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The Infusion of Inquiry-based Learning into School-based Agricultural Education: A Review of Literature

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Abstract

Demands for increases in student achievement have led education professionals to incorporate various and rigorous teaching strategies into classrooms across the United States. Within school-based agricultural education (SBAE), agriculture teachers have responded to these challenges quite well. SBAE incorporates a wide variety of teaching and learning strategies, theories, and ideas into its conceptual framework. One such teaching and learning strategy is referred to as inquiry-based learning, commonly known in SBAE as problem-based learning. This method emphasizes cognitive development, critical thinking, and intellectual growth in students. The purpose of this study was to develop an understanding of the emergence and current utilization of inquiry-based learning in SBAE. We found that inquiry-based learning has been a long-standing staple in SBAE, particularly in terms of increasing the achievement of agricultural students. As a result, a model of the use of inquiry-based learning in SBAE programs was developed. Recommendations, discussion, and implications for research and classroom practice were included in this study.

Keywords: inquiry-based learning; school-based agricultural education; teaching methodology

In recent years, calls for increases in student achievement have paved the way for innovative and challenging teaching and learning methods within all classrooms, including those within career and technical education (CTE) (Pearson et al., 2010; Stone, Alfeld, & Pearson, 2008). Innovative methods are desired to help address student deficiencies in critical thought, cognitive abilities, and real-world skill development (Stone et al., 2008; Stone, Alfeld, Pearson, Lewis, & Jensen, 2006). Further, these teaching methods should emphasize pragmatism and high-quality learning through hands-on applications that reinforce academic content, all the while grasping toward students' natural inclinations and abilities to learn useful content (Phipps, Osborne, Dyer, & Ball, 2008; Stone et al., 2008).

In order to help further enhance students' interests in various content areas, many educators have incorporated the use of inquiry-based learning into their curricula. As supported by

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educational philosopher John Dewey (1910, as cited in Thoron & Myers, 2011), inquiry-based learning aids in students' processes of discovery about selected topics, particularly those of interest to individual students. As a result, higher-order thinking skills (HOTS) and more cognitively-rooted ideas are more apt to occur (Thoron & Myers, 2011). Interestingly, inquiry-based learning and teaching has historically occupied a very prominent role in agricultural education classrooms across the United States in the form of problem-based learning (PBL) (Parr & Edwards, 2004). As found by Parr and Edwards (2004), PBL and inquiry-based learning are congruent in their structure, methodology, and implementation. As described by Phipps et al. (2008),"Problem-based learning… is a teaching strategy that includes problem solving, inquiry learning, project-based teaching, and case studies. These four approaches use problems as the focal point for student investigation and learning." (p. 237).

It is apparent that inquiry-based learning has existed as a fundamental fixture of agricultural education, and it appears that this will remain the case for years to come. However, since the work of Parr and Edwards (2004) comparing the congruency between inquiry- and problem-based learning and teaching styles, much advancement has been made regarding the use of inquiry-based learning in SBAE. As a result, there exists the need to further address this new knowledge and develop additional dialogue concerning the forthcoming place of inquiry-based learning within agricultural education curricula. Perhaps a literature review of this area of inquiry will shed greater light on the subject.

Review of Literature

Edwards (2004) described the need for SBAE programs to move beyond curricula that emphasize simple rote memorization and toward challenging and advanced concepts that require knowledge in academic subjects. More specifically, Edwards (2004) concluded that SBAE programs are in a prime position in which to incorporate teaching and learning strategies that emphasize the development of the individuals as a whole, particularly in the areas of critical thinking and applied learning. As Phipps et al. (2008) noted, SBAE curricula offer a wide variety of learning experiences that suit a broad spectrum of student interest and learning styles. Further, such research has indicated that SBAE programs are capable of accomplishing a wide variety of tasks essential to the development of agricultural students as a whole, such as: 1) enhanced understanding of academic content when applied and understood in agriculture-based contexts (Parr, Edwards, & Leising, 2006, 2008, 2009; Young, Edwards, & Leising, 2009); 2) increased leadership education capacities through involvement in FFA activities (Phipps et al., 2008); and 3) increases in the variety of potential career area choices (Phipps et al., 2008). As each of these elements is essential to the growth and sustainability of SBAE programs as an educational entity, it is reasonable to postulate that high-quality teaching methods (such as inquiry-based learning) may play a role in these increased pursuits.

As described by Parr and Edwards (2004) and Phipps et al. (2008), problem-based learning (i.e., inquiry-based learning) is designed to expand students' cognitive capacities through exposure to ill-structured agricultural issues that require complex thought. Further, these agricultural issues often require students to develop action plans that demand articulated and flexible responses. Numerous examples of these concepts abound in SBAE, particularly in laboratory settings. For example, students participating in agricultural mechanics activities are exposed to a wide range of problems that require pragmatic, structured, and logical thought to adequately solve (Parr et al., 2008; Wells & Parr, 2011). Many of these issues require utilizing applied academic and technical knowledge to adequately address and solve. As a result, higher levels of cognition are needed to analyze such practices appropriately (Parr et al., 2009).

In order to facilitate such increased cognition, agriculture teachers can select and structure classroom- and laboratory-based problems around technical issues that may exist in the real world (Parr, 2004; Parr et al., 2006), such as the framing of a barn for the school farm, etc. However, of

vital necessity is the deep engagement of the students in the process, such as the use of questioning to draw answers (and even additional questions out of students) and the use of in-class research to solve a practical problem. As such, students become more thoroughly engaged in the complete process of research and solving technical issues via inquiry-based learning. This serves as an interesting and thought-provoking example of the use of inquiry-based learning in classroom and laboratory settings. However, a question remains: How can such strategies best be incorporated into out-of-classroom experiences?

As originally conceived by Stimson (1919), supervised agricultural experiences (SAE) serve as student-led projects that are to be conducted outside of typical class time and classroom/laboratory settings (Phipps et al., 2008). As traditionally directed, students select SAE projects based upon individual interests that appeal to them, such as future career choices, interests in agricultural topics, enterprises conducted at home, etc. The SAE decision-making process is guided by the agriculture teacher, who helps students identify such areas and develop a plan for implementation. Additionally, the agriculture teacher supervises the student through his/her progression within the SAE, allowing for experienced oversight that guides the process appropriately (Phipps et al., 2008).

SAE projects allow for a multitude of teaching and learning interests to be explored, particularly in the pursuit of high-quality SBAE program development (Phipps et al., 2008; Wells & Retallick, 2013). As described by Wells and Retallick (2013), SAE emphasizes much in terms of developing students for and through academically-rigorous work through the use of a practical, hands-on context. This was particularly true for mathematics and science content integration. As SAEs are naturally rooted within classroom- and laboratory-based content areas (Ramsey & Edwards, 2012), this area exhibits much potential for academic content education and emphasis (Wells & Retallick, 2013), and are designed to be based upon student interests (Phipps et al., 2008), it stands to reason that perhaps inquiry-based instruction is paramount to the long-term durability of SAEs. Further, as SBAE seeks to incorporate academic content, such as reading, science, and mathematics curricula, alongside teaching methods that emphasize higher levels of cognition within students, the entire model of SBAE should be crafted to fit into the necessary mold of rigor and relevance (Edwards, 2004; Parr & Edwards, 2004; Parr et al., 2006, 2008, 2009; Phipps et al., 2008; Young, 2006; Young et al., 2009).

Conceptual Framework

The idea that guided the current study was rooted in the National Research Agenda (NRA) of the American Association for Agricultural Education (AAAE) (Doerfert, 2011). In particular, this study was aligned with both Priority 4 and Priority 5 of the document. Priority 4, "Meaningful, Engaged Learning in All Environments" described how,"[m]eaningful learning occurs when learners go beyond rote memorization of facts to the ability to interpret the interconnectedness of facts or material, regulate their understanding, transfer the understanding of concepts to new situations, and think creatively" (Doerfert, 2011, p. 21).

As described by us within the present study, Priority 4 emphasized the basic tenets and purposes of inquiry-based learning in SBAE. Further, as "[t]he role of the teacher… is to move from being the sole source of knowledge to becoming a facilitator of a… engaged learning process" (p. 21).

Moving to Priority 5 of the NRA, "Efficient and Effective Agricultural Education Programs", this notion has underscored the need for advancing agricultural education into a model that emphasizes pragmatic, high-quality, and academically-rigorous curricula. As inquiry-based learning is designed to create relevant and problem-based learning environments (Parr & Edwards, 2004; Thoron & Myers, 2011), the creation and sustainment of high-quality SBAE through this teaching and learning theory is well-supported.

Purpose of this Study & Objectives

The purpose of this study was to describe the historical use of inquiry-based learning in the field of SBAE. This purpose was supported by the following objectives:

1) Describe the role that inquiry-based learning has historically played in SBAE.

2) Describe the incorporation of inquiry-based learning into the three-circle model of SBAE.

Methods & Procedures

To accomplish the purpose of this study, we conducted a review of various studies pertinent to SBAE, inquiry-based learning theory, and student achievement, particularly literature that focused upon the use of inquiry-based learning strategies. The reviewed literature was gathered from Internet resources and search engines, agricultural education magazines and textbooks, peer-reviewed journal articles, doctoral dissertations, and conference proceedings. We evaluated each article for its suitability in the present study through a thorough discussion and dissection of each literary item, ultimately reaching a consensus within the research team. Further, consultation with an expert in SBAE was used whenever questions or concerns arose regarding an item's utility for this study. In total, 45 ($N = 45$) resources were identified and used as a part of this study.

Findings

A forever-changing society with a constantly expanding knowledge base requires frequent evaluation about what is considered effective teaching and learning. By definition, agriculture is an applied science that combines principles of physical, chemical and biological sciences in the production of food and fiber (Merriam-Webster, 1988). Agricultural education in the United States has a long history of integration with science, mathematics and other academic content (Dailey, Conroy, & Shelley-Tolbert, 2001). Similarly, a history of legislation has stressed the importance of students being able to meet ever increasing achievement standards. However, it is not just historical or legislative expectations that see the melding of science, math and agriculture but the history of inquiry-based learning in agriculture that lends itself to success in science and math. This success is even more critical as CTE funding is partially based on standardized assessment as required in the "Core Indicators of Performance for Career and Technical Education Students at the Secondary Level" (Washburn & Myers, 2010).

Inquiry-based instruction is a method that encourages the curiosity of students while developing critical thinking skills. Subject matter, such as science and math, are given meaning, and made less abstract, by using a natural process of learning (Warner & Myers, 2011). Students are taught in a manner that nurtures the desire in them to seek information even after class is done for the day (Newcomb & Trefz, 1987). This progression of developing questions, exploring problems, observing and applying new information lends itself perfectly to the scientific method. Agriculture teachers have the unique ability to develop science and math skills through teaching agriculture in a way that goes beyond the memorization of facts (Warner & Myers, 2011), lending itself to a higher-order of learning.

Research has found that scientific reasoning ability is higher in classrooms that use inquiry-based learning (Chiasson & Burnett, 2001; Gerber, Cavallo, & Marek, 2001; Von Secker & Lissitz, 1999), and that students often fail to develop a deep understanding of science and mathematics in traditional classrooms (Bailey & Meritt, 1997). Inquiry-based instruction has been promoted as a best practice for educating students in and about scientific principles (National Research Council, 1988). Agriculture teachers often believe that melding science within agricultural curricula aids

students in connecting agriculture and scientific principles as well as increasing program enrollment and stakeholder support of the program (Washburn & Myers, 2010).

Students' perceptions of agricultural courses have shown to be positive when instructed through inquiry-based instruction. In a study conducted by Thoron and Burleson (2014), 170 secondary agriscience students perceived their agriscience course with much enthusiasm when taught through inquiry-based instruction. Even though a quarter of the students found inquiry-based learning confusing, almost half of the students within the study preferred the inquiry-taught instruction and would welcome inquiry-based instruction within other classes (Thoron & Burleson, 2014). In a quasi-experimental study conducted by Thoron & Myers (2011), inquiry-based instruction was measured against the subject matter approach on student content knowledge achievement in 15 agriscience education classes in 7 different secondary schools throughout the United States. The students were divided into two groups; one utilized inquiry-based instruction and the second group utilized the subject matter approach. A pre-test and post-test were administered to both groups. Research concluded that the inquiry-based learning group had a higher content knowledge achievement than the subject matter approach group.

In regard to the incorporation of inquiry-based learning in each of the three components of the comprehensive and complete SBAE program (i.e., classroom-/laboratory-based instruction, SAE, and FFA participation) (National FFA Organization, 2014; Phipps et al., 2008), it appeared that the vast majority of the literature dealt strictly with the explicit instruction element. This finding was troubling, as researchers (Wells & Parr, 2011; Wells & Retallick, 2013) have reported that both the FFA and SAE components have exhibited much potential for alignment with academic content standards. Based upon the previous literature that emphasized academic enhancement through inquiry-based methods (Thoron & Burleson, 2014; Thoron & Myers, 2011), it would seem that these areas could, due to their embedded academic curricula, hold significant potential for the incorporation of inquiry-based instructional strategies. Interestingly, Rogers (1969, as cited in Roberts, 2006) noted that inquiry-based learning can be used heavily in the experiential learning portion of SAE. As SAE emphasizes the application of classroom and laboratory content into real-world settings (Roberts, 2006), numerous potential exists for further incorporation of inquiry-based learning to solve practical problems. Perhaps such work is currently occurring in agricultural classrooms, particularly in preparation for Career Development Event (CDE) and SAE selection activities.

Such results indicate that inquiry-based instruction positively influences student achievement in the context of SBAE. As Edwards (2004) indicated, further establishing the relevance of SBAE is vital to the long-term survival of such programs in schools. Parr et al. (2006) declared that academic enhancement (such as the use of scientific, inquiry-based learning) and contextualized learning must be established and maintained. Further, as secondary students perceive such advancements in a positive light (Conroy & Walker, 2000; Thoron & Burleson, 2014), such transitions to academically-rigorous coursework can be eased.

Based upon these findings, we developed the following model that described the incorporation of inquiry-based learning into the comprehensive SBAE program. The model depicted is designed to be based upon the three-circle model as presented by the National FFA Organization (2014). To describe this model, the literature has indicated a need for increased academic achievement and increased program relevance (Edwards, 2004; Parr et al., 2006, 2008, 2009; Stone et al., 2008). To accomplish this purpose, academically-rooted inquiry-based learning strategies have been utilized within SBAE programs; as a result, student achievement improved (Thoron & Myers, 2011). Each component is vital to the comprehensive SBAE program and thus could accommodate inquiry-based teaching (Roberts, 2006; Rogers, 1969). Moving further into the model, positive student and teacher perceptions and performances when utilizing academically-enhanced, inquiry-based curricula are vital to the sustainability of such an approach; both populations seemed to indicate positive reception with the use of such an approach (Conroy & Walker, 2000; Thoron & Burleson, 2014; Ulmer et al., 2013). As a result, it would stand to reason

that the continued use of inquiry-based instruction would only result if such a strategy and its aligned efforts are effective.

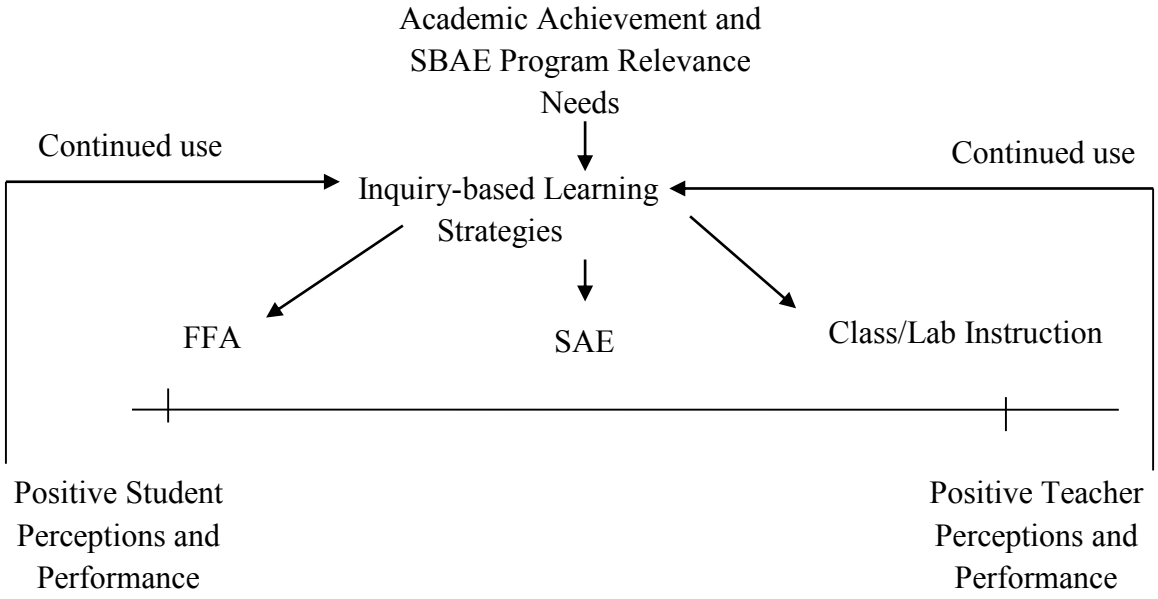

Figure 1. Inquiry-based learning in the comprehensive SBAE program.

Conclusions

For agriculture teachers, one of the discipline's primary goals is to foster student interest in agricultural content. Inquiry-based learning is a primary pedagogical method that poses questions, problems, or scenarios to students and incorporates problem-based learning to help foster that interest in learning and higher level thinking (Parr & Edwards, 2004; Phipps et al., 2008). As teacher accountability in school settings is increasingly important and emphasized with the passage of new legislation, it is vital that students are meeting increased achievement standards (Edwards, 2004). The research body presented here has illustrated that inquiry-based instruction in SBAE classrooms not only encourages the curiosity of students, but also helps them to develop the higher-order critical thinking skills that students need to master the new skills and problems that they will face with in the 21st century (Phipps et al., 2008) Such rigorous instruction should be prevalent and demanded across all areas of CTE (Stone et al., 2008).

With the integration of science and math skills through teaching agriculture, inquiry-based instruction has been determined to be one of the best practices for educating students in scientific principles, while connecting them to agriculture (Bailey & Meritt, 1997; Gerber et al., 2001; National Research Council, 1988; Von Secker & Lissitz, 1999; Washburn & Myers, 2010). The literature reviewed in this study revealed an interesting pedagogical correlation between the concept of inquiry-based learning and increased student achievement (Thoron & Burleson, 2014; Thoron & Meyers, 2011).

Regarding the AAAE's National Research Agenda, this study provided an interesting look into how agriculture teachers are working to address Priority 4 and Priority 5 (Doerfert, 2011). Further, as inquiry-based learning emphasizes higher-order thinking (Phipps et al., 2008; Thoron & Myers, 2011), more engaged learning can occur within agricultural coursework. This engagement could occur through increasing the rigor as well as relevance of SBAE, a need well-documented (Edwards, 2004). The use of this instructional strategy also addressed Priority 5's description of the need for more "Efficient and Effective Agricultural Education Programs" (Doerfert, 2011). Based upon previous research (Thoron & Burleson, Thoron & Myers, 2011;

Ulmer et al., 2013), inquiry-based learning has helped to positively influence student achievement and perceptions of the utility of the modern SBAE program. As a result, the use of this valuable teaching method appears to pay dividends toward the rigor, relevance, and utility of SBAE.

Discussion and Implications

In an ever-changing society and workplace, students need to build upon the skills that they are learning in today's classroom and master the new skills that they are going to be faced with in the 21st century (Doerfert, 2011; Stone et al., 2008). Students in today's society must receive the best education possible in order to meet the increasing achievement standards set forth by legislation. The success of the use of inquiry-based learning in SBAE programs ultimately rests upon the agriculture teachers who teach and effectively incorporate this type of instruction into their curriculum. Many researches although doubt that all teachers have the ability to do so properly though (Boone, 1990; Moore & Moore, 1984; Osborne, 1999; Warmbrod, 1969). As the profession of SBAE looks forward, we need to make sure that agricultural education programs receive appropriate attention to ensure the existence of consistently high-quality programs.

In order for inquiry-based learning in SBAE programs to be effective, things such as continual teacher retraining, comprehensive, rigorous and relevant curriculum, and professional development must occur (Virginia Department of Education, 2013). In addition, Priority 4 of the AAAE National Research Agenda calls for additional research and practice to achieve the goal of having all learners in *all* agricultural education learning environments actively and emotionally engaged in learning that results in high levels of achievement. More specifically, the focus for such learning should be upon deepened understanding of the effective teaching and learning process, the development of meaningful, engaged learning experiences, the increased use of problem-solving, and the transfer of learning and higher order thinking skills (Doerfert, 2011).

It should be noted that as SBAE programs are increasingly focused upon the increase of student achievement, there exist some significant ramifications for agriculture teachers. As it stands, significant gains must be made for current students to become better prepared for the workforce of the 21st century (Stone et al., 2008). This is particularly true for students entering into the agricultural sciences. As university-level agricultural science programs advance toward the teaching of scientific research and inquiry to its undergraduate populace, its future clientele (current SBAE students) must be prepared to assimilate into this model of education (Doerfert, 2011). As a result, agriculture teachers must be prepared to implement scientifically- and inquiry-based learning strategies within their classrooms. As Thoron and Myers (2011) found, student comprehension of scientific content is increased through inquiry-based learning.

Additional ramifications include new curriculum types to help address inquiry-based learning and student achievement needs. Recently, the National Council for Agricultural Education developed the Curriculum for Agricultural Science Education (CASE) (CASE, 2013). The objective of this program was to provide agriculture teachers with a method of enhancing the rigor and relevance of SBAE content. Additionally, consistent professional development is paramount to the long-term sustainability of this educational resource and method, as expressed by CASE (2013). In regard to teacher efficacy, Ulmer et al. (2013) found that agriculture teachers who underwent CASE curriculum training "experienced gains during the institute on both their personal science teaching efficacy and their science teaching outcome efficacy" (p. 121). It was interesting to note that "after nine months… the CASE Institute had a lasting impact on the participants' personal efficacy, but not their outcome expectancy beliefs." (Ulmer et al., 2013, p. 121). Perhaps this is relative to concerns regarding students' abilities to grasp the tenets of inquiry-based learning. Anecdotal evidence suggests that many secondary students lack independence to guide their own learning (B. Cox, personal communication, April 18, 2014). This could spell trouble for agriculture teachers who intend to implement practices such as CASE into their classrooms.

In regard to inquiry-based learning through CASE, it was interesting to note that Ulmer et al. (2013) illustrated that many CASE Institute attendees were present due to administrator requests. Perhaps this is indicative of administrators' perceptions of the value of agricultural education as a context for improving student achievement (Ulmer et al., 2013). As Paulsen and Martin (2013) indicated, administrator perceptions can hold ramifications for SBAE programs, particularly in terms of the value and activities of programs. As student achievement increases (such as the gains that can be made through inquiry-based learning) are paramount for the profession of agricultural education (Edwards, 2004), closely involving school administrators in the process of planning agricultural curricula and activities may create in administrators a greater regard for the work of the agriculture teacher. Further, decisions such as funding, program growth, and student selection often remain in the hands of administrators; thus, it is vital that administrators understand the work of a high-quality SBAE program and its teacher(s) (Paulsen & Martin, 2013). Such positive perceptions can help to advance the work and ultimate goals of SBAE.

Recommendations and Possibilities for Future Research and Practice

The current study illustrated previous instances of the use of inquiry-based learning in SBAE programs. However, additional possibilities remain. As demonstrated by Thoron and Myers (2011), inquiry-based learning holds much promise for increasing students' retention of content knowledge while increasing their overall academic achievement. Such work can highlight the potential value of SBAE for overall student development. However, little empirical evidence has been added to the agricultural education literature base since the prior study. Additional research should follow suit and work to establish a more solid body of knowledge regarding inquiry-based learning in SBAE. New literature should also emphasize methods that specialized teaching strategies (such as inquiry-based learning) can utilize to increase students' retention of both academic and technical content knowledge, as described by Doerfert (2011). Such methods could hold much promise for furthering the utility and value of SBAE in modern school settings (Parr et al., 2006).

We recognize that inquiry-based learning can be integrated into SBAE in multiple ways and content areas, such as agricultural mechanics, horticulture, animal science, biotechnology, and more. As a result, perhaps additional research should be conducted to analyze current agriculture teachers' use of inquiry-based learning within their curricula, such as the content analysis of lesson plans. Washburn and Myers (2010) found that agriculture teachers believed that science integration and inquiry-based teaching were important to SBAE as an entity; however, this population also indicated limited use of inquiry-based learning within classrooms. Perhaps this is tied to selected barriers regarding science integration, as described by past researchers (Myers & Washburn, 2007; Thompson, 1998; Washburn & Myers, 2010). These barriers included "insufficient planning time, lack of requisite materials, and insufficient funding" (Washburn & Myers, 2010, p. 89). Further research should look to address this potential correlation between such factors and the adoption of inquiry-based learning in SBAE.

The lack of literature regarding the use of inquiry-based learning in the FFA and SAE components of SBAE programs is alarming to us. While other researchers (Roberts, 2006; Rogers, 1969) have emphasized how the experiential model of learning with SBAE is ripe for the use of problem-based learning and inquiry-based learning, the quest for literature pertaining to the process's use within the SAE and FFA elements was quite fruitless. However, this does not mean that the process is not occurring with SBAE programs across the nation. On the contrary, perhaps there exists a dearth of productive research in these areas. Perhaps studies should be launched to address perceptual, adoption, and incorporation of inquiry-based learning in *all* aspects of comprehensive SBAE programs.

Regarding the practice of integrating inquiry-based learning, agriculture teachers should continuously look for methods to integrate this historic practice into their coursework (Parr &

Edwards, 2004; Phipps et al., 2008; Washburn & Myers, 2010). As this practice is more commonly known as problem-based learning within the SBAE community (Parr & Edwards, 2004), many teachers currently utilize this method effectively (Phipps et al., 2008). Interestingly, as science curricula are often taught through an inquiry-based approach, and as science is inherently tied within agricultural coursework, many agriculture teachers report that pressure to practice science integration has come from a top-down approach (e.g., state mandates, administrator requests, etc.) (Washburn & Myers, 2010). Perhaps teachers feel more inclined to teach through inquiry-based learning only when science integration pressures are a factor. Agriculture teacher in-service meetings may serve as a valuable medium for opening the dialogue concerning these issues.

As developing and instilling the practice of effective teaching is achieved at the pre-service level (Phipps et al., 2008), teacher education coursework should include instruction in inquiry-based learning (Washburn & Myers, 2010). Further, this coursework should emphasize the use of such instruction in all facets of the SBAE model (i.e., classroom/laboratory instruction, SAE, and FFA). Phipps et al. (2008) and Thoron and Myers (2011) described how this method of teaching can positively influence students' classroom performance, while Wells and Retallick (2013) found that significant potential for academic instruction exists within the realm of SAE. As SAE serves as the natural outlet of classroom/laboratory-based teaching and learning (Ramsey & Edwards, 2012), inquiry-based instruction may hold significant possibilities for increasing student understanding of real-world phenomena that may result in higher overall program experience quality. Wells, Perry, Anderson, Shultz, and Paulsen (2013) found that experiences at the secondary level can influence post-secondary educational pursuits. Thus, agriculture teachers should heed these calls to improve professional practice, as the eventual fate of the discipline (e.g., the recruitment and retention of future teachers) depends upon it.

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