

# The Influence of COVID-19 and Virtual Learning on the PCK Development of Arizona Preservice SBAE Teachers

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## Abstract

*The central research question was: what is the influence of COVID-19 restrictions and modifications on the pedagogical content knowledge (PCK) development of Arizona school-based agricultural education preservice teachers in agriculture, food, and natural resources content? This research was conducted using a single case study design of one preservice teacher cohort over the Spring 2021 semester. Semi-structured interviews were conducted for all five preservice teachers, their five supervising practitioners, two university instructors, and one teaching assistant throughout the student teaching experience. Seven major themes emerged from the data: it was primarily a classroom teaching experience, student teachers were prepared well in curriculum development, a lack of experimentation and problem solving in teaching, a lack of relationship building with students and professionals, student teachers were more protected from failure due to the COVID-19 environment, this cohort exhibited resilience, and overall student teachers are prepared to teach. These themes support future research on PCK development through online and hybrid modalities while still incorporating early field experiences (EFE) and student teaching in-person. Further exploration on this cohort while in their first job can provide information on the development and application of their PCK outside of the context of COVID-19. Recommendations for practice include implementing multiple EFE's with deep reflection and the creation of one semester worth of curriculum prior to student teaching during teacher preparation. Additionally, it is recommended supervising practitioners and university instructors maintain a balance of constructive criticism and positive feedback throughout the student teaching process regardless of current circumstances.*

## Introduction

The rise of the novel coronavirus, commonly referred to as COVID-19, created mass disruption of education systems worldwide during the Spring of 2020. Almost overnight, more than 55 million U. S. school children were instructed to stay home due to the cancellation of traditional education within the in-person classroom setting (Garcia & Weiss, 2020). University campuses around the nation, being the home to millions of students in higher education, were also forced to shut down their ecosystems. By mid-March, more than 1,100 universities and colleges throughout the U. S. cancelled in-person courses, impacting over 14 million higher education students, and leading to the implementation of virtual learning for course work that had previously been delivered in-person (Hess, 2020; Smalley, 2020).

Virtual learning, a system for teaching and learning using the internet and other specialized software (Cambridge Dictionary, n.d.), commonly involves instruction utilizing computers as the pathway for students to receive information, often coupled with online learning management systems like Google classroom or Blackboard (Beek, 2011). Students connect with their instructor through a variety of virtual

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learning options including synchronous learning (teacher and students interact in real time), asynchronous learning (learning does not require real-time interaction), and/or hybrid learning (Finol, 2020).

Virtual learning as a teaching modality is not new, having been a part of higher education for decades (Kentnor, 2015). The first institution to offer fully online bachelor's and master's degrees was the University of Phoenix in 1989 (Writers, 2020). Prior to the global pandemic, universities and colleges nationwide have continued to expand their virtual footprint through the offering of courses, workshops, and even entire degree programs completely online (Writers, 2020). However, the impacts of COVID-19 forced higher education to deliver most content in a virtual format, within a severely truncated time frame, and often without the needed support systems in place to create high quality virtual instruction (Gardner, 2020). Virtual learning was no longer a choice based on content and student needs but instead was mandated for most higher education programs, including teacher preparation degree programs.

A plethora of research has been conducted on learning in virtual environments, surfacing both opportunities and challenges for educators (Hackarth, 1996; Kanuka, 2004; Kiser, 1999; Matthews, 1999; Ni, 2013; Simon & Bennett, 2012; Swan et al., 2000). However, the challenges with virtual learning were exacerbated with the dramatic shift to online learning spurred by COVID-19 restrictions. There is a growing concern about the digital divide and a lack of student interest in subject matter (Allen & Seaman, 2007). Additional documented challenges include the lack of facetime between students and teachers, devaluation of oral discourse/discussion practices, techno-centric models prioritized over in-person culture, lack of decision-making and service provision, increased technological and pedagogical inconsistency, violation of privacy policies, and redefining established cultural practices and discourse (Kanuka, 2004; Maki et al., 2000). One particularly alarming finding from researchers is extensive and deep learning cannot be adequately achieved without real-time classroom experience (Kanuka, 2004).

Real time experience and deep learning is crucial for many degree programs in higher education but is especially important for teacher preparation programs because of the need to intersect knowledge and practice through the application and use of experiential learning techniques (Myers & Dyer, 2004). Within school-based agricultural education (SBAE) teacher preparation specifically, the learning process is multi-faceted and relies heavily on application and interaction that is more difficult to facilitate in virtual formats. Preservice teachers learn to teach diverse learners and to create, implement, and evaluate the scope, sequence, and structure of agriculture through experiential learning (Whittington, 2005). This process culminates in student teaching, where preservice teachers take the skills and knowledge they need to be effective and apply it in a classroom setting (Whittington, 2005).

Early field experiences (EFEs) are a foundational element of teacher preparation programs, particularly in SBAE, as they provide opportunities for preservice teachers to practice instructional skills, develop perceptions of the teaching profession, and engage in experiential learning (Myers & Dyer, 2004; NCATE, 2002; Retallick & Miller, 2010). EFEs can take many forms including placement in current classrooms for a required number of contact hours and microteaching experiences within current coursework, both providing students with an opportunity to observe and practice the craft of teaching prior to internship. Grounded in Dewey's (1938) model of experiential learning, EFEs support the development of preservice teachers' classroom orientations, beliefs, and professional identity well before student teaching (McIntyre, 1983; Whittington, 2005).

Various aspects of SBAE teacher preparation outcomes were potentially impacted by the move to virtual learning; however, we are concerned with the impacts on preservice teacher knowledge, more specifically knowledge for teaching or pedagogical content knowledge (PCK). PCK is a specialized form of teacher knowledge that includes the knowledge of, logic behind, and enactment of teaching content for enhanced student outcomes (Berry et al., 2015). Experts have asserted preservice teachers in all education disciplines need to hold and demonstrate PCK to be effective in the classroom (Darling-Hammond, 1997;

NCATE, 2002). In SBAE teacher preparation, the development of PCK is vital (Rice & Kitchel, 2017) due to its positive influence on multiple teaching decisions related to student understanding of content such as selecting appropriate representations and examples of concepts, addressing student misconceptions of concepts, and incorporating and arranging ideas and concepts in the curriculum (Ball et al., 2008).

However, in various education disciplines, including science and mathematics education, researchers have found PCK in preservice teachers is lacking (Berry et al., 2015; Kind, 2009). Preservice teachers in mathematics education struggled to apply examples of topics in a useful way to promote student understanding (Chick, 2007), and experienced difficulties diagnosing student misconceptions with content to provide meaningful feedback (Marshman & Porter, 2013). PCK is complex and develops over time through experiences (Grossman, 1990) but can begin at the preservice level through purposeful instruction (Hume & Berry, 2010). Classroom practice is an essential component of PCK development (Berry et al., 2015), leading SBAE teacher preparation programs nationwide to include field experiences, microteaching experiences, and student teaching as critical components for teacher knowledge development (Retallick & Miller, 2010). Learning from the act of teaching is a fundamental aspect of the vocation of teaching (Berry et al., 2015) and was directly impeded by the move to virtual learning propelled by the global pandemic.

If PCK is difficult for preservice teachers to develop in the best of circumstances, and is a vital factor in teacher preparation, how has COVID-19 and the subsequent moves to virtual learning formats impacted SBAE preservice teachers' knowledge development? This study examined SBAE preservice teachers at The University of Arizona (UA) and how the transition to virtual learning impacted their PCK development at all stages of preparation for the 2020-2021 academic year. While the COVID-19 pandemic serves as the contextual background, this study examined how virtual learning environments may subsequently influence curriculum development, instructional design, and development of knowledge for teaching when compared to traditional in-person settings.

### **Purpose of the Study and Research Questions**

The purpose of this study was to explore the influence of COVID-19, and the shift to virtual learning, on the preparation of SBAE preservice teachers at UA with a focus on their PCK development. A closer look at how SBAE preservice teachers were prepared, from the onset of COVID-19 through student teaching, is essential as teacher preparation programs across the country continue to adapt to virtual and hybrid environments. The following central research question guided this study: What is the influence of COVID-19 restrictions and modifications on the PCK development of UA SBAE preservice teachers in agriculture, food, and natural resources content? Secondary research questions included: 1) How did COVID-19 and virtual learning impact preservice teachers' development and enactment of professional knowledge bases for teaching? 2) How did COVID-19 and virtual learning impact preservice teachers' development and enactment of topic-specific professional knowledge? 3) How did COVID-19 and virtual learning impact preservice teachers' beliefs and orientations for teaching? 4) How did COVID-19 and virtual learning impact preservice teachers' classroom practice during student teaching?

### **Conceptual and Theoretical Frameworks**

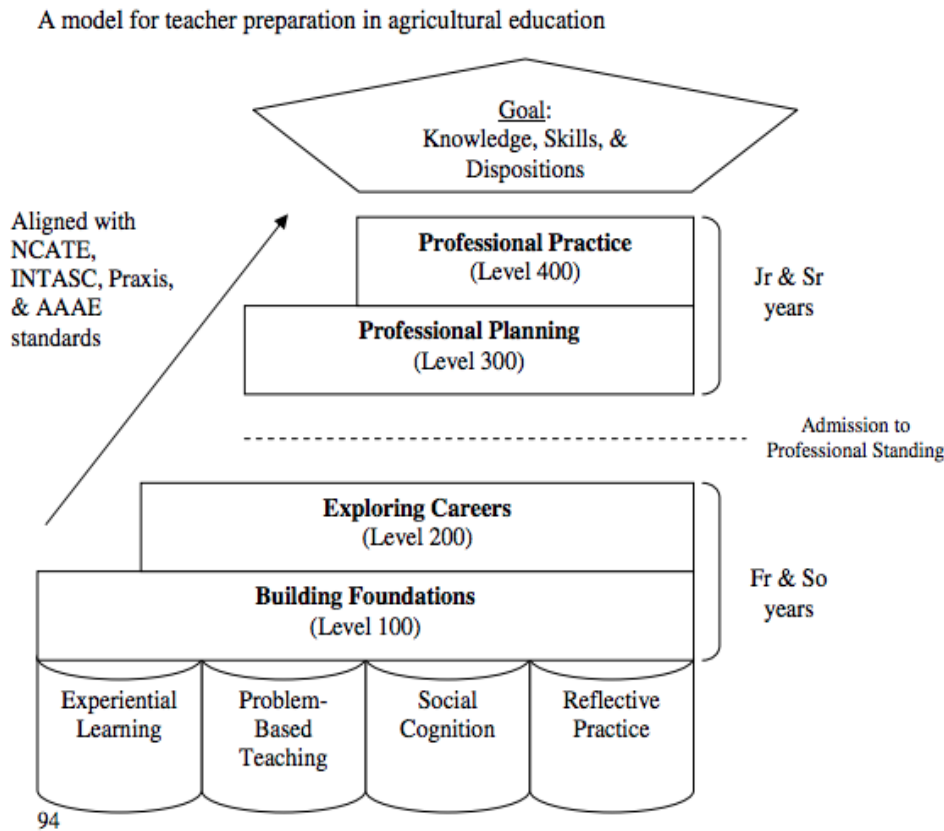
We grounded this study in two guiding frameworks: the SBAE Teacher Preparation Model and the Model of Teacher Professional Knowledge and Skill Including PCK. Together, these frameworks provided a lens for understanding the development of preservice teachers' pedagogical knowledge and professional practice, particularly in light of disruptions like the COVID-19 pandemic.

Figure 1 illustrates the conceptual framework for SBAE teacher preparation (Whittington, 2005), which outlines a four-stage model of undergraduate teacher development: building foundations, exploring careers, professional planning, and professional practice. This sequence is aligned with national standards,

including NCATE, INTASC, and Praxis, and grounded in Dewey’s (1938) experiential learning theory. At UA, the professional planning and professional practice stages are emphasized during students’ junior and senior years. These stages encompass pedagogical coursework and a capstone student teaching experience, forming the focus of this research.

**Figure 1**

*A Model for Teacher Preparation in Agricultural Education (Whittington, 2005)*



In the professional planning stage, preservice teachers develop knowledge in program planning, curriculum design, laboratory instruction, and teaching methods (Whittington, 2005). Relevant UA courses included Curriculum Development (AED 462), Teaching Methods (AED 438), and Inquiry-Based Science Methods and CASE AFNR certification (AED 496D). These courses emphasize planning instruction, lesson development, classroom management, and inquiry-based teaching. Students also engage in field experience and microteaching to provide early exposure to real-world teaching environments.

The professional practice stage synthesizes prior coursework in a 14-week student teaching internship, supported by a supervising practitioner. This phase supports preservice teachers in enacting a vision of professional practice (Darling-Hammond, 2006) and is critical to their transition into the teaching profession. It is during this stage that preservice teachers begin applying pedagogical knowledge in diverse classroom contexts while adapting to student needs and institutional expectations.

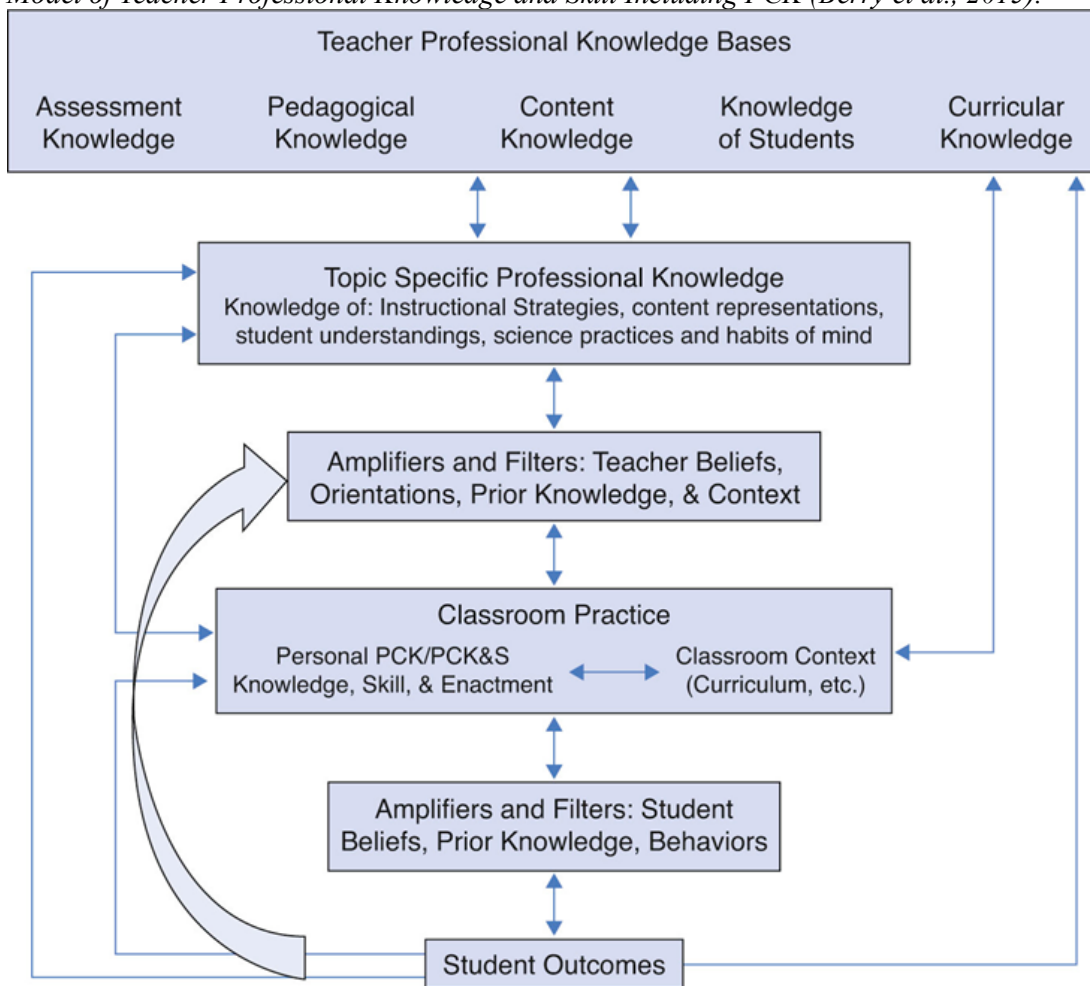
To complement this conceptual framework, Berry et al.’s (2015) Model of Teacher Professional Knowledge and Skill Including PCK serves as the theoretical framework (see Figure 2). Originally developed in science education, this framework extends to SBAE due to its interdisciplinary, applied

science nature (Newsome, 2015). It depicts the relationship between teacher knowledge and student outcomes through interrelated knowledge bases: Teacher Professional Knowledge Base (TPKB), Topic-Specific Professional Knowledge (TSPK), teacher and student beliefs, classroom practice, and student outcomes.

TPKB includes broad pedagogical, content, assessment, curricular, and student knowledge, while TSPK contextualizes that knowledge within specific content areas and instructional strategies. For example, a teacher applying TSPK in a food safety unit might use hands-on labs tailored to students’ developmental levels. Both TPKB and TSPK are enacted through the filter of teacher beliefs and shaped by student responses and classroom dynamics (Newsome, 2015). These experiences feed back into the teacher’s ongoing knowledge development as they reflect on student outcomes and refine instructional practice.

Figure 2

Model of Teacher Professional Knowledge and Skill Including PCK (Berry et al., 2015).



The combined conceptual and theoretical frameworks support an exploration of how preservice SBAE teachers at UA developed and enacted pedagogical knowledge during the professional planning and professional practice stages amid the COVID-19 shift to virtual learning. The frameworks guided analysis of how preservice teachers acquired and applied knowledge in curriculum development, teaching methods, and laboratory instruction—and how they adapted instruction based on classroom realities and student needs.

## Methods

This research employed a single case study design of one preservice teacher cohort (Hancock & Algozzine, 2011). Researchers use case studies to conduct empirical investigation on a contemporary phenomenon (Hancock & Algozzine, 2011). In this study, we examined the experiences of preservice SBAE teachers using multiple sources of evidence. Case studies are also time-bound (Hancock & Algozzine, 2011), and this study examined how SBAE student teachers spent their time in preparation courses and student teaching during the COVID-19 pandemic. We selected this particular case because of the unique nature of the teacher preparation during the COVID-19 pandemic and the shift to virtual learning. A single case study can represent a critical test of a significant theory and answers how and why questions (Hancock & Algozzine, 2011). Therefore, case study methodology aligned with our central research question. It allowed us to explore PCK development during the COVID-19 pandemic and its influence on teacher preparation and classroom practice from multiple perspectives.

We approached this study through a constructivist lens, which holds that knowledge is not absolute; individuals co-construct knowledge through their experiences with a phenomenon (Boghossian, 2006). From this perspective, people shape knowledge through their observations, prior experiences, and lived realities (Ültanır, 2012). By grounding the study in constructivism, we explored how participants understood their PCK development and enactment during teacher preparation, particularly how and why it was influenced by the shift to virtual learning during the COVID-19 pandemic.

To address potential bias and acknowledge our own perspectives, we also disclose our positionality as researchers (Creswell, 2013). Two of us completed the UA SBAE teacher preparation program in spring 2018, prior to the COVID-19 pandemic. We experienced every course in person without the need for face masks or social distancing and completed all required coursework and student teaching under traditional conditions. Additionally, we served as teaching assistants for AED 496D and AED 462; however, only one of us held this role during the pandemic when both courses were affected by virtual learning. Another research team member served as a faculty member in SBAE teacher preparation at UA prior to, during, and after the COVID-19 pandemic.

## Description of the Case

This study focused on UA SBAE preservice teachers, their supervising practitioners, and UA instructors and teaching assistants during the 2020-2021 academic year. Seven preservice teachers completed UA agricultural education department course prerequisites, permitting them to complete final coursework in fall of 2020. Of those seven, five students received approval to begin student teaching in Spring 2021 and were included in this study. When describing the case, we considered all COVID-19 modifications and virtual learning from both the UA perspective and the SBAE teacher preparation perspective.

### *COVID-19 Restrictions and Virtual Learning at UA*

On March 6, 2020, UA's President emailed students, faculty, and staff acknowledging the COVID-19 outbreak. He noted that the health risk in Tucson, Arizona, where the university is located, remained low. Expecting to resume normal operations after spring break, the UA temporarily shifted to virtual learning. By March 30th, 2020, the university had shut down facilities, suspended experiential learning and in-person activities, and canceled commencements. The Tucson Mayor declared a local emergency, closing dining rooms in restaurants, bars, and food courts. The Arizona Governor issued a statewide stay-at-home order from March 31st to April 30th, 2020. The UA later moved all summer courses online and remained hopeful for in-person classes to return in Fall 2020. On July 23rd, 2020, UA President announced that the university would offer classes in four learning modalities for the fall: In-Person, Flex In-Person, Live

Online, and iCourse. When classes began on August 24th, only selected courses operated in person. To prepare for re-opening, the university overhauled campus facilities to prevent COVID-19 transmission, including upgrading air systems and installing 1,755 plexiglass barriers, 1,530 hand sanitizer dispensers, and 3,000 touchless paper-towel dispensers (Fishman, 2020). Classrooms operated at reduced capacity and everyone on campus was required to wear face coverings indoors and outdoors.

Although some core courses met in person, COVID-19 restrictions required significant modifications to teaching and learning. Collaborative group work was limited, and those attending in-person classes had to comply with safety measures such as physical distancing and face coverings (UA, 2020). Flex In-Person classes included a rotating schedule of in-person and online meetings, determined by the instructor. Live Online courses required students and instructors to meet online in real time. iCourses were delivered asynchronously, allowing students to complete coursework independently without scheduled online meetings.

### ***COVID-19 Restrictions and Virtual Learning within SBAE Teacher Preparation Program***

All five UA preservice teachers in this study completed three core curriculum courses (AED 462, AED 438, and AED 496D) before student teaching. Faculty adapted each course to meet university COVID-19 guidelines. Before the pandemic, these courses were conducted fully in-person with collaborative learning environments. AED 462 was the most disrupted by the pandemic, as it met fully in-person until mid-March 2020, when UA transitioned to online instruction. The course continued its regular schedule using a live, synchronous online modality, with modified delivery but consistent content from the original syllabus.

AED 496D, which traditionally involved fully in-person CASE AFNR activities completed individually or in small groups, transitioned to a flex in-person model for the fall of 2020. In the flex in-person model, students completed 40% of the activities in person and 60% synchronously online. To follow social distancing protocols, instructors rearranged lab spaces, so students worked individually with their own stations and equipment. The teaching assistant was physically present, and the lead instructor joined via Zoom. Labs conducted online were adapted for completion without specialized equipment, and in some cases, were demonstrated by the teaching assistant via Zoom. Not all students could attend every in-person session due to COVID-19 exposures, illness, or other issues, and some attended virtually as needed.

AED 438, typically taught 100% in-person before COVID-19, also shifted to a flex in-person model with 40% of instruction in person and 60% live online via Zoom for the fall of 2020. Although the course modality changed, the curriculum remained consistent. During in-person sessions, one instructor was physically present while the other joined remotely. Similar to AED 496D, some students participated via Zoom during in-person sessions due to illness, exposures, or other complications.

### **Participants**

Participants in this study included five UA undergraduate SBAE preservice teachers, two UA instructors, one UA teaching assistant, and five supervising practitioners from high schools across Arizona. These five preservice teachers (see Table 1) all fall between the ages of 20-24. We included them in the study because of their direct experience of student teaching during COVID-19 in 2021. Additionally, all five preservice teachers met the requirements for inclusion in this study, including the completion of core teacher preparation curriculum courses (AED 462, AED 438, and AED 496D). All course work completed in 2019 occurred pre-COVID-19 and all course work completed in 2020 and 2021 was directly impacted by COVID-19 and included virtual learning components. It is important to note that due to varying paths to degree completion, one preservice teacher completed AED 462 pre-COVID-19.

The five supervising practitioners (see Table 2) were employed at high schools across Arizona. We selected these supervising practitioners for the study because they served as a mentor to a preservice teacher for their student teaching experience during spring 2021. In addition, they experienced the student teachers in the classroom and were able to observe their knowledge in action.

The final group of participants included the two UA instructors and one UA teaching assistant (see Table 3) who taught one or more teacher preparation courses during 2020 and 2021. We chose these participants because of their experience in the course work prior to COVID-19 and during COVID-19. In addition, these instructors have insights into the development of preservice teachers' PCK prior to student teaching through engagement in coursework.

**Table 1***Preservice Teacher Demographics and Coursework Description*

Pseudonym	Gender Identity	Semester of Curriculum Course Completion			
		AED 462	AED 438	AED 496D	Student Teaching
Vanessa	Woman	Spring 2019	Fall 2020	Fall 2020	Spring 2021
Aaron	Man	Spring 2020	Fall 2020	Fall 2020	Spring 2021
Rachel	Woman	Spring 2020	Fall 2020	Fall 2020	Spring 2021
Michelle	Woman	Spring 2020	Fall 2020	Fall 2020	Spring 2021
Kimberly	Woman	Spring 2020	Fall 2020	Fall 2020	Spring 2021

**Table 2***Supervising Practitioner Demographics and Cooperating Site Description*

Supervising Practitioner Pseudonym	Years Teaching	Total Student Teachers Supervised	Cooperating Site Location	Student Teacher	Modality Used at Site
Ms. Roberts	5	1	Urban	Michelle	Hybrid
Ms. Wilson	20	9	Urban	Kimberly	In-Person w/restrictions
Ms. Murphy	20	7	Urban	Aaron	In-Person w/restrictions
Mr. Martin	8	1	Suburban	Vanessa	Hybrid
Ms. Pack	5	1	Rural	Rachel	In-Person w/restrictions

**Table 3***University Instructor Demographics and Courses Taught*

Pseudonyms	Instructor Role	Years Teaching	Years in UA SBAE
Dr. Robinson	Instructor	14	5
Mr. Miller	Instructor	20	15
Ms. Smith	Teaching Assistant	0	1

**Data Collection, Analysis, and Trustworthiness**

Data were collected over the Spring of 2021 semester. Semi-structured interviews were conducted with all five preservice teachers, five supervising practitioners, two university instructors, and one teaching assistant. Using a variety of methods to collect data decreased the risk of chance associations and biases present in a single method of data collection and allowed for triangulation of data within the case study method (Hancock & Algozzine, 2011). These interviews were conducted via Zoom, as this was the most logical method due to the location of individuals across Arizona and to comply with COVID-19 restrictions at the cooperating sites.

Three individual interviews were conducted with all five preservice teachers utilizing Zoom. The first interview took place prior to the beginning of the student teaching experience in January 2021, the second interview took place in March 2021 midway through the student teaching experience, and the final interview was conducted in May 2021 at the conclusion of the student teaching experience. These interviews were conducted within this timeline to monitor changes within the preservice teachers' experiences in PCK development, classroom delivery, and personal readiness. Two interviews were conducted with the two University instructors and one teaching assistant, one prior to the beginning of student teaching in January 2021 and one after the student teaching experience ended in May 2021. The two university instructors and one teaching assistant were interviewed a second time at the end of student teaching as they were involved in the student teaching experience through university seminars and supervision of preservice teachers. Two interviews were conducted with the five supervising practitioners, one at the mid-point of the student teaching experience in March 2021 and one at the end of the student teaching experience in May 2021 via Zoom. Supervising practitioners were interviewed to gain additional insight into preservice teacher development and enactment of their PCK through classroom instruction with students.

In addition to interviews, documents were analyzed to provide another data source in the case study. The syllabi from the three core teacher preparation courses (AED 462, 496D, and 438) were analyzed for changes and modifications under COVID-19 restrictions. Additionally, cooperating site schedules were examined for each cooperating site to provide further insight into the modalities of instruction for spring 2021. Finally, preservice teacher lesson plans were analyzed to uncover evidence of PCK during the planning process.

All data sources were included in analysis. Data were analyzed for trends aligned with the central research question and secondary questions that guided the study. Inductive and deductive approaches were utilized. Deductive coding was used to create codes from the guiding frameworks (Berry et al., 2015; Whittington, 2005). In addition to theoretical coding, inductive coding was used to create open codes to capture any emergent findings outside of the guiding frameworks. Initial coding was conducted by a single researcher and then shared with a second researcher. In total, 103 individual codes were generated from

deductive and inductive measures. After both inductive and deductive coding were completed, the emerging data were further collapsed into 25 categories by looking at relationship among codes. This process was conducted by two individuals on the research team. Finally, the 25 categories were collapsed into seven themes that served as the basis of the findings.

To ensure the trustworthiness of the study, strategies such as data triangulation, member checking, rich thick description, and clarification of researcher bias through positionality disclosure were employed, as recommended for quality qualitative research (Tracy, 2010). Data triangulation was achieved through multiple interviews with diverse participant groups, including preservice teachers, university instructors and teaching assistants, and supervising practitioners. Additional insights were gained through the analysis of relevant documents to support the emerging findings. Member checking was conducted by reaching out to participants to confirm that the findings accurately reflected their experiences. Rich, thick description was used to enhance credibility by incorporating detailed examples and direct quotations from the data. Researcher bias was addressed through a clear outline of positionality and personal beliefs, making transparent the lens used during data analysis (Creswell, 2013).

### Findings

All five preservice teachers completed their 14-week student teaching experience and graduated with a degree in Agricultural Education. Seven themes emerged following data analysis. The findings showed that 1) *it was primarily a classroom teaching experience*. All participants agreed that 2) *student teachers were prepared well in curriculum development*. However, due to COVID-19 restrictions, there were unavoidable modifications that ultimately changed the full experience. This led to 3) *a lack of experimentation and problem solving in teaching* and 4) *a lack of relationship building with students and professionals*. Due to the extenuating circumstances surrounding the COVID-19 pandemic, all participants practiced grace and compassion in their expectations of one another which led to 5) *student teachers being more protected from failure due to the COVID-19 environment*. All supervising practitioners spoke very highly of their student teacher, and each student teacher enjoyed their student teaching experience. Nevertheless, 6) *this cohort exhibited resilience* despite the unprecedented obstacles they faced and 7) *overall student teachers are prepared to teach*.

#### It Was Primarily a Classroom Teaching Experience

During their internship, preservice teachers primarily engaged in classroom instruction and had limited exposure to the broader SBAE model due to COVID-19 restrictions. Preservice teachers were unable to visit their cooperating sites before beginning student teaching and missed all typical national, state, and local FFA/CDE events, including the State Leadership Conference (SLC). This resulted in student teachers not having the opportunity to build relationships with supervising practitioners, students they would be teaching, and opportunities to be an advisor and supervisor for events outside of the classroom. Michelle surfaced her professional planning stage experience, “Not getting to go out for the five days, I really feel like we have a disconnect. I haven't gotten to meet their officer team. I didn't get to connect with my students.” This was also mentioned by UA instructors, highlighted here by Dr. Robinson:

They had to contact their teacher and meet them virtually. SLC in June was virtual, that's where they meet some students face-to-face for the first time. Student teachers in the past had that endorsement going into it [student teaching] already. SLC laid that groundwork for a positive relationship, and they got a chance to see just how high school students really are.

Supervising practitioners shared concerns about missed advising experiences. Mr. Martin, commented, “Hopefully she'll be able to get some of those skills that maybe she'll miss out on like

collecting money and planning for events and trips.” Ms. Roberts, further elaborated, “She missed out on the planning and implementation of a field trip. How to register with Arizona FFA, collect those permission slips, and notify parents. We didn't have FFA events. She didn't get the experience there.” Ms. Pack added, “New teacher things. Making sure that you're juggling everything at one time, there's so many different parts that you have to keep track of, sponsors and all of those things.” UA instructors and supervising practitioners both expressed concern for how steep the climb will be when these student teachers take on a position of their own that requires all three components of classroom teacher, advisor, and supervisor.

### **Student Teachers Were Prepared Well in Curriculum Development**

Despite limitations, participants overwhelmingly agreed that student teachers were well prepared in curriculum and lesson planning. UA instructor Mr. Miller said, “If you ask me content wise, I would say that it is apples for apples. I think the content has been the same.” Reflecting on her internship, Rachel stated, “I think that I'm most prepared within my curriculum that I've created, and confidence also comes from thinking if I didn't have the curriculum that I have right now, I would be very scared.” Aaron commented midway through his experience, “Lesson planning, all of it in one semester, is difficult and frustrating. But it's really helpful now that I'm in the classroom. I'm not having to spend hours every day prepping for the next class.” While reflecting, Kimberly stated, “I definitely feel especially with our lesson plans, although they've changed a little bit, everything I needed was there...content wise, everything I needed was readily available.” When analyzing the student teachers' lessons plans, it was clear that each one included all essential components and were executed at a high level.

Supervising practitioners echoed the student teachers and university supervisors' assessment of curriculum preparedness. Ms. Pack, stated at the beginning of the semester, “She's most prepared with her lessons, they're ready to go.” In the final interview, Mr. Martin shared, “She's excellent at curriculum and lesson planning. Very, very good. She's very creative with her lessons, especially for this online, I would say online she has done really well with it.” Ms. Wilson claimed Kimberly was most prepared with lesson planning. She said, “She's got her lessons ready; she reviews them the night before she updates them, and she adjusts. I feel like she could teach any subject. So overall, lesson planning.”

Participants across all three groups also noted enhanced technology skills as a benefit of curriculum development during COVID. Kimberly stated, “I feel like we really benefited from learning how to use online platforms.” Michelle elaborated, “COVID prepared me for this online stuff. I had gone pretty much my whole college career avoiding Google classroom. I got familiar with some of the technology I'm going to have to be using when I start student teaching.” Mr. Miller, UA instructor, echoed this by reflecting on their experience, “I was blown away by how technically sound and savvy this group became. The technical ability they have now because of COVID is amazing.”

### **There Was a Lack of Experimentation and Problem Solving in Teaching**

Although lesson plan development was strong across the cohort, COVID-19 limited experimentation in classroom management and lesson delivery. Even before beginning the student teaching internship, preservice teachers missed out on microteaching experiences to practice giving instruction in real-time with students. Vanessa said, “I feel like having that exposure to students would have helped me know what to expect.” UA instructor, Mr. Miller, commented:

They didn't get that experience of being able to go in the classroom in-person and teach a lesson. The longer I do this, the more I realize that those real time experiences in the classroom are so beneficial. They're going to be fine because they have the information. But how quickly can they connect the information with reality? So, I'm a little worried

about that. Not that they are prepared, but just that they're not prepared to utilize it yet in the sense that they haven't had the experience.

Varying levels of COVID-19 restrictions limited the student teachers' opportunities to facilitate a full functioning high school classroom during student teaching, including classroom management strategies and the experimentation of methods when disseminating labs and activities. Some students remained partially online all year, lowering class sizes drastically from the norm. Supervising practitioner, Mr. Martin, stated, "Classroom management or lab management with a large number of students, it's a totally different dynamic when you have a big class. Classroom management with even 10 kids is nothing compared to a class of 20."

Social distancing was still in place at all cooperating sites, meaning even if the student teachers were operating in-person, students had to be put in the same groups each class period. Students could not share equipment, making labs more difficult to facilitate. Depending upon the site, student teachers could not take a group of students out to the mechanic shop or school greenhouse. Supervising practitioner Ms. Roberts described some of the experiences her student teacher missed out on, "Doing an activity, lab, or going outside to the shop with them. She's missing out on the group part of it, the large class activities."

If the student teacher was teaching in a hybrid modality, they were also constrained to stay by a computer to teach online students while simultaneously teaching the in-person students. This limited freedom across classrooms ultimately did not give student teachers as much room to experiment in the classroom and make mistakes. After a university observation, Mr. Miller said, "The ability to engage students through activity was also diminished quite a bit. I recognized that with all the student teachers. Those emotional connection moments to the content and people weren't near as deep as normal."

### **There Was a Lack of Relationship Building with Students and Professionals**

The findings revealed there was a lack of relationship building with students and professionals for the student teachers. While the student teachers were able to have positive relationships with the students that came in-person and virtually, COVID-19 restrictions still impacted the number of organic interactions they could have with students during classroom instruction. Mr. Martin commented on this change in interactions for his student teacher Vanessa, "Normally, I don't think there's a day students aren't here after school. We're always doing something, studying for contests, building something, breaking something. Now we don't have that. That's why we do what we do, to be with students." Ms. Wilson elaborated on what she felt Kimberly missed out on. She said, "Interacting with kids all year long. It was really hard for her to get involved and get to know kids and kind of figure out the type of kid they were." UA instructor, Mr. Miller, felt this cohort would be the least prepared in navigating human interaction as a teacher:

While we are teaching, we make connections with other teachers and faculty. How do you build colleague relationships and administrator relationships? Then how do you navigate students? Because none of that really happened at the same capacity. And so much of when you're a young teacher is how you establish yourself as a professional. I don't think this group was given the opportunity to experience the reality of teaching real life human adolescence.

### **Student Teachers Were More Protected from Failure Due to COVID Environment**

When comparing this cohort's experience to previous cohorts, this cohort was more protected from failure. Within the preparation stage, mental health checks were put in place throughout the semester in each teacher preparation course. UA instructor Dr. Robinson stated, "When we could, we tried to give some grace, and I say we because I also saw this modeled with Mr. Miller." While student teaching, it was also

apparent that supervising practitioners were less critical of their student teachers than in previous years. When asked where student teachers could improve, or were least prepared, all supervising practitioners were hesitant to answer. Ms. Pack shared, “She's most prepared in every way.” Ms. Wilson replied, “That's a hard one, because she's really good.” The interviewer had to ask multiple times in different ways to get an answer regarding where the student teacher could improve in all interviews with supervising practitioners.

Overall, every participant pointed out this year was difficult, and they were just trying to keep their head above water. Supervising practitioner, Mr. Martin, stated, “This year was so hard. I mean, I think they just did the best that they could, given the situations that were at hand. I know even the most seasoned veteran teachers have learned a lot this year.” Analysis also revealed most supervising practitioners stayed in closer proximity to the student teacher on a daily basis, more than they would in a typical year. UA teaching assistant Ms. Smith reflected, “When I student taught, I wouldn't see my supervising practitioner until lunch sometimes. I was running the show, whereas this year all the supervising practitioners either stay in the room, or their office connected to the room.”

### **This Cohort Exhibited Resilience**

Despite challenges, the student teaching cohort demonstrated adaptability and resilience. All five of the student teachers completed the Spring and Fall semesters of teacher preparation coursework successfully. All their lesson plans were completed by the time they went to student teach, and all at a high level of accuracy and depth of content, even compared to previous cohorts. While student teaching, each dealt with individual site modality changes and other extenuating circumstances due to COVID-19. UA instructor, Mr. Miller, commented, “They [student teachers] stood out, their adaptability, the fact that they could move and adapt very quickly to almost everything. I don't think we would be out of line if we said daily changes to expectations.”

Interviews revealed all the student teachers enjoyed student teaching and gained much from the experience. Kimberly stated in her second interview, “I love it. I think it's the best thing ever. This is the best semester of school.” Rachel shared in her final interview, “I've been extremely fortunate and happy with how things have gone and where I've landed.” Despite challenges of the pandemic, Aaron also exhibited enthusiasm about student teaching. He said:

I really enjoyed it, and I knew the first week, it was definitely the right career choice, there is no question. Even on the days that have been really tough, it's exciting and challenging, but in a really fun way. It's never boring. There are always days when I don't wake up or I don't want to think, I want to relax. But when I'm teaching, we're going to see it never feels like a chore or a job. So, I really, really enjoy it overall and feel very prepared.

### **Overall Student Teachers are Prepared to Teach**

With the inconsistencies and unknowns the pandemic presented, all participants were concerned about what the student teaching experience would look like in practice. Despite the modifications made in the Spring and Fall semesters, the online delivery of teacher preparation courses, and the lack of microteaching experiences, all student teachers felt prepared to student teach. Michelle commented, “I feel like my instructors went above and beyond with the extremely limited amount of time that they had to throw this together.” Ms. Roberts, Michelle's supervising practitioner, shared, “I feel like they've done an excellent job of preparing students to get to this point. I can't think of anything else they could have done.”

When asked if they are prepared to teach upon graduation, all student teacher's answers were similar to Rachel's. She said, “I definitely think so. Actually going in and student teaching really did prepare

me.” Aaron echoed Rachel’s statement, “Yeah, definitely and definitely in the classroom and just like all of the classroom skills and creating curriculum and teaching it.” Supervising practitioners all had similar responses with independent anecdotes of their student teacher. Ms. Murphey, Aaron’s supervising practitioner, stated, “He’s going to be green behind the ears like all of us were when we first started, but he’s definitely going to be successful.” UA instructors may have been the most critical, and had the most hesitations, but overall agreed that each student teacher will be successful as an agriculture teacher.

### **Discussion**

This study explored how COVID-19 shaped the preparation experience of SBAE preservice teachers. While the pandemic provided the primary context, the data also highlighted how shifts from traditional in-person instruction to virtual learning influenced the development and enactment of PCK. Overall, the student teachers described a largely positive internship experience, gaining knowledge, skills, and dispositions as future agricultural educators. Despite these positives, the findings also show they did not receive a full SBAE student teaching experience, missing out on the areas of SAE and FFA from the three-component model of agricultural education. While the classroom teaching component is arguably the most important part of student teaching, SAE and FFA are not only integral to what makes agricultural education unique, but experience in these areas is essential to preparing well-rounded, practice-ready teachers. Supervising practitioners and university instructors all noted this cohort missed opportunities for common outside-of-the-classroom experiences, creating a gap in their preparation for future employment.

The COVID-19 restrictions each student teacher experienced ultimately impeded the preparation and practice stages of SBAE teacher development, supporting the findings of Whittington (2005) on the importance of the preparation and practice for student teaching, with the greatest impact occurring within the professional practice stage of student teaching. Individual PCK development (Berry et al., 2015) was also stifled in areas of TPKB including knowledge of content and teaching, knowledge of content and students, and knowledge of content and assessment. This affected their TSPK, classroom practice, beliefs and orientations, and overall PCK. However, development of knowledge of content and curriculum PCK flourished during professional preparation and practice, suggesting some aspects of PCK can still be developed through virtual or hybrid methods.

While the professional planning stage was predominantly online, all student teachers created strong curriculum they were able to utilize within the professional practice stage. Their success in developing curriculum during student teaching suggests that content and curriculum PCK can be effectively fostered through a virtual platform. This cohort did miss out on EFE’s, including microteaching at local high schools and attending SLC. Due to the cohort’s personal resilience, missing these EFEs did not discourage their overall perception of student teaching; however, they all recognized the benefits of EFEs and wished they were able to participate in them when reflecting upon their overall experience. EFEs play an important role in preservice teachers’ perceptions, orientations, and beliefs of a classroom prior to student teaching.

Each student teacher faced different challenges based on the COVID-19 restrictions within their professional practice stage including reduced class sizes, lack of face-to-face time, missing out on organic relationships inside and outside of the classroom, and having to adjust lessons to fit altered teaching modalities. Observed by university instructors and supervising practitioners, student teachers were unable to develop full relationships with students. From a previous study conducted on Arizona preservice student teachers, knowledge of content and students was one of the most important pieces of PCK student teachers gained through their student teaching experience (Argueta, 2018). The absence of a deep connection with students, catalyzed by Zoom technology use, mask wearing, and lack of after-school activities, led student teachers to make instructional decisions based on their current circumstances rather than having an emphasis on student learning.

This breakdown highlights multiple pieces from the PCK model (Berry et al., 2015), specifically student outcomes, which have a direct arrow to teacher beliefs and orientations, situated between TSPK and classroom practice. Previous research highlights students have better social and academic outcomes with a close student-teacher relationship (Decker et al., 2007). The stifled knowledge of content and students PCK can lead to teachers not being able to properly gauge student outcomes or meet students where they are developmentally and academically (Berry et al., 2015). This lack of student knowledge in relation to the content also affects instructional strategy choices, content representations, and real-time instruction during classroom practice. While student teachers may have felt like they were not missing anything from their student teaching experience, the findings revealed their supervising practitioners protected them from failure. This led to a lack of experimentation and problem-solving during teaching. While the intentions behind the protection stemmed from wanting to extend grace and understanding to the student teachers to mitigate the impact of COVID-19, it ultimately created an environment that inhibited their ability to learn from mistakes.

Additionally, this cohort's knowledge of content and teaching PCK was severely impacted by COVID-19 restrictions. Methods for classroom management, instructional strategies to use for different students or classes, and the overall lack of instructional freedom limited their ability to experience the reality of a typical high school classroom. This also ripples into knowledge of content and assessments PCK, as without freedom in the classroom, student teachers stuck to traditional assessment tactics. Subsequently, this cohort's classroom practice was impacted, influencing other areas of the PCK model including student outcomes, teacher beliefs, orientations, prior knowledge, and context. While this professional practice stage was their first true experience with classroom practice, it leaves room for university instructors and supervising practitioners to question the development of this cohort's beliefs and orientations for classroom teaching. Although university instructors and supervising practitioners were not extremely concerned about the individuals in this cohort due to their excelled curriculum and personal resilience, the overarching fear was there will still be a greater learning curve when these student teachers take their first teaching job. Conclusively, the findings support the importance of experiential learning practices within teacher preparation and the need for preparation programs to require a fully in-person student teaching experience.

### **Recommendations for Practice and Research**

This cohort demonstrated excellent curriculum development and growth in knowledge of content and curriculum PCK, which demonstrates a hybrid teacher preparation program could potentially be successful, at least for a curriculum development course or similar courses. It is recommended teacher preparation programs implement the creation of a full semester's worth of curriculum prior to the student teaching experience to provide student teachers with a base of knowledge to build upon during student teaching, as this facilitates knowledge of content and curriculum PCK. However, further research is still needed as the findings reveal a fully online teacher preparation program is not ideal for other areas of PCK growth including knowledge of content and teaching, knowledge of content and students, and knowledge of content and assessments. Additionally, within the preparation stage, EFE's are shown to be a vital portion of this process that influences classroom practice and serves as the foundation for their knowledge of content and students, teaching, and assessments. It is recommended teacher preparation programs implement multiple EFE's during preparation, such as microteachings at local high schools and attending extracurricular events such as CDE's and state conventions. Furthermore, it is recommended the student teachers deeply reflect following the EFE to ensure it is the most impactful experience possible.

A longitudinal study of this cohort during their first year teaching on their own could provide further information on the development and application of their PCK outside of the context of COVID-19. It is recommended a study be conducted with this cohort to gauge their beliefs and orientations as their experience did not reveal development in how student outcomes affect instructional strategies. It is also recommended for all parties to hold the same standards for student teachers each year, regardless of

extenuating circumstances like those experienced during the COVID-19 pandemic. While the intentions behind the grace and compassion from all parties came from a nurturing place, the lack of experience led to stifled PCK and a lack of experimentation and problem solving which is important for teacher development. While this cohort is prepared to teach, it is in the supervising practitioners and university instructor's hands to maintain a balance of constructive criticism in all situations to ensure qualified teachers are produced.

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