Pedagogical Content Knowledge Development in an Agriscience for Teachers Course

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Introduction

Effective teaching in the classroom requires teachers to develop a wide range of knowledge bases including pedagogical knowledge, content knowledge, and pedagogical content knowledge (National Research Council, 2010). Pedagogical content knowledge (PCK) is a special knowledge base for teachers that combines the two aforementioned knowledge bases (Shulman, 1986). PCK is one of the most important knowledge bases for all teachers to possess, including agriculture teachers (Roberts & Kitchel, 2010). Magnusson, Krajcik, and Borko (1999) assert that PCK development, while complex, can begin to be achieved in preservice teachers during their preparation programs. However, this important knowledge base must include purposeful instruction for development. One such course with potential to develop PCK in preservice teachers is the University of Georgia Agriscience for Teachers course. A version of this course has been offered since 2003, but the focus was on content knowledge development. Fall 2015, the course was revamped to more closely target the development of PCK. The particular course was chosen as the first platform to develop PCK, because a basic agriscience course is one of the most commonly taught courses in Georgia (Georgia Department of Education, 2013). Traditionally, University of Georgia offers a methods course prior to student teaching that encompasses all agricultural content through microteaching. However, the focus of the Agriscience for Teachers course was to specifically develop agriscience knowledge, and to provide students with the knowledge of how to best teach it.

How it Works

The purpose of the course was to combine content knowledge with pedagogical knowledge to develop students' PCK for teaching agriscience. The objectives of the course were for students to learn how to: manage an agriscience laboratory, build skills in safety and measurement, organize and present science and math concepts within an agriculture context, and connect pedagogical and agriscience content knowledge skills for teaching. The six units in the course were constructed based upon the 2013 Georgia Department of Education Basic Agriculture Science Standards. The units included: plant science, forestry, food science, environmental science, animal science, and agricultural mechanics. For each unit, two meeting times were used for the instructor, teaching assistant, and/or qualified guest speaker to demonstrate ways of teaching that particular area of agriscience. Guest speakers included state staff specialists and middle and high school agriculture teachers in Georgia. The specialists are content and pedagogical experts who are hired to evaluate and aid teachers in their respective regions. Additional meeting days were utilized for teaching demonstrations from the students.

Course assignments included team lab demonstrations, individual lab demonstrations, completion of an agriscience fair project, and peer critiques throughout the semester. For the team and individual demonstrations, students were required to submit content representations (CoRe) reflections developed through previous science PCK research (Loughran, Berry, & Mulhall, 2012). In a study utilizing the CoRe reflection in a science classroom, Hume and Berry

(2011) determined the tool was useful in assisting students in developing their PCK at the preservice level. Questions from the CoRe rubric included: what difficulties or limitations were connected with teaching this idea, what misconceptions or preconceptions will students have with this idea, what knowledge about students' thinking will influence your teaching of this idea, and what teaching procedures will be used to engage with this idea, among others. For each individual demonstration, the observing students completed a peer reflection sheet. These reflection questions were also utilized as discussion points throughout the semester to help students develop their PCK for the major topics covered in the course.

Results

A questionnaire was distributed to the course participants anonymously halfway through the semester to provide feedback on the effectiveness of the course. Overall, students enjoyed the content of the course, but still felt rushed with the 75 minute twice a week time frame. In order to more fully explore the why behind the content, more time for the course or restructuring of the course would be ideal. The students particularly enjoyed the guest speakers because they taught them the content while teaching them how to teach the content, an important component of PCK. One student commented, "Not only do we have the opportunity to learn the content, but we will also leave the class with a set of lessons for each content area." However, some students did not fully connect the importance of completing the CoRe rubric to their PCK development and their future teaching. One student commented, "I often found the CoRe sheet to be more of a hindrance than a benefit to my planning strategies." This is similar to research from Hume and Berry (2011) who experienced some pushback with their initial implementation of the CoRe rubric. It is recommended if the CoRe rubric is utilized in the future that more explicit instruction be provided as to its importance and purpose in developing PCK.

Future Plans

The Agriscience for Teachers course template should be utilized to form other courses to educate preservice teachers on how to teach particular content areas. Additionally, beginning the course with an explicit explanation of PCK to increase students' understanding could also be beneficial. Open ended responses from the questionnaire suggested that students are still segmenting content knowledge and knowledge of teaching strategies. Finally, utilizing the CoRe rubric in another existing course like Greenhouse for Teachers in spring 2016 may shed light on if the struggle with the CoRe reflection was subject specific in nature, related to the amount of critical thinking required, and/or if more explanation on its purpose can be given to change the perception on its effectiveness as a teaching tool.

Costs

The University of Georgia charged each student a $60 fee for enrolling in the course to purchase and provide resources and materials for labs. Instructors utilized money to provide each student with a Project Learning Tree: Environmental Education Activity Guide, Project Wild K-12 Curriculum and Activity Guide, and various laboratory demonstration kits.

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