Journal of Agricultural Education, 58(2), 198-213.
https://doi.org/10.5032/jae.2017.02198

Teachers' Beliefs about the Purpose of Agricultural Education and its Influence on their Pedagogical Content Knowledge

Amber H. Rice[1] & Tracy Kitchel[2]

Abstract

The purpose of this grounded theory study was to conceptualize the pedagogical content knowledge (PCK) of experienced agriculture teachers in the plant sciences. The overarching theme that emerged during data collection and analysis was the influence of beliefs on participants' PCK. This finding guided subsequent data collection and analysis that focused on what was shaping the participants' PCK in plant sciences. The integrated beliefs system was the driving force in shaping the participants' PCK and the primary component of this system was the participants' beliefs about the purpose of agricultural education. These individual purposes for agricultural education included: career preparation, college preparation, practical life skills, agricultural literacy, and student individualization. These purposes influenced the type of experiences teachers sought out to develop new knowledge and how they transferred that knowledge in the classroom. These findings support further examination of how beliefs about the purpose of agricultural education are influencing teacher knowledge and practice.

Keywords: Pedagogical content knowledge; teacher beliefs; agriculture teacher pedagogical content knowledge; teacher knowledge

Introduction

Teacher education in agriculture has acknowledged the importance of pedagogical content knowledge (PCK) as a knowledge base for quality teachers to possess because of its positive impact on teaching and learning (Knobloch, 2002; Roberts & Kitchel, 2010). PCK influences numerous teaching decisions related to student understanding of content such as selecting appropriate representations and examples of concepts, addressing student misconceptions of specific concepts, and integrating and sequencing ideas and concepts in the curriculum (Ball, Thames, & Phelps, 2008). Therefore, it is imperative teacher education programs assist agriculture teachers in developing their PCK. However, what PCK agriculture teachers possess and its influence on their teaching remains unclear due to a lack of relevant research.

The agricultural education field does not currently have a conceptualization of PCK for any specific topic area. Therefore, it was critical to first examine experienced agriculture teachers who have PCK. Since PCK is topic specific (Etkina 2010; Hashweh, 2005; Van Driel & Berry 2012), it was also important to examine PCK for specific agricultural education topics. This study focused on the investigation of agriculture teachers' PCK related to the plant sciences. The

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[1] Amber H. Rice is an Assistant Professor in the Department of Agricultural Education in the College of Agriculture and Life Sciences at the University of Arizona, 1110 E. South Campus Drive, Tucson, AZ, 85721, amrice@email.arizona.edu

[2] Tracy Kitchel is a Professor and Chair in the Department of Agricultural Communication, Education, and Leadership in the College of Food, Agricultural, and Environmental Sciences at The Ohio State University, 208 Ag Admin Building, 2120 Fyffe Road, Columbus, OH, 43210, kitchel.2@osu.edu

illustration of experienced agriculture teachers' PCK has the potential to provide valuable information to agriculture teacher preparation programs and inservice professional development initiatives, which could help to ensure the quality of agriculture teachers and, subsequently, enhance student learning.

Review of Literature

The definition of PCK has evolved over time, with the majority of researchers in agreement that PCK is more complex than Shulman (1986) originally conceived (Kind, 2009). The most recent definition of PCK came from a 2014 summit where current minds in science PCK research attempted to create a consensus definition. PCK was defined as the knowledge of, the rationale behind, the planning for, and the act of teaching a piece of subject matter using specific methods for specific students to promote student learning (Carlson, Stokes, Helms, Gess-Newsome, & Gardner, 2015). This definition of PCK highlighted its presence in the planning stage and the in-the-moment action of teaching.

While PCK is now widely accepted as a crucial knowledge base for teachers to possess (Loughran, Mulhall, & Berry 2004), there is some variation in the recognition and understanding of the components and how they interact together (Ballantyne & Packer, 2004; Hashweh, 2005). In mathematics education research, PCK is commonly referred to as mathematical knowledge for teaching and components include knowledge of content combined with knowledge of students, knowledge of content combined with knowledge of teaching methods, and knowledge of content combined with knowledge of curriculum (Hill, Ball, & Schilling, 2008). Similar components are included in science education PCK: knowledge of science curricula, knowledge of assessment of scientific literacy, knowledge of instructional strategies, and knowledge of students' understanding of science (Magnusson, Krajcik, & Borko, 1999). Regardless of the subtle variations in the understanding of PCK, instruction, students, curriculum, and assessment knowledge all within a subject matter context repeatedly appeared as important components of PCK in various research studies (Kind, 2009). However, discrepancies amongst developed models may lead to difficulties when examining PCK in largely non-researched education disciplines.

In addition to the debate between various components of PCK, another aspect of PCK research has dealt with the topic specific nature of PCK. While early research presented PCK in a more generalized fashion, current studies have claimed PCK should be treated in a topic specific manner (Etkina, 2010; Magnusson et al., 1999; Van Driel & Berry, 2012). A recent study in science education examined the topic specific nature of teaching electrochemical cells and nuclear reactions (Aydin, Friedrichsen, Boz, & Hanuscin, 2014). When comparing chemistry teachers, the researchers discovered teachers' knowledge of instructional strategies, learners, and curriculum were topic specific, but other areas such as knowledge of assessment and orientations were not topic specific. It remains unclear if PCK is generally topic specific or if it differs by the various components of PCK (Aydin et al., 2014).

Van Driel and Berry (2012) further described PCK as topic, person, and situation specific. The PCK definition and model from the 2014 summit of science educators also reflected the personal and topic specific nature of PCK, by including components such as beliefs, orientations, and personal PCK (Carlson et al., 2015). Knowledge, beliefs, and experiences of individual teachers have been identified as shaping their PCK (Van Dijk & Kattmann, 2007). PCK is constructed through an individual teacher's lens, and is described as idiosyncratic (Lee, 2011; Loughran, Berry, & Mulhall, 2012). No two teachers will possess the exact same PCK for a given topic; however, there can be overlaps and similarities (Padilla & Van Driel, 2011). Friedrichsen, Van Driel, and Abell (2010) called for further exploration into the role of science teaching orientations on PCK. They proposed personalized goals and purposes of science teaching, views of science, and beliefs should be specifically examined (Friedrichsen et al., 2010).

The limited research conducted in agricultural education points to potential issues in both teacher preparation of content knowledge and PCK and the existing PCK of beginning and experienced agriculture teachers. Rice and Kitchel (2015a) revealed content knowledge preparation was perceived as inadequate by preservice teachers, including their perceived ability to apply content knowledge to teaching. Investigation of beginning teachers in the field also highlighted issues with the application of content knowledge. The ability to break down content for student understanding was impeded for agriculture teachers by self-proclaimed content knowledge deficiencies in various agriscience topics. This led to a grounded theory on how beginning teachers coped with breaking down content they didn't know and what influenced those coping strategies. The authors recommended that future studies explore the concept of PCK in more depth, particularly examining the areas of philosophies and orientations (Rice & Kitchel, 2016). An additional study of agriculture teachers at various career stages quantitatively examined the relationship between content knowledge sources and the development of PCK. Recommendations from this research included the call for additional qualitative exploration of PCK as a means of further revealing the complex nature of teacher knowledge bases (Rice & Kitchel, 2015b). Finally, Stewart, Antonenko, Robinson, and Mwavita (2013) provided an exploration of the factors that influenced the technological pedagogical content knowledge (TPACK) of agriculture teachers. However, this particular study was not focused on PCK itself. In short, the PCK research base in the agricultural education literature is both limited and preliminary, warranting more in-depth studies on the PCK of agriculture teachers.

Purpose of Study

The purpose of this study was to both conceptualize PCK for a specific topic in agriculture and develop a model for the investigation and conceptualization of additional topics. The guiding question aligned with priority four of the 2016-2020 National Research Agenda (meaningful and engaged learning in all environments) (Roberts, Harder, & Brashears, 2016): What is experienced agriculture teachers' PCK related to the plant sciences?

Methods

The methods used in this current study are an extension of a larger study. I chose the emergent design of grounded theory because of the exploratory nature of the research question. Agricultural education research in PCK has been limited and the field does not have a conceptualization of PCK for any topic area within agriculture. Generating a theory in one particular subject area, plant sciences, can serve as the foundation for future PCK research in agricultural education. Aiming to better understand the complexity of social situations and experiences and investigating the processes that shape and sustain a phenomenon are two defining tenants of grounded theory methodology (Corbin & Strauss, 2008). Considering PCK is the knowledge teachers use as they plan and go through the teaching process (Kind, 2009), the decision to apply Corbin and Strauss's (2008) grounded theory approach is further supported.

I approached this study from a pragmatic lens. The epistemological roots of grounded theory rest in pragmatism and interactionism (Strubing, 2007), making this lens appropriate for the methodology. The purpose of grounded theory is to generate theory from data which are treated as reality under construction (Strubing, 2007). Key assumptions of grounded theory, such as the importance of actions and interactions in developing meaning, have roots in the work of early pragmatist philosophers John Dewey and George Mead (Corbin & Strauss, 2008). Pragmatists view reality as something that cannot be separated from the researcher because reality exists as experienced through people. The actor and the environment determine each other and truth is what is known at the time but is subject to change (Corbin & Strauss, 2008).

Participants

Participants in this study included eight high school agriculture teachers in Missouri with a minimum of eight years teaching experience. I chose this specific experience range based on literature stating expertise begins to be achieved for teachers after they have spent approximately five to eight years in the field (Darling-Hammond & Bransford, 2005). I specifically chose experienced teachers to increase the likelihood they would possess PCK. Recommendations from teacher educators regarding teachers' quality and possession of PCK in the plant sciences were used in the purposeful selection of teachers. All selected teachers had professional development experiences in plant science and a reputation as an effective teacher by teacher educators. All participants were located within a 120-mile radius of the university to allow for field work.

Data Sources and Collection

Teachers can demonstrate PCK in a variety of settings. At a 2014 PCK summit, the consensual PCK definition developed by science education researchers indicated PCK emerges in both the planning and in-the-moment phases of teaching (Carlson et al., 2015). Additionally, reflection is a key piece of PCK development (Schneider & Plasman, 2011; Van Driel & Berry, 2012), with knowledge, reasoning, and planning prompting explicit reflection *on* action and the act of teaching leading to explicit or tactic reflection *in* action (Carlson et al., 2015). Hashweh (2005) asserted experienced teachers develop PCK as a result of planning, teaching, and reflecting on teaching. To adequately capture agriculture teachers' PCK in plant sciences, the exploration of data sources spanning those various settings became important.

I collected the following six sources of qualitative data: pre-observation interviews, classroom teaching observations, field notes, lesson artifacts, teacher journal reflections, and post-observation interviews with stimulated recall. Each data source occurred during one of the three settings above and provided a unique contribution for creating a complete picture of agriculture teachers' PCK. A multi-level approach is best when investigating PCK (Kapyla Heikkinen, & Asunta, 2009; Loughran et al., 2004). A review of mathematics PCK literature revealed when PCK was examined within a specific context, classroom observations supplemented with interviews, artifacts, and reflections were most typically used as data sources (Depaepe, Verschafeel, & Kelchtermans, 2013). Using various data sources served to capture as many data points as possible in the short timeframe of a single instructional unit to achieve saturation of the data (Creswell, 2013). Saturation occurs when no new themes can be developed from the data (Corbin & Strauss, 2008). Saturation is not bound by the number of participants in a study; it is also influenced by items such as time spent with each participant (e. g. length of interviews or number of other data points collected such as observations) (Fusch & Ness, 2015).

I collected data during fall 2014 over the course of a single plant science unit for each participant in the study (see Figure 1). Plant science was chosen because it is a commonly taught content area in Missouri schools, there were numerous experienced agriculture teachers in plant science, and I had familiarity with the content area in order to recognize and study PCK.

Figure 1. Data collection timeline

I visited each participant on six separate occasions, totaling 48 visits. I conducted one-on-one semi-structured interviews; each of which lasted between 45 minutes to an hour. I conducted all pre-observation interviews prior to teachers beginning classroom instruction for the plant science unit to capture PCK emerging during the planning phase of teaching. PCK is partially an internal construct (Baxter & Lederman, 1999), making interviews an integral part of data collection (Padilla & Van Driel, 2011). An example of a pre-observation interview question was: What preconceptions do students typically have with concepts in this unit?

I conducted classroom teaching observations to capture PCK emerging during the in-the-moment teaching phase. For example, if a student displays difficulty grasping a concept during a lesson, the teacher may or may not demonstrate PCK in response to addressing that difficulty by explaining the problem in a different way as the lesson unfolds. Additionally, people are not always aware of what they are doing or unable to recall what happened in a given situation (Corbin & Strauss, 2008), making researcher observations an important piece of this study. Furthermore, PCK may not be evident from one single lesson observation (Loughran et al., 2004); therefore, I conducted two observation blocks each lasting two days in length. I video recorded observations to capture and replay instances of PCK during analysis and stimulated recall during post-observation interviews. Additionally, I wrote field notes to capture instances of PCK emerging during the in-the-moment teaching phase not evident on the video recording.

I collected two sources of data that spanned the entire plant science unit. I collected lesson artifacts to capture PCK emerging during both the planning phases and in-the-moment teaching phases of teaching (see Hume and Berry, 2011). I used teacher journal reflections to capture PCK emerging during the reflection phase of teaching. The knowledge behind PCK is often hidden within a teachers' thought process making it difficult to identify (Kind, 2009). My limited time in the field and the complex nature of PCK led to a desire to capture the participants' thoughts as the unit progressed. After each lesson was complete, the participants responded to five reflection questions corresponding to that particular lesson. An example of a reflection question was: What representations, illustrations, or analogies related to content did you utilize during this lesson and why did you choose those particular strategies?

Finally, I used post-observation interviews with stimulated recall to capture PCK emerging during the reflection phase of teaching at the conclusion of the unit. I conducted one-on-one semi-structured interviews lasting between 45 minutes to 90 minutes in length. An example of a post-observation interview question was: What changes (if any) would you make to this unit if you were to teach it again? In addition to general reflection questions based on the unit, I played a minimum of three video clips from the two teaching observation blocks to engage the participants in stimulated recall. Stimulated recall is an introspective technique designed to allow participants to explain their thought processes and decision making after hearing or viewing a stimulus to prompt recollections (Mackey & Gass, 2005). Meade, McMeniman, Wilson, Kanes, and Davey (1991) indicated stimulated recall can be effective for examining knowledge bases of teachers that underlie their classroom actions.

Data Analysis and Changes to Central Question

I engaged in collection and analysis simultaneously due to the nature of grounded theory methodology (Corbin & Strauss, 2008). All six data sources were used in data analysis. I analyzed data using a constant comparative process where data is compared against data, beginning with the first piece of datum collected to search for similarities and differences (Corbin & Strauss, 2008). I followed the three step coding process of open, axial, and selective coding (Corbin & Strauss, 2008). The purpose of open coding is to develop categories, the purpose of axial coding is to connect categories, and the purpose of selective coding is to create a story ending in a developed theory (Corbin & Strauss, 2008). To begin the open coding process, I examined all data sources as they became available for initial codes and adapted my data collection and analysis based on information needed to saturate a particular idea (Creswell, 2013). Once an initial set of categories had been developed, I identified a pervasive phenomenon to focus on for this study that served as the central piece of my theory (Creswell, 2013).

It became apparent after the first three interviews that plant sciences was not specific enough of a topic to be able to adequately describe the participants' PCK in a way that allowed for comparisons between participants and ultimately the development of a theory. While all of the participants taught a plant science unit, the actual topics they covered within that unit varied. Simultaneous to this realization, a different phenomenon began to surface. Beginning with the first pre-observation interviews, the participants discussed their beliefs regarding agricultural education. This was of particular interest because my questions regarding orientations were purposefully left for the post-observation interviews. When I open coded the first participant interview, I also noticed this emerging theme of beliefs that seemed to shape teacher knowledge. In grounded theory, a wide net is cast in the form of a research question to see what truly emerges from the data (Creswell, 2013). At times the central phenomenon that emerges from the data demands that the original research question be altered to reflect the new direction of the study. My original research question was: "What is experienced agriculture teachers' PCK related to the plant sciences?" Upon the emergence of the central phenomenon, the new guiding research question became: "What shapes experienced agricultural teachers PCK in the plant sciences?" Using this question as my guide, I re-coded existing data and applied the new research question to all subsequent data collected and analyzed.

The next step in the coding process was axial coding. Utilizing my central phenomenon as a guide, I continued to analyze the data using the strategies mentioned above. Corbin and Strauss (2008) describe open coding as breaking the data apart and axial coding as bringing the data back together in a new, more meaningful way. I analyzed the data for context, conditions, and consequences (Corbin & Strauss, 2008), to better understand the central phenomenon and how the categories interrelated. This process helped me to see how beliefs shaped the PCK of my participants. I kept memos throughout the entire process and reflected upon them during data collection and analysis. Memos were used not to simply record information but also to analyze information, making memos a crucial part of the data analysis process (Corbin & Strauss, 2008).

Validation Strategies

Throughout the study, I engaged in various validation strategies described by Creswell (2013) for qualitative work. I utilized six separate sources of data to provide detailed evidence of the phenomenon being investigated. Triangulation was achieved by using various data sources to corroborate evidence and validate the study (Creswell, 2013). I used rich, thick description to assist the reader in understanding how the theory was developed and to aid in transferability (Creswell, 2013). Memoing was utilized throughout the entire research process as a way to ask questions of the data, develop connections between concepts, and document my thoughts (Corbin & Strauss, 2008). I engaged in reflexivity by examining my own position within the data and how my position was shaping data analysis (Creswell, 2013). Finally, to confirm the credibility of the findings, I engaged in member checking of findings and interpretations as the theory evolved (Creswell, 2013).

Findings

These findings were part of a larger study where a substantive theory emerged from the data to explain what was shaping experienced agriculture teachers' PCK in the plant sciences. The overall theory was comprised of three major components: integrated belief systems, experience, and context. The integrated belief systems emerged as the driving force shaping participants' PCK, and was further broken down into beliefs about plant science education, beliefs about teaching and learning, and beliefs about the purpose of agricultural education. Specifically, beliefs about the purpose of agricultural education was the most emergent and dominant category of the integrated belief systems, as the participants' beliefs about plant science education and beliefs about teaching and learning mirrored their overall beliefs about the purpose of agricultural education. Therefore, I made the decision to report a single component of the overall theory, beliefs about the purpose of agricultural education, by itself in this manuscript due to the richness of the findings and discussion (Corbin & Strauss, 2008). The findings presented here will describe in detail the five purposes of agricultural education and the impact these purposes had on the participants' PCK.

Beliefs about the Purpose of Agricultural Education

The four main purposes of agricultural education that emerged from the data were: career preparation, college preparation, agricultural literacy, and practical life skills. While the majority of participants in the study held multiple views about the purpose of agricultural education for their students, some expressed more of an emphasis on specific views than others. A fifth view labeled individualization, was surfaced by Clint as the purpose of agricultural education as he attempted to combine all of the purposes to best meet the individual needs of his various students and classes as a whole.

Many participants viewed the purpose of agricultural education to be career preparation and skills development. Cora, however, was the only participant in the study with career preparation as her sole primary view. "My goal is to teach kids to be successful when they leave here so they could go to work in a greenhouse or they could raise their own plants." Due to the uniqueness of career preparation as her sole primary view, I asked Cora if she thought other agriculture teachers were operating under similar beliefs. Her response was, "Unfortunately, not enough. I truly believe that we need to teach kids by doing."

If the participants did not hold a career preparatory view it was most often because it didn't fit their audience (students). To explain why she didn't have career preparation as one of her views, Jane stated, "But a lot of our students, you know, they're in our programs not to learn career preparation, but they are in it for everything else." Later in the interview, Jane clarified that the majority of students in her greenhouse class had taken agriculture leadership courses previously and enrolled in the greenhouse class to avoid an agriculture mechanics class. Ashley described the limited number of students in her program that pursued a career in the greenhouse industry during her 18 years in the classroom. "Right now I have one current student with a greenhouse and two formers students with greenhouses. The rest of them don't [have greenhouses], so right now it's not real applicable."

A second view participants' held regarding the purpose of agricultural education was the college preparation of their students. This view included both specific content knowledge they wanted their students to acquire in plant science (or another agriculture subject area) in preparation for college, as well as general college readiness skills such as note taking, synthesizing information, and critical thinking. Jane explained to her students how the content she taught in her classroom will prepare them for college. "Things you hear in my classroom you're going to see on college entrance exams. It's my job to go over the most stuff I can; it's preparation for those other tests and courses they are going to be taking." Dawn described how career and college preparation overlap in her views about the purpose of agricultural education. She stated, "Well some of the kids, like one in particular, he wants to go into turf grass. He's a big baseball player. So, if they can grasp concepts now, they're employable in college. It's easier for them in college."

The similarity between college and career preparation views on the purpose of agricultural education was they both focused on an ultimate career outcome for students. This included careers in the plant science industry directly out of high school, returning to traditional production farms and raising crops for livestock, employability during college in the plant sciences industry to earn money and gain experience, or preparation for a college degree in agriculture or another field. Most of the participants who held a college preparation view also held a career preparation view about the purpose of agricultural education.

Every participant, even the individuals who held career and/or college preparation as their primary views, discussed agricultural literacy as a purpose of agricultural education in some capacity. The difference between the participants was how much of an emphasis they placed on agricultural literacy. Allison, who incorporated skills and science in her classroom, said this to her students about agricultural literacy during a classroom observation, "…we are going to talk about the technical aspects, but you also have to be able to answer the how and the why. I want you to be a good consumer." This quote illustrated how even with a focus on other purposes of agricultural education, agricultural literacy was still important to Allison.

When I asked Jane what the purpose of agricultural education was, her immediate response was, "It's literacy. It's literacy." Jane discussed agricultural literacy throughout both of her interviews and multiple journal reflections. She stated, "I feel like that's my job, I was put into the position that I am in now, for ag literacy purposes." The experiences that shaped Jane's agricultural literacy view stemmed partially from the characteristics of the students involved in her agriculture program. She said, "A lot of it would be ag literacy because the kids are just getting much farther removed from the farming operation. So, they're starting to not see the relevance of it anymore like I got to see growing up." Clint also discussed how his students took information back to their parents, grandparents, and other members of his local community.

Even Cora, who had a heavy career preparation focus to her program, saw the value of agricultural literacy as a purpose for agricultural education. She said, "As a consumer or as a grower they are going to need to understand those principles." Some of the participants even second guessed their agricultural literacy focus. After describing her agricultural literacy and practical life skills related views Kelly said, "Maybe that's the wrong way to think about it." It is possible the participants felt regret for not pushing agriculture professions or specific career skills when they adopted a more general agricultural literacy purpose. Overall, agricultural literacy was the only purpose of agricultural education mentioned by all participants in some capacity.

The fourth view held by participants about the purpose of agricultural education was practical life skills, which shared similarities with the agricultural literacy view (i.e. development of general knowledge and awareness about agriculture). However, the life skills view took it a step further than mere literacy to focus on students' developing tangible skills such as being able to grow a garden, create a weld, or operate a chainsaw. Some participants also mentioned soft skills (e.g. being able to conduct a meeting, interpersonal communication) as being practical life skills that should be developed through agricultural education. Originally, the practical life skills view was included within agricultural literacy, but upon further reflection, it became apparent there were distinct differences between the purposes.

The practical life skills Kelly described in her classroom went beyond plant science content, even within her plant science classes. As a component of her floral industry unit, she had the students complete a wedding project. When we discussed her purpose of this particular assignment, Kelly indicated that in addition to skills related to the floral industry, she was also assisting students in developing basic math skills and communication skills. Cora also discussed the importance of practical life skills in the form of soft skills. "Maybe they're not learning plant science, but they're learning life skills. Citizenship, cooperation, they're learning so many skills that will make them productive citizens because of what I have taught them." Soft skills were not explicitly mentioned as a purpose of agricultural education by participants, but evidence of soft skill development occurred in the majority of the classrooms I observed.

Practical life skills and agricultural literacy were overlapping views because they both focused on knowledge and awareness about agriculture. However, practical life skills could be regarded as an application or an additional step beyond agricultural literacy, just like college preparation could be regarded as an additional step beyond career preparation. For this study, if a participant viewed the purpose of agricultural education as practical life skills, they also viewed the purpose as agricultural literacy. However, there were participants who held an agricultural literacy view but not a practical life skills view as their purpose.

While all of the views about the purpose of agricultural education mentioned previously were rooted in what the participants thought their students needed, one participant took it a step further. Clint developed a new view, which encompassed all four of the different views mentioned previously. Clint and I described this combined purpose as individualization because it focused on meeting the needs of each individual student. Clint felt an obligation to teach to each student individually. He summed up his belief with this comment, "Could I say well 51% of my students are going to benefit from a scientific based agricultural curriculum so we're going to do it. So I just leave out 49% of my students? I'm not doing that." Clint's individualization view overlapped with all of the other views regarding the purpose of agricultural education including career preparation, college preparation, agricultural literacy, and practical life skills. Career preparation views commonly overlapped those associated with college preparation, while agricultural literacy views commonly overlapped those associated with practical life skills. Figure 2 illustrated the overlapping beliefs about the purpose of agricultural education for the participants in this study.

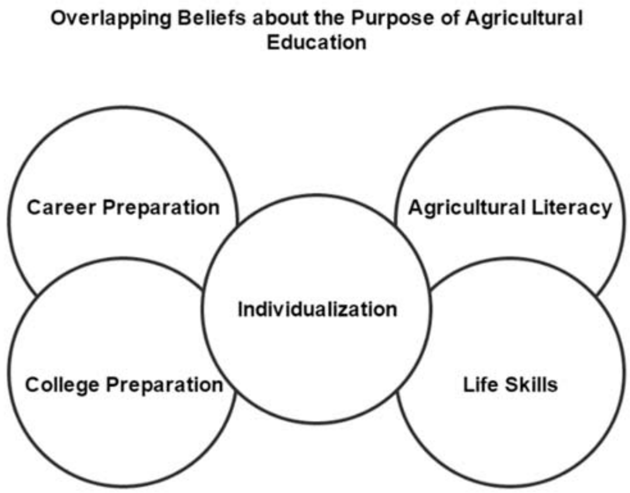

Figure 2. Overlapping beliefs about the purpose of agricultural education

Beliefs about the Purpose of Agricultural Education and its Connection with Teachers' PCK

Participants with career preparation as their primary view developed PCK that included more manual skill learning outcomes such as dividing plants, greenhouse maintenance, treating plant diseases, greenhouse sales, and greenhouse management. Participants with a career preparation view also gained knowledge more often related to authentic assessments because they wanted the students to physically demonstrate skill mastery rather than memorization of information. Allison and Cora, who both had career preparation as a primary view for the purpose of agricultural education, groomed students to be greenhouse managers. Thus, they utilized more inquiry-based teaching methods and engaged students in thinking about potential issues from a business perspective. Cora's career preparation view influenced how and what content she chose. In particular, she expressed to me that if she doesn't use the knowledge herself in the operation of her school greenhouse then she doesn't teach it to students.

Viewing career preparation as the purpose of agricultural education also influenced some of the experiences the participants engaged in for their content and PCK development, including seeking knowledge and assistance from other agriculture teachers in the field. The participants with a career preparatory view all had a heavy incorporation of the greenhouse into their classroom, which increased the participants' need to attend professional development to learn practical manual greenhouse operation skills. Cora commented teacher preparation did not prepare her to operate a greenhouse and this terrified her when she first began her teaching career. She expressed professional development workshops and discussions with professionals were her primary sources of PCK because of her lack of background knowledge.

Participants' with the career preparation view stressed hands-on learning and skill development in their classrooms. One of the biggest complaints about a popular curriculum source was it did not include enough activities or hands-on applications. All of the participants in the study were familiar with Missouri agriculture curriculum and incorporated that curriculum into their classrooms to some degree. While this curriculum included the content information, study questions and objectives, and instructor and student workbooks, it did not include many activities to reinforce and apply the content. If participants' viewed the purpose of agricultural education as a career preparation that necessitated hands-on application and skill development, they would most likely need more than the Missouri agriculture curriculum alone to achieve this purpose.

In contrast, participants with a primary agricultural literacy view were more likely to focus on developing knowledge and less on developing skills. This altered the type of assignments given to the students and the teaching methods utilized to deliver material. Agricultural literacy focused participants tended to utilize classroom discussion, reading, and writing assignments more heavily than participants whose views were focused on other purposes of agricultural education. Jane illustrated how her primary view of agricultural literacy influenced her classroom assignments. "They are the future consumers of our food; do they understand why that is important? And so we do writing assignments to make sure they understand it and we do a lot of discussions." The agricultural literacy view also influenced the type of content the participants deemed important to teach, and subsequently the knowledge they developed on how to best teach that content. Dawn summed up how she chose the content she covered in her classroom, "If the students can't use it in the future, what's the point?" This illustrated a direct connection between her views about the purposes of agricultural education, the content she felt was more important to learn about, and the subsequent PCK she developed.

Clint stood out from the rest of the participants by having a student individualization view as his purpose of agricultural education. He discussed the responsibility he felt to take each student as far as they could go, which caused him to have to know the content he was teaching "pretty dang well." This view influenced Clint to seek out various knowledge and teaching strategies to fit the needs and interests of all his students. He commented that he needed to teach the same agriculture content on different levels depending on the abilities of his students and for different purposes depending on the end goals of his students after high school.

Discussion

Beliefs about the purpose of agricultural education influenced the following in the participants: how much content they knew, how much content they felt they needed to know, what content they decided to teach, and how they decided to teach it. Beliefs emerged as one of the most influential components shaping the participants' PCK. However, it is uncertain if holding multiple views about the purpose of agricultural education creates well-rounded teachers who can reach a variety of students, or if it limits the PCK development of a teacher because their purposes are split across multiple views.

All of the participants believed that agricultural literacy was a purpose of agricultural education, either as a primary or secondary view. This finding is similar to a previous study of preservice agriculture teachers where all of the participants expressed that their primary goal of agricultural education when they entered the classroom was agricultural literacy (Rice & Kitchel, 2015a). This suggests that this view begins at least at the preservice level, if not earlier, which is consistent with a study from Kapyla et al. (2009) that found student teachers' orientations to teaching were connected to their backgrounds in education. Agricultural literacy, for many participants, was described as a responsibility. Some of the participants discussed they taught with an agricultural literacy purpose more often in introductory level classes. This could be because teachers see literacy as a foundation for agricultural education. With more and more students entering agricultural education classes without agriculture backgrounds (National FFA, 2015); the need to begin at a basic level with agricultural education may be increasing in importance. If agriculture teachers have to begin at the literacy level to meet their students where they are currently at in terms of knowledge, we may not be able to expect students to gain knowledge beyond agricultural literacy within the typical four years of an agriculture program. Many of the teachers indicated they taught agricultural literacy because it fit their student audience and their students' needs after high school. Jane said it was rare for her students to get a degree in agriculture, so she focused on literacy. However, are her students not pursuing agriculture degrees *because* she is teaching literacy over skills or is it simply *why* she is teaching literacy over skills?

Another concern about an agricultural literacy focus is the content may be too shallow. When asked for their definitions of agricultural literacy, participants used phrases such as "basic knowledge of agriculture" and "informed consumers and voters." Similarly, the National Council for Agricultural Education (2009) described agricultural literacy as a vision for agricultural education that included all people valuing and understanding agriculture. This raises the question, how much do teachers actually need to know (both content knowledge and PCK) to teach with an agricultural literacy focus? If part of the need for literacy is to appeal to current student needs, it may be beneficial for agriculture programs to focus more on science integration and/or science related careers.

Participants that believed the purpose of agricultural education was career preparation or practical life skills, and subsequently felt the need to teach students specific skills, developed PCK that included knowing how to actually perform those skills themselves and how to break those skills down for student understanding. This required very different preparation and knowledge development than participants who held other views about the purpose of agricultural education. Dawn commented most teachers do not have the greenhouse operation skills upon graduation and have to seek out additional knowledge. Cora discussed when teaching students psychomotor skills, it is more difficult to "fake it". This phenomenon could be similar to other career and technical education areas or other disciplines such as music education. Music education teachers would presumably need more than a rudimentary knowledge of instruments in order to instruct students how to play instruments. PCK research in music education has established the need for skill development in preservice teachers (Ballantyne & Packer, 2004; Haston & Leon-Guerro, 2008). Specifically, Haston and Leon-Guerrero (2008) found the instrumental training history prior to admittance into the teacher preparation program was a factor in the PCK of music teachers. Examining various teachers who engage in teaching students psychomotor skills may uncover valuable information about the nature of PCK.

While skill development and hands-on education were described by many participants as hallmarks of agricultural education and were substantiated by the literature (Talbert, Vaughn, & Croom, 2005), there may be issues with teachers focusing solely on skill development in the classroom. Some agriculture content areas, like agricultural economics, would be difficult to teach through a psychomotor skill-based view of agricultural education. Because of the wide array of content that can be taught in agricultural education, it may be possible that a single primary view about the purpose of agricultural education is not appropriate for all agriculture content areas. The individualization view, surfaced by Clint, attempted to combine all of the purposes of agricultural education. This view may have benefits for students, but this purpose may not be practical for teachers. It is extremely difficult for any teacher to meet the needs of all of their students all of the time. Split focuses on college preparation, career preparation, practical life skills, agricultural literacy, and the all-encompassing individualization belief has the potential to alter instruction in teacher preparation programs.

Recommendations

It is unknown if agricultural education teacher preparation programs are preparing future teachers for these vastly different approaches. And because these beliefs shape much of teachers' PCK development, it is recommended teacher preparation programs guide teachers in considering these beliefs in both their preservice and inservice careers. PCK development takes time and continues to be developed with experience in the classroom (Baxter & Lederman, 1999; Clermont, Borko, & Krajcik 1994; Hashweh, 2005; Kind, 2009; Lee, 2011). It is also possible that explicitly addressing PCK and what shapes this knowledge base is in some ways beyond the developmental readiness of preservice teachers (Kapyla et al., 2009), and instead should be implicitly embedded throughout the curriculum. This could be in the form of reflective writing, the use of Content Representations (CoRe) rubrics in lesson planning (Loughran et al., 2004), and exposing preservice teachers to a framework for PCK that they can refer to for future development.

For this specific group of participants, five different beliefs about the purpose of agricultural education were surfaced. It is possible there are additional beliefs teachers' may possess about the purpose of agricultural education. Considering the significant impact the belief systems theme had on the participants' PCK, it would be important to explore other agriculture teachers in Missouri and other states to see if they have similar beliefs about the purpose of agricultural education or if other beliefs emerge. Future research should further explore the impact of multiple views about the purpose of agriculture education on PCK development and specifically target beginning agriculture teachers who are still in the early stages of PCK development (Schneider & Plasman, 2011). A longitudinal study examining teachers over time to see how their beliefs change could also be important future research, especially considering the indication from participants James and Kelly that their purposes of agricultural education had changed over the course of their teaching careers.

One participant stood out in both his unique beliefs about the purpose of agricultural education and his extensive contribution to the study. A case study just focused on Clint could yield additional information about PCK. Examining how Clint teaches other agricultural units or having him complete CoRes (Loughran et al., 2004) could provide beneficial data on agriculture teachers' PCK. Specifically, because of Clint's individualization focus, it would be interesting to see how this purpose emerges and is managed within other agriculture subjects and how Clint's emphasis on lifelong learning and reflection impacted his teaching.

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