Exploring Technology Competencies of Field-Based Teacher Educators

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

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Introduction and Background

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

Statement of the Problem

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

Purpose

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

This research builds on the recently released Teacher Educator Technology Competencies (TETCs). Drawing on the United States Department of Education's 2017 National Educational Technology Plan, Foulger et al. (2017) identified a list of 12 technology-based competencies so that teacher educators could provide consistent and appropriate experiences with technology for teacher candidates. Knezek et al. (2019) developed and validated a 12-item Likert-style survey which can be used to examine teacher educators' technology competencies. Ultimately, the research seeks to deliver on the stated hope of Knezek et al. where “teacher education programs could use the instrument as a tool to guide teacher educator professional development focused on enhancing the integration of technology to prepare future teachers” (2019, p. 466). Through the use of this survey, we hope to gain a broader understanding of the technology competencies possessed by cooperating teachers.

Research Questions

This study is guided by the following research questions:

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

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

Review of Related Literature

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

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

Cooperating Teachers Technology Competencies

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

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

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

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

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

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

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

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

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

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

Methodology

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

Population and Sample

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

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

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

Data Collection and Analysis

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

In addition to the 12 Likert-type questions, several demographic questions (district, grade level, content area, years of teaching experience, education level, etc.) were included to help identify influencing factors that may impact participants' technology competencies. The survey also included one open-ended survey question which examines the technological challenges participants encountered while mentoring teacher candidates during the pandemic. Responses were exported from Qualtrics to SPSS for data analysis to identify critical trends that influence cooperating teachers' TETCs knowledge. Both descriptive and inferential statistical analysis were conducted to determine the pattern and relationships that exist within data collected. To analyze the responses to the open-ended questions, participants' responses were grouped into thematic clusters and examined for emergent trends (Creswell, 2012).

Results

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

Cooperating teachers' self-assessment of their technology competency

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

Table 2: *Cooperating Teachers Technology Self-Assessment*

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

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

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

Table 3: *Challenges faced by Cooperating Teachers*

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

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

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

Discussion of Findings

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

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

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

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

While the true impact is unknown, the results identify that all cooperating teachers report possessing a high level of technology competency regardless of years of experience, content area, grade level or other demographic qualifiers. This is important information for teacher education programs that have increased field experiences to better bridge theory and practice for teacher candidates. For example, the participating university uses a Professional Development School model where the majority of teacher candidates spend an extended amount of time in the classroom through the partnership (Parker, et al. 2016). With the high level of technology competencies that cooperating teachers reported, universities may be confident that technology integration is being effectively modeled for teacher candidates during their internships. The findings from this study also strongly suggest that cooperating teachers' demographic factors-level of education, experience and knowledge has no significant on their application of TETCs while mentoring teacher candidates. Future research including other forms of data (observations, interviews, etc.) may confirm whether these self-reported assessments are reflected in cooperating teachers' classroom practices.

Implications for Practice

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

Suggestions for Future Research

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

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

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

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

Conclusion

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

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