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Inquiry-based Instruction: Perceptions of National Agriscience Teacher Ambassadors

Jessica M. Blythe[1], Catherine A. DiBenedetto[2], and Brian E. Myers[3]

Abstract

To assist students in developing positive scientific attitudes and improve student scientific literacy, learning environments should utilize inquiry-based instruction (IBI). In order to further develop the implementation of IBI in agricultural education settings, this research sought to describe the perceptions of National Agricultural Teacher Ambassador Academy participants' transitions to IBI. Utilizing focus groups, this research identified three themes concerning the implementation of IBI: the perceptions of time required to implementing IBI, perceptions of the transition from former teaching methods into IBI, and perceptions of the reactions from their school environment of participants' implementation of IBI. Though participants reported initial personal and student struggles when transitioning to IBI, they also perceived that once students understood the processes associated with IBI students reported learning more than with other teaching methods. The findings indicate that a variety of professional development opportunities and supports must be provided for agricultural teachers implementing IBI in their classrooms.

Keywords: Professional Development, Inquiry-Based Instruction, Agriscience, NATAA

Today's society and workplace demand that its citizens and employees be scientifically literate (Edwards, Leising, & Parr, 2002). Science education researchers posit that students greatest achievements in science occur when their learning experiences are constructivist or inquiry-based in design and delivery (Edwards, Leising, & Parr, 2002). A variety of scientific pursuits and thinking skills (such as inquiry and investigation, collection and analysis of evidence, logical reasoning, and communication and application of information) should be included throughout K-12 education in order to develop scientific proficiency (National Research Council, 2012). To aid students in acquiring positive attitudes about science and improve student achievement in science, learning environments should maximize inquiry-based instructional (IBI) methods (Edwards, Leising, & Parr, 2002).

The National Research Council (NRC) publication, *Inquiry and the National Science Education Standards*, states inquiry is "something that students do, not something that is done to them" (NRC, 2000, p. 2). School-based agricultural education (SBAE) programs provide a plethora of opportunities for science integration, and have responded to that call to highlight the science in agriculture (Myers, Thoron, & Thompson, 2009; Myers & Washburn, 2008; Balschweid & Thompson, 2002). In order for agriscience teachers to continue to improve their efforts to effectively integrate science into their classrooms, support for professional development, collaboration throughout the profession and instructional change is required. Understanding and implementing IBI is one method to assist agriscience teachers with those efforts.

[1] Jessica M. Blythe is an Assistant Professor in the Department of Agricultural and Extension Education at West Virginia University, PO Box 6108, 2050 Agricultural Sciences Building, Morgantown, WV 26505-6108, Email: jmblythe@mail.wvu.edu
[2] Catherine A. DiBenedetto is a Ph.D. Candidate in the Department of Agricultural Education and Communication at the University of Florida, 310 Rolfs Hall, Gainesville, FL 32611, Email: cdibenedetto@ufl.edu
[3] Brian E. Myers is a Professor in the Department of Agricultural Education and Communication at the University of Florida, 307A Rolfs Hall, Gainesville, FL 32611, Email: bmyers@ufl.edu

The appeal of inquiry-based teaching for learners and educators is the structure of "knowledge-in-action" rather than "knowledge-out-of-context" (Applebee, 1996, p. 30). This can be a difficult structure for teachers and students to comprehend. A shift in the teacher mindset to become a facilitator of knowledge rather than a provider of content must occur. Students are challenged to think and problem solve, while constructing answers that may or may not be correct. For some students, this method of learning is difficult to grasp and can become frustrating (Anderson, 2002). The results of the research conducted by Thoron, Myers and Abrams (2011) indicated persevering through these struggles resulted with a rewarding increase in student motivation and more meaningful construction of questions. The National Science Teachers Association Reader's Guide to a Framework for K-12 Science Education (NRC, 2012), recommends that science be built around three dimensions: 1) scientific and engineering practices, 2) crosscutting concepts and 3) disciplinary core ideas. Through discussion and reflection, students can come to realize that scientific inquiry embodies a set of values (NRC, 2012). These values include respect for the importance of logical thinking, precision, open-mindedness, objectivity, skepticism, a requirement for transparent research procedures and honest reporting of findings (NRC, 2012).

There is no exact operational definition of IBI (Anderson, 2002). In the field of education, IBI is viewed as an attribute of a preferred type of teaching and a category within learning activities (Anderson, 2002). Inquiry learning refers to an active learning process in which students are engaged and students develop knowledge and understandings of scientific ideas (Anderson, 2002).Given the widespread diversity in the meaning of IBI it is important to better determine a common understanding among all education leaders and teachers. Teachers are the linchpin in any effort to change K-12 science education and it stands to reason that in order to support implementation of the new standards and the curricula designed to achieve them, the initial preparation and professional development of teachers of science will need to change (NRC, 2012). Priority area four of the National Research Agenda calls for meaningful, engaged learning in all environments (Doefert, 2011). The key outcome is to prepare learners in agricultural education to be actively and emotionally engaged in learning (Doefert, 2011).

IBI could be viewed as a new tool or new innovation for agriscience teachers to adopt and diffuse into their classroom teaching practices. Accurate use of this tool and effective implementation of this innovation can aid in the nations efforts to prepare a scientifically literate workforce. The National Association of Agricultural Educators recognized the need for this change and began offering an intensive week-long professional development program focusing on IBI methods, referred to as the National Agriscience Teacher Ambassador Academy (NATAA). Over the past 10 years, more than 170 agriscience teachers from around the nation have been trained in IBI through this program. NATAA selects and trains the innovators to hasten the rate of adoption of this innovation throughout the nation. The perceptions of NATAA teachers, who are at the forefront of disseminating IBI into the world of agriscience classrooms, can assist in our ability to come to a common understanding of how inquiry can be utilized by agriscience teachers, how teachers transition into incorporating IBI into their daily lesson plans, and how students react to IBI when it is effectively implemented into agriscience classrooms.

Literature Review and Theoretical Framework

During a twenty-five year time span after Sputnik was launched, from 1956 to 1980, science was restructured to emphasize process approaches to teaching (Grossen & Romance, 1994). An instructional shift from teacher-directed approaches to student-centered, process approaches is embedded in the constructivist theory. Knowledge is not passively accumulated. Learners construct their own meaning by connecting new learning to previous learning (Schunk, 2012). Knowledge is presented in a naturalistic context, without explicit, teacher directed instruction (Grossen & Romance, 1994). This allows the learner to participate actively, rather than passively

in the learning environment; developing knowledge for themselves through the discovery of basic principles (Schunk, 2012). Teachers should work collaboratively to plan curriculum; connecting the big concepts for learners to interact socially; developing diverse types of experiences (Schunk, 2012). IBI provides a platform for teachers to guide and facilitate the learner. Information provided and questions asked are used as a scaffold within IBI to uncover the learning process and allow students to go on a journey or be challenged by a mission. Vygotsky has had the most influence on modern constructivist thinking (Schunk, 2012). Constructivism lies in the major belief that interactions with people in the environment stimulate developmental processes and foster cognitive growth (Schunk, 2012).

Findings from research efforts are generating important information with regard to how learners acquire meaning and understanding of science concepts both in and out of school (Saunders, 1992). Hands on, investigative laboratory experiences support opportunities for learners to integrate occurrences; enabling understanding of sensory practices (Saunders, 1992). SBAE programs provide the environment and the resources for those experiences. Saunders also suggests not all laboratory activities are equally effective in constructing meaningful learning. A clear understanding of the definition of IBI becomes necessary for teachers to differentiate effective IBI activities which construct meaningful learning and those which provide step by step procedures for students to follow. This can typically be described by two approaches to laboratory instruction: 1) the traditional or verification lab and 2) the investigative or inquiry approach (Saunders, 1992). The traditional approach provides learners with a workbook, guide, handout, lab manual or some form of printed instructional materials containing an outline, description, purpose and detailed instructions to adhere to while completing the experiment. This is typically referred to as a cookbook approach to science where the cognitive work has been completed for the learner (Saunders, 1992). Simply carrying out the steps of the experiment as presented will not lead the learner to increased knowledge and understanding if they are unsure of the meaning underlying the procedure. When the learner is questioned about their understanding of the experimental procedure, they usually respond with, "I don't know" This step by step approach is a passive mechanism to learning, which lacks cognitive engagement (Saunders, 1992). To foster and produce a scientifically literate workforce, teachers need to challenge their students to think and problem solve. The inquiry approach requires the learner to predict what is likely to be observed and necessitates active cognitive immersion (Saunders, 1992). This approach facilitates a deeper understanding of the purpose and provides an opportunity for the learner to become absorbed in the environment while constructing new knowledge, formulating meaningful questions, and critically solving problems.

Schneider, Krajcik and Marx (2013) posit reform-based curriculum designed to support students' construction of knowledge in science through inquiry relies on teachers to fulfill this vision of learning for students. Instructional practices will need to change and teachers will require support throughout the change process (Schneider et al., 2013). In order for teachers to present reform-based curriculum, they will need to learn new instructional methods (Borko & Putnam, 1996). This research focused on the perceptions of NATAA participants who were formally and intensively trained in IBI. Instruction was modeled and participants were afforded numerous occasions to practice and reflect both during and after the training sessions. Previous research has found that teachers maintain positive perceptions of their teaching and school environment after IBI training through NATAA (Thoron et.al, 2011). Results from Myers, Thoron and Thompson (2009) indicate the majority of NATAA participants incorporated IBI strategies two or more times each week. NATAA participants reported asking open-ended questions to invoke deeper scientific thinking and observation occurred three or more times each week (Myers, et al., 2009). In addition, NATAA participants reported a positive attitude toward integrated science through IBI into their agricultural education programs (Myers, et al., 2009). In order to continue to develop and improve authentic professional development experiences for agricultural education teachers, and determine

the impacts on both teacher learning and increased student achievement, further investigation of the current integration of IBI and the perceptions of practicing NATAA participants is required.

Purpose and Objectives

As agricultural education looks for opportunities to positively impact agriscience teaching practices that support science literacy, it is essential to utilize the experiences of current NATAA teachers in support of effective implementation of IBI into agriscience classrooms. If IBI is the method to move the profession further into science integration, local-level research should be conducted (Schunk, 2000). To that end, the purpose of this research was to describe NATAA teachers' perceptions of transitioning to and implementing IBI. The objectives of the research were to: (a) describe NATAA teachers' perceptions of the transition from their former teaching methods into incorporation of IBI; (b) NATAA teachers' perceptions of the reaction by their school environment (students, peer teachers, administration) when they utilized IBI; and (c) compare the perceptions of IBI transition and implementation based on NATAA year of attendance.

Methods

To determine the perceptions of past and present NATAA participants when implementing IBI in their local program this research implemented multiple focus groups. Procedures and materials for the focus groups were developed and conducted by the researchers following the protocol established by Krueger and Casey (2000). A written plan was developed and a list of nine guiding questions was used to help maintain flow and consistency among multiple focus groups. Additionally, a script was produced that included a welcome, an overview of the topic, ground rules, and the guiding questions. The nine research questions were designed by the researchers to gather participants' perceptions regarding implementing IBI. The script also provided the opportunity to gather focus group participant feedback at the end of each session to confirm the accuracy of the main points. A panel of experts familiar with both focus group methodology and IBI examined the moderator's interview guide for face and content validity.

Four focus groups were conducted with a combined total of 36 participants; no focus group had more than 10 participants. The participants were purposely selected based on their participation in the NATAA program, which focuses on implementing IBI methods in individual classrooms. Each focus group included a cross section of male (n = 15) and female (n = 21) teachers with 3 to 25 years of teaching experience. Two focus groups were comprised of NATAA participants from 2012 NATAA program, representing the current ambassadors who had only four months of experience implementing IBI. One focus group was comprised of teachers who participated in past NATAA programs (2003-2011), representing a range of experiences with implementing IBI. The fourth focus group was comprised of a mixture of 2012 NATAA teachers and previous NATAA teachers. Each focus group was approximately 90 minutes in length.

An objective moderator with knowledge of focus groups methodology conducted all four focus groups. An assistant moderator and a note taker were also present at each focus group to ensure the content of the focus group participants' comments were accurately captured. The discussions were audio recorded and transcribed. Data analysis was conducted using transcripts of the focus group interviews, field notes and member checks (Krueger & Casey, 2000). Researchers analyzed the transcripts using Glaser's (1967) constant comparative technique in which researchers looked for common themes, similarities and differences among the text. Transcripts were coded for themes and categories were created. As themes emerged they were compared to existing categories to look for common relationships. New categories were created for distinct themes that did not fit into previously created categories.

To assess the quality of the research, confirmability and dependability were established through the researchers' audit trails between the raw data and the analysis. It should be noted that

focus groups are conducted to provide in-depth examinations of the topic of interest and are not meant to produce generalizable results (Krueger & Casey, 2000). Readers should determine whether the results of this research may be applied to similar situations, which follows Lincoln and Guba's (1985) standard of transferability. Confidentiality was maintained through the removal of names and a coding system which allowed researchers to track individual participants' comments without attributing them to a specific name. Additionally pseudonyms were used within the reporting process.

Findings

A summary of the themes that emerged from the data collected throughout the focus groups is provided. Three main themes emerged from the research: (a) participants' perceptions of time required to implement IBI, (b) perceptions of transitions to IBI, and (c) perceptions of reactions from participants' school environments. Participants' names have been changed to protect anonymity. It should be noted that the first theme identified does not align with the objectives of the study, however, because of the frequency and duration of which participants discussed the aspects of time related to their implementation of IBI the researchers identified it as the primary unique theme.

Perceptions of time required to implement inquiry-based instruction. Time was the theme that was most prevalent in each of the focus groups. Though none of the guiding questions specifically inquired into the element of time for implementation, it became a point of discussion throughout the sessions. The two major sub-themes concerning time were (a) the length of time it requires for a teacher to feel comfortable with inquiry in their own classrooms and (b) the amount of time to plan and prepare for lessons that incorporate inquiry strategies.

The conversation of the 2012 participants shared struggles to frequently and consistently utilize IBI. Sarabeth expressed, "I would hope that there would be some immediate change, but I don't know, it hasn't happened for me yet." Kelley added, "I haven't hit my stride yet, give me a couple of years. It just, you know, I feel like I love the concepts, but sometimes my day boils down to, you know, I have to get something together for tomorrow and I'm just not that far. And my thought is, in my third year, I'm really going to be on top of things." Similar comments were commonly agreed upon by the 2012 ambassadors.

Though the participants were not very confident and consistent when implementing IBI, the struggles they discussed were echoed throughout the sessions. Spencer said,

> You really need student buy-in. And I think that might have been the biggest issue for me going into it thinking that my students were going to buy into this and it was going to be great. And I have not really had the opportunity to do a whole lot just based on the fact that my students won't buy in. And that has definitely...I love the process, I think it is wonderful and when I am able to use it, it works. But it is not as consistent as I would like it to be. And obviously, it is not going to start out that way, but I am not sure.

Dan added,

> I struggle to find the time to always say, "Okay, how can I incorporate inquiry into this?" So, I know it's one of those things like I do something it's okay, here's my note of what I can change to make that better for next year and it doesn't come into play because I ran out of time between of all my responsibilities. So, that's my struggle with it. I feel like I don't always have enough time to really incorporate it as much as I want. So, my goal sounds little of once a week, but for my crazy days, that's still a struggle for me.

The idea that it takes a couple years to become comfortable implementing IBI on a regular basis was supported by the past ambassadors. The past ambassadors agreed that it took two, three, or even four years to make implementing inquiry in their classrooms easy and consistent. Greg

said, "I say two to three years is the...I mean, this is the third year after it, and I'd say now it's consistent." This sentiment was echoed throughout the focus groups of past ambassadors. "It took me two to three years to be consistent." Chris added. Many of the past ambassadors provided that implementing inquiry in a classroom is similar to being a reflective teacher. This is exemplified in Chris's statement "It's just like any lesson as far as being a teacher, you monitor and adjust."

The second evident sub-theme focused on the amount of time that was required to plan and prepare IBI lessons. Both present and past NATAA ambassadors discussed the time commitment that it takes to plan and prepare lessons using IBI. Dylan explained, "It's [IBI] great, but it takes more time for preparation, especially if you have four or five preps during the day to try to do inquiry lessons at least once a week for all of those takes a lot more time to plan for all that.". Kelley added, "it [IBI] takes a lot of time in class. I'm normally organized with what day I am supposed to be doing something and I found that an activity that I thought was going to take half a class period, ended up taking us three days because the students got really excited about it. And I think (name omitted) was saying about the not feeling as strong in the areas that they get curious...because they get really curious and ask questions".

When asked to expand on the challenges of implementing IBI, gauging the amount of time that an IBI lesson takes for students to work through, was difficult. Amanda, a past ambassador, said,

> I would say like time management is a challenge. Because at first when they don't want to think, you know, like trying to come up with ideas to get them to think. And, you know, planning it out. Like, oh, it should take this long and then it doesn't, either it was really fast or it goes too long and now you have to extend an experiment that maybe shouldn't be extended to the next day. And each class is different. If you get a lot of needy kids, an activity you did in the first hour may take double that in the next hour.

However, participants discussed how the intensity of teaching required in a class period is actually easier than the teaching methods they used prior to implementing IBI. Kelley said, "It is actually an easier class, I think, while you are actually teaching it. But, the prep work beforehand is a lot, so that is the problem.", and several participants agreed.

Perceptions of the transition from former teaching methods into IBI. Participants were asked questions regarding their implementation of IBI techniques into their classrooms, causing the transition from former teaching methods to IBI to become a focused conversation. The sub-themes discovered in their responses were: (a) how IBI aligns with individual classrooms and (b) the journey of personal change as a teacher that occurs when implementing IBI.

When discussing how the teachers use inquiry in their classrooms many participants described a change in teaching methods not a change in content. Participants identified using inquiry-based methods in a variety of ways when planning lessons. Dan said "I will either teach something first and use that as the activity to assess their understanding of it or I will use just that activity to see how much they know up front." Spencer described, "I think it [IBI] is just a teaching tool. I think you are almost doing a disservice if you try to use it all the time because it is just like anything else, if you do the same teaching method or procedure every single time, the kids will get bored with that, too", and identified the need to use a diverse set of teaching strategies, which was echoed by the other participants. The values of IBI methods, such as engaging students in logical thinking, research processes and exploration were solidified by many of the participants. Ashton said,

> I have a student that is taking Earth Science and my Environmental Science class at the same time because he wants to graduate a year early. And he said, "You know, we are covering the same thing right now that Mrs. Dee is covering in Earth Science. But yours makes sense because I get to touch it and feel it and see it and I get to explore it, where she is just kinda giving us notes and then we have to spit them back to her on a worksheet.

Dan shared a specific example for implementation, which others agreed was similar to what they were implementing. "When I was going over greenhouse structures, I gave them diagrams of

different structures and had them match up the names and what type it was first and then they had to have ownership. And they were proud that they finally got it right, it took them a couple of tries. They had to use clues and figure stuff out on their own instead of me just giving it to them."

Overall, the participants focused on the benefits and opportunities for student learning that IBI can provide. Greg shared, "I think inquiry helps the kids think on their feet. So, you know, out on the job force or you know, even if they're taking a test and they don't feel comfortable with it...you learn clues and ways to evaluate things, so you don't always have to know the right answer, but you can discover the right answer." Jennifer shared what IBI helps students learn:

> [Students] learn how to defend their thoughts. I think that's really important. They...I mean we do it with reasons when we teach judging, but now you're reaching out to more than just those kids that are doing those CDE's. All kids...it's an expectation that everybody has to be able to defend your thoughts. And it's not just, 'Well, because.' 'No, you have to give me specific reasons.' And it forces the kids that don't do anything to kind of step it up.

One of the biggest challenges reported by participants when implementing IBI was the journey of personal change; this is presented in the second sub-theme. Many teachers reported improved planning and organizational skills as a result of IBI implementation. Sarabeth said, "I think I am a little more organized because of some of the strategies", which was agreed with by a majority of the participants.

A majority of participants shared that it was a personal challenge to implement IBI because it was not what the teachers were used to. Bob shared "My kids are doing a good job of it [IBI] but I feel like the old dog that doesn't want to learn the new trick, I am trying to make myself do it but yet at the same time, I still catch myself falling back into those old habits. And I think I have got to be more focused on being consistent with it, rather than...okay, we are going to have this really good lesson and then two weeks later we will have one more. Because my kids have no idea what to expect from me." Additionally, Jennifer said,

> I think it's being patient with yourself [is most difficult]. Because we want it to go well, we want it to go smoothly, and then anything we try...whether you're teaching your class or trying new you know, teaching strategy or you do inquiry and it doesn't go as smoothly as you'd hoped...the temptation is to get frustrated and quit. I mean, we know it works, but you're like, oh it's just...you know, those little modifications to make your lesson go smoother, that you want to do right away. And I guess that's not very well articulated, but it's one of those things where you really have to stick with it to make it work because otherwise you can get frustrated and just give up, I guess.

Participants were similarly challenged by the increased demands for change required in teaching, in addition to the personal change in teaching methods required for implementation of IBI. One new ambassador, Ashton, exemplified this challenge by sharing her story.

> I don't want to drop it, I want to keep on and I want to be better at it, but at the same time I don't think that it is ideal that I am learning a brand new curriculum and trying to do it at the same time. I think if I was a new teacher with a new curriculum learning, making my habits from the beginning...or if I was an older teacher that was already comfortable with my curriculum. But being in the middle of the road with a new curriculum and a new teaching style is kind of being a big challenge for me.

Many participants reported this change made teaching more enjoyable. Greg, a past ambassador said, "It's not that I've changed what I'm doing, I've changed the way that I do it, or developed or morphed the way I do things to try to fit inquiry better. It's made teaching more enjoyable, for me."

Perceptions of the reactions from their school environment. The focus group participants felt that IBI was beneficial to students, though the reactions from their schools were not always immediately positive. The sub-themes found were: (a) adaptation to IBI by different types of students, (b) reactions of peer teachers.

Overall, participants' reports of the students' struggles centered on the differences between IBI and the previous teaching methods they found most familiar. Jennifer said, "I think that [name omitted] uses a word that hits it really well, it's process. Those high achieving kids are really good at memorizing and because that's the process they've learned to get them the grade they needed. And I think it is that transitioning the process, whether they're a high achieving or low achieving student, getting them to understand the [IBI] process." Dan added, "it takes a real shift from the students, because they are not used to it so it...you have got to keep fighting at it and pushing it because it is not going to be the first week that they are all going to be on board. And they are going to get frustrated throughout the year because you may be the only person during the day that does it with them."

The participants' discussions did identify differences in adapting to IBI between high-achieving students and lower-achieving students. This can be exemplified by Greg's statement:

> The one thing that I've definitely noticed and I don't mean this to sound mean or categorizing, but my lower achieving students love it. My higher level students hate it because, "I gotta have an A, you gotta tell me the answer, you gotta give me this, this, and this." And they just flipped out on me and they still flip out. "Well, what do you mean, I may not get the right answer?" "It's okay." But my lower achieving kids, you know they're used to not having the right answer, so it doesn't matter.

Many of both current and past ambassadors identified difficulties high-achieving students have when learning using IBI methods. This was supported by Sarabeths' story:

> I have a ninth grader who is pushed into that class, and his mom is a teacher and he is awesome at basic knowledge. You could give him a multiple choice test and he will get a hundred every time, all day long, all year long. But he cannot apply the knowledge at all, nor will he try to. And she understands that he needs to be able to do that, but he is refusing to do it. "If I know the answer and that is the answer, that is good enough." Because on our state tests, in most cases, those questions will give him enough credit to pass. The application questions and the part two and part three, if he doesn't get those all right, so he doesn't get the hundred, he doesn't care.

Participants shared many success stories, of their lower-achieving and average students. These stories often compared what students said they learned in their agriculture courses and those taught in other areas. Jennifer shared "I got a lot of those comments, too, where the kids are like...like for example, the mitosis one I did, one of my students in the back was like, '(Name omitted) you're such a good teacher. I learned this in so and so's class and now I actually understand it rather than just memorizing it that way'." Chris also shared a similar conversation with a student: "Eric said, "I appreciate you." And I said, "Why is that, Eric?" He said, "Because you get my brain going, you make me think. The rest of them don't do that and they wonder why I don't pass their class." And I thought that was the vote of a lifetime." These types of stories made the participants feel validated as a teacher and show encouraging signs for the rewards which follow the struggles, as teachers effectively implement IBI into their classrooms.

The second theme identified concerning reactions of the school, was centered on reactions of peer teachers. A majority of evidence for this theme came from past ambassadors, indicating it may take time to develop collaborative relationships built around inquiry. This became apparent because of the participants' use of IBI, they were sought by their peers to share their ideas. Amanda said,

> I have found certain teachers are more willing to collaborate...they'll stop by my room, because even though I'm part of the Science Department, I'm like amongst the Social Studies teachers. They'll come down and say, "Hey, I want to teach this; what do you have for ideas?" So, they come to me to ask for advice like, "How would you teach this?" Or, "How would you teach that?" Or, "Do you have anything to do this?" Because I think...because of the training, I'm more apt to be like, "Yeah, you could do this, or you

> could try this, or here's a resource there, pull it there." And I think that helps to foster relationships that they start to see you as an actual academic teacher.

Additionally, Tom added,

> I did [collaborated] with my Social Studies teacher. He was doing a unit with his advanced kids and they were talking about over-farming some of the land. I can't remember what country they were talking about and how their waterways were getting worse and so I helped put together a runoff lab for him. And he came back and goes, 'I don't know how you do that every day.' But he enjoyed it. He says, 'But next time, we're gonna do more prep work.' I'm like, 'Okay.' And I've collaborated with my science teachers, used the same types of lab reports, so that's consistent within our building.

Some teachers did report resistance from the science department, when asked about opportunities for collaboration. Cacee shared "moving to my new school, the Science Department was very resistant because I...the kids were getting credit for Ag classes and they were telling their kids that was a lie. And so they're still kind of resistant, but I think that will come with time." Participants reported lack of collaboration with science teachers, was often due to the tensions over science credits for agriculture courses. Dylan shared "They don't like that we are stepping in their space. I have got...there are three science teachers in the high school and one of them is just like, "You are doing way too much science." "I teach Ag Science and they get a science credit for my classes. Why wouldn't I be teaching science, John?"

The focus groups did identify differences between schools when discussing support for implementing IBI. Dan, a current ambassador, said "Some schools are great, and are buying in for everybody, but for me, I am the only person in my school that is doing it with them and they are not sure what is going on in my room." A few participants shared stories of support from administrators. Cacee said, "We were given strategies that can be applied to anything. I use them and my administrators raved about the strategies I use and the ones they rave about are the ones I got from the training we attended."

Conclusions, Implications, and Recommendations

Based on the themes identified through examination of the data guided by the objectives of this research, the researchers agree upon the following conclusions. Directly following each conclusion is a discussion of its implications and recommendations to the profession. The first objective of the research examined teacher perceptions of the transition in teaching methods to incorporate IBI. Teachers perceived that it took more time than they originally expected to become comfortable with teaching using IBI. The lack of comfort was evidenced in a lack of confidence in the classroom, as well as increased time required for preparation. There was strong agreement for this conclusion throughout the focus group members. It is important to note, these teachers were selected for the NATAA professional development based on applications that included a nomination from state staff and other agricultural education professionals. These teachers were already perceived as highly successful teachers by their peers. Several of the teachers noted the transition to IBI required them to have patience with themselves as they noticed or perceived a drop in teaching effectiveness when first attempting IBI in their own classrooms. However, through focused attention on the change and a belief that IBI was important to implement, the teachers were able to persevere through the perceived "teaching slump" to a perceived more engaged classroom through the use of IBI. This reinforces the importance of teacher attitude toward a change. Further investigation is warranted to understand the reason(s) behind the teachers' deep commitment to this implementation of IBI.

It was further noted that teachers with experience with IBI did not feel confident in their ability to use IBI until after the second or third year of implementation. This finding is consistent with that of Thoron, Myers, and Abrams (2011). Teachers in their first year of implementation concurred with the sentiment of this conclusion by noting their confidence level was improving

and they too estimated a strong comfort level with IBI after two or three years of use. Based on this conclusion, it is recommended that systems be developed and implemented to support teachers as they attempt to incorporate IBI into their classroom instruction. This group of historically successful teachers noted the struggles of this implementation. Through strong self-motivation, as well as support structures within NATAA and other support systems, the teachers were able to successfully and confidently implement this teaching method. Further investigation is needed to better understand the support systems these teachers utilized to be successful. With a better understanding of the proven support systems, these systems can be expanded and replicated to assist a larger number of teachers in this transition and possibly other teaching innovations.

The second objective of this research sought to describe NATAA teachers' perceptions of the reaction by others in their school environment to their implementation of IBI. Overall, teachers noted positive reactions from others in their schools. A small number of participants noted some resistance to collaboration from science teachers at their schools. It was the perception of the teachers who experienced this resistance that the cause of this friction was not necessarily the agriculture teacher's use of IBI, but the awarding of science credit for agriculture courses. Thus, academic policy issues and teachers' perceptions of those issues did play a role in the culture of collaboration. With the exception of the few noted teachers, it was concluded that the implementation of IBI encouraged teachers to seek collaboration from peer teachers. The collaborations noted by the NATAA teachers were mainly with science teachers in the area of content, teaching ideas, and equipment, but also included collaboration with teachers across several content areas.

The NATAA teachers also noted that "high achieving" students seemed to struggle with the implementation of IBI in the agriculture classroom. Meanwhile, "lower achieving" students seemed to enjoy the new teaching format. Teachers perceived these conflicting perceptions of IBI by these two groups of students based on each group's past history with schooling. It was perceived that the high achieving group had "learned the system" of knowledge-based testing. This group of students was also perceived to be much more focused on grades rather than understanding the material. Teachers perceived this group struggled when "the rules of the game" were changed with the implementation of IBI. Conversely, teachers perceived lower achieving students' attraction to IBI to be caused by the fact it was different than what they had experienced in other classes, where they experienced less success. Many teachers noted students of this group commented about how much they enjoyed this teaching method compared to what was taught in other courses in the school; indicating a better understanding of the content when it was taught in their agriscience course through IBI. This phenomenon needs further investigation. A better understanding of how students transition to the use of IBI is very important. Materials and methods to help all students' transition to the IBI format are needed.

The final objective of this research investigated differences in perceptions based on the number of years the teacher has implemented IBI. The data revealed that perceptions of all NATAA teachers were consistent. No material differences were noted in any area included in this research. Teachers who completed the NATAA in years past shared their own struggles with those teachers just beginning the implementation of IBI. This sharing of experiences was observed as a comfort to both groups. It helped veteran IBI implementers reaffirm a "normal" experience during their transition to IBI and encouraged the new adopters to persevere. It was a reaffirmation to the veteran IBI implementers that what they experienced was "normal" during their transition to IBI. It encouraged the new adopters in speaking with other teachers, who had "survived" the transition and gave them hope and suggestions to continue implementation of IBI. Research is needed to investigate the most effective means for this sharing to occur.

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