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Teachers' Use of Experiential Learning Stages in Agricultural Laboratories

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Abstract

Experiential learning in agricultural laboratories has been a foundational component of secondary agricultural education. While inclusion of the four stages of the experiential learning cycle can enhance student learning in laboratory settings to help students reach various goals related to scientific literacy and higher-level thinking, agricultural laboratories have traditionally been sites of psychomotor skill development. This exploratory study used a nonexperimental survey design to assess NAAE members' use of the stages of Kolb's experiential learning cycle (1984) during lessons involving agricultural laboratories. Results indicated that respondents incorporated concrete experience activities and those associated with grasping information more frequently and for longer durations than they included active experimentation activities or those associated with transforming information. Further, over half of the respondents reported designing lessons in laboratory settings that engaged students in fewer than all four stages of the experiential learning cycle. Recommendations include further study in order to gain a more holistic understanding of how experiential learning is used in agricultural laboratories.

Keywords: experiential learning, agriculture teacher, experiential learning cycle, Kolb

Experiential learning in various settings has been a foundational component of secondary agricultural education since its inception (Cheek, Arrington, Carter, & Randell, 1994; Mabie & Baker, 1996; Parr & Edwards, 2004; Phipps, Osborne, Dyer, & Ball, 2008; Roberts, 2006; Smith-Hughes Act, 1917). These learning settings can include classroom instruction, laboratory work, field trips, and supervised agricultural experience programs among other experiences (McCormick, Cox, & Miller, 1989; Osborne, 1994b; Phipps, et al., 2008). However, experiences in these settings do not automatically lead to learning; as Dewey offered in his publication regarding the value of educational experiences, "everything depends on the *quality* of the experience which is had" (Dewey, 1938, p. 27). When quality experiences are offered, agricultural laboratories can be utilized to improve student attainment of a variety of goals, including critical thinking, scientific inquiry, skill mastery, and work habits (Abdulwahed & Nagy, 2009; Hofstein & Lunetta, 2004; Hofstein & Mamlok-Naaman, 2007; Osborne, 1994b; Phipps et al., 2008).

The National Research Council publications pertaining to both agricultural education (1988) and the National Science Education Standards (1996) have recommended that education include goals related to scientific literacy: *Understanding Agriculture: New Directions for Education* (NRC, 1988) called for agriculture programs that prepared students for careers beyond production to include agricultural research and sciences, while the *National Science Education Standards* (NRC, 1996) noted that scientifically literate students are better prepared for successful scientifically-based careers. Several dimensions of scientific literacy (Showalter, 1974) align with principles guiding agriscience education (Phipps et al., 2008). Both Showalter's (1974) scientific literacy dimensions and the guiding principles of agriscience education highlight the need for students to use scientific processes, experimentation, inquiry, critical thinking, and problem solving to engage in scientific discovery and decision making. The link between the goals of laboratory instruction, scientific literacy, and agriscience education suggest that well-designed experiences in agricultural laboratories can be designed to enhance students' scientific literacy.

In previous studies, laboratories have been utilized in agricultural education to improve students' psychomotor skills (Franklin, 2008; Johnson, Wardlow, & Franklin, 1997), suggesting that the experiences provided for in these settings may not permit attainment of other listed goals related to the improvement of scientific literacy (Osborne, 1994b). Many agriculture teachers have ample opportunity to provide students with laboratory experiences that enhance skills associated with scientific literacy and agriscience education, as their access to these agricultural laboratories is currently high (Franklin, 2008; McCormick, 1994; Newcomb, McCracken, Warmbrod, & Whittington, 2004; Shoulders & Myers, 2012). Further, the National Research Agenda (Doerfert, 2011) identified research assessing learning in various environments as a priority area. This study served to address this priority area by assessing how the contexts of agricultural laboratories are currently used to enhance student learning through meaningful experiences.

Theoretical/Conceptual Framework

The use of agricultural laboratories to enhance learning is guided by the theory of experiential learning. Previous literature citing the theoretical tenets, uses, and benefits of experiential learning and its use in laboratories provided the framework for this study.

Experiential Learning

By human nature, learning and development cannot occur without some sort of experience (Beard & Wilson, 2006; Dewey, 1938; Joplin, 1981; Kolb, 1984; McCormick, Cox, & Miller, 1989; Vygotsky, 1978). Numerous definitions of "experience" have guided experiential learning theory. Joplin (1981) referred to experience as "significantly identify[ing] with, seriously interact[ing] with, form[ing] a personal relationship with, etc." (p. 17). McCormick, Cox, and Miller (1989) utilized Guralnik's (1982) definition of "experience", defined as "activity that includes training, observation of practice, and personal participation" (p. 493). When applying the definitions of "experience" to the process of learning, Kolb (1984) described experiential learning as a process of knowledge creation through the transformation of experience. Chickering (1976) and the Association of Experiential Education (1994) referred to any changes in an individual resulting from a direct experience as experiential learning. From an educator's perspective, experiential learning describes "a series of pragmatic activities sequenced in such a way that it is thought to enhance the educational experience for the student learner" (Clark, Threeton, & Ewing, 2010, para. 2). While the components of definitions of "experience" and "experiential learning" may differ, the notion that learning is the result of interacting in some manner with an external subject remains a constant premise of experiential learning.

According to Zull (2002), the theory of experiential learning aligns with the structures of the human brain. The senses enable humans to internalize experiences with the external environment through creation and action among neural synapses. As neural networks are altered through sensory experiences (termed "plasticity" [p. 115]), the brain organizes new knowledge with previous knowledge, forming the basis for learning. The development of knowledge through experience enables individuals to both enter experiences with different perspectives as well as gain different types of knowledge from shared experiences (Kolb, 1984; Steinaker & Bell, 1979; Zull, 2002). Because of the constant shifting of neural networks, an individual's experiences are linked (Joplin, 1981; Roberts, 2006; Zull, 2002), and "no two thoughts are ever the same, since experience always intervenes" (Kolb, 1984, p. 26).

Experiential Learning in Education

While not all experiential learning occurs in a classroom, the theory of experiential learning has its use in formal educational settings (Gibbons & Hopkins, 1980). Zull (2002) described the classroom as a concrete experience, offering numerous sensory inputs to learners. Multiple educational resources have urged teachers to provide students with meaningful experiences for students (Knapp, 2010). In agricultural education, researchers have encouraged teachers to consider the aspects of experiences that can help students learn (McCormick, Cox, & Miller, 1989). Science education has given new focus to experiential learning as researchers have adopted a constructivist theoretical model to better understand how learners construct knowledge from their experiences (Hofstein & Lunetta, 2004). Dale (1946) even went so far as to say it was the "doing" aspect of educational experiences that "prevent[ed] schools from being impractical" (p. 53). Although experiential learning has been promoted in education, many educational settings refrain from incorporating the entire theory, leading theorists to posit that only partial learning is accomplished (Joplin, 1981; Siegel, 1967; Steinaker & Bell, 1979). While teachers have become well-versed in providing students with activities, their lessons have frequently lacked appropriate time devoted to the overall process of experiential learning, including reflection (Clark, Threeton, & Ewing, 2010; Knapp, 2010; Osborne, 1994b). In his work addressing the need for experiential learning in today's schools, Itin (1999) alluded to the unwanted impacts of educational programs guided by ill-chosen experiences and void of experiential learning philosophy, stating that "if we want to develop critically thinking, self-motivated, problem-solving individuals who participate actively in their communities, we must have an educational system and educational approaches that model and support this" (p. 94).

The struggles of incorporating the philosophy of experiential learning in educational settings are not unwarranted; researchers have reported the challenges of implementing experiential learning, one of which is the selection of appropriate experiences (Townsend & Briers, 1990). Experiences from which students are to learn are most effective when they are direct and purposeful, with outcomes upon which students can be evaluated (Joplin, 1980; Steinaker & Bell, 1979; Townsend & Briers, 1990; Zull, 2002). It is the responsibility of the teacher to provide well-planned, appropriate experiences (Itin, 1999). Numerous researchers and theorists have offered further responsibilities for teachers when employing experiential learning in their classrooms. Itin (1999) suggested that teachers should present experiences, help students utilize the experiences, establish the learning environment, place boundaries on objectives, share necessary information, support learners, ensure physical and emotional safety, guide reflection, and facilitate learning. Dale (1946) posited that assisting students in naming objects and ideas is one of the teacher's most important tasks. Steinaker and Bell (1979) noted that the teacher's role changes as students progress in their learning through an experience; roles that teachers assume begin with being a motivator, then move through catalyst, moderator, sustainer, and critiquor as the student progresses through the experience. Although not as specific as the roles listed by Steinaker and Bell, Dewey (1938) and Freire (1973) have supported the notion that the teacher's role changes as the learner progresses through the learning experience.

Numerous theorists have offered models to explain aspects related to how learners progress through a learning experience. Gibbons and Hopkins (1980) offered the scale of experientiality to overcome challenges associated with the selection of appropriate experiences according to their outcomes. The scale was developed to distinguish among the wide variety of experiences to which learners are exposed. At the first stage, the learner is a passive audience member; the level of engagement and involvement increases through the stages. The final stages become indistinguishable from life's activities, and from experiences in these stages students' lives can be impacted indefinitely. Gibbons and Hopkins (1980) cautioned that while the scale of experientiality is useful in selecting types of experiences, the students' ability to respond to the experience, as well as the quality of the experience, must be considered as well.

Steinaker and Bell (1979) developed an experiential learning taxonomy to help teachers guide learners' responses to experiences. Ranging from a scale of one to five, the taxonomy "defines the sequence of activities and feelings that the learner follows from exposure to the dissemination of experience" (p. 19). At level one, the student is exposed to the experience. Stage two requires participation by the student. At stage three, the learner begins to identify with the idea by incorporating the experience into specific contexts of value. At stage four, the experience begins to affect the learner's life-style. Finally, learners at stage five disseminate the idea to others, as they value the experience and wish for others to experience it as well. Each of these categories contains subcategories which further differentiate between types of experiences. Subcategories and further explanation can be found in Steinaker and Bell (1979).

The experiential learning taxonomy views personally engaged and vicarious experiences as one and the same (Steinaker & Bell, 1979). This notion may be accurate, as research in cognitive processes suggests that the same neurons fire when animals observe an action as when they perform the action (Zull, 2002). However, learner engagement in an experience can vary greatly, and researchers have stated that direct experience is most beneficial to learners (Gibbons & Hopkins, 1980; Itin, 1999; Townsend & Briers, 1990). Dale (1946) created the Cone of Experience to illustrate how experiences range from direct to abstract. At the bottom of the cone, the most direct experiences, each involving action on the part of the learner, include direct experiences, contrived experiences, and dramatic participation. Experiences requiring observation include demonstrations, field trips, exhibits, motion pictures, radio, recordings, and still pictures. Experiences that involve symbolizing are the most abstract, and include visual and verbal symbols.

Experiential Learning Stages

Regardless of the specific components of the experience, engaging in a more holistic process of reflecting, evaluating, refining, and testing must occur in order for learning to take place (Clark, Threeton, & Ewing, 2010; Itin, 1999; Knapp, 2010; Kolb, 1984; Osborne, 1994b; Stehno, 1986; Steinaker & Bell, 1979; Zull, 2002). Numerous theorists, including Joplin (1981) and Kolb (1984), have created models of the experiential learning cycle, all displaying certain recurring characteristics. Roberts (2006) identified the similar traits between these prominent models as indication of a cyclical process, initial focus being on the learner, learner's direct experience with phenomenon, and the presence of reflection and then development of rules or hypotheses. Each of these similarities can be observed in Kolb's Model of the Experiential Learning Process (1984) (Figure 1).

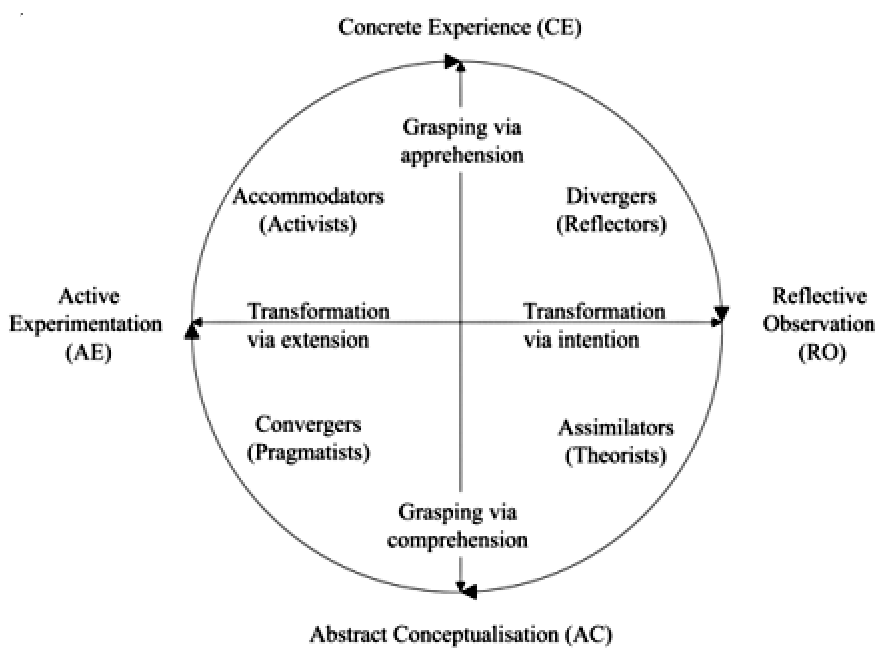

Figure 1. Model of the Experiential Learning Process (Kolb, 1984).

The cycle involves a learner grasping information, through either a concrete experience (via apprehension) or abstract conceptualization (via comprehension). Once information has been grasped, it is transformed through either reflective observation (via intension) or active experimentation (via extension). The learning cycle can begin at any of the four stages (Kolb & Fry, 1975), but in order for learning to occur, the learner must experience a process involving a method of grasping information and then transforming that information (Cuffaro, 1995; Kolb, 1984). Zull's examination of the brain supports the notion that while all of the stages must occur in order for the learning cycle to be complete, the stage at which one begins and the direction in which the cycle is experienced can vary (2002). While Piaget (1978) posited that certain cognitive stages are superior in the learning process, Kolb (1984) noted that each of the four stages is equally important in contributing to learning (Abdulwahed & Nagy, 2009).

The cyclical nature of the experiential learning process allows for experiences to be repeated in order to enhance learning. Joplin (1981) posited that a learning experience can take seconds or years to complete, and can consist of anything from a "flash of insight" to a conversation, to a class period, to a unit, or to an entire course. The duration of a learning experience may vary, and research as of yet does not recommend one ideal duration of a learning experience (Joplin, 1981; Roberts, 2006).

Kolb's theory of experiential learning is not without critics. Seaman (2008) posited that the historical contexts surrounding the development of the experiential learning cycle have changed, causing a conflict between the theory's need for personal, internal reflection and the intervention of instructors to guide reflection toward what learners should know following an experience. While Seaman's argument should not be dismissed, the heavy use of Kolb's experiential learning theory in agriculture education and in other areas of career and technical education suggest that it is not irrelevant (Abdulwahed & Nagy, 2009; Osborne, 1994b; Roberts, 2006). Kolb's experiential learning theory has been touted as "the most established model of experiential learning" (Cano, 2005, p. 2), and has been found to be of greatest potential within research in career and technical education (Clark, Threeton, & Ewing, 2010). Numerous studies in engineering have utilized Kolb's experiential learning theory to modify their courses (Abdulwahed & Nagy, 2009; Bender, 2001; David, Wyrick, & Hilsen, 2002; Moor & Piergiovanni, 2003). Zull's (2002) work depicted the alignment of Kolb's experiential learning cycle with the structures of the brain, which he claimed offered great support of Kolb's cycle, as "neurobiology has no educational philosophy" (p. 130). Because of its heavy use in career and technical education as a whole and agricultural education specifically, its high regard in agricultural education research, and its alignment with human cognitive structures, Kolb's experiential learning cycle was chosen as the theory utilized for this study.

Experiential Learning in Agricultural Education

In spite of its presence in agricultural education history and philosophy, the theory of experiential learning has not yet been mastered by agricultural educators. Osborne (1994a) posited that when carrying out experiences agricultural educators rarely provide active experimentation or internal reflection opportunities for students. Following a literature review, Clark, Threeton, & Ewing (2010) found that researchers in career and technical education frequently focused on concrete experiences rather than on the more holistic process of experiential learning. The numerous sites of learning in agricultural education have provided ample opportunities for concrete learning experiences, but teachers can further students' learning by supplementing these experiences with opportunities for reflection, abstract conceptualization, and experimentation.

Experiential Learning in Agricultural Laboratories

Just as is depicted in Dale's Cone of Experience (1946), the activities that constitute experiential learning in agricultural education vary greatly (Roberts, 2006) and include classroom and agricultural laboratory-based experiences (McCormick, Cox, & Miller, 1989). Educational laboratories are loosely defined to encompass a variety of settings, but can be summarized as "experiences in school settings where students interact with materials to observe and understand the natural world" (Hofstein & Mamlok-Naaman, 2007, p. 105). Dale (1946) stated that laboratories exuded a sense of adventure, experimentation, and exploration. Hofstein & Lunetta (2004) recommended laboratories be sites of scientific inquiry that enable students to investigate phenomena. Osborne (1994b) stated that laboratories must include experimentation, and that the opportunity for experimentation should be just as valuable as the opportunity for direct experience. When identifying specific laboratories as sites for experiential learning, both Ewert & Sibthorp (2009) and Hofstein & Mamlok-Naaman (2007) found that reported laboratories have included substantial differences, making a more specific definition unfeasible. In agricultural education, the term "laboratory" has remained ill-defined, but has been inclusive of outdoor areas supporting classroom instruction (Osborne, 1994b). Shoulders and Myers (2012) identified a list of agricultural laboratories to which a national sample of secondary agriculture teachers reported having access. These laboratories included "mechanics , carpentry, and welding facilities, greenhouses, landscaping areas, gardens, aquaculture tanks/ponds, livestock/equine facilities, field crops, biotechnology/science laboratories, forestry plots, food science laboratories, nurseries/orchards/groves, turf grass management areas, small animal/veterinary laboratories, meats laboratories, apiaries, and vineyards" (p. 129).

Educational laboratory settings have great potential to increase learning as educational programs have shifted to focus more heavily on knowledge gained via experience (Abdulwahed & Nagy, 2009). However, many laboratory experiences offer students practice with psychomotor skills and omit opportunities for reflection, abstraction, and experimentation (Abdulwahed & Nagy, 2009; Franklin, 2008; Gunstone & Champagne, 1990; Hofstein & Lunetta, 2004; Johnson, Wardlow, & Franklin, 1997). With increasing research and discussion supporting the notion that laboratories "generate poor learning outcomes compared to the time, effort, and costs invested in laboratory education" (Abdulwahed & Nagy, 2009, p. 284) the need to justify the use of agricultural laboratories is great.

Purpose and Objectives

The purpose of this exploratory study was to describe how secondary agriculture teachers utilize the four stages of Kolb's experiential learning cycle during laboratory instruction. In order to achieve this purpose, the following objectives were developed:

1. Determine the frequency with which teachers plan student activities associated with each stage of the experiential learning cycle during laboratory instruction.
2. Describe the number of experiential learning stages teachers report incorporating during a lesson in a laboratory setting.
3. Describe the type of experiential learning stages (either grasping or transforming) teachers report incorporating during a lesson in a laboratory setting.
4. Describe teachers' intended duration of student activities associated with each stage of the experiential learning cycle during laboratory instruction.

Methods

This exploratory study utilized a descriptive survey design to gather data relating to the above objectives. The overall survey population for the study was members of the National Association of Agricultural Educators (NAAE) (N = 7650). The NAAE is the national professional organization of secondary level agriculture teachers, although not all agricultural education teachers are NAAE members. The NAAE was selected as the accessible population because it contains the largest, most current database of contact information for secondary level agricultural educators when compared with other databases used by researchers in agricultural education (Lawrence, Moore, Rayfield, & Outley, 2012; Shoulders & Myers, 2012). An appropriate sample size (n = 933) was calculated based on the population size, a 3% level of precision, and 95% confidence interval (Dillman, Smyth, & Christian, 2009). Thirty-five individuals were removed by request, leading to a final sample size of 898.

A researcher-developed electronic questionnaire was utilized to collect participant responses. Survey item development followed the guidelines of Dillman, et al. (2009). Respondents began the questionnaire by identifying the laboratories to which they had access; laboratories offered in this item followed the list developed by Shoulders and Myers (2012) and confirmed by a national group of agriculture teachers during their study. Additional questionnaire items consisted of descriptive, closed-ended survey questions which offered categorical choices in a random order (Dillman, et al., 2009) assessing teachers' use of each of the experiential learning stages during laboratory instruction. The term "laboratory" was utilized in each item, but was left to be operationally defined by the respondent, as laboratory settings vary greatly among agricultural education programs. Item choices aligned with stages of Kolb's experiential learning cycle and were reviewed for face and content validity by a panel of five university faculty members who were experts in experiential learning and agricultural education. Teachers were also asked to design a one-class lesson to be carried out in an agricultural facility by selecting activities they would incorporate, the order in which they would incorporate them, and the duration of each activity. Activity choices were each aligned with a specific stage of experiential learning. Again, activity choices were reviewed by a panel of experts for face and content validity. In order to identify and rectify problems with wording, question order, visual design, and navigation, three think-aloud cognitive interviews were conducted with individuals with classroom teaching experience in agricultural education (Dillman, et al., 2009; Presser, et al., 2004). Questionnaire items were appropriately revised according to interview feedback. A pilot test was conducted with 14 current secondary agricultural education teachers in order to test implementation procedures on the survey population (Dillman, et al., 2009). Because items were not intended to assess a construct or constructs, they were analyzed individually, making the calculation of internal consistency implausible (Huck, 2008; Presser, et al., 2004). Time constraints prevented the calculation of test-retest reliability with the pilot sample (Huck, 2004).

The instrument link was sent via email to the sample. Multiple contacts, including an initial invitation and reminders at 7, 14, 18, 24, and 28 days, were utilized to increase response rate (Dillman et al., 2009). Reminder dates were set based on response trends per day, and accounted for weekends and holidays, as teachers' emails were associated with schools. Three hundred and eighty-seven responses were recorded, leading to a response rate of 43.1%.

Nonresponse error can be present in studies with response rates of less than 100% (Miller & Smith, 1983). In order to address nonresponse error, a simple random sample of 15% of the nonrespondents was called in order to "double dip" and compare these responses to those of initial respondents (Gall, Borg, & Gall, 1996; Lindner, Murphy, & Briers, 2001; Miller & Smith, 1983). Of the five methods of handling nonresponse error supplied by Miller and Smith (1983), double-dipping was chosen because it "would produce the most empirically sound procedure, and would be preferred over the other techniques. Comparing early to late respondents on known characteristics, or comparing respondents to the population, each necessitate assumptions that leave the results open to question" (p. 49). However, of the simple random sample (n = 83), 52 had incorrect contact information or were no longer serving as agriculture teachers at that school, and 30 were unable to be reached. One individual from the simple random sample of nonrespondents was reached and offered responses.

The poor response rate of nonrespondents made addressing nonresponse error impossible for this study, and the authors caution against generalizing results beyond the respondents; this study is exploratory in nature. While this lack of generalizability is considered a main limitation of this study, the absence of a more up-to-date national database of agriculture teachers made efforts to generalize to the accessible population of NAAE members impossible. Results reported in this exploratory study can be utilized to gain insight into respondents' use of agricultural laboratories, as well as provide a framework to assess teachers' use of experiential learning in more generalizable state-wide studies with more accurate databases of agriculture teachers.

Data were collected via Qualtrics and analyzed using descriptive methods through SPSS. Results were reported through frequencies, means, and standard deviations, where appropriate. Some respondents chose to refrain from answering one or more individual items. Therefore, the total number of respondents per item is included in the results. All reported data reflect percentages from the number of teachers responding to the item.

Findings

Frequency of Activities Associated with Experiential Learning Stages

The first objective sought to determine the frequency with which teachers planned student activities associated with each stage of the experiential learning cycle during laboratory instruction. As shown in Table 1, over half the teachers indicated that they planned activities associated with each of the first three stages of the experiential learning cycle (*n* = 367).

Table 1

Number of Respondents Planning Activities in Each Stage of Experiential Learning during Laboratory Instruction

Experiential Learning Stage	*f*	%
Concrete Experience	348	94.8
Reflective Observation	281	76.6
Abstract Conceptualization	308	83.9
Active Experimentation	185	50.4

Activities associated with concrete experience were most frequently planned by teachers during lessons in agricultural laboratories (*n* = 348), while activities associated with active experimentation were the least frequently planned (*n* = 185). These results also indicate that activities associated with grasping information through concrete experiences and abstract conceptualization were planned for by more teachers than activities associated with transforming information through reflective observation or active experimentation.

Number of Experiential Learning Stages Incorporated into Laboratory Lessons

Objective 2 sought to describe the number of experiential learning stages teachers claimed to incorporate during a lesson in a laboratory setting. Table 2 displays the number of teachers that utilized activities that addressed one, two, three, or all four stages of the experiential learning cycle during a lesson in an agricultural laboratory, regardless of which stage(s) they utilized (*n* = 367).

Table 2

Number of Experiential Learning Stages Used by Respondents during a Lesson in an Agricultural Laboratory

Number of Stages Used	*f*	%
3 stages	167	45.5
4 stages	115	31.3
2 stages	75	20.4
1 stage	10	2.7

When planning a hypothetical lesson in an agricultural laboratory, 68.7% of the teachers did not plan activities that addressed all four stages of the experiential learning cycle (*n* = 252). The majority of the teachers planned a range of activities that addressed three stages of the experiential learning cycle (*n* = 167), while very few teachers planned activities that addressed only one stage (*n* = 10). Twenty teachers did not respond to the item measuring the number of stages used.

The high number of teachers utilizing less than all four stages of the experiential learning cycle warranted an examination of the frequency with which respondents omitted active experimentation, reflective observation, abstract conceptualization, and concrete experience, as is shown in Table 3.

Table 3

Number of Respondents that Omitted Each Experiential Learning Stage When Planning a Lesson in an Agricultural Laboratory

Stage Omitted	***f***	**%**
Active Experimentation	202	55.0
Reflective Observation	106	28.9
Abstract Conceptualization	79	21.5
Concrete Experience	39	10.6

Over half of the teachers did not select activities that were associated with active experimentation (*n* = 202), while only 10.6% (*n* = 39) omitted activities associated with concrete experience. The higher frequencies of omitted reflective observation and active experimentation activities indicate once again that fewer teachers included activities that transformed information, while more included activities that helped students grasp information.

Grasping and Transforming Activities Incorporated into Laboratory Lessons

Objective 3 sought to describe the type of experiential learning stages (either grasping or transforming) teachers claimed to incorporate during a lesson in a laboratory setting. Table 4 displays the number of teachers that only included activities associated with either grasping information (including concrete experience or abstract conceptualization activities) or transforming information (including reflective observation or active experimentation activities).

Table 4

Number of Respondents Including Only Grasping or Transforming Stages of Experiential Learning during a Laboratory Lesson

Type of Stage Used	***f***	**% of Respondents Using 1 or 2 Stages (*n* = 85)**	**% of Total Item Respondents (*n* = 367)**
Grasping	40	47.1	10.9
Transforming	5	5.9	1.4

Of the respondents (*n* = 367), 12.3% (*n* = 45) included activities only associated with either grasping information or transforming information. These teachers omitted at least two stages of the experiential learning cycle, those two being either both associated with grasping information or transforming information. Almost half of the teachers omitting at least two experiential learning stages from their laboratory lessons (n = 40) included only activities associated with grasping information through concrete experience and/or abstract conceptualization, while only 5.9% (n = 5) included only activities associated with transforming information through reflective observation and/or active experimentation.

Duration of Activities in Each Experiential Learning Stage during Laboratory Lessons

Objective 4 sought to describe teachers' intended duration of student activities associated with each stage of the experiential learning cycle during laboratory instruction. Table 5 displays the average percent of a lesson that teachers planned for activities associated with each stage of the experiential learning cycle (n = 367).

Table 5

Percentage of Lesson Associated with Each Stage of Experiential Learning

Stage	Mean % of Time in Lesson	% of Time Range
Concrete Experience	43.4	5 - 100
Abstract Conceptualization	24.3	3 - 100
Reflective Observation	15.4	2 - 100
Active Experimentation	11.8	2 - 100

While the time range for each of the four stages indicate that teachers varied greatly in the percentage of lesson they allotted for activities in each experiential learning stage, the average duration of activities in each stage corresponds with the number of teachers incorporating activities in each stage. Activities associated with concrete experiences were given the greatest amount of time during a lesson, while activities associated with active experimentation were given the least amount of time. Activities associated with grasping information were given more time than those associated with transforming information.

Conclusions

Over half of the respondents of this exploratory study reported using agricultural laboratories to engage students in activities associated with the first three stages of the experiential learning cycle. Activities associated with concrete experience were the most often planned for by respondents, while those associated with active experimentation were planned for least often. These results are supported by previous research which found that agricultural laboratories are most frequently settings of psychomotor development, providing concrete experiences for students by allowing them to apply a set of skills in a laboratory setting (Franklin, 2008; Johnson, Wardlow, & Franklin, 1997). These findings are not limited to agricultural education, as laboratories in science education have been criticized for their omission of reflective, abstraction, and experimentation opportunities (Abdulwahed & Nagy, 2009; Gunstone & Champagne, 1990; Hofstein & Lunetta, 2004).

Regardless of which stages they utilized, respondents most often planned activities associated with three out of the four stages of experiential learning during laboratory lessons. Approximately 31% of respondents (n = 115) incorporated activities into their lessons that were associated with all four stages of experiential learning. The most frequently omitted stage was active experimentation, which was not included in the plans of 55% of respondents (n = 202), while concrete experience was only omitted by 10.6% of respondents (n = 39). Again, the traditional goal of the development of psychomotor skills in laboratory settings supports the high frequency of concrete experience activities and low frequency of higher-level active experimentation activities (Abdulwahed & Nagy, 2009; Franklin, 2008; Gunstone & Champagne, 1990; Hofstein & Lunetta, 2004; Johnson, Wardlow, & Franklin, 1997).

Of respondents that omitted at least two stages, more reported using experiential learning stages associated with grasping information (*n* = 40) than those associated with transforming information (*n* = 5). Psychomotor skill development common in agricultural laboratories (Franklin, 2008; Johnson, Wardlow, & Franklin, 1997; Osborne, 1994a) requires the grasping of information in order to perform skills, but does not require transformation of information, as was seen by these results.

On average, respondents allotted the majority of lesson time (43.4%) to activities associated with concrete experience. Abstract conceptualization was allotted on average 24.3% of the lesson time, making these two stages, associated with grasping information, greater in duration than either of the transforming information stages. This finding supports Osborne's (1994a) position that agricultural educators rarely provide opportunities for knowledge transformation. Reflective observation activities were allotted on average 15.4% of the lesson time, while active experimentation was allotted 11.8% of lesson time. The previous results revealing respondents' more frequent use of grasping stages support the longer durations found for these stages.

Implications and Recommendations

While limitations regarding the generalizability of this study, as well as its exploratory nature, reduce the level at which implications can be applied, this study provides a foundation from which several research recommendations can be made. Experiential learning in agricultural laboratories can be enhanced by including activities that require both grasping information and transforming information, as well as through incorporation of activities that are associated with each stage of the experiential learning cycle (Kolb, 1984). The current exploratory study indicates that respondents continue to utilize agricultural laboratories to provide students with concrete experiences designed to improve psychomotor skills. The relatively low frequency of respondents incorporating activities associated with active experimentation and low duration of these activities when included in lesson plans imply that these laboratories are not often utilized to provide students with opportunities for experimentation, problem solving, and inquiry associated with scientific literacy, as has been found in previous science and agricultural education research (Abdulwahed & Nagy, 2009; Franklin, 2008; Gunstone & Champagne, 1990; Hofstein & Lunetta, 2004; Johnson, Wardlow, & Franklin, 1997). Because these more complex skills are currently prominent goals of agricultural education (Phipps, et al., 2008) and laboratories are well suited to offer opportunities for inquiry and experimentation to students Abdulwahed & Nagy, 2009; Osborne, 1994b), researchers should investigate reasons for respondents' omission of active experimentation activities in laboratory settings, and then work with them to overcome barriers they may have toward their incorporation into laboratory lessons.

The high frequency of respondents utilizing less than all four of the experiential learning stages during laboratory lessons could imply that they may be utilizing their laboratories to provide students with activities that act as components of larger learning experiences, which may include other experiences outside of the laboratory associated with stages of experiential learning that would complete the entire cycle. Alternatively, respondents of this study may not be providing students with activities that allow them to engage in all four stages of the experiential learning cycle. The cyclical nature of the experiential learning cycle suggests that learners should engage in activities in each of the four stages in order to fully benefit from a learning experience (Cuffaro, 1995; Kolb, 1984, Zull, 2002). Researchers and teacher educators should further investigate whether agriculture teachers provide students with experiences in all four experiential learning stages during lessons in laboratory settings, and strive to gain a more holistic understanding of how the overall agricultural education program impacts student learning through experiences.

On the study's questionnaire, respondents more often constructed lessons including only activities designed to grasp information through concrete experience and/or abstract conceptualization rather than to transform that information through reflective observation and/or active experimentation. In order for true learning to occur, learners must both grasp information and then transform that information through reflection or experimentation (Kolb, 1984). These results imply that students served by the respondents may not be engaging in an appropriate range of activities to allow for learning to occur in laboratory settings. Researchers should assess whether teachers perceive barriers to incorporating reflective or experimental activities in order to help students transform information, and work to help them overcome any perceived barriers, as activities in these stages were least commonly reported by respondents to be included in laboratory activities. Alternatively, respondents may be incorporating transforming activities in other settings either prior to or following laboratory experiences. Further study should be conducted to gain a more holistic view of teachers' lessons involving laboratory experiences. While findings in this exploratory study may not be representative of all agriculture teachers, teacher educators should take efforts to ensure that all agriculture teachers are educated on how to develop lessons with explicit attention to the stages of the experiential learning cycle so that students are engaging in both grasping and transforming experiences.

Historically, Kolb's experiential learning cycle has provided a sound framework upon which agricultural education's use of laboratories is justified. However, some researchers in experiential education claim that Kolb's experiential learning cycle no longer applies to today's educational environment (Seaman, 2008). While no recommendation to abandon Kolb's experiential learning stages is made, the utility of other experiential learning theories, including Dale's cone (1946), Steinaker and Bell's experiential taxonomy (1979), and Gibbons and Hopkins' scale of experientiality (1980), should be explored further by researchers in agricultural education. Each of these models of experiential learning offers another facet through which researchers can more clearly understand how agriculture teachers plan meaningful experiences in their laboratories.

While often included in the theoretical frameworks of studies in agricultural education experiential learning has rarely been the subject of measurement in agricultural education research. This exploratory study sought to describe how NAAE members utilize the stages of the experiential learning cycle during lessons in agricultural laboratories. The lack of accuracy in the study's sampling frame from the accessible population, as well as the study's exploratory nature, limits the generalizability of the findings. It is recommended that similar studies examining the use of experiential learning in laboratory settings be conducted at the state-wide level, as more accurate sampling frames from state teacher databases would improve the generalizability of results to that state. Further, studies involving a range of research methods, including qualitative methods and/or classroom observation, could help provide a more holistic description of how the stages of experiential learning are utilized to enhance student learning experiences in agricultural laboratories.

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