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Christian E. Legler
Wayne State College, chlegle1@wsc.edu

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Supporting STEM Teachers through Online Induction: An E-Mentor's Exploration in Cyberspace

Christian E. Legler
Wayne State College

Abstract

This self-study examines the processes involved in e-mentoring novice STEM teachers while using a university-sponsored comprehensive online induction platform. During this self-study, I e-mentored three STEM teachers for four months. The self-study of teaching and teacher education practices (S-STTEP) methodology was used to study my own e-mentoring facilitation. Data were collected from interviews, online textual data, and my own personal reflective journals. By studying the process of e-mentoring, I gained a more thorough understanding of the challenges involved in e-mentoring novice STEM teachers. This research also helped me better understand the induction of novice STEM teachers through e-mentoring on a university-sponsored online induction platform.

Keywords: online induction, e-mentoring, STEM, self-study

E-mentoring has been used to support novice teachers who may not have adequate school-based mentoring. Smith and Israel (2010) define e-mentoring as “the use of online tools such as e-mail, discussion boards, chat rooms, blogs, web conferencing, and growing internet-based solutions that are changing the way mentors and mentees interact” (p. 30). E-mentoring can provide beginning teachers with a peer in the same discipline even if that person does not teach at the same school. The perceived lack of e-mentoring support for new STEM teachers led to my interest in conducting a self-study of my own e-mentoring teacher education practices. A self-study is defined as the “critical examination of one’s actions and the context of those actions in order to achieve a more conscious mode of professional activity” (Samaras, 2002, p. xiii). By studying the process of e-mentoring through self-study, I felt that I could gain a more thorough understanding of the challenges involved in e-mentoring beginning STEM teachers. Additionally, I felt that this research could help me better understand the induction of new STEM teachers through e-mentoring on a university-sponsored online induction platform.

Literature Review

What does the research say about the needs of beginning STEM teachers?

Some beginning teachers leave the profession because they do not receive the support they need. In the United States, the attrition rates for new teachers within the first five years is 42% (Perda, 2013). When new teachers have a mentor in their own subject area, the risk of those teachers resigning at the end of the school year is reduced by 30%. Even a mentor outside of their subject area reduces the risk of attrition by 18% (Smith & Ingersoll, 2004). Beginning teachers

require a myriad of supports from mentors and school leaders to thrive in the classroom. The Excellence in Teaching program 2010 Excel Award winners identified that to become highly effective, new teachers need help with lesson planning, classroom management, professional decision-making, routine school procedures, modeling, effective mentoring relationships, and support from school administrators (Ross et al., 2011). Similarly, in a needs survey administered to 594 new and experienced STEM teachers, Jones et al. (2016) found that both groups needed the most support with instructional strategies, data literacy, and differentiated instruction. The findings from these two studies suggest that mentors could meet the needs of mentees if the mentor lacks content knowledge.

What does the research say about online induction?

Technological advancements in computer-mediated communication (CMC), or synchronous or asynchronous online communication tools, have transformed teacher induction. Online induction has emerged from these advancements in technology as a specific type of induction that requires the use of CMC tools. Online induction utilizes CMC tools to facilitate mentoring, collaboration, and reflection. The mentoring component of online induction is often referred to as e-mentoring. The flexible nature of online induction makes it possible for school systems to provide support when traditional teacher induction programs (TIPs) with face-to-face support are not a viable option.

Recent online induction studies primarily focus on e-mentoring support for beginning teachers, online induction support through online learning communities (OLCs), and the development of new teacher's reflective skills. Studies by Bang and Luft (2014), Hunt et al. (2013), and Jones et al. (2016) provide insight into how e-mentoring supports novice content area and special education teachers.

Bang and Luft (2014) investigated the interactions of novice teachers and experts in a subject-specific, e-mentoring program developed to boost STEM achievement. The interactions between two beginning science teachers and their mentor teachers were examined over the course of one year. WebCT served as the online platform for communication between mentors and mentees. This platform included a virtual room for asynchronous communication between mentors and mentees. During the study, participants were advised to post comments approximately four times a week regarding science teaching issues. In addition, e-mentors and mentees were asked to plan, implement, and reflect on a lesson together. Computer-mediated discourse analysis was used to analyze participation patterns, interaction, and social behavior. The findings indicated that all participants felt like they were partnered with like-minded individuals, and the experience helped them develop a sense of comradery. Mentees believed that online mentoring helped their teaching practices, while e-mentors believed that the experience helped them improve their pedagogical content knowledge. This study was significant because the formal e-mentoring partnerships afforded benefits to both mentors and mentees. Additionally, asynchronous communication tools within an online platform offered flexibility of time and location.

Hunt et al. (2013) examined the efficacy of novice special education teachers using the New Teacher Center's Electronic Mentoring for Student Success (eMSS) mentoring and induction platform. The New Teacher Center (NTC) is a non-profit organization driven to improve student achievement by contributing to the effectiveness of novice teachers and administrators ("About New Teacher Center," n.d.). Twenty-two novice special education teachers participated in the

eMSS e-mentoring program. Data was collected from a pre- and post-survey that was administered to these teachers. The eMSS platform was designed to provide mentoring according to a teachers' content area or exceptionality specialization (e-Mentoring for Student Success (eMSS),” n.d). However, Hunt et al. (2013) found that the perceptions of the novice teachers regarding knowledge acquisition, teaching practices, and professional growth were unfavorable. This study was important because the results indicated that “one size fits all” online induction programs may not be appropriately tailored to the needs of novice teachers who teach in different contexts.

Jones et al. (2016) piloted the Florida STEM TIPS online induction platform with four school district partners. STEM TIPS supports school district induction programs with the goal of retaining new STEM teachers. The platform includes online curriculum resources and an array of CMC tools designed to facilitate communication between mentors and mentees. Jones et al. (2016) examined the impact of the platform by administering a survey to 1075 enrolled users. Sixty-one teachers completed the survey. The data indicated that new teachers requested support for lesson planning, instructional strategies, data literacy, and differentiated instruction. Respondents indicated that the flexibility of the platform helped to meet the complicated needs of teachers. The findings also showed that 34 out of the 61 respondents shared that lack of time affected their usage of the platform. Finally, the platform was shown to help teachers solve their problems without worrying about how they would be perceived by mentors.

The results of Bang and Luft (2014), Hunt et al. (2013), and Jones et al. (2016) show that there is a need for e-mentoring for novice teachers who teach within the same subject area, exceptionality, or grade level. While Bang and Luft (2014) found that tailored e-mentoring programs provide benefits to mentors and mentees, it is apparent from the findings of Hunt et al. (2013) that careful consideration is required in the design of e-mentoring support for new teachers who require specialized support. In other findings, Jones et al. (2016) reported that beginning STEM teachers requested e-mentoring support for instructional planning including teaching strategies, differentiating instruction, and using data. Additionally, time was considered a factor for those teachers who did not interact with e-mentors.

Some online induction programs feature OLCs as the primary means of support for novice teachers. OLCs evolved from professional learning communities (PLCs) which are comprised of a small group of practitioners who collaboratively work together to focus on learning and hold each other accountable for results (DuFour, 2004). OLCs also work toward these aims but are carried out with CMC tools.

Taranto (2011) examined how OLCs and TIPs complement each other with CMCs. This study used a mixed-methods approach. Quantitative data included surveys and tracking of the types of social interactions that took place on the wiki. Qualitative data included textual data from discussion board threads, questionnaires, and transcriptions from focus group interviews. A cohort of 16 new teachers who were hired for the 2009-2010 academic year participated in this study for one year. The OLC investigated in this study included participation on the wiki by a wide variety of educators including four experienced teachers, five district administrators, five principals, and four professors. The OLC was housed on Wikispaces, an online wiki platform. Wikis are a collaborative CMC tool that allows users to edit the content of the website. The researcher created wiki pages based on professional development themes from a pilot study. Within each wiki page, the researcher uploaded content to share with participants. Additionally, a discussion board was created on each wiki page to stimulate discussion. Taranto (2011) found that new teachers in the

study supported the use of the OLC. In addition, all the new teachers in the study reported that the online learning community was helpful and useful and contributed to improved classroom instruction.

OLCs can also be developed through school-university partnerships. Donne and Lin (2013) examined how a university-sponsored online induction website supported recent special education teacher education program graduates. In response to limited funding, the small private university involved in the partnership initiated the OLC to fulfill state requirements and support new teachers. Additional goals of the initiative included providing professional support, developing a peer mentoring community, and sharing resources and experiences. A wiki served as the platform for the OLC. The wiki included sections such as “Working as a Special Educator,” “Teacher Community,” and “Stay Connected with the University.” Data were collected on frequency and use of specific resources on the wiki for one year. The results showed that 83% of graduates participated on the wiki, although the total number of graduates was not provided. Graduates benefited from the wiki through the contributions from multiple users. The wiki also provided a free platform where it was unnecessary to have a designated leader. Finally, the wiki was flexible in terms of time and location. The study by Donne and Lin (2013) illustrated how universities can provide low-cost support for school districts.

The studies by Donne and Lin (2013), and Taranto (2011) support the use of OLCs for induction. Wikis were found to have multiple benefits for beginning teachers (Donne & Lin, 2013; Taranto, 2011). While Taranto (2011) found that wikis impacted classroom instruction, Donne and Lin (2013) found that wikis provide financial savings to educational institutions.

A limited number of studies have examined the effectiveness of technology tools that are used for reflection in online induction. In one study, Hwang and Vrongistinos (2012) investigated the Quality Teachers for Quality Students (QTQS) project developed by the University of Southern California. The purpose of the QTQS project was to increase instructional support for beginning teachers who were working with English language learners (ELLs) in San Bernardino County, California. The QTQS project featured an online support platform that provided opportunities for mentoring, training, support, and networking with experienced teachers and university faculty. Thirteen beginning teachers and four mentor teachers participated in the study. Participants in the study were experienced teachers who served as mentors and the new teachers who were the mentees. Three mentees were assigned to work with one mentor. Mentors primarily supported mentees with the instructional strategies for ELLs. Initially, Blackboard was the technology tool used to support mentoring partnerships in the online platform. This technology is a web-based learning management system that provides several learning and communication tools. Skype, a video conferencing tool, was later added which increased flexibility. Mentees were required to self-evaluate his/her recorded lesson. The QTQS project included multiple tasks for mentors-mentees related to a video self-reflection. These tasks primarily focused on teaching of ELLs and literacy development. Between 2007 and 2010, a qualitative survey was administered to the participants at the end of each year. The survey questions focused on the use of Blackboard and Skype as mentoring tools. The results showed that the online technologies used in the QTQS project reduced the time constraints of face-to-face mentoring. Furthermore, the novice teachers in the study felt that QTQS benefitted their instruction and provided non-judgmental support. This study was significant because it provided support for the benefits of video conferencing during informal online mentoring partnerships.

McFadden et al. (2014) examined the use of video annotation as a tool for developing reflective practices for secondary science teachers who participated in an online teacher induction course. Annotations extracted from sixteen first and second-year teachers between 2009 and 2011 were coded. The findings indicated that teachers discussed their own teaching practices and decisions, rather than the interactions and behavior of students. In addition, most annotations focused on description and explanation, rather than higher-order reflective practices such as interpretation and evaluation. Although video annotation and feedback provide new methods for self-reflection in TIPs, it is apparent from the McFadden et al. (2014) study that novice teachers require professional development on the topic of effective reflection.

The findings from McFadden et al. (2014) indicate that the use of technology tools does not necessarily lead to increases in reflective practices. Accountability and professional development are two considerations that should be addressed prior to implementation. Hwang and Vrongistinos (2012), on the other hand, were able to show that the development of reflective skills improved when novice teachers worked directly with a mentor.

The technology tools used in online induction support varied in the literature. More importantly, many of the studies featured in this literature review focused on the outcomes of the use of specific technology tools including asynchronous discussions (Bang & Luft, 2014; Hunt et al., 2013), wikis (Donne & Lin, 2013; Taranto, 2011), Blackboard and Skype (Hwang & Vrongistinos, 2012), and video annotation and feedback tools (McFadden et al., 2014). Little is known regarding which combination of these tools is most effective for online induction. Furthermore, there is limited research on the process of e-mentoring in online induction platforms. In other words, we have more information about the tools to use, but not specifically the process of how to use them in the context of e-mentoring beginning teachers.

— This gap in the literature led to the development of the following self-study research questions: (1) How has e-mentoring on a university-sponsored online induction platform informed my understanding of the induction of novice teachers? (2) How has e-mentoring novice teachers on a university-sponsored online induction platform informed my practice as a teacher educator? Research in this area helped me better understand how to make mentoring decisions to best meet the needs of my mentees. In addition, filling this gap in the literature can help university-sponsored online induction e-mentors learn effective methods for supporting new graduates and school district teacher induction programs.

Theoretical Framework

The “Phases of First-Year Teacher’ Attitudes toward Teaching” developed by Moir (1999) was used as a framework for guiding my work with the mentees during the self-study. I chose this framework because these phases are helpful to mentors when developing supports for beginning teachers. According to Moir (1999), not all new teachers go through these phases (Figure 1) sequentially, but understanding these phases is important for educators who are supporting beginning teachers. Moir’s “phases” have been only used as a theoretical framework in a limited number of agricultural education studies focused on beginning agriculture education teachers’ experiences (Disberger, 2020) and attitudes toward teaching (Rayfield, McKim, Lawrence, & Star, 2014; Rayfield, McKim, Smith, & Lawrence, 2014).

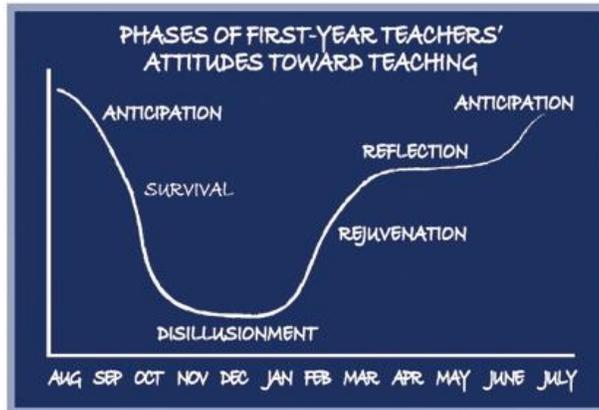


Figure 1. Moir’s (1999) Phases of First-Year Teacher’s Attitudes toward Teaching

This self-study began during the anticipation phase which lasted through the first few weeks of school. During this phase, beginning teachers are typically optimistic about the upcoming school year. Beginning in September, new teachers go through the survival phase where they are very busy but maintain a positive outlook. In mid-October, new teachers begin the disillusionment phase where they succumb to the stresses of the job. I decided to end the e-mentoring partnerships before winter break. This allowed me to work closely with my mentees to help them through the trials and tribulations of the two most challenging phases.

Methods

S-STTEP

Self-study of teaching and teacher education practices (S-STTEP) methodology was employed during this self-study. S-STTEP is a systematic approach for educators who want to research their own teaching and teacher education practices (Pinnegar & Hamilton, 2009). The eight components that guide S-STTEP include:

1. Provocation - An idea within one’s teaching practice that evokes interest;
2. Exploration - Potential resources, ideas, and knowledge are explored;
3. Refinement - Connecting background and experience to build a case for the topic of the inquiry;
4. Identify Focus - The focus of the topic for the inquiry is introduced;
5. Design of the Study - Choice of data sources, data collection, participant selections, data analysis, and other design decisions;
6. Reconsideration Process - This process involves developing understandings based on the data and dialogue with others;
7. Ethical Action - A discussion of how the inquiry is conducted with integrity and transparency; and
8. Presentation - Sharing of the self-study with the educational research community.

During this self-study, I e-mentored three novice science teachers while using a university-sponsored online induction platform for a period of four months. This technology is designed to support induction programs with the goal of retaining new STEM teachers. In this study, the online induction platform will be referred to as the “Platform.” I worked with my mentees to mutually

decide on two teaching practices that each wanted to focus on while being e-mentored. These teaching practices were based on the mentees' district instructional framework.

Participants

The teachers that I recruited were recent graduates of a STEM educator preparation program (EPP) at a large research-intensive university located in the Southeast. A small sample of new science teachers was selected to participate in this self-study. The mentees for this study were recruited based on the following criteria:

1. A first- or second-year science teacher who was a University graduate and completed the STEM educator preparation program;
2. A secondary science teacher.

After contacting all mentee prospects, three teachers volunteered to participate. Kara and Dan were both first-year teachers. Nancy was a second-year teacher. Pseudonyms are provided for the names of mentees and the schools where they were employed at the time of the study.

Mentee Vignettes

The vignettes below provide context related to my mentees' background, experience, and my familiarity with each of them. Additionally, this section provides an overview of my work with each mentee.

Kara

Kara, who identified as a white female, was a first-year middle school science teacher at the time of my study. In the EPP the year prior, I was her instructor for the capstone "Apprentice Teaching" course. Upon graduation, Kara accepted a position at Achieve Middle School, which is an urban charter school that prides itself on educating under-served students.

At the time of the study, Kara taught seventh grade physical science. I learned during Kara's first interview that her school did not have a teacher induction program (TIP) for beginning teachers. However, her school did provide mentoring support for all teachers. Interestingly, Kara's mentor was her principal, Mr. Johnson.

Kara shared with me that she wanted differentiated instruction and problem-based learning (PBL) to be the focus of our work together. She chose differentiated instruction because she had limited experience with it, and her principal wanted her to begin planning and implementing that instructional strategy in her classroom. Regarding PBL, Kara stated, "I want a very engaging curriculum throughout the year, and I know to plan a year of PBL is very difficult" (Interview 1). Once her school year began, I realized I could not begin working with Kara on these strategies until she was more settled in her teaching job. Kara seemed to have difficulty adjusting to her students and the demands of full-time teaching. She required emotional support and help with her most immediate needs, such as lesson planning.

In October, we started focusing on differentiated instruction because Kara was more settled. Initially, I uploaded several resources for her on the Platform. During weekly video conferences, we discussed how to plan and implement differentiated lessons but her activity on the platform stalled due to technical issues that she was experiencing.

In November, our work together shifted to PBL. I had limited experience with PBL myself, so this type of instruction was going to be a learning experience for both of us. During the planning stage, Kara and I had three productive video conferences where we generated ideas and developed plans. Unfortunately, the action items that Kara assumed responsibility for were never completed.

For Kara, mentoring focused on planning for differentiated instruction and PBL. In the final interview, she mentioned that the resources that I provided helped her the most. However, Kara often did not follow through with plans which hindered our progress together.

Dan

Dan, who identified as a white male, was a new high school science teacher at Opportunity High School. Like Kara, his school was located in an urban setting. I was also his instructor for the “Apprentice Teaching” course when he was in the EPP.

Dan taught physical science and advanced physics classes. Most of Dan’s physical science students were culturally diverse and came from poverty. His physics students, on the other hand, were primarily white. Dan was hired shortly before the first day of school. Consequently, we started online induction one week after my other two mentees because he needed some additional time to get settled into his new classroom. I learned that Dan’s school district did not offer induction support. However, he did have some mentoring from a member of his department.

Dan decided to focus on student engagement and unit planning. During interview one, Dan shared with me why he chose student engagement in his physical science course. He explained that his supervisor said, “Don’t worry about innovating with them right now. They are your lowest priority.” Dan was charged with increasing achievement in the advanced physics classes. However, Dan did not want to continue teaching through worksheets and dismissed the suggestion from his supervisor. He believed that his physical science students deserved the same level of engaging curriculum as his advanced students. In the second interview, Dan stated, “I think the major thing is I am sure after four chapters the students are very tired of those worksheets. . . . I don’t know, there is not a lot of innovation going on.” It was at this point that I started helping Dan find some more engaging learning activities for his physical science class. In late September, I shared with Dan a variety of resources, lesson plans, and strategies to engage his students. Dan implemented some of the items that I provided him on the Platform. For example, Dan used the Socrative online assessment tool to help his students review for an upcoming assessment.

Later, Dan and I worked together to develop two unit plans using the Understanding by Design (UbD) framework (Wiggins & McTighe, 2005). We first planned a unit on forces. My content knowledge related to physics was limited, therefore, I mostly helped Dan better understand the UbD unit planning framework. I feared that Dan would think that the work we had done on the unit plan was a waste of time. I was more helpful to Dan during our second unit plan on chemical reactions. Dan and I collaborated on the unit plans during our video conferences, but he often did not follow through with the action items that he committed to completing.

For Dan, mentoring consisted of providing him with a wide variety of engaging learning activities for his physical science classes, as well as developing unit plans. In the final interview, Dan stated that the resources that I provided him were “very beneficial”. According to Dan, I helped him “both from just an actual education standpoint and from a mental health standpoint.”

Nancy

Nancy, who identified as a white female, was a second-year teacher at Success Middle School. I previously knew Nancy through her involvement as a peer mentor in the EPP. Her school was located in a suburban setting. Nancy taught both standard and advanced science courses.

During Nancy's first year, she was assigned a school district mentor. She met with her mentor, Mr. Jones, on a weekly or bi-weekly basis. Mr. Jones was a veteran English language arts teacher. Although he had limited science content-area knowledge, she found his pedagogical support invaluable. In the initial interview, I learned that he modeled teaching strategies for her, and they co-taught some lessons together. In year two, Nancy was not provided any school-based mentoring support. Nancy seemed more confident and optimistic going into her second year.

Nancy decided that her focus during online induction would be planning engaging inquiry-based science activities. During interview one, Nancy expressed how she aspired to plan more engaging inquiry-based lessons:

I'd like to work on doing more cool science labs or integrate the scientific method more throughout the year. . . . It would be nice to get back into that and you know really focus on that throughout the year.

Nancy also believed she lacked skills related to integrating technology in the curriculum. I was especially excited to help her build knowledge and skills in that area.

For Nancy, mentoring focused on technology integration in her curriculum and planning engaging science activities for her students. In the final interview, Nancy shared with me, "I think that it was good to be exposed to different websites and then virtual labs and things that I otherwise wouldn't have seen or tried." Our e-mentoring partnership seemed to push Nancy to try new things to improve student engagement and academic achievement.

Data Collection

Except for an early visit in person to each of my mentees' schools, all mentoring activities and communications took place on the Platform. All communications were saved for data analysis. The Platform includes online curriculum resources and the following CMC tools designed to facilitate communication between mentors and mentees:

1. Zoom video conferencing tool offers several features including screen sharing, annotating, and recording. This tool was used for the mentee interviews and video conferencing.
2. Collaboration Groups are asynchronous meeting spaces. They were used for leaving messages at different time intervals. I established private groups for communication with each mentee. Additionally, I created an OLC for all mentees. Protocols were not used in the Collaboration Groups.
3. Torsh TALENT video analysis of teaching tool supports the recording, upload, storage, and management of classroom videos. The mentees in my study had the option to record some of their lessons using this tool. After a lesson was recorded, it was automatically uploaded to the Platform. Later, I added time-stamped feedback and summary comments to the uploaded video.

The mentees were required to participate in three semi-structured interviews that were conducted with Zoom. In order to improve my own e-mentoring practices, it was critical to learn the perspectives of those whom I would be mentoring (Kosnik et al., 2009). Semi-structured interviews provided me with the flexibility to plan questions, but I could deviate if needed.

The first interview focused on the background and teaching experiences of the mentees. During this interview, I guided mentees toward identification of two teaching practices that they felt needed improvement. The second interview focused on the experiences of my mentees during online induction. Interview data was used to adjust my online induction mentoring practices. The third interview focused on the experiences and reflections of mentees related to online induction and mentoring. Protocols (see Appendices A-C) were prepared so that consistency was established regarding the questions and topics that were discussed (Patton, 2002). Each interview was digitally recorded and transcribed.

Additionally, I maintained three reflective journals including Weekly Memos, a Running Journal, and Critical Friend Journal. The Weekly Memos consisted of written narratives related to my reflections during the self-study. Also, I recorded details about my mentees and my interactions with them in a Running Journal.

I maintained a Critical Friend Journal that detailed my relationship and interactions with my critical friend, Susan. Dialogue with others can help self-study researchers to develop better understandings of the teaching practice under investigation (Beck et al., 2007). These weekly meetings provided me with an opportunity to receive feedback from a colleague who challenged and supported my decisions, interpretations, and findings.

During our meetings, I shared with Susan what I learned from data analysis and sought feedback from her. On occasion, I would provide Susan with writing samples in advance of our meetings so that I could gain her feedback. These journals allowed me to track my ideas as they evolved through the self-study. Later, these journals were addressed during the Reconsideration Process component of S-STTEP.

Data Analysis

The Miles et al. (2014) qualitative inductive thematic analysis approach was used to analyze all data sources. I chose this data analysis method because it was useful for the analysis of textual data and helped me identify patterns that were shared among the data sources (Miles et al., 2014). This approach involves selectively collecting data, identifying patterns by comparing/contrasting the data, seeking more data to confirm emerging themes, and making inferences based on the developing themes. Specific steps guide this process including first cycle coding, second cycle coding, and assertions.

Step 1: First Cycle Coding. This step involved labeling chunks of data with a descriptive label. This process allows for the identification of relevant data as well as provides a way to form comparisons with similar data.

Step 2: Second Cycle Coding. Second cycle coding involved reducing the number of first cycle codes into fewer categories.

Step 3: Assertions. Assertions are declarative statements, or findings, that are supported with evidence from the data.

Findings

Through the S-STTEP process, I know more now about the induction of beginning STEM teachers and the e-mentoring role. Since e-mentoring was a new experience for me, I encountered several dilemmas that I needed to reflect and act on in a way that would best support my mentees. These tensions provide a way to describe teacher educators' experiences of their practice (Berry, 2007). During data analysis, dilemmas pertaining to the "confidence and uncertainty" tension was prominent in the data that were collected. Berry (2007) describes this tension as "experienced by teacher educators as they move away from the confidence of established approaches to teaching to explore new, more uncertain approaches to teacher education" (pp. 120). The following findings are framed around this tension.

Mentee Participation

The voluntary nature of the online induction support that I was providing competed with my mentees' time. The support that I offered my mentees was strictly voluntary and supplemental to any school-based induction supports. My mentees sometimes did not complete tasks or respond to my inquiries on the platform. This was particularly the case with my first-year mentees. On one occasion, Dan emailed me to inform me that he could not participate in a video conference because of a social engagement. In that email, Dan stated, "I'll try and add a few more things to the unit plan to complete it, but I'm pretty swamped." Unfortunately, he did not make any additional changes to the unit plan. In another example, I received an email in December from Kara informing me that she could not meet for our weekly video conference. She stated, "Totally thrown in a loop. They changed the schedule on us today for a band concert field trip." In response, I asked Kara to let me know if she needed any help with her PBL unit that we were planning together. Additionally, I asked her to record one of her lessons on Torsh TALENT. Unfortunately, Kara did not follow through with my requests. Besides cancelling meetings or not following through with tasks, Kara and Dan sometimes seemed unengaged during our weekly video conferences. In week seven, I wrote:

I was a little put off during my video conference with Kara. She was conferencing with me on her mobile device and was setting up for class as she spoke with me. I could tell she was busy and unfocused so I asked her if we should reschedule.
(Week 7 Memo)

Based on my secondary teaching experience, I was familiar with the time pressures a new teacher must contend with. It was not surprising to me that these new teachers did not follow-through on tasks. Voluntary online induction programs may hinder full mentee participation because it is easy to ignore when teachers face other demands on their time.

Addressing Mentee Participation

Throughout the self-study, I reflected on my dilemmas and decisions in my weekly memos. These memos helped me reflect on the uncertain nature of voluntary online induction so that I could best support my mentees and reduce that tension I was experiencing. During week four, I reflected on this tension that I experienced with Kara:

During our first two video conferences, she mentioned that she cried a couple of times. . . . Her experience so far seems reminiscent of my first month as a teacher.

I think that being a listening ear and showing empathy will help our mentoring partnership. (Week 4 Memo)

My reflection regarding Kara's difficulties in the classroom helped guide future conversations with her. It seemed that my role included more than helping Kara navigate her first year.

Dialogue was another key strategy for helping me address the uncertainties of voluntary online induction. My meetings with Susan afforded me the opportunity to share my ideas regarding how I wanted to e-mentor my mentees. During one critical friend meeting in early October, I asked Susan if "try-its" would be an effective strategy to use with my mentees. Susan supported my idea and after that meeting, I started rolling out the try-its with Nancy. In the following Week 10 Memo, I reflected on the use of the try-its:

I felt like try-its are the way to go with e-mentoring. I had such a great experience with Nancy. She told me before the interview how well her Glogster activity went. Students were engaged and it seemed like this one tool opened up many possibilities for her in her curriculum.

My meetings with Susan also helped me cope with my e-mentoring role and boosted my self-confidence. The following excerpt from one of my Critical Friend Journal entries illustrates how Susan supported me through some of the trepidation I was feeling related to working with Kara on her PBL unit:

I learned from Susan that I do not have to be an expert on all teaching practices to be an effective e-mentor. Furthermore, I learned from Susan that e-mentoring requires some negotiation to determine how I can best help my mentees despite my own weakness areas.

Entering the teaching profession is hard, especially in high-poverty contexts. The same could be true of e-mentoring beginning STEM teachers who have low SES students. E-mentors need support as do beginning STEM teachers. A critical friend might have been that type of support for me. Reflection and dialogue with a critical friend were useful for addressing the confidence and uncertainty tension that I experienced so that I could better understand and meet the needs of my mentees.

Building Rapport in an Online Environment

The e-mentoring I provided was designed to supplement, not replace, any existing face-to-face mentoring the novices were receiving from their schools. The lack of face-to-face time with my mentees made building rapport unpredictable.

All three participants discussed some of the ways in which e-mentoring provided challenges as compared to face-to-face mentoring. It seemed difficult for an e-mentor to develop the same level of rapport with mentees without face-to-face interaction. For example, Dan said, "I eat lunch with her every day. We can talk about things there . . . after school she comes in and asks if I need anything" (Interview 1). During the initial interview, Nancy described some of the instructional support that she received from her mentor that would not be possible through online induction:

I taught with him . . . or sometimes he would teach one of my class periods and then I would see what he was doing, and I would teach the next class period. I feel

like I learned a lot just watching him teach too because I don't get to observe the teachers especially when they are with my students that I struggle with sometimes.

Through communication with my mentees, it seemed that traditional mentoring and e-mentoring both provide professional and emotional support. Furthermore, both provide novice teachers with an opportunity to learn, implement, and receive feedback on new strategies. The lack of face-to-face contact with e-mentoring was limiting. It seemed much more difficult to develop mentoring relationships online. There are also things that e-mentors cannot do including modeling and co-teaching.

Effective facilitation on an OLC is critical. My eight announcement posts were not engaging, nor did they stimulate collaboration. Kara, Dan, and Nancy did not know each other prior to online induction. I missed opportunities to build rapport, such as setting up introductions. I was naïve to think that my mentees would collaborate with each without having met or being introduced to each other.

Addressing Building Rapport in an Online Environment

The online induction platform afforded me the opportunity to provide increased levels of support to my mentees despite being completely online. E-mentoring through the platform proved to be convenient for video conferencing and asynchronous communication that allowed me to interact with the teachers more often than typical mentors do. Kara video-conferenced with me weekly during her planning period. Nancy and Dan chose to schedule their weekly video conferences after school. In addition, the Collaboration Groups that I created on the platform allowed me to post questions, provide encouragement, and upload resources at any time of day. The Platform also provided flexibility. I was able to schedule video conferences at times that worked best within my mentees' schedules. Establishing a specific day each week for a video conference may have held my mentees more accountable for following through with action items. During the third interview, Dan discussed how video conferencing held him accountable during online induction:

If this was something where you just laid it all out at my feet and said okay do this stuff, I probably wouldn't have done it just because I have so many other things I have to constantly worry about.

Early in the self-study, I realized that it would be important to make at least one face-to-face visit with my mentees. These visits were scheduled to further build the mentoring relationship and to help me understand their teaching context. In this Running Journal entry, I detailed my experience visiting Achieve Middle School:

I was impressed that the principal stopped by Kara's classroom to meet me. . . . He seemed very supportive of Kara and online induction. . . . Mr. Johnson wants outside institutions and organizations to be involved with his school, and he encouraged me to visit any time and observe classes. (Running Journal)

Although Kara described her teaching context during interview one, I gained some valuable insights from the visit that I did not expect. For example, after speaking with Mr. Johnson, I learned my work with Kara was supported by her school.

Although I did not solve the OLC challenges, I did learn how to make these communities more engaging for mentees. Most importantly, it seems like I should have waited until there was a perceived need from my mentees before developing an OLC. Also, I learned some other uses for the community from my mentees. In the final interview, Nancy described how her mentor would periodically email strategies to her when she stated, “he sent more common strategies that I would be more aware of as a second or maybe even a fifth-year teacher but didn't really know of as a first-year teacher.” This concept of sharing strategies could be applied in the OLC and might boost participation if mentees found the tips valuable. Engaging mentees on an OLC may also require that I initiate dialogue by posing questions or challenges.

Initially, it was unclear how I would build rapport through online induction as this was a new experience for me. However, I integrated and experimented with the CMC tools on the Platform in an effort to address this tension and build the mentoring partnerships. Additionally, taking initiative to visit my mentees’ schools elevated my relationships with my mentees and alleviated the tension of confidence and uncertainty pertaining to rapport building.

The Timing of E-Mentoring

Online induction requires ongoing support, planning for upcoming video conferences, and time for mentees to get acquainted with the CMC tools. Based on the struggles that Dan and Kara experienced during their first few months of teaching, the timing of e-mentoring may need to be adjusted so beginning teachers can adjust to their schools, students, and curriculum. It seemed that Kara and Dan needed more emotional support and help with immediate problems, rather than professional learning.

Initially, I planned to work with each mentee on two teaching strategies, but this was delayed so that I could assist them with their most immediate needs. Kara had difficulty adjusting to the fast-paced school environment and unanticipated changes in the school schedule. She seemed to struggle the most with the emotional stress of teaching. For instance, Kara admitted during the third interview that she underestimated how difficult teaching full-time would be. She referred to her experience as “being in shambles all the time.” Kara mostly experienced challenges related to parents and students. During one of our early video conferences, she explained how a parent showed up at her room and confronted her about an issue related to her child:

I cried at school yesterday. . . . Luckily, there were adults around. . . . One swooped me into an empty room. And then I just broke down. It's a very low class. And they don't get along. . . . I don't know how to handle that. (Video Conference)

Addressing the Timing of E-Mentoring

During online induction, it was unclear how long it would take to work with my mentees on the two instructional practices that they identified. Careful planning was a strategy I used to address this tension. Below is an example of how I planned an agenda in my Week 2 Memo:

This week, I plan on doing the following:

1. Email twice.
2. Focus on encouragement and helping my mentees with their immediate needs.
3. Tell my mentees that I plan on visiting them in the next few weeks.

4. Prepare questions for each video conference.

The memos were critical to the planning process. Within these memos, I detailed next steps for planning.

Four months of online induction did not seem like enough time for mentees to adjust to using an unfamiliar platform. My mentees primarily used the Platform for accessing the Zoom tool. It seemed that my mentees did not want to invest too much time on familiarizing themselves with the Platform. Early in the self-study, I stated, “Email seems to be a better form of communication with Dan. He always seems to respond to that” (Running Journal). Following that entry, I began emailing Dan more frequently as method to be more responsive to his needs.

Since I lacked experience with the timing of online induction for beginning STEM teachers, the ambiguity of the process was disconcerting. Planning for video conferences allowed me to manage this tension. In addition, due to the unpredictable nature of mentee Platform use, I discovered that that it may be beneficial to introduce mentees to all the tools and then tailor use based on their preferences.

Discussion

Through S-STTEP, I know more now about the induction of beginning STEM teachers than when I started, thus answering my first research question, “How has e-mentoring on a university-sponsored comprehensive online induction platform informed my understanding of the induction of novice STEM teachers?” Furthermore, the literature on the needs of beginning STEM teachers and online induction was instrumental in informing my self-study. While contending with Berry’s (2007) confidence and uncertainty tension, I began to understand through my experiences that the induction of novice STEM teachers through online induction allows for more opportunities for one-on-one support than traditional mentoring partnerships. In addition, the focus of online induction may need to be adjusted as e-mentoring proceeds to meet the diverse needs of mentees which connects to Hunt et al.’s (2013) finding that a “one size fits all” approach to online induction is ineffective.

The instructional strategies that were the focus of online induction with Kara, Dan, Nancy were similar (e.g., lesson planning and differentiated instruction) to some of the needs of new teachers identified in the findings from Ross et al. (2011) and Jones et al. (2016). The only challenge pertaining to my lack of content knowledge during online induction occurred when I helped Dan with a physics unit plan. Although only science teachers were selected to participate in this study, the findings have implications for mentors in other STEM disciplines. The findings are relevant to mentors who are paired with beginning teachers from STEM disciplines different from their own, as well as partners who teach in the same content areas.

While addressing the confidence and uncertainty tension, I also came away from this self-study with several useful strategies for e-mentoring novice STEM teachers through an online induction platform. These strategies provided answers to my second research question, “How has e-mentoring novice STEM teachers on a university-sponsored online induction platform informed my practice as a teacher educator?” Self-study gave me a structured approach for better understanding the e-mentoring role working toward continuous improvement. The need for dialogue with a critical friend was imperative for maintaining my focus and mentoring partnerships. I also learned that face-to-face visits with mentees at the beginning of online

induction builds rapport. Furthermore, establishing an engaging OLC may encourage collaboration among mentees. This jibes with Donne and Lin's (2013) findings that OLCs can be beneficial if engaging topics that attract multiple users are included. E-mentoring also requires careful planning for upcoming video conferences and more time should be allocated for mentees to get acquainted with the platform.

Revisiting Moir's (1999) "Phases of First-Year Teacher's Attitudes toward Teaching" Framework

After encountering tension related to the short online induction period, I revisited Moir's (1999) framework. I learned that actively listening to my mentees, as well as providing emotional support, was what they needed most during the first couple of months. The phases in the framework are closely connected to the challenges that I experienced with Kara and Dan. I e-mentored them during the anticipation, survival, and disillusionment phases of a first-year teacher. In retrospect, I should have waited until the rejuvenation phase to begin work on the two teaching practices with each of them. This phase would have been the optimal time to support Kara and Dan with teaching strategies because new teachers tend to be invigorated following the winter break. Ultimately, it would benefit mentees professional learning if online induction lasted at least through the first year of teaching. I also missed an opportunity to experience the rejuvenation and reflection phases. Additionally, it would have been a celebratory opportunity to return to the anticipation phase with my mentees (anticipation is the first and last phase).

Implications for Practice

The findings have implications for those engaged in, or planning to, e-mentor beginning STEM teachers. There are four main implications from my self-study: two of them stem from the reflections on my own e-mentoring facilitation, and the other two are related to the rich possibilities that e-mentoring can provide.

E-mentors Should Study Their Own Practice to Become Aware of Their Areas for Growth. During my self-study, I strived to be reflective. I documented what I learned while e-mentoring when I answered the reflective prompt, "What did I learn this week about how to mentor novice teachers?" I responded to this prompt in each of the 17 weekly memos. For example, in the Week 3 Memo I wrote, "This week, I learned that e-mentors need to be empathetic. Sometimes mentees need a listening ear. During video conferences, active listening skills are essential for ensuring that mentees know that you are concerned about their issues."

E-Mentors Need Training on the Online Induction Platform. Based on my experiences, I did not have adequate training on the use of the Platform prior to my work with the mentees. At the onset of this self-study, I thought that I had enough experience using the Platform. I had the opportunity to use the Platform for one semester with my preservice students. In addition, I conducted a research study that used the video analysis on teaching tools within the Platform. I was confident in my ability to teach my mentees how to use the Platform. However, I was unfamiliar with the nuances of the Platform. Therefore, it may help e-mentors to receive structured and comprehensive training program before working with mentees.

Considerations for Developing University-Based Online Induction Programs. Since voluntary online induction may present obstacles, it is essential that EPPs develop strong partnerships with school systems that employ recent graduates. This may ease the path for EPPs that are working toward establishing online induction partnerships. In addition to supporting recent graduates, university-based online induction can be relatively inexpensive to develop and maintain which is what Donne and Lin's (2013) study found through using a wiki. Once these partnerships are established, EPPs should consider communicating with schools to ensure that the focus of online induction aligns with the needs of the school. Platforms for e-mentoring beginning STEM teachers should be in place well before they graduate. Students would then be familiar with the technology and will have established strong relationships with the e-mentors before they become teachers. These platforms afford pre-service STEM teachers with another vehicle to communicate and collaborate with instructors, cooperating teachers, and peers.

Concluding thoughts

E-mentoring beginning STEM teachers through a comprehensive university-sponsored online induction platform is one more layer of support that can be used to turn struggles to successes and improve teaching and learning. Through my active participation as an e-mentor, I learned first-hand the need for effective methods for supporting beginning STEM teachers within a university-sponsored online induction platform. I am confident that my decisions and actions while e-mentoring increased the support that my mentees were receiving.

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Author

Christian E. Legler

Assistant Professor

Wayne State College

Educational Foundations and Leadership

Email: chlegle1@wsc.edu

APPENDIX A

FIRST PARTICIPANT INTERVIEW PROTOCOL

Participant #: _____**Date:** _____**First Participant Interview Protocol**

1. Tell me a little bit about your school.
2. Tell me a little bit about your classroom – what do you teach? What are your students like?
3. How prepared do you feel to teach?
4. What do you still need to learn?
5. How did your preparation help you become ready to teach?
6. Did you have a mentor? Did that person help you learn anything about teaching?
 - a. (PROBE) If yes, ask for an example.
7. Do you have a mentor assigned to you now in your school? Describe that relationship to me.
 - a. (PROBE) Can you give me an example of how you two work together?
8. What do you know about your district induction program?
 - a. (PROBE) Can you describe how it works to me?
9. Prior to this interview, I asked you to think about two specific teaching practices that you felt needed improvement based on your district’s instructional framework. These teaching practices are going to be the focus of the e-mentoring. What were the two teaching practices that you identified? Why did you choose these two teaching practices?

APPENDIX B

SECOND PARTICIPANT INTERVIEW PROTOCOL

Participant #: _____**Date:** _____**Second Participant Interview Protocol**

1. How has teaching been going for you so far this fall?
 - a. (PROBE) What are some challenges you have experienced?
 - b. (PROBE) What are some successes you have experienced?
2. What is working for you related to our work together?
 - a. (PROBE) How do you know it is working?
3. What is not quite as helpful?
 - a. (PROBE) What else might be helpful to you?
4. Describe the teacher induction supports that you are currently receiving from your school and school district.
 - a. (PROBE) What is helpful to you?
 - b. (PROBE) What is not quite as helpful?
5. In our first interview, we developed an action plan based on two teaching strategies that you wanted to improve during the course of the online induction that I would provide. So far, you and I have _____. Did that help you _____?
 - a. (PROBE) What else do you think you need in order to get better at _____?
 - b. (PROBE) How can I help you get that support?
 - c. We also did _____. Tell me about that....
 - d. (PROBE) What else do you think you need in order to get better at _____?
 - e. (PROBE) How can I help you get that support?

APPENDIX C

FINAL PARTICIPANT INTERVIEW PROTOCOL

Participant #: _____

Date: _____

Final Participant Interview Protocol

1. In general, how did e-mentoring work out for you this fall?
 - a. (PROBE) What are some challenges that you experienced?
 - b. (PROBE) What are some successes that you experienced?
2. Did you experience any unexpected challenges? Explain.
3. When receiving e-mentoring support, what seemed to facilitate your learning during the process?
 - a. (PROBE) Can you give me an example?
4. What suggestions do you have for how e-mentors should use an online induction platform like Florida STEM TIPS in the future?
5. Can you talk a little bit about how this e-mentoring was similar to or different from your district's induction supports?
 - a. (PROBE) Can you give me an example?