

An Analysis of National Agriscience Teacher Ambassadors' Stages of Concern Regarding Inquiry-Based Instruction

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As teachers are held more and more accountable for the achievement of their students, agriscience teachers must focus on effectively integrating scientific core concepts into agriculture classes. Inquiry-based instruction is currently considered a best practice in increasing students' science content understanding, but is often avoided by teachers who are hesitant about utilizing this form of instruction. The National Agriscience Teacher Ambassador Academy (NATAA) is a professional development opportunity offered to agriscience teachers in an effort to increase their skill at and willingness to incorporate inquiry-based instruction into their classrooms. This study investigates the stages of concern of the 71 NATAA participants through the use of the Stages of Concern Questionnaire in an effort to determine the utilization of NATAA as an effective means of coaching agriscience teachers to use inquiry-based instruction. Participant responses indicate that NATAA's professional development reduces low-level concerns for those who participated for two years instead of one, as well as for teachers who attended the professional development after its reformatting in 2007. Lastly, results suggest that participants with more than six years of teaching experience are more consistent in their concerns than less experienced teachers.

Keywords: stages of concern, agricultural education, inquiry based instruction, national agriscience teacher ambassador academy

Introduction

While the idea of integrating various areas of curricula into agricultural education classes through the use of inquiry-based instruction can provide a fluid method of learning, teaching in this fashion proves to be difficult, and is often associated with many barriers, including successful teacher professional development (Enderlin & Osborne, 1992). Addressing this need through professional development is thought to be an effective method of disseminating information on the process and practice of inquiry-based instruction to enhance curriculum integration. Although arriving in various forms of workshops, sessions, collaborations, observations, and meetings, professional development in general is considered a keystone in implementing change (Guskey, 1994).

Researchers have identified the need for additional investigation related to the implementation of inquiry-based instruction in the areas of teacher beliefs about inquiry, teacher knowledge base for implementing inquiry, and teacher inquiry practices (Keys & Bryan, 2001). By conducting a study to determine the stage of concern teachers in the National Agriscience Teacher Ambassador Academy (NATAA) perceive regarding their competence in utilizing inquiry-based instruction, we can identify key factors as identified in previous research that affect the program's success as a professional development tool and add to the available literature on the implementation of inquiry-based instruction. Further, we can determine the degree to which this particular method of professional development prepares teachers to utilize inquiry-based instruction in the integration of science curriculum into agriculture

classes. If this method is found to be successful, it could be replicated for professional development on other topics.

Conceptual Framework

While the philosophy of curriculum integration is not universally accepted, it has received a great deal of attention in many educational settings (Innovative Teaching Concepts, 1996). Claimed benefits of curriculum integration are numerous, and center around increased student achievement due to connections, relevance, and student ownership (Innovative Teaching Concepts, 1996).

Curriculum integration in the agriculture classroom can greatly impact high school students due to the holistic nature of agricultural education, as well as its natural relevance to student lives (Bailey, 1998). These implications impact federal legislation; the Carl D. Perkins Career and Technical Education Improvement Act of 2008 stated specifically the need for Agricultural Education programs to integrate core academic content into their classes (Carl D. Perkins Vocational and Technical Education Act, 2008). Washburn and Myers (2008) reported that some level of science integration was present in 217 Florida high school agriculture classrooms, and efforts to integrate were due to state standards, administrative expectations, the changing nature of the agriculture industry, science credit for agriculture courses, the notion that agriculture classes should be taught via science integration, and the notion that integration increases student learning, enrollment and enjoyment. Six studies cited in research by Myers and Thompson (2009) supported findings that higher student achievement resulted from the integration of scientific principles into agriculture classes.

Currently, there are a number of approaches to attempt the implementation of a successful integration program. Among these, project-based learning (involving inquiry-based instruction) is a popular example (National School-to-Work Office, 1997). Project-based learning is more student-centered than the traditional classroom, requiring collaboration of teachers and students to develop projects focused on specific occupational issues. Teaching science through an inquiry-oriented approach is strongly recommended by both the

National Science Education Standards (National Research Council [NRC], 1996) and the Benchmarks for Science Literacy (American Association for the Advancement of Science, 1993).

Both the National Science Education Standards (NRC, 1996) and research conducted by Keys and Bryan (2001) maintain that inquiry-based instruction is not a specific teaching method or curriculum model, but rather a guiding principle on how instruction is delivered. While the National Science Education Standards do not provide specific methods for conducting inquiry-based instruction, they do suggest that learning through scientific inquiry allows students to develop abilities necessary to conduct scientific inquiry, as well as an understanding of scientific inquiry (NRC, 1996). Chiappetta and Adams (2004) also identified several objectives of inquiry-based instruction in the science classroom, including the development of the disposition to ask and answer questions about the natural world and a positive attitude about science, in addition to the two aforementioned objectives identified by the National Science Education Standards (Gengarelly & Abrams, 2008).

While the positive outcomes of implementing inquiry-based instruction are well documented, individual teachers responsible for this implementation ultimately control its success (Hall & George, 1979). Several research endeavors have identified barriers to incorporating inquiry-based instruction in science, and teacher beliefs regarding science, students, and teaching is a common thread between these identified barriers (Keys & Bryan, 2001). Regardless of the general view that inquiry-based instruction can positively impact student learning, Deters (2004) and Windschitl (2004) have observed that teachers oftentimes resist implementation because of their expectancy of undesired consequences. Gengarelly and Abrams (2008) specified some of these undesired consequences as loss of classroom control and safety mishaps. Other teacher concerns include the possibility of longer time requirements, increases in student misconceptions, and subjective grading. Keys and Bryan (2001) also identified teacher perceptions of the rigidity of the scientific method as a barrier to inquiry-based instruction, possibly influenced by a teacher's own lack of

inquiry-based exploration (Windschitl, 2004). One of the key sources for these barriers is teacher experience, and these are magnified in less experienced teachers (Crawford, 1999). Teachers relatively new to the profession can lack key knowledge in the areas of pedagogy, content, students, and classroom management, all of which can hinder inquiry-based instruction as a useful teaching tool.

Despite the indication of agriculture teachers' willingness to integrate science curriculum into their classrooms, the previously mentioned barriers hinder the degree to which science integration through inquiry-based instruction is utilized. These barriers collectively seem insurmountable to overcome when implementing inquiry-based instruction; however, they can all be addressed through effective professional development. Because teacher beliefs influence knowledge focused on, tasks assigned, course content taught, and assessments used, developing teachers effectively is imperative when reforming education (Keys & Bryan, 2001). A keystone in Francis Fuller's Concerns-Based Adoption Model (CBAM), serving as a piece of the theoretical framework for this study, is the notion that teachers must be attended to in order to establish "a frame of reference for understanding, studying, and managing the change process" (Hall & George, 1979). This focus on teachers adopting an innovation is not random or general; Fuller's theory states that concerns typically occur in a natural sequence through which all individuals adopting an innovation progress (Hall & George, 1979). With regard to inquiry-based instruction as an innovation, Eick, Meadows, and Balkcom (2005), Windschitl (2004), and Gengarelly and Abrams (2008) have all stated that the successful implementation of inquiry-based instruction in a classroom can be improved through support provided for the teacher. The notion that professional development can improve teaching methods is not unconventional; the majority of efforts to reform schools utilize professional development as a means to implement change (Guskey, 1994).

In an effort to better prepare agriscience teachers to utilize inquiry-based instructional methods when incorporating science curriculum into agriculture classes, the National FFA Organization, partnering with DuPont and

LabAids, developed the National Agriscience Teacher Ambassador Academy (NATAA) for agriculture teachers. Between 2002 and 2006, the NATAA focused primarily on offering science curricula professional development to agriculture teachers through the utilization of Lab Aids, as well as showing the importance of promoting careers in science (L. Gossen, personal communication, October 12, 2009). In 2007, the NATAA added a strong focus in inquiry-based instruction to its professional development, under the idea that classrooms that utilize inquiry-based instruction can potentially improve student understanding of science curricula (Keys & Bryan, 2001). Currently, the NATAA is an intensive week-long professional development opportunity that immerses participants in inquiry-based teaching techniques. The high-intensity format has shown to increase active teacher participation and learning (Garet, Porter, Desimone, Birman, & Yoon, 2001). Sessions are led by nationally recognized experts in inquiry-based teaching techniques and teacher professional development design and delivery. Upon completion of the professional development, teachers are referred to as Ambassadors for Agriscience (National FFA Organization, 2009). These ambassadors provide workshops and lead professional development at the Agriscience Institute, provided for agriculture teachers at National FFA Convention, and the National Association of Agriculture Educators Conference, both held annually. Teachers are permitted to participate in the professional development for a maximum of two years. Allowing teachers to participate in the professional development for two years coincides with research that identifies duration as a significant factor in increasing teacher depth of change (Garet, et al., 2001). Additionally, Supovitz and Turner (2000) posit the quantity of professional development in which teachers participate is strongly linked to inquiry-based teaching practices.

Theoretical Framework

In order to determine how successful a professional development session is in bringing about a desired change, a number of factors can be considered. One of these is teacher concern regarding the innovation, which has been

assessed in past research through the Stages of Concern Questionnaire (SoCQ) (George, Hall, & Steigelbauer, 2006). Deriving from Francis Fuller's CBAM, the stages of concern provide explanations of the developmental progression individuals go through when adopting an innovation. These concerns typically begin with self-related concerns, and then progress to task-related concerns and finally impact-related concerns (Hall & George, 1979). The seven stages, shown in Table 1 (Hall & Hord, 2006),

were originally identified through various research endeavors conducted by the staff members of the Research and Development Center for Teacher Education of the University of Texas at Austin in 1969. Innovation users can move through these stages according to their developmental familiarity with the innovation. While this developmental pattern is not a certainty, it remains fairly consistent (George, Hall, & Steigelbauer, 2006).

Table 1
Seven Stages of Concern

Stage	Title	Description
6	Refocusing	The individual focuses on exploring ways to reap more universal benefits from the innovation, including the possibility of making major changes to it or replacing it with a more powerful alternative.
5	Collaboration	The individual focuses on coordinating and cooperating with others regarding the use of the innovation.
4	Consequences	The individual focuses on the innovation's impact on students in his or her immediate sphere of influence.
3	Management	The individual focuses on the processes and tasks of using the innovation and the best use of information and resources.
2	Personal	The individual is uncertain about the demands of the innovations, his/her adequacy to meet those demands, and/or his/her role with the innovation.
1	Informational	The individual indicates a general awareness of the innovation and interest in learning more details about it. The individual does not seem worried about him or herself in relation to the innovation.
0	Unconcerned	The individual indicates little concern about or involvement with the innovation.

Used to identify the stages of concern perceived by teachers, the SoCQ has been used repeatedly in order to examine teacher concerns across academic settings. In 2004, Christou, Eliophotou-Menon, and Philippou utilized the SoCQ in Cypress to assess the concerns of 655 primary school teachers across 100 schools to determine the success of a mathematics curriculum integration. In this study, researchers found the assessment of teacher concerns to be essential to successful implementation. In 1997, Gwele utilized the SoCQ to assess staff concerns during the

implementation of a problem-based learning program in a nursing school. This study supports the use of concerns data to plan staff development.

A study regarding the stage of concern participants of the NATAA perceive regarding inquiry-based instruction can determine the efficacy of the academy in helping agriscience teachers overcome initial self-related concerns and effectively incorporate inquiry-based instruction into their classrooms. Further, factors including teaching experience, duration of participation in NATAA, and implementation

of specific inquiry-based instruction professional development into the academy can be examined to determine their effect on the program's success. Information gained by investigating this professional development model can be utilized in the development and delivery of professional development for other topics in the profession.

Purpose

Quantity, content focus, and teaching experience are each well-documented factors contributing to the success of teacher learning (Featherstone, 1993; Supovitz & Turner, 2000). Evaluation of these factors found in the NATAA can help determine its merit as an effective professional development tool for agricultural education teachers. The purpose of this study was to determine the stages of concern participants of the NATAA perceive regarding inquiry-based instruction, and whether their comfort level was affected by the level of involvement they have had in NATAA professional development.

Objectives

To accomplish the aforementioned purpose, this study has 3 objectives:

1. To determine differences in stages of concern percentiles regarding inquiry-based instruction of participants in the NATAA grouped by number of times they participated in the academy.
2. To determine differences in stages of concern percentiles regarding inquiry-based instruction of participants in the NATAA grouped by NATAA format they attended (before or after its alteration in 2007).
3. To determine differences in stages of concern percentiles regarding inquiry-based instruction of participants in the NATAA grouped by length of teaching experience.

Methods

To complete the objectives, an email including a survey invitation was sent to the population of NATAA participants ($N = 71$). According to Dillman, Smyth, and Christian (2009), the most effective method of increasing

participation rate on internet surveys is multiple contacts. Because little research has been performed regarding the optimal combination of contacts, the number of contacts after the initial invitation is left up to the researcher. However, it is recommended that when response rate per reminder email stalls, the researcher ceases sending reminders. In this study, the original survey invitation resulted in a participation rate of 39% ($n = 28$). Three reminders were sent at one week intervals with respective participation rates of 26% ($n = 11$), 19% ($n = 6$), and 46% ($n = 12$). Overall participation rate was 80% ($n = 57$).

To address the objectives, an electronic version of The Stages of Concern Questionnaire (SoCQ) designed by George, Hall, and Steigelbauer (2006) was used. The questionnaire consists of 35 Likert-type questions that assess the respondent's level of concern regarding inquiry-based instruction. An answer of zero indicates no relevant concern is present; one indicates the concern is not true of the respondent now, progressing to seven, which indicates the concern is very true of the respondent now (Bailey & Palsha, 1992). Additionally, ten demographics questions were added to the questionnaire in order to determine possible relationships between stages of concern and demographic variables. An open-ended question inviting respondent comments on their views of implementing inquiry-based instruction was also included, as is recommended by Hall and Hord (2006).

The Stages of Concern Questionnaire was chosen because of its long history of continuous improvement, as well as its high levels of established reliability (Warner, 2009). George et al. (2006) stated that validity has been tested through calculating the relationships among stages, as well as between stages and variables identified in other concerns theories. In the original validation studies of the SoCQ, "analysis led project members to infer that the seven scales tapped seven independent constructs that could be identified readily with the seven Stages of Concern proposed in the Concerns-Based Adoption Model" (George et al., 2006, p.14). Validation of the instrument is provided in its high item correlation with the stage to which the item was assigned (Bailey & Palsha, 1992). Bailey and Palsha indicated that 72% of the items correlated more highly with

the stage to which they had been assigned than with any other stage. This study also supports the proposed order of the scale, indicating a decreasing correlation between subscales as the distance between them increases. Further, several validation studies stated in George, Hall, and Steigelbauer (2006) indicate that resulting scores followed the Stages of Concern model based on their level of professional development in the innovation. Coefficients of internal reliability are stated in George et al. (2006), and each stage of concern, with the exception of Stage 0, meets the acceptable criterion of an alpha score above .07, set forth by Santos (1999). The test–retest correlations reported by George et al. also meet the acceptable criterion, again with the exception of Stage 0. Stage 0 is currently under revision to improve its reliability (George et al., 2006). Cronbach's alpha was calculated *post hoc* for the overall use of the SoCQ and was found to be .90. Following the guidelines set forth by Santos this was deemed acceptable.

Upon completion of data collection, responses were analyzed using the calculations recommended by George et al. (2006) and developed in Excel format by Scott and Persichette (2006). Raw scores in each stage of concern were averaged by different groupings according to variables identified in the objectives. In order to perform accurate analysis, average raw scores of different variable groups in each stage of concern were converted into percentile scores. Examination of group data can be done through averaging raw scores before converting to percentile scores, as percentile scores do not have equal intervals. The 2006 Stages of Concern Questionnaire publication by George et al. as well as the Excel program, provides the raw score–percentile conversion chart, and can be utilized for producing individual and group profiles (George et al., 2006). This percentile chart was utilized throughout the previously mentioned validation studies, and has proved to be representative of various innovations (George et al., 2006). When analyzing percentile scores, the higher the score, the more intense the concerns are at that stage. Because percentile scores in each stage of concern are dependent on one another, analysis was conducted through the use of a concerns profile. The concerns profiles create visual images of the average concern intensities of a

group of respondents, as recommended by George et al. (2006) and are the most interpretive and most frequently used method for analyzing SoCQ data. The use of percentile scores is not recommended for statistical analysis due to the violations of assumptions on which the tests are based, so data were only analyzed through descriptive measures (George et al., 2006).

Results

Demographics

Out of the 57 respondents, 17.5% had between one and five years teaching experience ($n = 10$), 33.3% have been teaching for between six and ten years ($n = 19$), and 40.1% had been teaching for over 10 years ($n = 23$). Over half (59.6%) of the respondents attended the NATAA professional development for one year ($n = 34$), while 40.4% attended the professional development for two years ($n = 23$). Regarding attendance before or after the alteration of the NATAA in 2007, 40.4% of the respondents participated in NATAA professional development before 2007 ($n = 23$), while the remaining 59.6% participated after the professional development's alteration ($n = 43$). The similar group numbers between the variables merited a visual comparison of individual group members. It was determined that the similar n 's is a coincidence; groups from different variables are not comprised of the same group of individuals, as indicated by their different group profiles below.

Number of Years Participated

Figure 1 below compares the compiled percentiles in each stage of concern for respondents who participated in the NATAA professional development for one year with those who participated for two years. Respondents who attended one year of NATAA professional development had most intense percentile scores in Stage 0, which indicates that there are a number of initiatives, tasks, and activities that are of concern to this group of people. Their lowest score in Stage 4 suggests that this group has minimal concern about the effects of inquiry–based instruction on students. While the respondents who attended two years of NATAA professional development share this low level of Stage 4 concern, this group's

highest percentile in Stage 5 suggests concerns about working with others in relation to use of inquiry-based instruction. These two groups share similar profile patterns, except with regard to Stage 0, indicating that the group with two years of professional development is less concerned with other innovations than those

with one year of professional development. The profiles for both groups display a tailing-down effect at Stage 6 (Refocusing), which indicates group willingness to change; respondents do not have ideas that would potentially compete with the implementation of inquiry-based instruction (George et al., 2006).

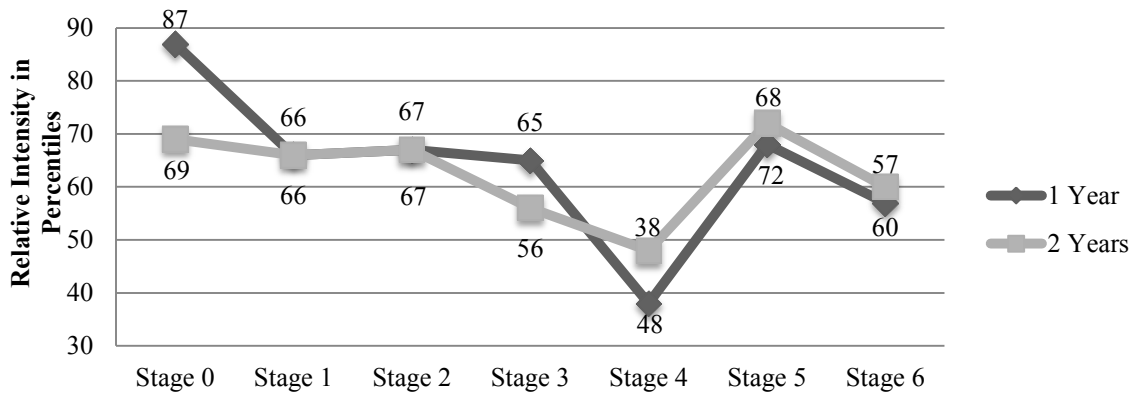


Figure 1. SoC profile of NATAA participants according to number of years participated

NATAA Format

The concerns profiles in Figure 2 compares overall percentile scores in each stage of concern between respondents participating in NATAA professional development between 2002 and 2006 and those participating in NATAA professional development between 2007 and 2009.

Both profiles display highest percentile scores in Stage 0, which indicates that there are a number of initiatives, tasks, and activities that are of concern to the groups. This stage does not indicate the degree to which individuals in each group use inquiry-based instruction. The next highest percentile score for 2002–2006 participants is in Stage 1, indicating that these individuals would like more fundamental information about inquiry-based instruction. The second highest percentile for 2007–2009 participants is in Stage 5, which indicates individuals are focused on coordinating with

others regarding use of inquiry-based instruction. This difference in second highest stage scores indicates that most individuals participating in NATAA professional development after its reconstruction in 2007 are more concerned with collaboration in inquiry-based instruction and less about general information regarding inquiry-based instruction than 2002–2006 participants. Again, both group profiles tail down at Stage 6. This indicates willingness to change, regardless of which NATAA professional development format participants attended. Lastly, the difference between 2002–2006 participant first and second percentiles is 19 points, indicating a great distinction between intensity of concern at these stages, while the respective difference in 2007–2009 participant scores is three points, indicating they are almost equally concerned with collaboration of inquiry-based instruction as they are with other initiatives.

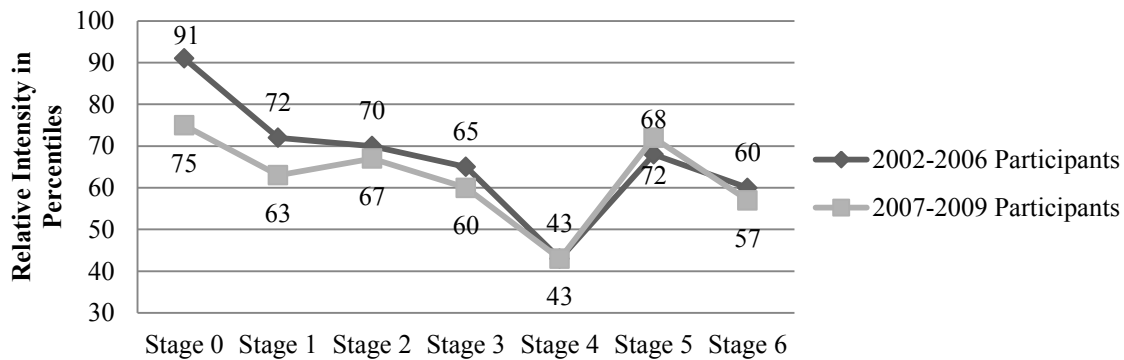


Figure 2. SoC profile of NATAA participants according to date of participation

Years of Teaching Experience

Figure 3 displays differences in percentile scores in each stage of concern between respondents with teaching experience between one and five years, those with teaching experience between 6 and 10 years, and those with over 10 years teaching experience.

Each group's percentile profile followed a similar pattern. Stage 0 percentiles are highest for all three groups, indicating that all groups perceive that there are a number of initiatives and tasks that are of concern. The tailing-down at Stage 6 for each of these groups indicated that respondents in each group display willingness to change. Top three highest stages of concern are Stages 0, 2, and 1 respectively for both groups with teaching experience over five years. This indicates that these two groups hold similar concerns regarding the innovation. However, the difference between the first and second highest percentiles of participants with over ten years teaching experience is greater than the respective difference seen in participants with six to ten years experience, indicating that

teachers with greater than ten years teaching experience have greater distinction between their concerns with other tasks and initiatives and their concerns with personal and informational aspects of implementing inquiry-based instruction.

The profile of participants with between one and five years teaching experience shows more variation than those of the other groups, suggesting that the intensity of different stages of concern varies more among individuals. Additionally, this group's second highest percentile is in Stage 5, indicating they have intense concerns regarding the coordination and cooperation of others when implementing inquiry-based instruction. Lastly, the *negative one-two split* shown between Stages 1 and 2 suggests that this group of teachers may have doubts and potential resistance to an innovation. This *split* indicates that concerns about the effect of inquiry-based instruction on job security may be greater than the desire to learn more about its implementation.

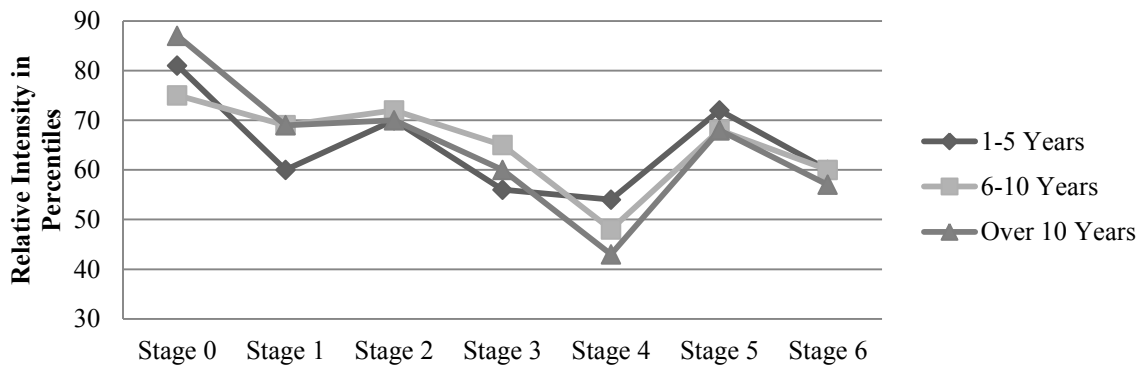


Figure 3. SoC profile of NATAA participants according to length of teaching experience

Conclusions

Individuals who participated in two years of NATAA professional development were most concerned with issues related to collaboration, while individuals who participated in one year of professional development were most concerned with issues pertaining to a variety of tasks and innovations. Individuals usually move through the five developmental stages in the SoC model and user concerns move toward higher-level stages with time, successful experience, and the obtaining of new knowledge and skills (George et al., 2006). Because the NATAA is designed to provide agriscience teachers with new knowledge and skills in inquiry-based instruction, as well as opportunities to develop their skills, it can be suggested that an increase in NATAA participation from one to two years resolves low-level, self-related concerns regarding inquiry-based instruction. Similarly, an increase in NATAA professional development also increases the ability of agriscience teachers to focus on higher-level, impact-related concerns that typically appear only after lower-level concerns have been resolved. This conclusion supports previous research that identifies the quantity of professional development as a factor affecting beliefs about inquiry-based teaching practices (Supovitz & Turner, 2000).

With regard to groups participating in NATAA professional development before or after its alteration to include development of inquiry-based instruction methods, both groups

have intense concerns related to a number of task initiatives. However, differences between the first and second highest percentiles of the group participating before and after the academy's alteration in 2007 are 19 and three respectively, suggesting that the academy version that includes specific professional development on inquiry-based instruction serves to alleviate the low-level, self-related concerns of some individuals and allow more individuals to identify concerns at a greater variety of levels. Stages showing second highest percentiles for each group (Stage 1 for those participating in the professional development before its alteration compared to the second-most intense Stage 5 concerns of those participating in the professional development after its alteration) further confirm this conclusion.

Profile variations according to length of teaching experience indicated differences between teachers with less than six years experience and those with greater than five years experience. Teachers with between one and five years experience displayed greater variety in their intensity of stages of concern, suggesting that their concerns were less uniform and therefore may require more time, experience, or professional development to address all concerns which is congruent with research suggesting newer teachers need to gain more experience before being able to successfully utilizing inquiry-based instruction (Crawford, 1999). Additionally, this group displayed a *negative one-two split* between Stages 1 and 2, which indicates that these individuals are concerned about how the implementation of inquiry-based

instruction may affect their job security. Past research states that no relationships between years of teaching experience and stages of concern have been discovered (George et al., 2006). However, this research suggested that while length of teaching experience may not have a direct effect on the efficacy of NATAA professional development, associated variables, such as tenure, current economic climate, and job security may cause some influence on the concerns of teachers with less than six years experience regarding implementing a new innovation, and may therefore cause an indirect effect on the efficacy of NATAA professional development.

When considering implications of this study, limitations to its utility must be pointed out. The three variables examined in this study each have research-based merit and can lead to valuable recommendations. However, no variables were controlled for when examining each separately, thus, the variables could have been confounded. Therefore, it is recommended that further study focus on possible relationships between variables in order to increase the study's impact.

Recommendations

Due to the value of the time and resources of all parties involved, efforts should be made to maximize utility and efficacy of professional development. Results of this study conclude that the NATAA may have a positive effect on the concerns of agriscience teachers regarding inquiry-based instruction. NATAA participation appears to resolve low-level, self-related concerns and allow teachers to focus on higher-level, impact-related concerns that usually emerge after lower-level concerns are alleviated. The increased focus on enhancing skills to utilize inquiry-based instruction seems to heighten this effect, as does increasing length of participation in the professional development from one to two years. Therefore, the NATAA should investigate the possibility of offering increased opportunities for teachers to

participate more than two times, hopefully enhancing this increased understanding of inquiry-based instruction further. Additionally, NATAA instructors should continue to focus on inquiry-based instruction professional development, as well as consider methods to improve the depth of knowledge and skill offered in this area. Lastly, inconsistency of concerns of teachers with less than six years teaching experience suggest that current NATAA professional development methods may not be as effective with this group as they are with more experienced teachers, whose concerns are more predictable and consistent. Therefore, it is recommended that the NATAA contributors maximize their efforts by focusing on working with teachers with at least five years teaching experience. Through this narrowing of participant criteria, the NATAA can focus more on concerns that affect a large number of participants who are more likely to implement inquiry-based instruction.

Professional development can be costly for many parties due to constraints in funding, time, and resources. This study serves to further solidify the NATAA as an effective, valuable method of teaching teachers to utilize a current best practice in teaching science through agriculture. Subsequent research on the various effects and practices of NATAA, including efficacy of participants leading teacher professional development, can add opportunity for the academy to improve methods and practices in professional development teachers to incorporate science in their classrooms through inquiry-based instruction. Findings from further study can also be utilized to identify factors of the NATAA that increase teacher understanding and change. These factors can then be implemented in various professional development opportunities, both being offered through the NATAA and other professional development vehicles, to increase teacher depth of change and understanding in many development areas.

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