allows for student learning. Additionally, teachers must also be able to self-assess and make decisions about their professional development needs that will enhance their teaching ability and address any deficiencies that may exist, especially for those from non-educational backgrounds. Locally certified teachers often do not possess the necessary pedagogical background that is necessary for effectively teaching students.

Quality Professional Development. Zhang (2017) states that there exists a lack of understanding regarding the professional development needs of teachers. While opinions on the areas of concern might differ from teachers to principals, the fact remains that there is a need for professional development in various areas related to topics such as pedagogy, classroom management, planning, and instruction. Studies show that teachers needed improvement in multiple areas of pedagogical content knowledge: learners, instructional strategies, curriculum, and assessment (Zhang, 2017). Providing professional development opportunities for all teachers is an important factor that contributes to student and teacher success. However, those opportunities must focus on the areas of need for teachers. There is a tendency for professional development activities to focus more on technology than of pedagogy (Mahlangu, 2018). Understanding how to teach should be the first priority in training sessions for all teachers. The focal point of professional development for new teachers should be pedagogy. The importance of professional development is magnified for teachers who are locally certified and lack the educational background related to the art of teaching. Although many characteristics of effective professional development have been identified, such programs still struggle to demonstrate successful results (Olofson & Garnett, 2018). The essential characteristic of professional development that makes it successful is the level of quality. High-quality, evidence-based professional development is essential to ensure that teachers obtain the knowledge, strategies and skills necessary to positively impact student learning (Gaumer-Erickson et al, 2017).

Individual Professional Development Plans. Individualized learning allows students to be provided with resources based on the student's individual needs (Truckenmiller, Yohannan & Cho, 2020). As student learning should be individual and unique, professional development must also be individualized. While all teachers can utilize some of the same professional development concepts, the material they teach dictates that not all delivery methods can be identical. "While the traditional PD models may not be well received, teachers could use support in the form of relevant, personalized, and responsive PD" (Wake & Mills, 2018, pg. 91). Additionally, by focusing on individual professional development needs of teachers, principals can better address deficiencies that would enhance classroom pedagogy.

The individualized professional development model has demonstrated to not only be effective; it also creates equity in instruction (Gunn, 2015). By creating individualized professional development for all teachers, but specifically locally certified teachers, school leaders can provide better opportunities for students to receive quality instruction from industry

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experts while training these experts in the best ways to deliver that instruction to ensure student learning. Allowing teachers to build their own professional development plans is critical to maximizing their training opportunities whole also growing their knowledge (Jackson, 2016). By focusing professional development on individual teachers' needs, the quality of those focused trainings would increase and the specific needs of each teacher could be addressed.

Cost Saving Through Shared Collaboration. One area of concern for principals in small, rural districts is the financial aspect of providing individualized professional development. In a time where state budgets continue to shrink, adding expenses is less than desirable for many districts. Federal and state funding mandates have created the need for partnerships and collaboration (Farnan et all, 2019). Many rural districts within close proximity to each other have created collaborative partnerships for offering career and technical education courses and programs. The premise is that each district will provide a career prep program open to students from all the participating schools (Hands, 2010). Students from different districts can attend classes at different neighboring schools so that they have access to courses and programs that are of interest but may not be offered at their home campuses. Among the programs offered, students can take courses in agriculture, skilled trades, business, and health related fields (Stone, 2014).

Methodology

The purpose of this qualitative study was to identify the professional development needs of locally certified teachers. High school principals from rural districts submitted responses to a survey about the use of locally certified teachers as instructors of career and technical education courses. The results of these principal interviews yielded concerns about problem areas for locally certified teachers in the areas of pedagogy, planning and turnover. The results also prompted the researcher to widen the study to include locally certified teachers from these campuses. Teachers were surveyed and interviewed about their experiences, their concerns and what supports they felt were needed for them to be successful.

Qualitative surveys and interviews of principals and locally certified teachers identified areas of needed professional development that would benefit teachers from non-educational backgrounds. The results yielded conversations regarding how to address individual teachers' needs through professional development. Additionally, ideas on how to cost effectively provide this individualized professional development were discussed.

Participants

Participants included an initial 50 principals rural South and East Texas school districts that were classified as UIL divisions 3A or smaller (University Interscholastic League, 2020. The breakdown of participating principals was as follows: 34 males and 16 females. The age range of participating principals was 32-64 years old. There were approximately 42% White, 27% African American, 23% Hispanic, and 8% two or more races participants.

Participants also included 50 teachers who were locally certified through the District of Innovation designation. All participating teachers were employees on the campuses of the participating principals. The breakdown of participating teachers was as follows: 27 males and 23 females. The age range of participating teachers was 24-57 years old. All participating teachers had 1-5 years of teaching experience. There were approximately 63% White, 17% Hispanic, 15% African American, and 5% two or more races participants.

Data Collection

A five-question survey was developed based upon factors identified in the review of literature related to teacher professional development needs (See Appendix). The survey was also designed to gather information about the new teachers who were locally certified through the District of Innovation designation, which included the number of courses these instructors teach, courses that they teach. A willingness to participate in the study was also determined.

Surveys were electronically distributed to 50 principals in rural East and South Texas high schools classified as 3A or smaller. From the initial survey information, interview questions were created for follow up interviews to discuss in detail,

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ideas and concerns related to professional development needs of locally certified teachers that do not have background knowledge or experience with teaching practices (Appendix A). After the surveys were returned, 20 principals were selected for follow-up interviews. Participating principals could choose between face to face and Zoom interviews or could respond to interview questions via e-mail.

Following a preliminary analysis of the results of principal surveys and interviews, a second tier of survey and interview data was added. In this second tier, the researcher surveyed 50 locally certified teachers to acquire information on years of experience, courses taught and willingness to participate (Appendix A). These locally certified teachers were also identified from the participating principals' campuses. Following the survey, a group of 35 teachers were selected to participate in follow up interviews (Appendix A). Participants were interviewed via Zoom or through e-mail response to examine their perceptions of their own professional development needs.

Data Analysis

Qualitative data can be analyzed through content, narrative, and discourse analysis or by using grounded theory (Bhatia, 2018). Content analysis is used to analyze responses from interviewees while narrative analysis stories from interviewees that attempt to answer the research questions (Bhatia, 2018).

Content analysis was used to determine courses taught along with career experience and professional development attended prior to the conclusion of their first year of teaching. Data related to content areas and professional experience along with professional development attendance, were organized and categorized to look for patterns of commonality. Specifically, the data was analyzed to determine if there were commonalities in professional development for teachers in similar content areas from different school districts.

Narrative analysis was used in analyzing the various experiences that participating teachers described in the classroom or within the classroom setting. Data collected from teachers was analyzed and categorized by areas or perceived strengths and weaknesses, self-identified professional development needs and areas of concern regarding teaching. Then, the data collected from both principals and teachers was triangulated to examine emergent patterns of professional development needs based on courses taught, professional experience, and areas of deficiency. Specifically, data was analyzed to examine the areas of perceived strengths and weaknesses, as well as perceived professional development needs, and determine whether they were similar or different across the perspectives of teachers and principals.

Results

Results indicated that principals view pedagogy as the primary area of need in terms of professional development for locally certified teachers. 82% of participating principals stated that pedagogy was the area where they observed the greatest deficiencies. Specifically, principals felt teachers struggled with transferring the training used in the professional world, to instruction in an educational setting. The overarching consensus of the principals was that the locally certified teachers had the greatest difficulty understanding the difference between "showing" students how to do something and "teaching" students how to do it. Results also revealed that while pedagogy was the greatest concern, most professional development was not specific to pedagogical needs. Fewer than 10% of the participating principals stated that their professional development plans were individualized based on teachers' needs. The consensus was that most professional development was done at the district level and was generally a "one size fits all" model.

Results of the teachers' surveys and interviews showed that lesson planning and classroom management were the areas of most concern. 62% of the teachers felt that learning to effectively plan a lesson in regard to time management, was the most difficult challenge. 37% of the teachers felt that being able to keep students on task without disruptions, was their biggest area of deficiency. Ironically, almost every participant felt they had no issues with teaching students how to perform the technical tasks associated with their content (pedagogy). When asked about professional development, participating teachers felt that the professional development they experienced was not as applicable to their content because it was academic based not technical based. Participating teachers also felt that it would be beneficial to have professional

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development that is individualized based on their needs but that it was unlikely to happen based on the fact that they are only on campus for one - three periods per day.

Implications

The educational significance of this study is that it provides school leaders with information about the professional development needs of locally certified teachers. The findings produced by the surveys and interviews lead to conversations about professional development needs, individualized professional development plans and inter-district collaboration in providing professional development opportunities. All teachers have differing needs when it comes to classroom success. While these needs include the areas of pedagogy, classroom and time management, instructional strategies and lesson planning, needs specific to each teacher will vary. It is important to recognize that all teachers, especially those from non-educational backgrounds, require professional development activities that address their specific needs. If teachers' needs could be addressed in the same manner that individual students' needs are met, each individual teacher would become a stronger teacher.

The findings further recognize that barriers exist in creating individualized professional development plans and point to possible ways on how public school districts, particularly Districts of Innovation, can provide individualized professional development in a time when numerous budget restraints exist. If school districts could work collaboratively on providing professional development, the individual needs of teachers could be met while enabling school districts to alleviate some of their financial burden. Districts could develop and offer specific professional development opportunities that target specific needs, deficiencies or concepts. Teachers from different districts would have access to professional development that specifically meets their needs. Teachers participating in these collaborative professional development sessions would create networks for teachers who share similar experiences, content areas and concerns related to their areas of deficiency (Hrastinski & Rising, 2020). Participating districts could provide and share a wide array of professional development opportunities without the financial burden of having to fund all of them individually. For teachers, this could provide collaborative training sessions with colleagues on similar content areas that are experiencing the same classroom struggles, obstacles or just want more training in a specific area. Most significantly, teachers would receive professional development geared towards their specific needs.

Conclusions

In this study, content and narrative analysis of the data showed that a majority of campus principals felt that professional development in the area of pedagogy was the most important area to address concerning locally certified teachers. It was believed that while many of these teachers understand their areas of expertise and how to perform the associated tasks, they struggle with how to instruct others in a manner that truly teaches them the process in a way that students can understand and retain. The study also revealed a similar pattern consistent among the locally certified teachers who felt that they were teaching the material adequately and also acknowledged areas of needed professional development.

Principals acknowledge that individualized professional development would be ideal in addressing the needs of each individual teacher but also recognize that there are substantial obstacles that impact their ability to do so, such as budgets and resources. One potential solution would be for neighboring districts to partner in providing professional development opportunities. Through this collaboration school districts could address individual needs in a cost-effective manner. The end result: better trained teachers who are, therefore, better able to impact student understanding and success in the classroom.

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Appendix A

Principal and Teacher Survey and Interview Questions

Initial Principal Survey

1. Do you offer Career and Technical Education courses?
2. Are these courses taught by teachers who were locally certified through the use of the District of Innovation designation?
3. How many CTE courses are offered using locally certified teachers?
4. How many locally certified teachers are on your campus, and for how many periods per day?
5. When would be the best time to schedule an interview?

Principal Interview Questions

1. What general Professional Development do all teachers receive?
2. Are there additional PD requirements for locally certified teachers?
3. What issues related to classroom instruction, pedagogy or management do your locally certified teachers experience most often?
4. Are these struggles directly related to a lack of educational training backgrounds, in your opinion?
5. Are there other PD trainings that you feel would be most beneficial to locally certified teachers?
6. Are you planning to require any specific PD trainings prior to next school year?
7. What types of trainings do you recommend- online, face to face, hands on with mentor, etc?
8. What are your thoughts on individualized PD plans for all teachers, but especially locally certified teachers?
9. What are your thoughts on collaborative PD between neighboring school districts?
10. Do you have any additional comments or information you would like to share related to PD and locally certified teachers?

Initial Teacher Survey Questions

1. Are you a locally certified teacher?
2. Do you teach Career and Technical Education courses?
3. How many CTE courses are you currently teaching per day?
4. What is your professional background?
5. When would be the best time to schedule an interview?

Teacher Interview Questions

1. What do you feel are your strengths?
2. What do you feel are the areas you struggle with most?
3. What do you feel were the biggest obstacles when you started teaching?
4. What Professional Development did you do prior to teaching?
5. Are there additional PD requirements for you during the year?
6. Do you attend PD that is specific for you?
7. Did you experience issues with classroom management, instruction, planning, etc?
8. Do you feel that these struggles are directly related to the fact that you don't have an educational background?
9. Are there other PD trainings that you feel would be most beneficial you?
10. Do you have any additional comments or information you would like to share related to PD and locally certified teachers?

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SHIFTING FROM INVOLVEMENT TO ENGAGEMENT: STRATEGIES FOR SUPPORTING FAMILIES VIRTUALLY

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Abstract

The rapid shift to distance learning necessitates a change in how schools interact with families. Teachers that rely on traditional brick and mortar ways of working with families will be hard-pressed to engage families in student learning. On the other hand, teachers who enthusiastically shift to a family engagement approach understand how the digital classroom extends into the home. This article provides several strategies that teachers and teacher candidates might consider as they work with families in virtual learning spaces.

Keywords: family engagement, distance learning, teacher preparation

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Increased technology use in schools is changing the way that students are learning (Lopez et al., 2017). While teachers and students were using technology for learning, the rapid shift to distance learning in March 2020 highlighted the increased need for schools to collaborate with stakeholders to ensure that students continue to learn (Reich et al., 2020). The transition was not smooth, because teachers discovered that traditional ways of teaching and learning, coupled with the need for family participation, did not consistently go as planned. In many instances, families were left in the dark, due to a lack of access to broadband internet (Young & Donovan, 2020), limited available technology (Hodges et al., 2020), and being unprepared for their new family-centered role in student learning. Research indicates that a keystone to student academic and social/emotional success often includes family engagement (Henderson & Mapp, 2002; Latunde, 2017; Lawson & Alameda-Lawson, 2012; Shumow & Schmidt, 2014). Family engagement views families as assets in student learning.

Often, teachers conceptualize families in an involvement role, relegating them to being present in a physical space (e.g., attending a meeting or conference), rather than seeing families in multifaceted ways of being engaged, including supporting and teaching their children (Baker et al., 2016). Working within a digital platform (e.g., distance learning, online learning) necessitates a shift in how teachers and families collaborate with each other. Special attention to how teachers can support families during distance learning is necessary. The purpose of this article is to highlight several strategies for engaging with families in a digital classroom. Children have a variety of individuals who care and support them; therefore, in this article, families are defined as the caregivers of children in the home.

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Shifting to Family Engagement

The evolution of educational policy from the Elementary and Secondary Education Act (ESEA) of 1965 to the most recent iteration of Every Student Succeeds Act *(*ESSA) of 2015 outlines guidance for student accountability and assessment, and the evaluation of teacher effectiveness. In 2002, for the first time, an iteration of the 1965 educational policy, the No Child Left Behind Act (NCLB), included provisions for parent involvement in an effort to ensure notifications of school performance and subsequent choice in families selecting education spaces (i.e., school buildings, districts) for their children. While the NCLB legislation initiated a positive step toward connecting the home and school, there remained a lack of bidirectional communication and family engagement.

In 2015, the next iteration of educational policy, Every Student Succeeds Act (ESSA) was created, and it highlighted the need for stronger home, school, and community bonds that included guidelines for family engagement. The language in ESSA (2015) explicitly changed the term parent involvement to family engagement. Family engagement articulates to all stakeholders that families are a vital component of a school team and the learning environment (DeSpain et al., 2018). The goal of family engagement is for educators to create a bi-directional communication that necessitates that families participate in their children's education, including advocating and program decision making. The guiding principles that promote the shift to family engagement include: 1) school, family, and community share a responsibility for student learning, 2) family engagement spans across the child's life, and 3) family engagement is encouraged in multiple settings (e.g., home, school, community; Harvard Family Research Project, 2014).

As teachers and families establish shared communication, respect, and responsibility for student learning, the role that families play within the educational environment also shifts. Family engagement moves beyond a school-centric approach that views families from a deficit mindset to viewing families as an asset in a child's education. Table 1 illustrates the difference between parent involvement and family engagement. When families are engaged in their child's learning, they are responsible for significant educational decisions, and the views that families hold are valued by all members of the educational team.

Table 1
Family Involvement vs. Family Engagement

Family Involvement	Family Engagement

● Teacher-centric approach.
● Families are not equipped to teach.
● Families are school visitors.
● Families receive *one-way* messages from the school.
● Families participate in school sanctioned parent and teacher groups (e.g., school-based parent organizations).
● Parents, parents and teachers teach.
	● Shared responsibility for student learning (e.g., family-school collaboration).
	● Families are empowered to be teachers in the home.
	  ○ Teachers provide instructional models to follow (e.g., steps for teaching decoding multisyllabic words, solving multi-step equations).
	  ○ Teachers provide explicit directions on how to complete assignments.
	● Family feedback is valued and requested.
	● Teachers and families regularly communicate with each other in the mode families select.

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Family engagement is a thoughtful, time-taking endeavor that requires teachers to be intentional. There are several approaches that can ensure family engagement is present within the distance learning environment, including consistent communicating, thoughtful organizing of digital spaces, incorporating innovative activities, and considering care of the family.

Communicating

Family-school communication is vital within digital learning environments, especially considering that schools rely on families to provide support in online learning (Borup et al., 2019). Unfortunately, teacher preparation programs typically provide inadequate professional development on how to collaborate and communicate with families (Smith & Sheridan, 2019) in a manner that moves beyond viewing families through a single lens into understanding that families provide a connection to lifelong learning (Ferrara, 2011). In unidirectional communication, teachers report general information about classroom activities or individual student performance. Communicating within a virtual environment poses an even bigger conundrum, due in part to the limited visual interaction that often occurs when engaging in virtual communication.

Teachers provide feedback and updates through online communication with the family members that are providing a majority of the instructional support (Currie-Rubin & Smith, 2014), but families have little opportunity to engage in authentic communication. Engaging families ensures that they continue to be involved in the learning. Open collaboration requires that families share their preferred modes of communication. by selecting from a menu of choices, indicating availability and types of contact (e.g., email, text, calls). By providing choices, teachers empower families in ways to connect. Finally, family friendly teachers offer consistent office hours with a variety of options/time slots and include general housekeeping information.

Organizing

Distance learning requires students and families to access unfamiliar learning platforms. However, simply accessing the information does not equate to understanding. While there is much research supporting the idea that today's students are digital natives and their parents are digital immigrants (Prensky, 2009), the need for children to teach their parents how to navigate the online learning platforms can add tension to the family dynamics in the home (Nelissen & Van den Bulck, 2018). To help ease this burden, teachers can provide guidance on how the online content is organized. For example, providing clearly labeled folders or modules for each topic or area of instruction gives families a sharper understanding of the requirements of the class and where materials, videos and instructional supports are located. Videos that explain how to access the classroom website or learning platform, or introductory videos that provide an advanced organizer for families to understand the direction of learning for the week are helpful.

An easy way teachers can share their class page filing system is by recording a video of the computer screen, while explaining where files, due dates, contact information, and areas for work submission are located. Free programs that can be used for recording these videos include Screencast-O-Matic or ShowMe. Families may have multiple children in the home with multiple teachers using different online learning management systems. This can be extremely confusing and frustrating for families and students.

Families have had to shift to being the primary individuals providing support for instruction. Teachers can assist families in their new role by choosing a universal and understandable learning platform, such as Google Classroom or Microsoft Teams. In addition, there are a plethora of amazing online tools, but each one may come with its own username and password. To reduce possible tension in and among family members, teachers should minimize the use of several different digital tools.

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Innovating

Building relationships is vital in all learning environments. At the forefront of teacher-student relationships is understanding the whole child, including any barriers accessing technology. Innovative teachers recognize that learners and their families need a variety of tools to ensure engagement. In a time where virtual or hybrid learning environments are necessary, these tools may also need to address gaps in technological proficiency, in content knowledge, and in learner confidence. Teachers who thoughtfully consider potential obstacles to learning, types of assignments that are being provided, and online tools can help families and teachers support learners in an uncertain time. Virtual innovation should not be limited to instruction, but should be used for family outreach, as well.

Teachers will find it challenging to provide hands-on activities that connect with lesson plans, or foster creativity with learners through the computer screen (Brown, 2020). A recent survey conducted by Phi Delta Kappa International (2020) found that high school students want their virtual classroom experiences to be more structured and interactive. While teachers are navigating unexpected issues in an unexpected time, they must be able to provide learning opportunities for their students in ways they will respond to, even when schools are closed, or the future of the school year is unknown. Teachers will need to spend time looking for digital tools that will make teaching and learning more efficient. To ensure that teaching and learning occur in a home environment, families must be included in these learning opportunities.

Even in a virtual environment, content should be presented in a number of ways, keeping in mind Wi-Fi issues that may exist. Educators can find a range of ways to boost student engagement with cloud-based apps. In addition, videoconferencing remains a strong option for communication with students, small groups, and students' families to gauge understanding, confidence, and support needed for virtual classroom success. It is important to remember home language variances and ways that curriculum can be presented that reflect an awareness of these needs. Finally, teachers must choose tools that will account for all learners, including those with special needs.

Caring for Caregivers

Stress is not new for teachers or for students. However, students and their families may be dealing with unprecedented stress at home that is crucial to the current teaching dynamic. Supporting students and their families begins with finding a centralized location for communication, or hub. A consistent location where announcements or emails to families can be found, along with instructions on assignment submissions, email communications with parents, and teacher contact information will relieve some anxiety. Examples of resources for this hub might include Canvas, Blackboard, Class Dojo, Padlet, or Google Classroom (Connections Academy, 2020).

Focusing on the child as a whole- not just the content they are learning or the products they submit- is necessary at a time when, for many, basic needs are not being filled. Families are dealing with loss of income, additional home instabilities, and sickness. School work is only a small part of their daily stress, so teachers must find time to engage with students and families to see how they can help or provide support. Group messaging tools can be used to send quick reminders or one-on-one communications. Creating a list of community resources for telehealth or ways to deal with anxiety or loss may be helpful, in addition to a list of organizations providing food or additional income sources to families in need.

Many parents or caregivers will feel the need to provide support for their learners but will lack resources or content knowledge to do so. In the current hybrid or virtual learning environment, it becomes even more important for teachers to provide background knowledge with websites like Khan Academy, BrainPop, or the Smithsonian Learning Lab. Podcasts, multimedia presentations with voiceover recording, or screen recording tools (i.e., Loom) can help parents support learners. Because parents do not have the same training as educators, who are taught to intentionally facilitate and support a child's development, it can be difficult for caregivers to understand how to frame or facilitate a learning activity (Todd, 2020). Therefore, teachers should take advantage of opportunities to model strategies (i.e., reading aloud, demonstrating phonetic spelling, or using open-ended, prompting questions). In addition, individualized support and feedback, as well as student

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collaboration opportunities, will be even more important for learners to feel part of the classroom community, and successful in the work they are attempting on their own.

Teacher Candidate Preparation

Research has been underway for years regarding how to teach children in online classrooms (Koenig, 2020), but now is the time to realize the importance of preparing teachers to teach in remote settings. The unfortunate truth is that the sudden need for online instruction in K-12 systems has been a struggle for teachers. Most teachers have never received training in online instruction or received adequate preparation in the use of educational technologies (Koenig, 2020). Traditional preparation programs- even online preparation programs- usually focus on ensuring candidates are ready for a real-time, brick and mortar classroom teaching. A 2016 survey of teacher preparation programs found that only 4% of respondents offered field experiences in K-12 online settings (Koenig, 2020). If teacher training programs had not considered these types of experiences before the pandemic, now is the time to re-evaluate the need for this component in their current model. Because in-person family engagement currently looks very different, the tools and strategies used by the teacher must, as well.

While Pk-12 teachers are increasingly integrating online learning as an extension to face to face experiences, preparation programs have not yet caught up (Koehler and Farmer, 2020). Opportunities for more effectively teaching technological tools, online pedagogies, and lesson planning for remote instruction now abound. What does classroom management look like in a virtual classroom? How can teachers effectively assess learners and gather data to inform their instruction when they are communicating through a screen? How do teachers avoid a default busy-work mentality, and how can they effectively model strategies for learners remotely? How do they engage a family who is struggling to put food on the table? How do they communicate with families who have inconsistent or nonexistent technology? What can they do to enhance the confidence of families suddenly charged with facilitating teachers' plans for learning? These are just a few of the questions that teacher preparation programs now must answer through their curriculum. By prioritizing the changes in technology that exist in current teaching practices, preparation programs can be a strategic pipeline for ensuring current and future instructional needs are met. To be effective, this preparation must include tools for family engagement. The family engagement checklist provided in Figure 1 is a tool that teachers can use to ensure that family engagement is occurring. By considering these multiple aspects of family engagement, teachers can ensure that, while distance learning, families remain with students at the forefront of instruction.

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Figure 1
Family Engagement Checklist

Communication-Did I…?	**Yes/No**
Ask families their preferred method of communication (phone, text, email)	
Share my available times to be contacted	
Provide my return message policy to families	
Organization-Did I…?	
Create a video explaining the online classroom filing system	
Use a universal and understandable learning platform (Google Classroom, Microsoft Teams, etc.)	
Minimize the use of multiple digital tools	
Innovation-Did I…?	
Consider alternate assignments for students without internet access	
Create lessons that include digital tools that enhance engagement	
Consider diverse learners needs	
Care-Did I…?	
Utilize a uniform communication hub	
Provide a list of local resources (telehealth, food bank, income assistance)	
Model teaching strategies and techniques	

Concluding Thoughts

Remote teaching and remote learning are unchartered territory for most students, teachers, and families. Virtual instructional practices range by teacher, campus, and district. Each household, and its ability to respond to those practices, also varies. While the need for virtual teaching has disrupted a sense of normalcy for teachers, the additional chaos that has resulted for families is more concerning. The sudden need for caregivers to also become teachers during the pandemic adds tremendous stress to the home. As teachers, strategic choices must be made regarding communication with families, organization of instructional materials, consistency in use of technology choices, and support for basic needs within the home. Educators must provide guidance through modeling, individualized feedback, and conferencing opportunities. Understanding the personal and professional impact that COVID-19 has had on families who may have already been struggling to meet basic needs is one responsibility of educators, and one that can be navigated with appropriate resources, time, and vigilance. The engagement of families in new and innovative ways is a true opportunity to facilitate authentic learning that extends well beyond the classroom into the home.

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Excerpts from a previously published dissertation

NOW WHAT? TEACHER PERCEPTIONS OF THEIR INSTRUCTIONAL PRACTICES IN A POST-STANDARDIZED TESTED WORLD

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Abstract

House Bill 5 removed standardized testing from physics and chemistry classes throughout the state. This study followed two secondary science teachers as they transitioned from teaching a state-tested subject to a state non-tested subject. A thorough examination of their perceptions suggests that the teachers did not significantly alter their instructional practice although they had more autonomy in the classroom.

Keywords: standardized testing, assessment, science instruction

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Introduction

The implementation of the No Child Left Behind Act of 2001 dramatically changed education in the United States. Although this legislation only requires state assessments to be administered in grades 3-8 in reading and mathematics, the majority of states utilized state testing for accountability purposes in social studies and science. With the integration of the Texas Assessment of Knowledge and Skills (TAKS) test in 2003, Texas adopted high stakes testing in four major areas: mathematics, English language arts, social studies, and science. The science TAKS was administered in grades 5, 8, 10, and 11. In 2011, the Texas legislature decided to "up the ante" with end-of-course (EOC) exams, causing the number of high school state exams to increase from eight to 12. The student anxiety generated from an increase in rigor and number of exams enraged parents. Due to the parental outrage, House Bill 5 was crafted, decreasing the number of state tests from 12 to five. With this action, grade 5, 8, and biology would be the only science courses with an accompanying state test. After eight years of state testing, chemistry and physics were finally free!

Significance of Study

Texas is one of the first states to decrease the number of standardized exams. Without the restrictions imposed by high-stakes testing, educators in subjects no longer state tested have the ability to foster a love of learning in their classrooms. To date, no studies have examined Texas high school science teachers' perceptions of change or lack of change in their instruction during the transition from teaching a state tested subject to a state non-tested subject.

Research Questions

This research followed two secondary, alternatively certified science teachers, as they transitioned from a state tested subject to a state non-tested subject. The following question drove this research.

> When high stakes testing ceases in high school science classes, what happens to teacher perceptions of their instructional practices?

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Literature Review

Educational reform, with a focus on improvement through assessment and system evaluation, is universal. In response to global pressure to create and sustain an educated workforce, many countries including Canada, Great Britain, New Zealand, and the United States have implemented standardized testing to make schools, teachers, and students accountable for student learning (Te Riele, 2006). Although the history of standardized testing in the United States is vast, albeit unique to each state, the passing of No Child Left Behind (NCLB) in 2001 unified all states under an umbrella of accountability. This accountability impacted states with absentee standards and assessments.

Media coverage and searches in the literature associated with standardized testing typically emphasize negative effects of assessment on children and teachers; however, studies that have positive views and outcomes do exist. Proponents of standardized testing will argue that utilization of high stakes testing increases standards, holds public schools accountable, and enhances stakeholder's confidence in the public school system (Heubert & Hauser, 1999). In many states, implementation of standardized testing alone increases the quality and amount of professional development for educators (Cobb & Jackson, 2011; McMillan, 2005), leads to alignment of instruction with state content standards (Stecher, 2002; Yeh, 2005), increases student motivation to learn (Stecher, 2002), and provides more remediation opportunities for students (Barnes, 2005).

The negative effects of high-stakes testing are undeniably more prevalent in literature. High-stakes testing has received blame for anxiety among students and teachers resulting in lower teacher morale (Greenburg et al., 2016; Stauffer & Mason, 2013) and an increase in the student dropout rate among disadvantaged students (Groves, 2002; Nichols & Valenzuela, 2013). Due to the intense pressure, teachers may resort to narrowing the curriculum (Au, 2007; Nichols & Berliner, 2008; Madaus & Russell, 2011), focusing only on topics that are tested, and in rare cases, non-student "cheating" occurs (Starnes, 2011; Stecher, 2002). This research focused on the advantages and disadvantages of each situation by examining teachers that had experienced teaching the same subject during years of high stakes testing and years without a state exam.

Methodology

The "bounded context" (Miles & Huberman, 1994) for this case study occurred in an 18-month period in a large, urban high school in Texas. This research followed two teachers (Laura and Cris) that held a teaching certificate, worked in the same school environment, taught TAKS or EOC tested students in on-level physics or chemistry, taught the same course during the transition year, and were projected to teach the same course the following year. Multiple data sources were necessary to answer the research questions and to ensure accurate examination throughout this 18-month study.

Table 1
Data Sources Utilized Per Phase of the Study

Phase & Timeframe	Data Source
End of Year One	Interview 1
Year Two	Interviews 2, 3, 4, & 5 Field Notes from 14 Observations Post-observation Conferences from 13 Observations Artifacts from 14 Observations
Beginning of Year Three	Interview 6

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Interviews, field notes, and post-observation conferences were transcribed and read multiple times. Utilizing open coding methodology (Corbin & Strauss, 2014) allowed for the identification and tentative naming of conceptual categories. The axial coding method allowed conceptual categories to be reexamined to determine if relationships existed between each category before they were collapsed into themes. This selective coding method served to further develop and refine concepts, establishing the bigger picture of the phenomenon.

Trustworthiness

Multiple methods including triangulation, prolonged engagement, member-checking, and peer debriefing were employed in this study to improve credibility since my experience as an educator was a potential source of bias. Yin (2009) posited that using multiple methods of data collection leads to more valid, reliable, and diverse construction of realities. To adhere to his principles, multiple data sources (interviews, observations, field notes, post-observation conferences, and artifacts) have been used in this research.

Results

Teaching subjects no longer state tested, Laura and Cris had less accountability and options to alter their instructional practices. Entering their educational careers during high-stakes testing, both teachers admitted that their instructional practices were greatly altered by the pressure of state testing and the influence of their colleagues. The emerging themes in this study are *mentor influence* and *the continuation of traditional instruction.*

Theme 1: Mentor Influence

In this high-stakes environment where uniformity was encouraged, teachers communicated and collaborated daily. As new teachers teaching a state tested subject, Laura and Cris reported that they looked to mentors and colleagues for test preparation and guidance on how to teach their subject. The significance of what their mentors taught them cannot be overlooked, since teachers learn through experience, often modeling the methods of their mentors. The following excerpts describe the teachers' experiences at Lincoln High with test preparation and the search for guidance from mentors regarding teaching methods.

> *I was still trying to learn the expectations because they [the State Board of Education] give you the standards, but you never know how they're going to ask it. There were some veterans that knew exactly what they were going to do, and I was still learning.* (Laura, I1: 41)

> *Mary [my former teacher and mentor] made a huge impact on me, so I need to be like her.* (Laura, I2: 498)

Like Laura, Cris also followed veteran teachers and looked to a mentor for guidance.

> *Cris: I went with what other teachers were using, so I can do what they were doing… it was a tried and true method that they had used, and I just adopted it as my own.*

> *Researcher: Would you say that your teaching methods were actually modeled by whoever was helping you out?*

> *Cris: Most definitely. When I came in, the test scores were great compared to the rest of the state. I was like, " I'm not going to mess with that. I'm going to do whatever they're doing."* (Cris, I4: 253)

> *The other physics teacher would tell me certain things to cut out because she had a pacing system already that worked.* (Cris, I1: 104)

The preceding quotes show that as teachers new to the profession, Cris and Laura often looked for guidance and help. While they came with ideas of what education should look like, those ideas were altered the second the pressure of the

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state test became a reality. In fact, in many instances, teachers will follow their mentor's every move. When Cris transitioned into teaching physics, his mentor provided guidance and resources.

> *I did adopt Ms. Harrison's calendar… and followed it to the tee. I didn't mess with it or add anything because I didn't know what I was doing.* (Cris, I4: 357)

Because Cris had never taught physics, he mirrored his mentor's instructional practices and pacing. Ms. Harrison had taught physics for many years; therefore, Cris believed that she was using best practices for teaching that subject.

Theme 2: Continuation of Traditional Instruction

During interviews, the teachers were asked to use five words that described themselves while teaching a state tested subject and five words to describe themselves once they were no longer state tested. Teaching a state tested course, Laura described herself as "structured, focused, rigid, demanding, and impersonal." After the removal of the state test, she described herself as "fun, understanding, flexible, compassionate, and engaging." Being a state tested teacher, Cris described himself as "stressed, anxious, and short-tempered." As a state non-tested teacher, he described himself as "reflective, carefree, collaborative, and creative." The 180-degree turn in the teachers' descriptions of themselves is due to a newfound freedom and subsequently, the ability to teach however they like. To understand how the teachers had altered their instruction, it is imperative to first understand their restricted teaching practices.

Restricted Teaching (Standardized Testing)

The TAKS for tenth and eleventh graders was an accumulation of biology, chemistry, and physics concepts. To ensure students were prepared for the test, the school had a system for science test preparation that all teachers were expected to follow. Every science teacher would spend approximately 15 minutes on topics that did not specifically pertain to their course. For instance, physics courses would review biology and chemistry, while chemistry courses would review biology and physics. These mini-lessons occurred four days a week with a quiz on Friday. The quiz scores would then be reported to the science department head. In the following passage, Laura describes the beginning of a typical day when teaching a state tested subject.

> *On a typical day, we would start with a 10- or 15-minute warm-up activity where the kids would go over some topic that would be tested on TAKS… It was always a little bit weird because the review would not usually have anything to do with what we were teaching that day [in chemistry]. We would go over phylums and kingdoms. Then, "Okay kids, now let's balance this chemical reaction." It was hard for me to switch my brain over, so I'm sure it was hard for the kids too*. (Laura, I1: 7)

After test preparation, Laura would then begin the chemistry lesson.

> *Laura: Typically, I would teach them some kind of conceptual thing… Some days, I would teach them an equation and that would take all class… Then, there would probably be some kind of worksheet where they would practice the problems and we would go over it the next day.*
>
> *Researcher: So, as far as labs go, what percentage do you think you did during those days [during state testing]?*
>
> *Laura: Definitely not as much as I should have…Probably like 20 or 25%. It was at least one a week, but I was lucky if I got two in.* (Laura, I1: 51)

Cris also adhered to the mandatory TAKS reviews every day during state tested years. The following exchange describes Cris's day when he was state tested. Like Laura, he also expressed a lack of exploration in his lessons.

> *Researcher: After the TAKS quick reviews, what kind of activities did you do in your lesson?*

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> *Cris: There were demos arranged, Foldables…. different strategies, kind of tying in those TEKS. That first year, I really didn't have a science classroom, so I didn't really [do any labs]. It was hard for me to do labs in general, but it was almost prepping for two lessons within the same class period. So I felt pressured to pay more attention to TAKS instead of the actual [physics] lesson itself.* (Cris, I1: 44)

To adequately prepare their students to achieve passing (and preferably high) scores on the state exam, Cris and Laura focused an enormous amount of instructional time towards test preparation. The amount of time test preparation consumed during a class period significantly decreased the amount of instructional time actually spent on their specific subject.

Set Free (Post-standardized Testing)

No longer state tested or accountable to the district, both teachers felt the freedom to teach in any fashion they desired; however, only one proclaimed major changes in instructional practice. Laura had not changed her instructional practice and when asked the differences in lessons between state tested and state non-tested years, she admitted that the only change to her lesson was an increase in the amount of time to cover the topic. The lessons were the same.

> *They [the state] took away the EOC, but the TEKS didn't change, so… how I ran my class didn't change a whole ton.* (Laura, I1: 331)

After an observation, when asked to describe a typical day teaching a state non-tested subject, Laura responded with the following.

> *Typically, I actually do a lot more direct teach than this. They hate direct teach, but it works for most of them because they're used to it… They prefer to watch me just fill them in [fill-in-the-blank notes] and work problems. So, that's how I probably teach 80% of the time.* (Laura, I2: 122)

In fact, this description mirrors researcher notes from several observations. Laura would fill in notes on the document camera, and then the students would work problems on a worksheet. Other than occasional banter, the information was presented from teacher to student.

Although Laura had not altered her lessons or methods, she did report that she was more concerned with students gaining and retaining conceptual knowledge at the completion of her chemistry course. Hence, she started focusing on the big picture and omitted detailed information the average chemistry student may no longer need to know. This caused her to feel better about the job she was doing as an educator.

> *Researcher: So you feel better as a whole? Ethically?*
>
> *Laura: Yes. Which may not necessarily be reflected in black and white test scores because sometimes that means that I cut out TEKS. Because I know that it's more important that they have a solid foundation.* (Laura, I3: 169)
>
> *I can do my job more, honestly. I have less pressure rather than just keeping the bus trucking, while kids fall off left and right.* (Laura, I2: 52)

The additional time in class given for gaining conceptual knowledge and doing homework often meant that students did not get the opportunity to engage in activities, labs, and projects. Laura focused more on teaching concepts to students in the form of notes and worksheets. The following passage describes Laura's irritation with crafting creative activities and labs that went unused.

> *I have labs planned and set up… that I've got the materials to do and set up in the back lab, and we can't do it because it's taking the kids a little bit longer to understand the concept. Yea, I'm wanting to do more labs, but can't necessarily get back there.* (Laura, I1: 575)

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Cris used his "newfound freedom" to alter his classroom significantly. By having an additional 75 minutes per week that was previously used for test preparation, Cris was able to go more in-depth with the material and incorporate more labs, games, discussions, and research projects. Observation notes often documented labs and games in his classes. The following excerpts describe how Cris changed his instructional practices after the removal of the state test.

> *The [TAKS] quick reviews went away. So, you have more labs, more time for labs and… a little bit more technology, so we can do more virtual labs. I can actually do a research project now.* (Cris, I1: 316)

> *Because of that flexibility of not having that standardized test, you feel like you could do a lot more things. You can do more games. I feel like we do more discussions now than I did during TAKS because I feel like that without the pressure, I have more time, and I can manipulate the curriculum a little bit more.* (Cris, I1: 487)

> *They [students] probably feel like they're more part of the lesson now than before, where I was very dogmatic and in your face [during state testing] and now it's kind of the holistic thing.* (Cris, I3: 159)

In addition to allowing more time for labs, games, and projects, Cris also highlighted that the flexibility allowed for more note-taking that lead to more depth of content.

> *We're doing more notes… like they're writing it down. We go overall more in depth. Yes, the notes are longer, but the labs tie into the notes. A lab that we don't normally do.* (Cris, I4: 619)

Observation notes documented that note-taking comprised a large portion of instructional time in Cris's classroom. This direct instruction rarely allowed for interactions among students. During observation two, Cris stated, "We'll stop notes here because I'm losing you guys. Falling asleep." In fact, subsequent researcher notes cited that Cris would constantly ask students to keep their heads and eyes forward on the screen during notes on numerous occasions. The lack of engagement during notes was so apparent that Cris sarcastically stated how exciting the notes were and that they were having "just too much fun for one day" (Cris, OBS10).

Although the teachers reported they had freedom to instruct their courses however they deemed fit, the evidence suggests that many instructional strategies they used when teaching a state tested subject were still present in the classroom. *Traditional instruction* describes the majority of the observations; however, both teachers desired to make their classes more hands-on in the future. With little accountability and a passion to continuously improve, the teachers took responsibility to enhance their instruction.

Discussion

Teacher instructional practice is the dominant factor in student learning and retention (Wright et al., 1997), and mentors have tremendous influence on the instructional practices of novice teachers (Smylie, 1989). As an alternatively certified teacher in a very accelerated program, I can attest that my education about education was bare and impractical. My first-year teaching resembled my high school experience: lecture-based and teacher-centered. The transition into a larger school district resulted in the assignment of a well-seasoned mentor, who was kind enough to show me the ropes. Entering a high stakes testing environment and still unsure of my teaching identity, I followed her methods and instructional practices for teaching science. This narrative is often the reality for many new secondary teachers entering the public school system.

Out of the 345,373 educators in Texas in 2018-2019 school year, 124,681 (36.10%) were alternatively certified (Smith, 2020). Not all alternative certification programs are created equal. While many programs thoroughly prepare teachers for success in the classroom, others barely scratch the surface of the teaching profession and promise candidates rapid certification with little effort. In these cases, novice teachers are inclined to use veteran teachers as a resource to understand their role as a teacher in the public school system. Laura believed that she needed to teach like Mary. Cris looked to Ms. Harrison because he "didn't know what he was doing" (Cris, I4: 358). Unfortunately, mentor selection is often based on a person's desire to guide new teachers; thus, mentors may or may not use best teaching practices for the evolving student.

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Contrary to research on best instructional practices for effective learning, many teachers abandon their beliefs about what constitutes an effective science classroom the moment they begin teaching a course attached to a standardized exam. Being a high stakes testing novice, Cris and Laura learned to "teach to the test" from their colleagues to maximize standardized exam results. Unfortunately, these strategies often mean changing teaching methods and behavior (Avdeniz & Southerland, 2012). Mirroring the findings of Jones et al. (1999), the teachers in this study engaged in 75 minutes per week of test preparation, which decreased the amount of available time for actual chemistry or physics instruction. Consequently, frustrations surfaced as Cris and Laura spent the majority of their time coaching students on test-taking skills and teaching a curriculum based on an assessment (Johnson et al., 2004; Sass et al., 2012; Tye & O'Brien, 2002). Laura exhibited this frustration as she struggled with her own teaching philosophy and covering all the tested material. Similar to the study by Taylor et al. (2002), the stress and focus placed on the test, rather than on educating youth, lowered her morale and caused her to question her own future in education. This should not be surprising since extreme changes in teaching methods due to high-stakes testing were found to be the primary reason for teacher attrition (Sass et al., 2012; Tye & O'Brien, 2002).

In the post-standardized tested world, freedom from the pressure and stress of state testing could result in an effective science classroom based on best teaching practices. Although both teachers reported that they were free to teach in any fashion, the evidence suggests that the teachers continued to teach the way they did when state tested. The new sense of freedom that each teacher experienced had merely translated to a less stressful environment with slower paced lessons that largely mirrored those implemented during state tested years.

Shulman (1986) stated that content knowledge is crucial to effective teaching, but it is not sufficient for excellent teaching. He suggests that pedagogical content knowledge is also needed. Laura and Cris had the content knowledge; however, the evidence suggests that they did not have or did not use pedagogical content knowledge necessary for exploratory learning. There was never mention or evidence of the 5E model (Bybee et al., 2006) being used in either classroom. The internal struggle of doing what was best for the students and what was required, suggests that these teachers were ethical and would go to measures far beyond standard practice for their students' best interests. Both teachers consistently mentioned goals and adjustments they wanted to make to their instruction. Therefore, the lack of transformation in instructional practice for these teachers was not due to a lack of desire for improvement.

Initially, certification programs, mirroring traditional teaching methods, and testing pressure that ultimately changed instruction could be to blame for the lack of evidence of pedagogical content knowledge. Once chemistry became a state non-tested course, however, Laura continued the exact lessons and activities she did when she was state tested. The only difference mentioned by Laura and seen in observations was a prolonged period to cover each chemistry topic. Cris added more technology and labs into his lessons; nevertheless, he adhered to the teacher-directed notes that typically took the majority of the class period to complete. Therefore, the evidence in this study suggests that these teachers were unaware of best instructional practices for teaching science, and without quality professional development advocating these methods, many teachers in this situation will continue to lack the knowledge of inquiry-based classroom instruction.

Implications and Recommendations

Since many secondary science teachers entered the profession during high stakes testing and merely modeled "best practices for high test scores," veteran and novice teachers are both in need of training on Bybee's 5E model. In addition to implementing this inquiry-based approach, it is important that science coordinators communicate with ALL science teachers to understand their professional needs and interests when developing professional development. Differentiated instruction is encouraged in the classroom. Why is this not a reality when instructing teachers?

In the new post-standardized tested classroom, careful selection of mentors is imperative for pre-service and in-service teachers. Mentor selection should intentional and strategic. Administrators should assign novice teachers to mentors with knowledge and practice of inquiry-based instruction, and new teachers should be allotted time to view master teachers perform.

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To enhance science teaching on the entire campus, veteran and new teachers should be well-versed in inquiry and Bybee's 5E model. As mentioned previously, professional development would be an ideal time to ensure all teachers are cognizant of best practices in the science classroom. Teachers must realize that implementing these methods is not easy. It takes practice and devotion to transform their classroom. If financially feasible, instructional coaching can help with the implementation and consistent focus of inquiry-based learning, resulting in much greater utilization than just training alone (Poglinco & Bach, 2004).

Limitations

The researcher, first and foremost, limited this research. As someone with experience in an "under par" alternative certification program and a former educator who taught state tested subjects, I bring my own bias to the study. However, employing multiple data sources, an audit trail, peer debriefing, and member-checking alleviated as much subjectivity as possible.

Another limitation of this study was the uniformity of the participants and setting. In addition to working in the same school, Laura and Cris obtained their teaching certification through alternative certification means and entered their careers as teachers in state tested subjects. Although the setting allowed for consistency in the study, teacher perspectives may differ depending on their educational training, school rating, district teaching requirements, campus teaching expectations, school district location, local stress, demographics, and class scheduling system.

A larger population of teachers to examine would also have been more ideal for this research. However, with changing teaching schedules, it was only possible to follow two teachers in this school. Incorporating a larger sample of teachers would make the results more generalizable for educators and researchers throughout the country.

Recommendations for Future Research

Recommendations for future research include expanding this research to include more participants and more school districts. As mentioned in the limitations, teacher perspectives may differ depending on their certification program and many school factors, such as scheduling system, local stress, and district teaching requirements. A larger scale study of many physics and chemistry teachers would make the results more generalizable.

This study only examined science teachers' perspectives. House Bill 5 also removed state tests from other content areas, such as social studies, mathematics, and English. Investigating teacher perspectives from different subject areas where high-stakes testing has been removed to understand their experiences would also enhance the study. In addition, viewing areas that have never been state tested, such as the arts, would also lend findings important to this topic.

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TEACHING IN CHALLENGING TIMES: HOW CAN CULTURALLY RELEVANT PEDAGOGY ASSIST TEACHERS DURING COVID?

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Abstract

During challenging times, the teaching profession becomes the beacon of hope and enlightenment. As has been seen in the era of COVID-19, teachers have been appreciated and praised for providing teaching and learning experiences that promote success for students. Additionally, it has been demanded of them to provide more culturally relevant pedagogy (CRP) to ensure that all students are getting the most from the different forms of instruction that is provided during COVID-19 (i.e., virtual, blended, F2F with shields and masks). To ensure that pre-service teachers are prepared to deliver teaching and learning that includes CRP, targeted activities that include real-world opportunities are a must and should include simulated experiences, along with field experience, bridging, and professional development activities.

Keywords: COVID-19, culturally relevant pedagogy, preservice teachers

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How are teachers adapting to these challenging times? Before the COVID-19 quarantine, things were different. School functioned stereotypically as it always had. As of April 11, 2020, over 55.1 million students had been impacted by school closures (*Education Week*, 2020); suddenly thrusting families across all socio-economic lines into a new version of "homeschooling". Teachers and parents/guardians were equally unprepared for the challenge that ensued (McMenamin, 2020). For a majority of families in America, the role of "teacher" and "parent" quickly merged into one creating a sense of angst for both. Parents were given the responsibility of "finishing" the 2019-2020 school year as the "teacher" of record. Teachers were placed in the position of providing parents necessary resources for their child's conceptual mastery in an uncharted online venue that was unpredictable at best. That being said, the pandemic provided an excellent opportunity to once again examine teaching as a profession.

As professionals, teachers have had multiple "experts" telling them how to do their jobs for years. This includes legislators, members of multiple Boards of Education, and politicians who may not have entered a public-school building since they themselves were students. *The Washington Post* examined this very problem by describing the appointment of Betsy DeVos as the United States Secretary of Education (Strauss, 2017). Ms Devos has never (1) been a public-school educator, (2) attended a public school, or (3) considered placing her own child in public school. This could read one to believe in the adage, "those who can't do, teach" to be apropos; however, this could not be further from the truth. Educators

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go through rigorous training to become teachers possessing unique certifications required by state law to be "highly qualified". In addition, once hired, educators must participate in continuous professional development (Goodwin, 2019; Strauss, 2017), such as understanding and being responsive to the different needs of each student.

With this new era of teaching and learning that COVID has thrown us in, teaching and learning through strong pedagogy that includes Culturally Responsive Pedagogy is needed. The term Culturally Responsive Pedagogy (CRP) has been used a great deal lately by both educators and non-educators alike. However, this is not a new phenomenon or pedagogical approach. Renowned educators such as Geneva Gay, Gloria Ladson-Billings, and Django Paris have laid the foundation and continued engagement with the research supporting CRP. The term was originally published by Gloria Ladson-Billings in the early 1990's (Knight-Manuel & Mercaino, 2019). CRP is easily defined, but more difficult to utterly understand. Lynch (2016) defined CRP as, ". . . a student-centered approach to teaching in which the students' unique cultural strengths are identified and nurtured to promote student achievement and a sense of well-being about the student's cultural place in the world" (para 2). If this is the correct direction to help students best learn, then preparing pre-service teachers in understanding CRP is essential.

Preparing Preservice Teachers

In higher education, there is a continuous charge and demand for teachers to be ready to teach and meet the needs of all students on day one (DeMonte, 2015). Often, with the charge, more impetus is put on classroom aspects that focus only on instruction, assessment, and classroom management. The professional aspects of being a teacher may be left out as they are more difficult to define, observe, and assess. State and national teaching standards attempt to address these issues; but it is often more in the concept of understanding laws surrounding students and schools. Additionally, the concepts of culturally responsive pedagogy (CRP) are now required to be interwoven through all activities in and out of the classroom. Below are multiple ways that CRP can influence and improve the K-12 classroom.

Simulated Activities

Multiple programs offer differing simulated activities to assist preservice teachers in learning to become teachers. These commercial programs offer avatars for students and give the preservice teachers the ability to practice teaching in a controlled environment that can be artificially manipulated to teach certain skills. For example, when teaching questioning strategies, university faculty can utilize these simulated activities for preservice teachers to demonstrate competence in using questioning strategies in a more authentic environment. These simulated activities can also be used for different teaching aspects such as classroom management and instructional techniques. Bilingual avatars are used to allow preservice teachers the opportunity to practice working with second language learners and employ modifications to their instruction to support and enhance their instruction. Adult avatars can also be leveraged for learning to conduct a parent/teacher conference or for future administrators to practice providing feedback to teachers.

Field Experience Activities

One of the most authentic exercises for preservice teachers and future administrators comes from their work in the public schools. Through scaffolded and supported field experience activities, both preservice teachers and future administrators have the opportunities to enhance their pedagogical knowledge through authentic, hands-on learning, while still being supported by a mentor teacher or administrator. Barnes (2006) reaffirms that educator preparation programs must provide scaffolded learning experiences that allow preservice teachers opportunities to apply skills and strategies they have learned in diverse field placements. Purposeful and authentic experiences help candidates focus on their own dispositions and attitudes about diversity so they can better understand how to best meet students' needs.

As candidates are immersed in a learning context unlike one in which they experienced as a child they begin to broaden their perspectives about how to value and incorporate all students in the learning environment. However, just

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incorporating meaningful field experiences in a variety of settings does not mean that candidates are well prepared to meet the needs of all learners. It is also important that dialogue and discussion about what is seen in the classroom is embedded into pedagogical coursework. This allows for all candidates to critically reflect and construct new knowledge based on listening, understanding, and valuing others' perspectives. Through immersive experiences and critical discourse, educator preparation programs are assisting in supporting candidates' understanding of CRP.

Bridging Activities

The transition from preservice to inservice teacher is often a daunting task for recent graduates. In an attempt to help preservice teachers bridge the gap from preservice to inservice, additional professional learning before starting their first year of teaching. The NTA serves as a bridge by providing focused professional development specifically related to structures and systems new teachers must be ready to implement in the first week of school. The NTA includes breakout sessions facilitated by current teachers and administrators from area school districts. The breakout sessions extend on the practical application of practices that are learned in teacher preparation coursework. These sessions build on the foundation laid in coursework and early field experiences but extend the learning by exposing new teachers to additional research-based strategies and methodologies they can utilize during the first weeks and months of school.

Following NTA, faculty members continue supporting participants during their first year of teaching through emails, phone calls, and/or texts. This practice provides novice teachers opportunities to ask questions and seek help on issues they may not feel comfortable addressing with their campus administrative team. One past NTA participant noted "I am glad I can ask you a question because I don't want to ask my team or campus principal because I don't want to look dumb".

Professional Development Activities

One strategy that supports teachers as professionals is to allow them to determine their own continual growth needs. Allowing them to find professional development that meets the needs of their annual goals gives the teacher ownership of their growth and allows for a more professional teaching and learning environment (Konen, 2018). This also allows the teachers to become true models for their students and encourages them to practice what they preach. For example, teachers are expected to meet with each of their students and collaboratively seek both strengths and weaknesses in a given subject. The students are to set goals for themselves and are encouraged to find their preferred learning style. This parallels what administrators should do with teachers. Teachers should be able to set their own goals and work toward meeting those goals with the guidance of the instructional leader of the campus.

The principal and other campus administrators can also support the professionalism of teachers by allowing them more ownership of the campus. What this means is allowing them to set agendas for faculty meetings, professional development days, and/or beginning of the year teacher week. Because teachers are professionals and because they have specific knowledge about teaching and learning that works, they should be given time to facilitate faculty meetings, for example, especially if the meeting focuses on pedagogy, instruction, student learning objectives, or assessment. Usually, faculty meetings are a time to talk at teachers, but a better use of time would be a more collaborative meeting where teachers are given the opportunity to show their expertise. This not only illuminates what teachers are doing in the classroom, but it also allows the administration and other teachers to see their colleagues as valued members of the campus.

Allowing teachers to lead meetings gives them a chance to showcase their strengths and may even allow them a chance to work on their weaknesses. For example, when a teacher leads a discussion in a meeting, that discussion would be in an area that he/she is a guru. However, the weakness may be leading a discussion with peers, which may be stressful, but practicing this skill will eventually lessen the stress. The leading of meetings also gives the teachers an opportunity to show leadership.

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Create a Sense of Trust

Ultimately, any strategy where a teacher is told what to do without being given any autonomy is a horrible strategy. Not trusting professionals to perform at a professional level leaves no room for trust or growth. It also stifles collaboration and insight from different persons, which could bring about rich discussions, brainstorming, and ideas. When teachers are asked to use a standardized curriculum with continuous high-stakes testing, there is a lack of trust demonstrated for the teacher as a professional (Bruno, 2018).

This creation of trust also holds true for students who want to be valued as productive learners. Teachers who are culturally responsive to the needs of all students within their classroom will be fostering trust through targeted and specific instruction. For example, if a teacher creates a learning plan of action tailored to a student's learning needs, and the teacher consistently refers back to that plan to ensure the student is getting what is needed, then the student may begin to trust that the teacher will uphold her or his word recorded on that plan. Additionally, when students observe a teacher to show genuine interest in each and every student within the classroom without making any one student feel uncomfortable or singled out, trust becomes cultivated naturally.

Conclusion

Culturally Responsive Pedagogy is not new but is not always implemented into the K-12 classroom. Teachers and administrators need definite and concrete ways to utilize these theoretical constructs into practice in the classroom. Continued ways and next steps for integrating CRP into the classroom include:

- Allowing preservice teachers to spend more time in the classroom and practice the skills and craft that they are preparing for.
- Understanding the purpose of what a teacher looks like and learn to promote the attributes of this profession in a manner that is not only respected, but also, seen as a vital role in our communities.
- Analyzing state expectations and other requirements in order to become a professional teacher and meet those expectations through performance-based learning, or experiential activities.
- Allowing future educators to own their profession by learning how to best fit in, including CRP.

Universities can put these bullets in action, with the help of school districts. Having a strong relationship with school districts is paramount as it allows preservice teachers the time and practice to learn the craft of teaching. Giving preservice teachers this time only strengthens the profession and gives the preservice teachers opportunities to work with practicing professionals.

As the world moves forward into a new normal, the impacts of the Coronavirus on the United States' education system will continue to be felt but will lessen as time goes by. The reverence for teachers will wane and their professionalism will come under scrutiny again. It is up to universities, educators, and the public to remember the impact teachers have on society and the important role that they play in the development of a better society.

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MEETING THE NEEDS OF SECONDARY STUDENTS: ONE TEACHER CANDIDATE AT A TIME

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Abstract

Access to equitable literacy instruction remains a major barrier to future opportunities for many students across the country. Due to this, most teacher education programs require students to take a literacy course that focuses on disciplinary literacy. As teacher educators in different states, we noted resistance from our students in understanding the importance of all content area teachers contributing in their instruction to the literacy skills of students. In an effort to make this need practical, a partnership between teacher education students in California and freshman composition students in Texas was created. This qualitative study demonstrated the potential active learning opportunities of teacher candidates and highlights the need for programs to be responsive to trends in education, the needs of students, as well as current events.

Keywords: literacy, teacher education, disciplinary literacy

There is a continuous, shifting change in the landscape of today's secondary classroom. The need for teachers to adapt and adjust is critical and necessary as evidenced by the current challenges our world is facing as a result of COVID-19. As teacher educators in Texas and California charged with preparing candidates to enter middle and high school classrooms, the authors felt the pull of these changes and needs long before a pandemic altered our world.

In addition to serving as faculty members in education preparation programs, the authors are both former English Language Arts high school teachers, and currently teach disciplinary, or content area, literacy courses. Most states require that teacher candidates successfully complete a disciplinary literacy course (Draper, 2002, Masuda, & Ebersole, 2013 Park, 2013, Siebert & Draper, 2008). However, these courses often focus on how content area teachers can enhance the reading skills of their future students. The authors both recognized such tendencies in their own courses. In an effort to increase teacher candidates' abilities to incorporate writing and respond to the writing of their future students, the authors developed a partnership and facilitated a collaboration among graduate teacher candidates in California and freshman composition students in Texas, utilizing technology as a mode of interaction.

During this study, college freshman composition students digitally shared their literacy narrative drafts with the teacher candidate graduate students, and then scheduled a virtual meeting. The writing students' literacy narratives detailed a time in their life when writing had a significant effect on them. After reading the literacy narratives, the teacher candidates were tasked with responding both in writing, and interactively in real-time by meeting via Zoom. To facilitate this interaction, both the teacher candidates and the freshman composition students were asked to select a time and date that would correlate with their individual schedules utilizing a Google document (Figure 1).

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Figure 1
Zoom Schedule

1-February 11: 10 am (CA) 12pm (TX)
LINK HERE
Please **RECORD** your Zoom Meeting. Teacher Candidates save the recording to your Google Drive, Module Folder.

	Name	Gmail Address
Freshman Comp Student		
Freshman Comp Student		
Freshman Comp Student		
Teacher Candidate		
Teacher Candidate		

Following the two types of interactions, (written and virtual) the teacher candidates reflected on their experiences working with writing students, providing written feedback, and considering how this experience informed their understanding of literacy in their respective content areas.

The teacher candidates generated reflections that contained important information to consider as the authors worked to ensure that graduating teachers grasped the importance of literacy across content areas and were able to adapt and utilize technology as a necessary teaching tool.

Disciplinary Literacy in Teacher Education

Disciplinary literacy encompasses a wide range of skills, strategies, and knowledge. However, the authors describe disciplinary literacy as a framework that acknowledges that each content area, or discipline, has its own methods of knowing, of utilizing language, and engaging in communication. Disciplinary literacy draws on the idea that discourse is a "way of using language, of thinking, and of acting that can be used to identify oneself as a member of a socially meaningful group or social network" (Gee, 2001, p. 1). It is imperative that teachers of all content areas "know how to create a classroom culture of engaged academic literacy" (Greenleaf, Schoenbach, & Murphy, 2014, p. 2).

Despite the fact that disciplinary literacy enables teacher candidates to examine the way their chosen field utilizes language and communication; many still show negative responses when they first encounter literacy or a teacher education literacy course. For example, in a study conducted at the University of Hawaii, teacher candidates revealed that they "initially thought literacy was just reading and writing" (Masuda, & Ebersole, 2013, p.50). Furthermore, as evidenced by students in the authors courses, a common belief, and one that is a detriment to secondary students, is that literacy is the sole job of the English teacher. The authors have witnessed these misconceptions over and over in courses and this partnership was an effort to remedy some of these misconceptions.

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Teaching Writing

One element the authors believe is important to emphasize in the literacy course offered through educator preparation programs is writing. Teacher candidates must understand more than reading and reading strategies. As teacher educators, the authors are concerned with studies, like those written by Kiuhara, Graham, and Hawken's (2009), which revealed that 71% of teachers surveyed said they "received minimal to no preparation to teach writing during college (preservice preparation)" and that only 44% of in-service teachers reported professional development about teaching writing (p. 148).

The authors agree with Sperling & DiPardo, 2008 that writing is one of the most basic elements of English Language Arts and should be ever present in their curriculum. However, the authors argue, content teachers should "devote significant attention to the teaching of writing if they expect students to learn how to write within their discipline" (Kiuhara, Graham, & Hawken, 2009, p.151). The assignment presented in this research created an opportunity for teacher candidates to consider the methods needed to support the teaching of writing and written communication within their future classrooms.

Findings and Discussion

Teaching Literacy Skills as Educators

The teaching goal for this assignment was to facilitate an opportunity for the teacher candidates to recognize the importance of their role in supporting literacy acquisition. Oftentimes, non-English teacher candidates will see this as the role of the English teacher and not realize their own need to provide opportunities for students to engage in literacy activities. Through this experience, all teacher candidates gained a deeper understanding of the need to promote and practice literacy as a change agent that provides students with opportunity for future academic and career goals.

Defining Literacy

As a result of this assignment, the teacher candidates were able to better understand and define literacy, as it applied to their content area. One candidate shared, "as a social science teacher it is my job to teach students argumentation and critical thinking and give them opportunities to showcase these skills through their writing." Another candidate, seeking a health certification, recognized writing as important but sought to "make writing enjoyable and about topics that they are excited about or eager to research" explaining that "those are the experiences I want my students to be a part of."

These are important reflections because the authors recognize that teacher candidates "perceptions of what counts as literacy can influence the pedagogy and curriculum in which they engage their students" (Masuda & Ebersole, 2013, p. 48). Without a definition or personal understanding of literacy, and what it may mean to be a teacher of literacy, future teachers will struggle to find ways to incorporate meaningful literacy practices.

Literacy Is Across Content

One of the most difficult tasks in an education literacy course is to get students to buy in, to believe that literacy is a skill in all content areas and that writing can be implemented in their future classrooms. As a result of this assignment, teacher candidates formulated new understandings of the importance of their role in supporting literacy. One physical education teacher candidate reflected on the experience, "I could have them write a food journal and track their physical activity outside of class for the entire school year." The health teacher candidate explained, "I believe I should incorporate short writes". While clearly a surface level understanding of how writing could be incorporated in their content area, this is still an important finding. It is important to facilitate opportunities for teacher candidates to explore literacy ideas in order to expand their thoughts and beliefs about literacy practices (Barton, 2000).

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Expectations of Student Skills

The teacher candidates were surprised at the level of students' writing that they encountered. One future teacher expressed, "assisting these students with their writing was an eye-opening experience. I was shocked by how poorly written some of these essays were...I know not everybody is going to be an award-winning author, but I feel everybody should have the ability to write in clear coherent sentences and be able to form and support an argument throughout their paper. This experience helped me to understand the reason ALL teachers need to support literacy."

An English candidate reflecting on this experience wrote, "As this was one of the first papers that I had corrected for someone who was not a peer, I also got a new perspective on the writing level of those whose writing I will have to grade in the future. This experience also helped me to realize that just making the corrections is only one part of what needs to be done because once those corrections are made one would need to be able to explain why it has to be fixed and how to continue to do so in the future."

A 2015 community report written concerning the literacy rates near the university that the teacher candidates are enrolled in was shared with them during the course. This report alerts the community to the alarming literacy indicators in the area. For example, 71% of the county's third grade students do not read at grade level, making these students four times less likely to graduate high school as well as predicting future earnings of only $20,000 per year on average (Hughes & Kaanon, 2015). The research in this county continues to show disparities in literacy rates among minority groups, socioeconomically disadvantaged groups as well as in the English Language Learner populations (Hughes & Kaanon, 2015). Despite having access to these statistics, it became clear that hands-on experience with students' writing was the best teaching tool utilized. While the teacher candidates were aware of the unique challenges of their geographical area, the ability to engage in dialogue with recent high school graduates, as well as reading their literacy narratives, made this understanding more personal. Rather than viewing the disparities as nameless numbers, the need to promote literacy became relevant through the social interaction provided in this study.

Conclusion

Literacy is an ever-changing field. Educators are currently seeing the changes unfold as they work to continue to educate children across the world amidst a pandemic. Our promise to ourselves, as teacher educators, is to continue to search for ways to embrace the changing landscape of education. It is important for teacher educators to create opportunities for teacher candidates to explore the questions of content literacy and to facilitate spaces that encourage adapting and adjusting their literacy ideas and practices.

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THE IMPACT OF THE ROBERT NOYCE MENTORING PROGRAM ON INCREASED TEACHING EFFECTIVENESS AMONG TEACHER CANDIDATES

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Abstract

The State of Texas is in dire need of effective classroom teachers, particularly teachers in the STEM fields. In an effort to meet the needs of Texas schools, and to ensure that effective teacher candidates are entering Texas classrooms, a grant from the National Science Foundation to implement the Robert Noyce Scholarship program was obtained. In an effort to examine the effectiveness of the program, a qualitative study was employed. The findings highlight potentials for utilizing content area specialists to serve as mentors who facilitate specified field experiences.

Keywords: preservice teacher preparation, mentoring, STEM

Introduction

In 2016, only 2,880 math and science certifications were issued across the State of Texas, despite a much larger need (Bailey, 2017 p. 10). Additionally, Texas continuously sees many educators leaving the profession. In fact, in the 2016-2017 school year 35,959 educators left the teaching profession (TEA, 2019). In addition to the clear need for more educator, it is important that educator preparation programs continue to focus on increasing the teaching effectiveness of their candidates.

Effectiveness in STEM fields

Educational research findings indicate teacher effectiveness is not only difficult, but extremely complex, and often lacks validity and reliability (Goe, Bell, Little, 2008; Seidel & Shavelson, 2007). Research findings also indicate that educator preparation programs that have quality early field experiences, a consistent mentoring network, and high-quality specific content-based curriculum courses produce graduates that are more likely to succeed and stay in the classroom (Darling-Hammond, 2006).

The Robert Noyce Scholarship Program

In an effort to meet the needs of Texas schools, and to ensure that effective teacher candidates are entering Texas classrooms, the College of Sciences and Mathematics, in collaboration with the College of Education, at a rural Texas

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university, applied for and received a grant from the National Science Foundation to implement the Robert Noyce Scholarship program. The program is entitled Talented Teachers in Training for Texas (T4).

While T4 scholars have repeatedly pointed to the sizable scholarship attached with a T4 award as their greatest draw toward applying for the program, many say in hindsight the mentorship was the most valuable component. Not only did scholars meet biweekly with STEM and education faculty, hand-picked veteran science and math teachers were chosen to oversee their mentoring throughout scholars' undergraduate experience and into the classroom. These former classroom teachers ran biweekly training sessions for scholars leading up to their clinical teaching semester. These same mentors, having established rapport with the scholars, were scheduled as their supervising teacher during clinical teaching. In contrast, outside of the T4 program supervising teachers rarely knew their supervisees personally and typically had no STEM teaching experience as the university assigns supervising teachers based purely on school location. Perhaps best of all, however, these teaching mentors continued to support T4 scholars through the job application process and through their early years in the classroom. Additionally, the grant funded travel to regional math and science teaching conferences so scholars were able to reconnect with their mentors and peers during an intensive three- to four-day period, all while keeping abreast of the latest best practices in the field. T4 was created with the goals of:

1. Creating experiences through which university STEM majors examined careers in high school teaching through early intensive field experience (Hubbard, Embry-Jenlink, & Beverly, 2015).
2. Recruiting aspiring STEM teachers for engagement in structured mentoring networks (inclusive of experienced classroom teachers, aspiring STEM teachers, and STEM and education university faculty) for two years before graduation and three years after entry into the teaching profession (Hubbard, Embry-Jenlink, & Beverly, 2013);
3. Examining and identifying the most effective practices for STEM teacher training and retention.

Teacher Effectiveness

Teacher effectiveness within educational research is subject to diverse methodologies, definitions, and measurements (Goe, Bell, Little, 2008; Seidel & Shavelson, 2007). This research focused on four characteristics of effective teaching: student centered pedagogy, culturally responsive pedagogy, positive classroom management, and evidence of teacher content knowledge.

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Table 1
Four Characteristics of Effective Teaching

Quality	Definition	Supporting Research Findings
Student-Centered Pedagogy	The teacher initiates a student-centered classroom through creation of an environment that gives students opportunities to contribute, engage in hands on activities, interact in an authentic manner with the content and with their peers.	Fenstermacher & Richardson, 2005; Goe, Bell, Little, 2008, Seidel & Shavelson, 2007
Culturally Responsive Pedagogy	Culturally responsive pedagogy is woven into every aspect of the teacher's instructional curriculum and classroom management choices.	Gay, 2010; Ladson Billings, 1995; Freire, 1996; Swartz, 1996; Hooks, 1194
Positive Classroom Management	The teacher creates a classroom culture and climate based upon mutual respect, and positive socio-emotional interactions.	Fenstermacher & Richardson, 2005; Noddings, 1992; Siedel & Shavelson, 2007
Evidence of Content Knowledge	Evidence of rigorous content knowledge is observable in teacher lessons, classroom management, and student interactions.	Bransford, NRC (U.S.), 2000; Goe, Bell, & Little, 2008

Field Experiences

Research investigating traditional field experiences in teacher education has revealed that effective teacher preparation programs have unique and increased opportunities for candidates to work in the field (Boyd,et al., 2008). However, the quality of such experiences must match the sought outcome. In most university-based educator preparation programs, teacher candidates are placed at a K-12 school to learn under a cooperating teacher on that campus during their final semester. In addition to the cooperating teacher, a university supervisor, who is tasked with observing and evaluating the teacher candidate during clinical teaching, is assigned.

There are problematic challenges with these traditional methods for facilitating field experiences. Darling-Hammond (2009) argues that "often, the clinical side of teacher education has been fairly haphazard, depending on the idiosyncrasies of loosely selected placements with little guidance about what happens in them and little connection to university work" (p. 11). In fact, often when teacher candidates are placed in K-12 school settings to complete their clinical teaching experience they are placed alongside classroom teachers who have not been provided preparation or support to implement a purposeful mentoring experience (Zeichner 2010). Additionally, there is a disconnect, limiting teacher candidates' "opportunities to observe, try out, and receive focused feedback about their teaching of methods learned about in their campus courses" (Zeichner 2010, p. 91).

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Acknowledging these challenges and limitations and recognizing that quality field experiences are paramount for graduating effective teachers (Cochran-Smith & Lytle, 2009; Zeichner, 1996), the T4 Noyce Program employed university supervisors specifically for their teacher candidates. It began with a twenty-year secondary mathematics teaching veteran who then had moved to the Regional Service Center. After three years, an experienced science teacher was also hired (also having experience delivering professional development through a Regional Service Center and building connections with a wide variety of districts). These two STEM teaching mentors met biweekly with T4 scholars prior to their clinical teaching experience, then served as supervising teachers for the field experience, and finally acted as induction mentors once these scholars entered the classroom.

Reflection in Teacher Education

Another element of importance when considering teacher effectiveness is reflection. Since the early 2000's those in teacher education programs have called for the inclusion of reflective practices (Ottesen, 2007; Loughran, 2002; Rodgers, 2002; Birmingham, 2004; Admiraal & Wubbels, 2005). However, the definition of such practices and methods for implementation are varied and often unclear. For our purposes, we view reflection as a tool to promote understanding and to gain insights to facilitate a transformation of thought or practice. Thorsen and DeVore (2013) assert that:

> In order for teacher educators to understand and develop methods for promoting and assessing reflection, they must facilitate conversations about desired learning outcomes; help candidates analyze personal, moral, and ethical practices; and evaluate educational policy or political outcomes that may be desired as a result of reflection. Furthermore, teacher educators must be able to identify and analyze the reflective elements present or absent in artifacts and know how to nurture more sophisticated reflection. (p. 90)

Studying the reflective practices that were facilitated through the T4 Noyce Program an understanding of how reflective practices can bridge the gap between theory and practice was gleaned.

Theoretical Framework

This research utilized a sociocultural framework as a lens for examining the reflective activities. A sociocultural perspective of teaching acknowledged that teaching is a social act, contingent upon and embedded within social and cultural interaction (Vygotsky, 1978). In addition, Vygotsky argued that interaction and collaboration between people is needed to aid in development (1978). The collaboration and interactions that this research centered on occurred between the T4 scholar and their mentor teacher, the T4 scholars and their students, the T4 scholar and their colleagues, as well as the collaborations that occurred between T4 scholars.

Methodology

Our research utilized a qualitative approach and was predicated upon a case study design, focusing on three T4 scholars as they grew from preservice mathematics teachers to teachers of record (Merriam, 2002; Yin, 2003). Such an approach correlated with the theoretical framework as qualitative research examined the way in which "human behavior is significantly influenced by the setting in which is occurs" (Bogdan & Biklen, 2007, p. 4-5). Additionally, qualitative researchers were concerned with the process in addition to the outcome (Bogdan & Biklen, 2007). The qualitative lens facilitated opportunities to examine T4 scholars' journeys to become effective educators. The research was guided by the following research questions:

1. What benefits do STEM teachers gain in teaching effectiveness from their undergraduate experience within the T4 Noyce program?
2. What observable evidence exists of these benefits in their practice?
3. How did the reflective opportunities embedded within the T4 Noyce Program impact teacher effectiveness?

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Data Sources and Analysis

The data sources, which were collected over a period of seven years, included interviews with participants, written documentation from Noyce STEM teacher mentor, videos of participants teaching in their classrooms, and annual administrative evaluations of the participants. The diversified data and the utilization of the constant comparative method (Glaser and Strauss, 1967) for data analysis until theoretical saturation was achieved (Glaser & Strauss, 2017) ensured Lincoln and Guba's (1985) guidelines of trustworthiness were followed.

Participants

T4 scholars are actively recruited, both at the host university and at 11 community colleges. Identifying STEM teacher candidates well suited to and well served by the T4 program was critical. The program required that candidates be at least halfway through their undergraduate coursework and have at least a 2.75 GPA.

The T4 scholars who participated in this study were three of the nine scholars, Amanda, Beth, and Desire, who were enrolled in the first cohort of the program. All three began the program intending to certify in grades 7-12 Mathematics. They began the program with between 67 and 79 credit hours toward a 120-hour degree and all three graduated two years after beginning the program. All three entered a high-need mathematics classroom the fall after their graduation and have taught continuously since that time.

Themes and Discussion

From the data collected, three overarching themes emerged regarding the impact of the T4 Noyce Program:

1. Meaningful in-content-area field experiences were important for the development of the T4 scholars as teachers of record.
2. Extended collaboration between the T4 scholars was perceived as critically important.
3. Reflective opportunities, facilitated by a dedicated mentor, revealed a distinct connection between reflection and action.

Meaningful Field Experiences

The first cohort of T4 scholars consisted of nine students. Due to the length of the program, and the number of participants, much became known about the scholars and their needs. This knowledge enabled the program coordinators to facilitate purposeful field experiences, including their clinical teaching placements. Beth, who was placed in a mid-sized high school substantially larger than she had intended to apply to, explained:

> I think they also tried to put us in schools, when we were doing our student teaching that would challenge each of us individually. And so I know that I thought I wanted to teach in a small school and I actually got put into [a midsized] high school, so that was a totally different diversity than what I was expecting to see. So, they kind of tried to place us somewhere where we would kind of get to see a different field than what maybe we thought we would be the most comfortable with.

If Beth had participated in the traditional certification program at the university, she would have been afforded the opportunity to choose the location of her clinical teaching. As she admits, she would have likely chosen a school she was most comfortable teaching, not giving her the opportunity to gain experience with a more diverse population.

Beth, Amanda, and Desire also pinpointed specific field experiences that T4 scholars participated in as a strength of their preparation. Beth emphasized an opportunity to attend ESL training.

> Because T4 allowed us to be more aware of things that were going on. So they recommended we do the ESL training ahead of time, and I don't think a lot of students knew about it because they weren't involved. So that was

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another opportunity where we got to go sit in an ESL classroom for so many observation hours and that was kind of an added benefit to also us getting our certification.

While this specific field experience was not an opportunity to practice, its strength lies in the fact that learning and effective preparation can also happen "as long as the work being done is centered in authentic classroom materials" as the ESL training was (Darling-Hammond, Hammerness, Grossman, Rust, & Shulman, 2005 p.402.).

Similarly, when asked about the strengths Desire revealed that completing the T4 program gave her confidence: "Just kind of having that back there helps with, 'Okay, well I can do this in my classroom.' And I know that I know what I'm doing. Even though I haven't even started yet to like actually have confidence in that I had the training that I needed."

Collaboration of T4 Scholars

The data revealed several forms of collaboration among the T4 scholars. Beth explained that through her participation in the T4 program she gained insight to a variety of backgrounds. She explained that "we had people from Dallas and Houston who grew up with a lot more diversity than we did and just hearing their perspective, hearing like how they felt when they were in school, so just hearing that perspective just opened your eyes so much." By creating cohorts based on program admission dates the T4 scholars were able to engage in prolonged interactions with the same group of peers. We know that with extended interactions students are more likely to feel comfortable sharing personal experiences (Seifert and Mandzuk, 2006). The experiences that were shared were important enough for Beth to recall several years post-graduation. Beth's understanding of the importance of perspective reveals her strengths in culturally responsive teaching.

Beth and Amanda also commented on the ways in which the relationships they formed in T4 impacted their first-year teaching experience. Beth explained, "it is even just having each other to kind of share emotional experience with in our first year, having people to call and be like, 'Okay, well, they just threw us an entire book and said here you go.'" Amanda reiterated, "And I really think having my friends' support has been really helpful to, like, 'Well, what did you do? This isn't working for me.' And then just kind of piggyback off of each other's ideas for the T4 program."

In addition, three of the participants, Beth, Desire, and Amanda formed a close bond throughout their time in the T4 program. This bond turned into a professional collaboration years after their graduation. In fact, the T4 mentor teacher noted that "Desire, Beth, and Amanda work together to create material even though they are at different school districts." Essentially what these three teachers have created is their own community of practice (CoP). CoPs are a group of individuals who share knowledge, abilities, and experiences and are an important tool, especially for early career educators as they limit the seclusion many teachers experience (Baranr & Cagiltay, 2010).

Teaching is often a very isolated profession as teachers spend most of their day in their own classrooms, without much interaction with their colleagues (Vavasseur & MacGregor, 2008). This kind of isolation often means that beginning teachers are not able to engage in the types of collaborations they often did in their educator preparation program and can be attributed to teacher attrition (McCluskey et al., 2011).

In addition to combating isolation, "a new body of research suggests that teaching experience and pedagogical preparation matters for student achievement when teachers have opportunities to learn from their peers" (Berry et al, 2009, p. 1). In fact, "studies suggest that teachers at any experience level stand to gain from collaborative work. Teachers who have consistent opportunities to work with effective colleagues also improve in their teaching effectiveness" (Berry et al., 2009, p.2). Beth, Desire, and Amanda were able to create and sustain this important type of collaboration for years, as it continues today. While not all T4 scholars engaged in this type of partnership, it is an important finding, providing T4 instructors with a blueprint for promoting CoPs among future program participants.

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Mentor Facilitated Reflections Enable Action

During their five-year participation in the T4 program, Amanda, Beth, and Desire collaborated with one university mentor, Lisa. Lisa served as their connection to the university, observed them in the field, provided feedback and continued mentorship. In this capacity, Lisa was able to assist the scholars when they faced challenges. For example, Amanda faced some challenges in her teaching career regarding classroom management. Lisa noted that Amanda's main challenge in the classroom was her inability to "discover her style of classroom management."

Initially, Beth and Desire also faced challenges with classroom management. Lisa observed that Desire "had a little difficulty with classroom discipline in the beginning as she is so sweet and soft spoken." This struggle was further documented by the classroom mentor teacher who noted that "discipline in the classroom is still a struggle for [Desire]. She does ask whenever in doubt about how she should handle a situation." Lisa revealed that most of her conversations with Beth "center[ed] around classroom management strategies."

The struggles of all three was not surprising, as studies have shown that many teacher candidates and in-service teachers received little, or ineffective, classroom management preparation (Birman et al., 2000). But Lisa was able to provide continued support for her mentees. In fact, Lisa utilized "T4's professional development classroom management strategies" to facilitate one-on-one mentorship in order to assist." These strategies, which were utilized throughout the program, were important because when educator preparation programs "have coherent visions of teaching and learning" and "integrate relation strategies across course and field placements" there was a "greater impact on the initial conceptions and practices" of teachers (Darling-Hammond, et al., 2005, p. 392). These conversations were important as Desire explained:

> For me, it was just having Mrs. [Lisa] as our student teaching supervisor because we have that relationship with her beforehand. She was able to be honest in some of the things that we struggled with, and I think that is something that is very beneficial for the T4 program that we had someone we already knew be our student teacher supervisor, so that she could tell us this is what you need to work on and us not be offended or upset or hurt by it.

Not all the mentor facilitated reflections centered around challenges. In fact, many of the conversations between Lisa and the T4 scholars were a time in which Lisa was able to offer praise. Amanda noted that having Lisa "telling you what you are doing right, what your strengths" was a great "confidence booster."

Furthermore, the fact the Lisa was a former STEM educator was important. Beth commented that when she had trouble with a group of students, Lisa gave specific advice.

> Okay. Well, it came from a veteran and it may be easier for me to buy into than like things than our administrators might say, because most administrators have not taught math or were not in the environment like we are in. It's a totally different world, and especially when you're a young female. And so it's nice to hear from someone who has been in your shoes.

Darling-Hammond et al. (2005), concurred, arguing that while many preparation programs focused "on generic conceptions of knowledge and skill development, it now seems clear that, to be enacted, teachers' learning should be developed in ways that derive from and connect to the students they teach" (p. 403).

Additionally, the bi-weekly communications between Lisa and the scholars were influential. Desire described it as "almost like a beacon of hope because we knew that there was always going to be someone we could call." As Loughran (2002) explained, "this important interplay between experience and reflection is also influenced by the time of reflection, which has a dramatic impact on what can be seen and acted on (p.35)." With continuous communication there was less of a time lapse for the T4 scholars to reflect and consult.

Conclusion and Implications

The results of this study indicated that developing effective pre-service and early career teachers *can* be enhanced with a prolonged mentoring program that enables teachers to engage in reflective practices with content area experts.

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However, the authors acknowledge the unique opportunities of the T4 program. Most educator preparation programs serve much larger numbers, and simply do not have the financial means or the ability to employ content area experts. Despite these limitations, the need to increase the effectiveness of early career teachers remains and we assert that elements of the T4 program could be considered and adapted.

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PROJECT-BASED LEARNING: ENACTING PBL WITHOUT FEAR

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Abstract

Teachers considering the enactment of project-based learning in their classrooms face two challenges, time management, and classroom discipline. By identifying strategies and tools to use in the enactment of project-based learning, teachers can build confidence in their abilities to manage classrooms using contracts, task completion guides, and project workday assessments. The strategies and tools were modeled in an introduction to education course for preservice teachers. Exposure to methods and strategies resulted in a more informed class that is better prepared to enact project-based learning effectively in their future classroom.

Keywords: Project-based learning, time management, classroom management

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Over the past decade, extensive research has been conducted that demonstrated project-based learning can be an effective strategy for enhancing student engagement and student achievement (Brush, et al., 2013). According to Grahame (2011), project-based learning is "a systematic teaching method that engages students in learning essential knowledge and life-enhancing skills through an extended, student-influenced inquiry process structured around complex, authentic questions and carefully designed products and tasks" (p. 95) Thomas (2000), states project-based learning is an innovative methodology used to provide instruction for students in an authentic work-related setting.

In addition to academic gains, the instructional method has been associated with improving attendance rates (Creghan & Adair-Creghan, 2015; Zusevics, Lemke, Harley, & Florsheim, 2013). According to Creghan and Adair-Creghan (2015), the attendance of economically disadvantaged students using project-based learning resulted in academic gains that were "statistically significant over a period of three years." It is not surprising that as administrators have become more aware of this research it has led more K-12 schools to adopt project-based learning (PBL) as an overarching model for their curriculum (Brush & Saye, 2017). If the benefits of PBL have been noted for an extensive period of time and the use of the method has expanded into most schools; it is important to consider why teachers have refused its incorporation. One reason, perhaps, is that teachers find the preparation of such projects overwhelming and the multiple ways students may showcase knowledge may result in teacher perception they have lost classroom control (Barton & Levstik, 2015). Teachers fear collaborative groups will become loud and move around the classroom again giving the perception to administrators that the class is unorganized and out of the control.

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Some teachers are fearful that the incorporation of such projects will limit the ability to cover the material that is essential for the students to master (Larmer, 2018). According to Baghoussi and El Ouchdi (2019), the two major obstacles teachers faced in applying project-based learning in their classrooms was controlling/managing the class and a shortage of time. Coverage of material is the cardinal educational goal of most teachers in this era of high stakes testing. This mentality often overvalues the teacher's lecture and leaves little room for alternative methods to be utilized in the classroom (Matheson, 2008). According to Minarechova (2012),

> "High-stakes testing interferes with teaching and learning. Under high-stakes testing, the way students are taught is changing along with the methods used and the way in which teachers approach instruction. Creative interdisciplinary activities and project-based investigations are being left out" (p. 91).

Preparing Preservice Teachers

Professors, currently, have limited impact on federal legislation that dictates educational policy. Their control lies in effective modeling of methodologies to effectively preservice teachers. This study examined two major elements that prevented teachers from enacting project-based learning, managing their students and using class time efficiently. For the purposes of this study, those skills were taught by using the project-based learning method. Prior research suggested that providing preservice teachers the opportunity to participate in a PBL activity suggested an increased likelihood that they would incorporate the method in their own classrooms (Park & Ertmer, 2008; So & Kim, 2009). Therefore, undergraduate students participating in this study were tasked with the development of a cross-curricular project-based learning task.

The secondary education students at our institution major in their field of study and minor in education. This results in college classrooms filled with students of diverse content area expertise, and therefore, provided an ideal opportunity for collaboration and the promotion of cross-curricular pedagogy. The significance of cross-curricular teaching according to Resnick (1989),

> is increased student motivation and engagement because when students experience an interdisciplinary approach, the value of what they are learning becomes clearer as they can apply their acquired competences to many subjects as well as to how they react to and operate in the real world (p. 33).

Strutchens and Martin (2017) claimed preservice teachers should be provided with an opportunity to look across grades to determine how the curriculum grows and how topics are interconnected and scaffolded. This experience encouraged preservice teachers to look across secondary grades and through multiple content area lenses to enhance their understanding of what a high school student was required to learn. The researchers felt it was essential to provide preservice teachers an opportunity to work collaboratively to develop a cross-curricular project-based learning task in a safe environment where they could be introduced to tools, watch actions of experienced teachers, and ask questions throughout the process.

Dr. Swift's Class

The project was introduced to students via a one-minute video clip created at a charter school within the same state as our institution. The video clip included commentary from stakeholders of the school that communicated positive experiences students had participating in cross-curricular project-based learning tasks. Preservice teachers were asked to envision themselves working at a school where the principal required them to develop a cross-curricular project-based learning task that covered the standards taught that school year.

For the purposes of this study, presevice teacher participants were required to develop an authentic, real-world, project-based inquiry task that incorporated at least one standard from three different content areas. Multiple intelligence domains were utilized to ensure students had choice of investigation methodology. In addition, participants were given choice as to which state standards would be addressed within their project. The structure of the learning task included opportunities to (1) reflect on process, (2) receive critiques from peers, and (3) make a public presentation. The project rubric inclusive of the above criteria was explained to all participants and included all seven-essential project-based learning elements deemed critical by Larmer and Mergendoller (2010).

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Identifying Pedagogy

Following the project introduction, several items were brought to the attention of the class. Group work was defined as an essential expectation with the rationale being that students frequently become familiar with content through the expertise of their peers. For problem-based learning to be successful, an environment of trust and respect must be in place. Students must feel free to risk without thought of reprisal. According to Solomon (2007), creating a classroom environment where students feel empowered because they can see themselves as capable of participating in and being doers of education is important.

As the class transitioned from discussion to group work, preservice teacher study participants started constructing a project-based learning task under the researcher's supervision. This provided an opportunity to model the actions of a teacher and provide tools that could be used in their classrooms. Kujansivu and Rosell (2000) suggested teachers be involved in the following activities when enacting PBL: (1) observe students, (2) listen to group discussions from a proper distance, (3) ask questions to groups who become stuck, (4) provide positive feedback to individuals and groups, (5) watch not only for students who readily participate and those who do not; but also investigate potential reasons for this, and (6) remind the groups about rules, roles, and norms.

In project-based learning, the role of the teacher changes from director to facilitator (Hmelo-Silver, 2004). As the preservice teachers worked to complete the team contract, the researcher visited each table asking what content areas are in each group. The work progress was monitored to (1) determine if all the group members participated, and (2) to determine those individuals that seemed to withdraw or who were occupying themselves with portable technology. If a student was disengaged, the researcher moved to the group and directed several questions to that individual focused on items from the team contract. In addition, off task students were asked about the problem they had identified and how it aligned with the targeted standards. The instructional goal was to push, encourage, and guide the students down their path of investigation, while still ensuring on task behavior was the norm.

Tools

To ensure the success of Project based learning, students were provided with a few tools. The first tool was a team contact (Swift, 2019). See Appendix A. The team contract gave students in each group a working document on which to note: (1) how decisions would be made, (2) when the group would meet, (3) how they would share information, (4) how they would ensure quality work, (5) which task each member would be responsible for, and (6) each member's contact information. The contract served as a visible representation that each member of the group was essential and was required to participate. To complete the document, each group member was required to provide input and sign the document, stating that they would uphold their responsibilities. The team contract helped manage behavior by including each group member in the process of making decisions. The contract helped facilitate communication, thus providing an opportunity for each person to check the status of their partners.

On the project introduction day, students were eager to get started and conduct research. Capitalizing on student excitement and interest in a topic helps a teacher manage the classroom. To harness that excitement and apply that energy to investigating topics is more easily managed when students understand clearly all expectations. It is important that teachers utilizing PBL projects provide students with a specific plan during an in-class workday. To model this, the preservice teachers were given an individual project work analysis document (Swift, 2019). See Appendix B. The document guided students through the research process by providing a template for the organization of their findings explained through highly focused and clearly stated steps. The individual project work analysis document enabled students to state the topic they researched, report findings, describe obstacles they faced, explain solutions they developed, and summarize their progress. Requiring preservice teachers to complete the individual work analysis document gave them insight into how a student should be using their time during the project workday when given a specific task aligned with a measurable and obtainable objective.

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Modeling

As preservice teachers investigated state standards that could be combined to craft an engaging real-world problem for students to overcome, the researcher worked alongside and demonstrated evidenced-based strategies known to help students achieve success. Both Hmelo-Silver (2004) and Swift (2018) asserted the importance of teacher mentorship and guidance in seeking content-based solutions to authentic scenarios. Therefore, the researcher in this project emphasized conversed with participating students at all stages of project development in an effort to ensure that (1) questions were answered in a timely fashion, (2) resources were available and (3) effective instructional strategies were conveyed clearly. Such conversations, however, often produced more student questions as they dove deeper into their chosen topic; thus, enabling the researcher to give additional resources and guidance. Saye and Brush (2002) refer to this process as providing soft scaffolds or the ability to "continuously diagnose the understandings of learners and provide timely support based on student responses" (p. 82) Lottero-Perdue (2017) communicated the importance of teaching soft scaffolds for interns learning to teach PBL.

As the project workday concluded, student discussions were held focused on their thoughts about utilization of all phases of PBL including graphic organizers, conversations with ensuing questions between professor and students, and the use of proximity to manage behaviors. By debriefing such actions that occurred throughout the class period, student attention was purposefully drawn to those behaviors giving the researcher opportunities to explain the significance of each scaffolded action.

Danielson (2008) claims reflection is an essential teaching practice. By including the preservice teachers in this task, it became an opportunity for growth. As the preservice teachers left class, they were required to turn in their individual project work analysis documents as part of their grade in the course.

Feedback

During the next class, the students received their individual project work analysis documents with feedback. The feedback addressed incomplete work, suggestions for further research, and positive comments. The preservice teachers were encouraged to stay after class for any additional questions they had or to discuss their ideas in more detail. Providing the students with feedback allowed the teacher to support student inquiry and shape the direction the students were taking by suggesting topics to review or questions to address. This task played a vital role in the enactment of project-based learning by providing feedback and revision opportunities. Despite the importance of the step, it consumed very little class time, providing an opportunity for the teacher to scaffold learning by introducing new information through a different method.

Communication

One week after introducing the project to the preservice teachers, the instructor related the bell work activity in class to the project by asking the preservice teachers to complete the project obligation evaluation document (Swift, 2019). See Appendix C. The preservice teachers used the time to meet with their group, report on progress of individually assigned tasks, and present their group with evidence of their work's progress. Each group member had an opportunity to verify (hold accountable) the progress of their team members by signing the project evaluation document. As each group finished discussing their progress, the professor reviewed each document, checking to see how each group member was evaluated by their peers. The purpose of the tool was the subject of a debriefing session with students where insurance of document validity was discussed. Appropriate strategies to address unfavorable peer evaluations were discussed as well. Finally, the value of the graphic organizer and how it could be a useful tool in managing the classroom and maximizing time was addressed.

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Presentation

The preservice teachers were eager to present their cross-curricular project-based lesson plans with their peers. Each group had an opportunity to share their work with the class. As the preservice teachers listened to the presentations, they were required to complete a critical friend's protocol. I discussed the importance of keeping the class engaged during the presentation and holding them accountable for the new knowledge that was discussed. Each member of the class was asked to keep track of one specific element they appreciated about each of the projects and to keep a record of either one question that surfaced from each presentation or a suggestion of further steps that might be taken to enhance the project. By giving students specific tasks to complete during each PBL presentation, they remained engaged throughout the learning activity. The task also provided rich commentary and feedback for each group, allowing them to hear the strengths of their project as well as areas that could be improved upon.

Findings

The researchers believe the enactment of a project-based learning task for preservice teachers was and continues to be a vital component in equipping them with the skills to be effective educators. Recent definitions of the requirements for high-quality teaching emphasized not only content and pedagogical knowledge but also the use of innovative instructional strategies to support students' acquisition of complex problem solving (Bell, 2010; U.S. Department of Education, 2010). Through the PBL experience in a foundational education course, students developed a project-based learning task that they can enact in their classrooms. More importantly, researched-based fears of enacting project-based learning were addressed in an authentic context.

Classroom Management

The preservice teachers were introduced to the instructional strategies teachers use when enacting project-based learning tasks. Baker (2005) stated that teachers require a wide variety of classroom management procedures to develop an effective learning environment for students. Some of the methods the preservice teachers observed included the use of proximity, redirection through questioning, and holding students accountable by requiring the completion of specific tasks.

Time Management

Providing methods to help the preservice teachers alleviate their fears of managing the classroom allowed us to focus on utilizing time effectively. The preservice teachers used several graphic organizers that held students accountable to complete specific tasks. Graphic organizers can support self-monitoring strategies that encourage students to review their work and assist with planning (Harris, Graham, Mason, & Friedlander, 2008). Dexter and Hughes (2011) suggest, teachers use graphic organizers to support students with planning and organization. The graphic organizers the preservice teachers used were constructed in a way that allowed for quick analysis, which allowed the professor to determine the students' progress in a few minutes. The preservice teachers discussed the function of the graphic organizers and the need to frequently check student progress without devoting large amounts of time to the task. The preservice teachers experienced the questioning of decisions and findings to encourage deeper analysis and continued research. This strategy helped keep the class engaged and proved to be useful in redirecting students who were off task.

Conclusion

By helping preservice teachers address the two major challenges and identify ways to overcome those challenges the preservice teachers became more confident in the development and enactment of project-based learning. The project-based learning task that was incorporated in the introductory education class provided the preservice teachers with skills, tools, and a deeper understanding to successfully enact project-based learning in their classrooms.

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Appendix A
Team Contract

Project Name:	Class Period:
How will decisions be made?	
When will the group meet?	
How will the group share information?	
How will you ensure quality work?	

Name:	Email or Cell #:
Task(s):	
Task(s) completion date:	
_____ Signature	_____ Date

Name:	Email or Cell #:
Task(s):	
Task(s) completion date:	
_____ Signature	_____ Date

Name:	Email or Cell #:
Task(s):	
Task(s) completion date:	
_____ Signature	_____ Date

Name:	Email or Cell #:
Task(s):	
Task(s) completion date:	
_____ Signature	_____ Date

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Appendix B
Individual Project Work Analysis Document

Name:	Project Title:	
Date:	Class Period:	
State Standard Related to Todays Work:		
Research Objective:		
Topic:	Action Step:	Data Source:
Findings:		
Research Objective:		
Topic:	Action Step:	Data Source:
Findings:		
Project Development Task:		
Action Step:	Results:	
Anticipated Obstacle:	Solution:	
Progress Made:		
Resources Needed:		

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Appendix C
Project Obligation Evaluation

Project Name:	**Class Period:**

Group Member:		
Task(s):		
Due Date:		
Status:		
Task approval of group member 1 ☐ ☐ _____ No Yes initial	Task approval of group member 2 ☐ ☐ _____ No Yes initial	Task approval of group member 3 ☐ ☐ _____ No Yes initial

Teacher approval _____

Group Member:		
Task(s):		
Due Date:		
Status:		
Task approval of group member 1 ☐ ☐ _____ No Yes initial	Task approval of group member 2 ☐ ☐ _____ No Yes initial	Task approval of group member 3 ☐ ☐ _____ No Yes initial

Teacher approval _____

Group Member:		
Task:		
Due Date(s):		
Status:		
Task approval of group member 1 ☐ ☐ _____ No Yes initial	Task approval of group member 2 ☐ ☐ _____ No Yes initial	Task approval of group member 3 ☐ ☐ _____ No Yes initial

Teacher approval _____

Group Member:		
Task(s):		
Due Date:		
Status:		
Task approval of group member 1 ☐ ☐ _____ No Yes initial	Task approval of group member 2 ☐ ☐ _____ No Yes initial	Task approval of group member 3 ☐ ☐ _____ No Yes initial

Teacher approval _____

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INSTRUCTIONAL RESEARCH-BASED PRACTICES RELATED TO AGRICULTURE SCIENCE

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Abstract

This paper describes the Professional Development for Secondary School Teachers and Educational Professionals (PD-STEP) into the STEM Field professional development grant activities. The PD-STEP in the STEM Field grant is a United States Department of Agriculture National Institute of Food and Agriculture's competitive grant awarded to Texas A&M International University a South Texas regional university located along the US-Mexico border. A total of $150,000 dollars were earmarked for the development and delivery of research-based instructional strategies via professional development activities. These focused activities addressed five South Texas rural school districts' secondary school mathematics, science and career and technology teachers' educational challenges related to teaching hands-on agriculture science lessons aligned to Texas curriculum standards. In addition, these challenges included as goals specifically targeted to increase (1) female, Hispanic, low-income, and/or migrant student participation in STEM-related classes, including Advanced Placement and dual enrollment, and (2) students' agricultural literacy skills through participation in both outreach/extension programs outside of school, and (3) field-based experience opportunities for students in five participating rural schools. This proposed project addresses Agriculture and Food Research Initiative (AFRI) Priority #6: Agriculture economics and rural communities.

Keywords: mathematics, agriculture, science, rural

Introduction

The goal of the Professional Development for Secondary School Teachers and Educational Professionals STEP into the STEM Field grant (PD-STEP) is to provide professional development for STEM teachers that identifies, utilizes, replicates, and disseminates instructional research-based best practices in an agricultural real-world context. This paper begins with a short review of the literature regarding rural schoolteachers' challenges. To that end, a recent study concluded that teachers in rural areas may lack resources that are more readily available to their suburban counterparts (Rhodes, 2014). Previous studies have shown that rural schools face multiple obstacles in comparison to their urban and suburban counterparts (Showalter, Hartman, Johnson, & Klein, 2019; Tine, 2017). Earlier studies have also emphasized that rural school teachers face situations where they must instruct students in content areas in which they have minimal training, or

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capacity to teach... and this includes STEM fields (Harmon, 2001; Jimmerson, 2004; Levin, Manship, Chambers, Johnson, & Blakenship, 2011). Therefore, the research question guiding this paper is:
How can authentic agriculture-science instructional research-based practices enhance rural teachers' pedagogy and self-efficacy?

This paper is organized in three sections. First, the authors provide a brief description of the Professional Development for Secondary School Teachers and Educational Professionals (PD-STEP) into the STEM Field grant. Second, the authors introduce PD-STEP professional development activities that address the need to:

- Increase female, Hispanic, low-income, and/or migrant participation in STEM-related classes including Advanced Placement and dual enrollment,
- Increase students' agricultural literacy skills through participation in outreach and extension programs outside of school, and
- Increase field-based experience opportunities for students in five participating rural schools.

Third, the authors present participating rural school districts' demographics to compare 11th and 12th grade students' participation in both the Advanced Placement /Dual Enrollment courses and the Texas Success Initiative mathematics and science exams. Coburn, Penuel & Guel proposed that "long-term, mutualistic collaborations between practitioners and researchers that are intentionally organized to investigate problems of practice and solutions for improving district outcomes" established collaborative relationships between practitioners and researchers (2013, pg. 2).

Description of the PD-STEP into the STEM Field Grant

The National Institute of Food and Agriculture (NIFA), and U.S. Department of Agriculture (USDA) awarded Texas A&M International University, the PD-STEP project to develop and provide a cadre of mathematics, science, and career and technical education (CATE) rural high school teacher teams (STEM Field Teams), innovative agricultural-based hybrid professional development opportunities. The PD-STEP Team proposed development of the STEM Field Model, a novel professional development strategy that utilized research-based instructional strategies aligned to curriculum standards that were purposefully centered on: (1) agricultural mathematics, science, and technology knowledge and skills; (2) specific needs of English language learners; and (3) indigenous, authentic agricultural topics through field-based experiences first (Mireles, 2017). The PD-STEP STEM Field model objectives were to:

1) Recruit every year (2019-2023) about 15 energetic mathematics, science, and CATE teacher teams from rural high schools which respectively included (Webb CISD, Zapata ISD, Jim Hogg ISD, Cotulla ISD, Freer ISD).
2) Host and facilitate a hybrid (1 week face-to-face and monthly online) innovative professional development workshops for teacher students in mathematics, science, and career and technology education (CATE) teams from selected rural high schools.
3) Develop a set of initial lesson plans for teachers attending faculty development consistent with the proposed STEM Field Model purpose of Agriculture & Food Research Initiative (AFRI), as well as develop a web-based repository.
4) Train teacher candidates to develop their own set of lesson plans and help them connect them to agriculture through enhanced hands -on activities in multidisciplinary areas related to STEM fields.
5) Use collected data to assess, refine, and expand the STEM Field Model in order to (a) replicate in other Texas rural high schools, (b) contribute to the research base, and (c) disseminate findings in scholarly- and practitioner-based conferences and journals.

PD-STEP Professional Development Activities

The authors developed PD-STEP professional development activities that addressed instructional research-based practices related to agriculture science to enhance rural teachers' pedagogy and self-efficacy. What follows is a description of each activity and its accompanying impact(s) on participants:

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Increasing Female, Hispanic, Low-Income, and/or Migrant Participation in STEM-Related Classes Including Advanced Placement and Dual Enrollment

The research-practice partnership goal in this activity was to provide teacher-participants with background knowledge related to learning in context and honoring the rural students' funds of knowledge and culture (Gonzalez, Moll, & Amanti, 2005). Learning in context is often thought to afford the greatest pay-off because: (a) it is more specific, i.e., literally applied to the situation; and (b) it is social, thereby developing shared and collective knowledge and commitments (Fullan, p. 417, 2002). Fullan (2002) defined the concept of *learning in context* as "opportunities to learn from others on-the-job, the daily fostering of current and future leaders, the selective retention of good ideas and best practices, the explicit monitoring of performance, and the like" (p. 417). In addition, Vygotsky's (1978) sociocultural theory aligns with this model, as teacher-participants and their students learn from more knowledgeable others in an apprentice-style environment. With such hands-on training, explicit instruction, development of lessons, and applicable experience, teacher-participants will become better prepared to facilitate instruction. PD-STEP professional development activities were planned and delivered by the PD-STEP project team. Teacher- participants collaborated in hands-on classroom instruction activities that focused on the development of engaging math and science lessons targeting critical thinking skills such as analyzing, evaluating, and explaining key elements within the PD-STEP into the STEM Field Lesson Plan Model.

Texas A&M Agrilife Extension Center representatives presented the *Learn, Grow, Eat, & Grow Project;* a curriculum overview session that included a cooking demonstration which incorporated health-eating habits within core content subjects like biology, chemistry, and algebra. Specifically, teacher-participants discussed how to use mathematics lessons to explain the importance of agricultural mathematics in rural communities. Subsequently, participants discussed how to incorporate science lessons in the teaching of day-to-day applications in the agricultural field via the integration of students' rural funds of knowledge (Moll, Amanti, Neff, & Gonzalez, 1992). The following is one of the participant's comments regarding the integration of mathematics and science, "*The hands-on activities were engaging and practical. They are ready to be used in the classroom. Integrating mathematics and science into one lesson was also added and evident.*"

In addition, teacher-participants shared innovative instructional methods with fellow teachers about the importance of STEM and CATE teachers' collaboration as evidenced in the following quote: "*This professional development will enable me to implement the LGEG lessons into my science classes and to work with the agriculture teacher to build a school garden*."

Unfortunately, teacher-participants' discussions about how much freedom teachers really have to deviate from concepts they must teach, or pre-established curriculum, and the time-periods imposed upon them, greatly influenced the depth to which the mathematics and science concepts were taught. Therefore, the PD-STEP project team focused on reassuring teacher participants that the PD-STEP lessons were not meant to replace their current lessons, but to supplement them. The following is a teacher-participant's comment which is an example of a positive outlook to the grant's professional

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development activities:

> *I do agree with the premise of creating and using a 'hook' for students to be lured into the STEM fields. That hook is where PD-STEP comes in. How we design and use this 'hook' is what we are examining in the PD-STEP grant program. Just as in fishing, we must 'lure' with certain 'bait' certain types of fish. Some fish are easy to catch and others will not be interested in our 'lure'. PD-STEP enables us to create and re-design these 'lures' so as to increase the 'fish' (students) being caught, thus interested in STEM related fields.*

Increasing Rural School Teachers' Agriculture-Related Knowledge

The intent of this professional development activity was to create opportunities for discussion between participating rural school teachers and a local botanist who had previously collaborated with the PD-STEP project team in the development of an outreach and extension program. The botanist participating in this project created a program where Texas-based organic gardening techniques and demonstrations for growing vegetables, fruits, herbs and other edible plants were the focus. Teacher-participants observed and participated in the preparation of soil for planting, and understand the importance of using environmentally native plants and friendly soil-enrichment practices at the Laredo, Texas Canseco House Garden.

In addition, the PD-STEP project team demonstrated math and science-based lesson plan connections with the PD-STEP into the STEM Field created lesson plan entitled *Beautiful Patterns* based on the Fibonacci sequence (Appendix 1). An important component of the Beautiful Patterns lesson was the inclusion of teachers' valuable input concerning the pros and cons of blending specific content and agricultural concepts into an authentic lesson within a rural setting. As one teacher participant stated:

> *I believe that all activities and lessons were helpful. I enjoyed the pattern lesson and the Master gardening lessons. These will further enhance our class participation. However, most of all the lessons were mainly pertaining to the average and gifted and talented students, one modification for next year would be to consider the special education students and how to involve them in the lessons that were presented.*

Increasing Field-Based Experience Opportunities

On July 19, 2018 – the teacher –participants and the PD-STEP project team travelled to the Texas –based East Foundation San Antonio Viejo Ranch where the Education Director presented the following extension and outreach science-based professional development activities: (1) Conservation and Land Stewardship, (2) Characteristics of Environments, (3) Structure/Function and Survival, (4) Inherited Traits and Resemblance, (5) Ecosystems - Biotic and Abiotic (6) Groundwater, Surface, Water, and

Watersheds, and (7) Populations and Communities. Teacher-participants were treated with outdoor activities in a natural habitat. A very interesting observation from the participants' perspective was that although they all teach in rural school settings, the natural setting in which the professional development was delivered was a revelation to nature and wildlife located in their backyards. A teacher-participant shared the following thought*: "It will enhance my teaching and practice by placing more emphasis on the preservation of our land."* Furthermore, another teacher-participant shared her thoughts about outdoor and field-based activities:

> *Outdoor activities are always good because they provide a change for students. Community involvement is important and can help to create unity. Recently, I have been attending professional development that emphasizes constructivist learning. PD-STEP professional development emphasizes student mathematics and science activities that build knowledge through these outdoor activities to teach concepts to students.*

PD-STEP into the STEM Field Partners' Demographics

The research-practice partners' demographic data are presented to provide the readers with a complete overview of the rural school students' mathematics and science skills gaps and/or academic challenges addressed by the Professional Development for Secondary School Teachers and Educational Professionals (PD-STEP) into the STEM Field grant. This included students' access to classes and field-mathematics- and science-based opportunities (Table 1). The five-districts' mean for Hispanic students was 95.4%, compared to the state average of 33.4%, and 95.4% economically challenged students compared to the state average of 56.2% (TEA, 2015a-e).

Table 1
2015-2016 TAPR District Reports on 2014-2015 Data

Participating School Districts	Advanced Course / Dual Credit Completion any subject (11-12)	Advanced Course / Dual Credit Completion (11-12) Mathematics	Advanced Course / Dual Credit Completion (11-12) Science	Texas Success Initiative College Readiness Mathematics	College Career Readiness Graduates White Students	College Career Readiness Graduates Hispanic Students
Cotulla ISD	38.9%	4.9%	0	6.3%	100%	70.8%
Freer ISD	22.7%	20.3%	0	6.7%	100%	100%
Jim Hogg ISD	32.4%	24.5.%	25%	36.7%	N/A	64.4%
Webb County Consolidated ISD	31.4%	17.2%	0	5.9%	N/A	64.7%
Zapata ISD	57%	53.2.%	25%	9.3%	N/A	72.8%

Source (TEA, 2015-2016 a, b, c, d & e)

Via the comparison of 2014-2015 data utilized for the submission of the PD-STEP into the STEM Field's Professional Development grant (Mireles, 2017) and 2015-2016 districts' data, the reader can observe that the five participating school districts experience challenges in having 11th and 12th grade students successfully attempt and master mathematics and science advanced course/dual credit exams (Table 1). According to individual interviews with rural school districts' representatives, South Texas rural districts'11th and 12th grade students' faced challenges that included: (1) parental education, (2) family income, (3) family structure, (4) number of siblings, and (5) parental educational expectations. Furthermore, the majority of 11th and 12th rural school students were not connected to an agricultural-based economy but rather experienced family pressure to join the booming Eagle Ford oil and gas boom that resulted in the creation of thousands of jobs across South Texas. The Eagle Ford oil and gas-based economy began in 2008 and reached its maximum peak in 2012. It is projected to continue on a growth curve until 2022 (Tunstall, et al., 2013).

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As previously mentioned, this research addressed rural schools' teachers' challenges with the intent to fill the literature gap on how instructional research-based practices related to agriculture science can enhance rural teachers' pedagogy and self-efficacy? Relatedly, Texas Education Commissioner, Mike Morath, launched the Texas Rural Schools Task Force (RSTF) in an effort to bring rural school superintendents together to discuss their districts' educational and geographical needs. The (RSTF) is composed of 20 Superintendents, one from each of the educational service centers across Texas. On April 3, 2017, the RSTF released four Texas rural school districts priorities, which were to: (1) increase teacher recruitment and retention efforts; (2) create pathways to implement House Bill 5/career and technology education; (3) build capacity on technical education support; and 4) support rural school districts in their quest for access to grants and contracts (TEA, 2017).

Additionally, participating rural school districts high schools reported challenges with 11th and 12th grade students in their attempts to take/pass the Texas Success Initiative College Readiness (TSI) mathematics test (Table 2). School districts cited reasons for low 11th and 12th grade students' participation in the mathematics and science TSI exams included the fact that: (a) enrollment in Algebra I is often the determining factor for taking the TSI mathematics exam; (b) students who score a 4000 in the Algebra End of Course test do not take the TSI Math exam and are placed in a dual credit mathematics class in 11th and 12th years after taking Algebra II; and (c) community-based employment opportunities that require a four-year college degree are lacking. Since "rural contexts shape students' career expectations and, consequently, their postsecondary education" decisions, researchers propose that rural school high school students aspire to obtain employment based on their heuristic experiences (Schmitt-Wilson, Downey, & Beck, p. 1, 2018).

Table 2

2016-2017 TAPR District Reports (based on 2015-2016 data)

Participating School Districts	Advanced Course / Dual Credit Completion any subject (11-12)	Advanced Course / Dual Credit Completion (11-12) Mathematics	Advanced Course / Dual Credit Completion (11-12) Science	Texas Success Initiative College Readiness Mathematics	College Career Readiness Graduates White Students	College Career Readiness Graduates Hispanic Students
Cotulla ISD	64.2%	56.4%	14.4%	16.9%	N/A	60.3%
Freer ISD	21.1%	20.3%	0	25.6.%	N/A	97.5%
Jim Hogg ISD	50.0%	36%	5.5%	21.4%	N/A	83.6%
Webb County Consolidated ISD	31.4%	17.2%	0	17.2%	N/A	51.9%
Zapata ISD	57.2%	59.2%	11.7%	9.8%	N/A	84.2%

Source (TEA, 2016-2017 a, b, c, d &e

Discussion and Summary

Data obtained from participating rural school district teachers from indicated that STEM teachers play multiple roles within a school setting. Relatedly, sixty percent of the teacher- participants reported teaching 9th-12th grade students of diverse academic needs. In spite of this, similar to Tine (2017) findings, PD-STEP into the STEM Field participants reported that there were advantages to teaching in rural school settings such as the smaller student-to-teacher ratios, which customarily equate to more time for teachers to differentiate instruction and build stronger connections with their students. Nevertheless, some teachers reported that they had to prepare to teach multiple subjects with challenging course preparation times due to lack of content-based academic knowledge teachers at their respective high schools. In essence, these challenges could contribute to lower teacher attrition rates in rural school districts (Johnson & Zoellener, 2016; Tine, 2017). Preliminary data collected via teacher-participants' surveys correlated with rural school literature related to cross-certified teachers who were

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highly sought after by rural school districts. The literature also documented that this type of educator is often a challenge to find, hire and retain (Johnson & Zoellener, 2016; Tine, 2017). Similar to Tine (2017) findings, the PD-STEP teacher-participants did not report any frustration about their individual teaching assignments. Perhaps this was due to the fact that working in a rural school setting (as compared to larger school districts) resulted in smaller class sizes which translated into a reduction in paperwork and record keeping. Therefore, in comparison to their metroplex colleagues, rural educators enjoyed more time to build instructional activities that were more meaningful and relevant for their students. Unfortunately, based on the small size of the five rural Texas communities investigated for this study, school principals reported that a majority of graduating seniors migrated to larger urban areas for more attractive employment options.

Additionally, in the same pre- professional development survey teacher-participants revealed what previous studies have already concluded, one hundred percent of the PD-STEP participants concurred that they felt isolated (Showalter, et al. 2019). Therefore, the project team's challenge is to develop strategies to meet the professional needs of rural schoolteachers that address more networking and mentoring. This proposed project addressed the Agriculture and Food Research Initiative (AFRI) Priority #6: Agriculture economics and rural communities. Moving forward, the PD-STEP project team will continue to develop real-world settings instructional research-based practices related to agriculture science to enhance rural teachers' pedagogy and self-efficacy strategies. Furthermore, in order to continue to investigate the expected outcomes, the PD-STEP project team has to recognize the "role of geographic and community contexts in students' outcomes" (Sheridan, Bovaird, Glover, Garbacz, Witte, & Kwon, p.34, 2012).

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Appendix A
Title: Beautiful Patterns

Grade Level(s) and Focus Area

PD-STEP lessons should be appropriate to for 9th-12th grades focusing on Mathematics and Sciences.

The Texas Education Agency updated Career and Technology Essential Knowledge and Skills (CTE) to be implemented in 2017. Although, the PD-STEP into the STEM FIELD Project Team acknowledges that currently 16 (CTE) clusters exist in TAC § 130 for the purposes of the PD-STEP Lessons the focus will be on the following clusters:
Please mark the appropriate CTE cluster for the lesson: if applicable:

__x_ Agriculture, Food and Natural Resources
__x_ Education and Training
____ Health Science
____ Human Services

Identify Subject Area- Select and add all that apply

Teachers, please note that you will have the flexibility to select appropriate subject specific TEKS for your respective lesson:

Algebra I	x	Geometry	x	AP Biology	x	AP Chemistry		AP Environmental Science	

Content Objective(s):

1. Students will apply **mathematics** to problems arising in everyday life, society, and the workplace at 80% accuracy (TEKS **§** 111.42. Geometry).
2. Students will apply **science and technology** to problems arising in everyday life, society, and the workplace at 80% accuracy (TEKS **§** 127.11 - §127.16).
3. Students will identify the interrelationships among the resources within the **biology** system at 80% accuracy (TEKS §112.34. Biology).
4. Students will identify the interrelationships among the resources within Students will identify the interrelationships among the resources within the **Principles of Agriculture, Food, and Natural Resource** at 80% accuracy (TEKS § §130.2. Principles of Agriculture, Food, and Natural Resources)
5. Students will practice some math and science concepts in Nature.

Students Learning Outcomes (SLOs):

GEOMETRY: http://ritter.tea.state.tx.us/rules/tac/chapter111/ch111c.html#111.41

- The 9-12 teacher students will explain that different vegetable plants have different space requirements and that these requirements are listed on the seed packet.
- The 9-12 teacher students work with a partner to plant a garden, using given information on how far apart different vegetables should be planted.
- The 9-12 teacher students will identify different types of spirals.
- The 9-12 teacher students will calculate Fibonacci sequence of their own plants.
- The 9-12 teacher students will measure the golden ratio relative to a given row-length with at least 80% accuracy when growing their own plants.
- The 9-12 teacher students will relate the golden ratio to the Fibonacci sequence.
- The 9-12 teacher students will model the growth pattern algebraically (linear, quadratic, exponential) with at least 80% accuracy when growing their own plants.
- The 9-12 teacher students will calculate area and parameter of the different crops planted with at least 80% accuracy when growing their own plants.

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Biology
http://ritter.tea.state.tx.us/rules/tac/chapter112/ch112c.html

- The 9-12 teacher students will identify the steps of the scientific method and create a poster for evaluation.

Principles of Agriculture, Food, and Natural Resources
http://ritter.tea.state.tx.us/rules/tac/chapter130/ch130a.html

- The 9-12 teacher students will measure and calculate human dimensions to prove or disprove a theory.

Purpose of Agriculture & Food Research Initiative (AFRI):

- Sustainability
- Mitigating impacts of biotic and abiotic constraints of food production
- Animal Systems

Materials Needed:
List the materials needed to use in this lesson:

Mathematics Material:

- Flower petals, Seed heads, Cauliflower florets, Pinecone, Apples.
- Computer, internet connection, and projector to show videos.
- Copies of related Worksheet for each group.
- Sharpie pens, sparkly glues, plain colored tapes, ruler.

Science Material:

- Meter stick
- Measuring tape
- Graph paper
- Computer, internet connection, and projector to show videos.
- Copies of related Worksheet for each group.
- Sharpie pens, sparkly glues, plain colored tapes

Suggested List of Related Website Information for Teachers:
Da Vinci's Vitruvian Man of math - James Earle
https://www.youtube.com/watch?v=aMsaFP3kgqQ

Golden ratio explanation (cartoon)
https://www.youtube.com/watch?v=Wcq5x8rSMXo

Golden Ratio
https://www.mathsisfun.com/numbers/golden-ratio.html

MATHEMATICS

- Doodling in Math: Spirals, Fibonacci, and Being a Plant [1 of 3]
- **http://thehelpfulartteacher.blogspot.com/2012/01/spiral.html**
- **http://education.abc.net.au/home#!/media/1003900/spiral-away-with-fibonacci**

SCIENCE

Engagement Activity:

- Each PD-STEP lesson should start with an activity that stimulate students' prior knowledge. This activity should last approximately 5 minutes.
- Teaching Nutrition (Tips for Healthy Living)
- Take Charge of Your Health: A Guide for Teenagers

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Instructional Strategy
This lesson will follow the reciprocal teaching (***Palinscar & Brown, 1984***) instructional strategy. Students will observe their teacher explain the student learning objectives and will work in small groups to implement the explicitly taught procedures during each of the stages of preparing the materials for the garden, planting the seeds, taking care of the garden, collecting data from the garden during this lesson, and interpreting the results.

Lesson: The lesson will expand over 4- 6 weeks.

1. **Vocabulary instruction-** The following vocabulary words will be introduced, explained, and assessed during this lesson

Mathematic Vocabulary:
Algorithm: A step-by-step procedure for solving a problem.
Sequence: A set of elements ordered in a certain way.
Spirals: In mathematics, a spiral is a curve which emanates from a point, moving farther away as it revolves around the point.
Fibonacci sequence: The Fibonacci Sequence is the series of numbers:

0, 1, 1, 2, 3, 5, 8, 13, 21, 34, ...

The next number is found by adding up the two numbers before it. The 2 is found by adding the two numbers before it (1+1). The 3 is found by adding the two numbers before it (1+2), And the 5 is (2+3), and so on!

Golden ratio: The golden ratio (symbol is the Greek letter "phi" φ) is a special number approximately equal to 1.618… It appears many times in geometry, art, architecture and other areas. https://www.mathsisfun.com/numbers/golden-ratio.html

Science Vocabulary:
Scientific Method- a method of procedure that has characterized natural science since the 17th century, consisting in systematic observation, measurement, and experiment, and the formulation, testing, and modification of hypotheses.
Hypothesis-a supposition or proposed explanation made on the basis of limited evidence as a starting point for further investigation.
Theory- a supposition or a system of ideas intended to explain something, especially one based on general principles independent of the thing to be explained.
Vitruvius

2. **Reading-** The teacher and students will read an excerpt from the *Take Charge of your Health: A Guide for Teenagers* and Learning about Proteins http://kidshealth.org/en/kids/protein.html and discuss the importance of maintaining a healthy diet and exercise.

   Leonardo's vitruvian man-Reading passage
   https://leonardodavinci.stanford.edu/submissions/clabaugh/history/leonardo.html

3. **Lab Experiment/Hands-on Activity**- In this lesson the 9-12 teacher students will achive the following TEKS objectives:

Mathematics:
Resources for Mathematics activities:
- Doodling in Math: Spirals, Fibonacci, and Being a Plant [1 of 3] http://static.discoveryeducation.com/feeds/www/media/pdf/Lesson-Plans/numbersnature.pdf
- http://youtu.be/lOIP_Z_-0Hs
- http://youtu.be/14-NdQwKz9w
- **http://thehelpfulartteacher.blogspot.com/2012/01/spiral.html**

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Day/ Week	TEKS Objective	Math Model Activities
1	5A Geometry	The 9-12 teacher students will measure relative growth to specific length and width for different plants and then will calculate the Golden ratio and relate that to Fibonacci sequences.
	1A-G	The 9-12 teacher students may use any combination of vegetables that they choose, as long as they follow the space requirements. Also, give students about 30 minutes to discuss the design of their gardens with their partners. The 9-12 teacher students will identify different types of spirals. And the teacher will work with students to: 1. Prepare 10 beds, each bed with 5 feet width and 60 feet long. You will need both the length and the width for a rectangular piece of land, so say it is 70 ft. x 60 ft. 2. Count the number of plants (or sellable units) that you have per square foot. 3. Calculate the Fibonacci sequence related to the plant. 4. Calculate the Golden ratio and will relate the Golden ratio to the Fibonacci sequence. 5. Calculate the area of the above given planted examples with at least 80% accuracy when growing their own plants. .

Science:

Day/Week	TEKS Objective	Science Model Activities	Resources
1	2A-H (Bio)	The student will identify the steps of the scientific method by evaualting the Vitruvian Man Theory.	https://www.slideshare.net/stubeck/vitruvian-man-lab-for-freshmen-biology
	12A-B (AFRI)	The student will explore the legitimacy of Vitruvius' theory by developing a hypothesis regarding the Vitruvian Man by measuring human dimensions.	https://www.alvordschools.org/site/handlers/filedownload.ashx?moduleinstanceid=13792&dataid=22600&FileName=Lab%20-%20Vitruvian%20Man%20Hypothesis.pdf

4. **Creative assignment**
   Teachers will provide students with a journal entry. Each student will be expected to observe and record their findings in the journal. Suggested example of a journal here in this link:

5. **Scientific Classification:**
   Students should already have a good understanding of the science, art, and proportions.

6. **Application to Real World Problem:**
   Each lesson will identify key problems of local importance that impacts regional, national, global sustainability of organic and urban agricultural systems. For at least 40% of the instructional time the teacher needs to conduct hands-on laboratory and field investigations using safe, environmentally appropriate, and ethical practices.

Math Topic:

Fractals are patterns formed from chaotic equations and contain **self-similar patterns** of complexity increasing with magnification. If you divide a fractal pattern into parts, you get a nearly identical reduced-size copy of the whole. Its pattern is a natural representation of the **Fibonacci or golden spiral**, a logarithmic spiral where every quarter turn is farther from the origin by a factor of phi, the golden ratio. This is a number roughly equal to 1.618 and is known to produce the most aesthetically pleasing shapes by creating balanced proportions. **The Golden Ratio** ties in with the **Fibonacci Sequence**- that phenomenon with this series of numbers: 0, 1, 1, 2, 3, 5, 8, 13, 21, 34 ... where the next number is the sum of the previous two numbers. The ratio of any two successive numbers in the sequence is approximately **the Golden Ratio**.

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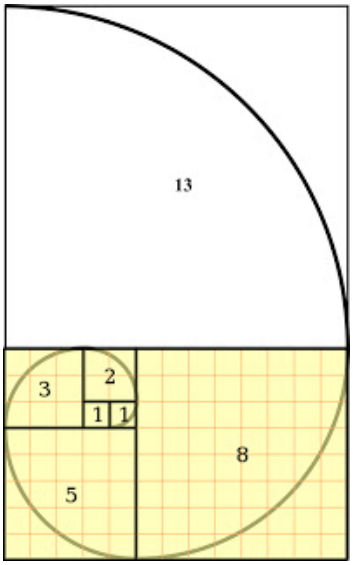

Science Topic:
One of the most common uses of the Vitruvian Man today is as an image associated with health/fitness, and with the practice of medicine. How can the body prove the theory?
In some cases, the Vitruvian Man is himself taken as an embodiment of health. How does it seem to be used more symbolically, as an image of science, art, and proportion enmeshed to embody the practice of medicine?

7. **Differentiation of instruction:**
   Teachers need to accommodate and/or modify the lesson's activities for ELL students by using instructional strategies like peer-to-peer assistance, one-to-one guidance, visual aids, and enrichment activities. Gifted and Talented (GT) students and/or students with exceptionalities will work on research, create presentations and might participate in district, local, state and national conferences.

8. **Closure:**
   This lesson's activities will be evaluated using two different culminating activities:
   - **Garden Worksheet:**
     Prepare your worksheet where the given information are clearly listed, then continue calculating the required information. Summarize and interpret your results.

crop	Cauliflower	Sunflowers	Purple onion	Cabbage
Type of spiral				
Fibonacci Sequence				
Golden ratio				
Area				
Units				

   - **Group Presentation on the Value of Plant Growth and Sustainability:**

.

   - Students can make a comic strip of the Vitruvian Man Theory. Alternatively, they could make a story book by taking three sheets of white computer papers, folding them in half, and stapling them in the seam.

Performance Assessment:
Students' formal assessment can consist of grading rubrics, pre and post lesson assessments for the lessons (2-4) developed by the PD-STEP team and the lesson appropriate deliverables:
1. Individual Daily Science Journal.
2. Group Work (Working with peers in planting and maintaining their garden space).
3. Individual Contribution to the Garden Worksheet and a Group Presentation on the Value of Plant Growth and Sustainability.

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4. Students who fully participate in 100% of the activities listed above will be awarded full credit and those students who do not will be evaluated according to their contributions.
5. Pre and Post Assessments for the selected PD-STEP lessons.

Follow-Up:

List any plans for follow-up here:

- Discuss whether students found anything difficult when creating their garden designs.
- Were they surprised by the amount of garden space some vegetables needed?
- Field Base Experiences:
    1. Vegetables need space between them so they can get all the water and food they need. Plants like pumpkin and melons need plenty of space to spread out. Other plants, like radishes and onions, don't need as much space. Gardeners usually plant their vegetables in rows. That way they can walk between the plants and take care of them.
    2. Give students a few seed packets to pass around, showing them where the spacing information can be found.
    3. Demonstrate the garden design by placing a broccoli on the grid and asking, "If I plant one head of broccoli here, where can I plant the second one?"
    4. Units and measurements used in farming are fairly unfamiliar to other areas. For example, it is hard to understand the size of an acre because our minds are trained to visualize miles or kilometers. We can use conversions to put an acre into perspective. There are 43,560 square feet in an acre. This is slightly smaller than the size of a football field, without the end zones.

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BOOK REVIEW

A Student's Guide to Academic and Professional Writing in Education

Authors: Katie O. Arosteguy, Allison Bright, Brenda J. Rinard, and Mya Poe

Publisher: Teachers College Press (2019)

This book review is presented by Thomas L. Hansen, Ph.D. Dr. Hansen is an education consultant and teaches courses as an adjunct in education and writing. He is a former State Supervisor for Foreign Languages for Illinois K-12 schools.

Katie O. Arosteguy, Allison Bright, and Brenda J. Rinard, faculty members in the University Writing Program at the University of California-Davis, wrote *A Student's Guide to Academic and Professional Writing in Education*. The authors teach a writing in education course. When first assigned to teach this course, the authors realized there was no textbook available that covered the material in a way that spoke to the nuances of academic and professional writing in the field of education. The three authors decided not to cobble together materials for all the disparate types of writing and assignments. Instead, they designed this text that has resulted in a targeted curriculum purposely focused on guiding education majors at all academic and professional continuum points- from the first significant writing projects to the professional writing they will complete as classroom teachers.

It is my custom not to give away all of the information or strategies found in the text, as I feel the reader should be involved in creating unique and individual meaning. In this review, I do provide chapter titles, overall categories, and direct comments.

The text comprises ten chapters; the first four are titled: *The Educational Landscape: How and Why Educators Write*, *Style Issues in Writing in Education*, *Writing a Reading Purpose*, and *Writing with Scholarly Sources: Annotated Bibliographies and Research Papers*. The fifth chapter, *Writing with Qualitative Data: Field Logs, Observation Write-Ups, Profiles, and Case Studies*, is my favorite. Each of the chapters explores, in clearly articulated language, the essential pieces of contemporary education career trajectories. The authors include both case studies and action research, two current and important elements in educational research and conversations.

The next three chapters are foundational for novice educators due to the clear connection to concepts inherently taught in successful educator preparation programs*: Writing Lesson Plans, Writing Teaching Philosophies, and Writing Critical Reflections*. Beginning with initial education coursework, teacher candidates must start thinking about classroom application of the theories, strategies, and methodologies under study. There is no downtime while they take their courses in higher education. Unlike many other majors, education forces students to garner and articulate perceptions of ideas, strategies, procedures, routines, and relationship building early in their careers, long before they even get to the gate.

The next chapter is a timely one, indeed: *Writing Proposals for Educational Policy Change*. At a time when everything about education at all levels is being questioned (and many powerful non-educators attempt to devalue schooling in an effort to serve personal agendas); it is very important that teachers are able to articulate their views, the needs of students, the benefits and challenges of schools in their communities, and many other topics, issues, and arguments.
The book's final chapter deals with the educator's need to master APA style in the research documentation process.
This book contains pertinent information for novice education majors to use at any point on their career path, from college entrance through graduation. Veteran teachers could also use the book in professional development settings as a refresher and reminder of appropriate style.

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The authors regret that the book does not contain a chapter on quantitative research. I would suggest that the lack of such a chapter may have been because education majors generally take a course on quantitative methods. However, the authors believe this to be a mistake because professors will need to include quantitative research information, possibly realigning this content from other courses for the proposed writing course to provide a comprehensive preparation.

Despite the lack of a quantitative research chapter, I still recommend this text and consider the book an overall good guide for education majors. Helping teacher candidates with the vast variety of writing formats and requirements is important work. The authors have done a very good job of covering almost all the bases.

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