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Teachers' Perceptions Regarding Experiential Learning Attributes in Agricultural Laboratories

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In laboratory settings, research has found a mismatch between teachers' practices and the likelihood they have to influence students' perceptions and behaviors in laboratory work. Various attributes of experiential learning can enhance learning experiences, yet many have not been subject to exploration in agricultural education. This nonexperimental, descriptive study sought to investigate how teachers' perceptions of the attributes which can make up experiential learning activities and how their ability to address these attributes might be associated with the different learning environments found in agricultural laboratories. Results indicated teachers found student ownership and the types of motivation students respond to as most important attributes, while duration of the activity and background knowledge of the students were found to be least important. Further, teachers reported the actions required during an activity and types of motivation were most frequently able to be addressed, while use of senses and family involvement were least frequently able to be addressed. These results, along with those associating specific laboratory settings with teachers' ability to address various experiential learning attributes, hold implications for teacher training related to the use of experiential learning within laboratory settings.

Keywords: agriculture teacher, agricultural education, experiential learning, teacher perceptions

Experiential learning has played a long-standing and crucial role in secondary agricultural education (Roberts, 2006). These programs have sought to engage students in meaningful experiences by placing an "emphasis on learning by doing, which is apparent in the attention given to laboratory work, field trips, problem solving and supervised occupational experience programs" (Phipps & Osborne, 1988, p. 19). Generally, agricultural education programs utilize many types of agricultural laboratories, including greenhouses, mechanics laboratories, livestock facilities, land laboratories, food science laboratories, biotechnology laboratories, and aquaculture facilities (Shoulders & Myers, 2011). However, the National Research Council (Singer, Hilton & Schweingruber, 2005) claimed teachers' current capacity to effectively plan laboratory experiences is lacking, leading students to engage in low quality laboratory experiences. There is a close relationship between the design of experiential learning activities and the learning environments in which they take place (Beard & Wilson, 2006), but teachers are often ill-informed about best professional practices in laboratory environments (Hofstein & Lunetta, 2003). Therefore, there is a mismatch between teachers' practices and the likelihood they have to influence "students' perceptions and behaviors in laboratory work" (Hofstein & Lunetta, 2003, p. 48).

In agricultural education, little is known about teachers' perceptions of the aspects which can make up experiential learning activities, and how their ability to address these attributes might be associated with the different learning environments found in agricultural laboratories. This study served to explore agricultural educators' perceptions of experiential learning attributes in agricultural laboratories. This study also addressed the fourth and fifth priority areas of the National Research Agenda (Doerfert, 2011), which call for research exploring "meaningful, engaged learning in all environments" (p. 9) and seek to develop "efficient and effective agricultural education programs" (p. 10). By gaining a more thorough understanding of teachers' perceptions of their use of experiential learning attributes within agricultural laboratories, researchers can begin to explore how to better educate and prepare teachers to utilize experiential learning in their agricultural facilities.

Experiential learning provided the theoretical framework for this study. Experiential learning can be defined as a direct encounter with a phenomenon under study and conscious transformation of that experience into new knowledge (Phipps, Osborne, Dyer, & Ball, 2008). While all learning occurs through experience, learning can be enhanced through consideration of various facets (Beard & Wilson, 2006), as it is through the transformation of experience into knowledge that learning occurs (Kolb, 1984). "Considerations of the place and space, the activities, the social and emotional dynamics, the stimulation of the senses and the stretching of learners' intelligences" (Beard & Wilson, 2006, p. 46) are facets of experiential learning opportunities that the teacher can facilitate successfully to increase students' positive learning gains. These facets provided the basis for the experiential learning attributes that were explored throughout this study, which included both attributes of the lesson (student ownership, creating student-centered learning, actions requires in an activity, social responsibility/control of actions, environment/setting, use of real societal problem, use of senses, following scientific inquiry processes, and duration of activity) and attributes of the student (type of motivation students respond to, student learning styles, student attitude regarding the subject, developmental readiness of students, family involvement in student learning, student overall mood/emotions, and background knowledge of students).

Beard and Wilson's learning combination lock (2006) (Figure 1) represents suggested elements that can be addressed when planning for experiential learning activities. "The learning combination lock… is based on the notion that the person interacts with the external environment through the senses" (Beard & Wilson, 2006, p. 5), a tenet that is a foundational component of experiential learning (Zull, 2002). The learning combination lock utilizes six tumblers to represent the "complexity of the many possible alternatives or ingredients which may be selected and used to develop effective learning opportunities" (Wilson & Beard, 2003, p. 91).

Wilson and Beard (2003) used the first tumbler to represent the different environmental factors which provide opportunities to encourage learning among students. In agricultural education, these environmental factors can include laboratory settings and are designed to provide students with hands-on application of classroom content (Phipps et al., 2008). Previous research has indicated teachers' perceptions regarding student learning are associated with their ability to access specific agricultural laboratories (Shoulders & Myers, 2011), suggesting the environmental factors in agricultural laboratories can provide varying opportunities for learning. The second tumbler examines possible learning strategies that allow the learners' journeys to play an important role in the learning process (Beard & Wilson, 2006). Termed "actions required in an activity" in this study, these learning strategies are determined by the teacher, and therefore can vary based on teacher preferences. The third tumbler allows for the senses to transmit information from the external environment to be interpreted and acted upon (Wilson & Beard, 2003). Acting as the vehicle connecting a learner's internal environment and the external environment, addressing a learner's senses during an experience can enhance learning (Beard & Wilson, 2006; Zull, 2002). Managing the emotional climate and utilizing emotions in the learning activity accounts for the fourth tumbler. Wilson and Beard (2003) recognized emotions are "critical components of learners and should be considered independently from other forms of intelligence, thus meriting a separate tumbler" (p. 94). Wilson and Beard (2003) addressed the ideas of multiple intelligences and different learning theories in the fifth tumbler, forms of intelligence, and the sixth tumbler, ways of learning. All of these tumblers rotate around the rod which represents the needs of the learner (Wilson & Beard, 2003). While each of these tumblers is suggested to enhance learning experiences, Beard and Wilson (2006) recognized that other facets contributing to learning experiences may be added to the model.

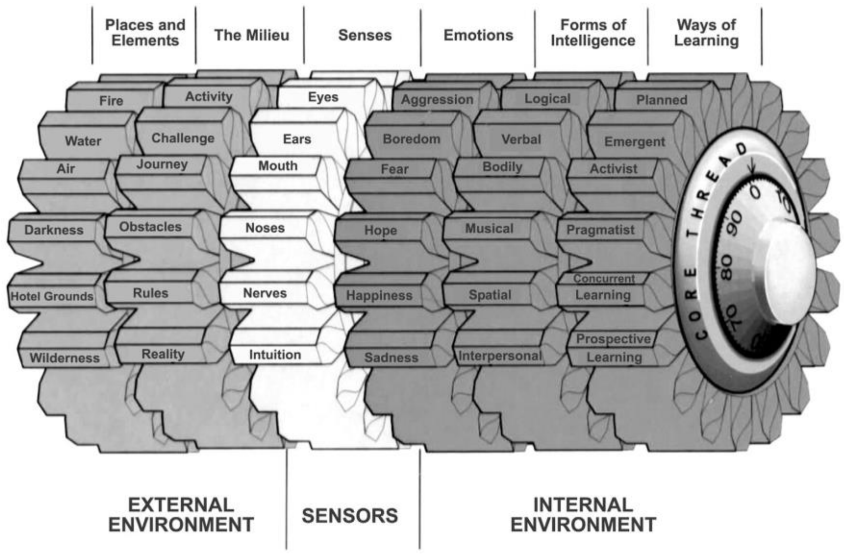

Figure 1. The learning combination lock (Wilson & Beard, 2006).

Additional experiential learning attributes that may be considered when planning experiences include the duration of the experience (Joplin, 1981), the motivation to which students respond (Zull, 2002), family involvement in student learning (Talbert & Balschweid, 2004), developmental learning readiness of students (Vygotsky, 1978), and student ownership in an experience and control of actions (Dewey, 1938). Joplin (1981) posited the duration of a learning experience can vary greatly, lasting a few seconds to several months. While the duration of the activity in agricultural laboratories is typically under the control of the teacher, no recommendation has been made as to the most effective experience duration (personal communication, T. G. Roberts, 2010). Understanding student motivation can also enhance learning experiences, as intrinsic motivation already present can help engage learners in their experiences (Zull, 2002). Family involvement in student learning has been found to be a factor in students' decisions to enroll in agricultural education (Reis & Kahler, 1997) and participate in the FFA (Gliem & Gliem, 1999). Considering the learners' developmental readiness when planning learning experiences is crucial, as well planned learning experiences can help guide students in achieving greater gains than they could alone (Vygotsky, 1978). Finally, well designed experiences can promote student ownership and encourage them to mediate their own actions, thereby alleviating managerial tasks of teachers related to student behavior (Dewey, 1938).

Few studies have examined agriculture teachers' perceptions of experiential learning. Arnold, Warner, & Osborne (2006) found three of four agriculture teachers interviewed did not have formal training or prior knowledge regarding the theory of experiential learning, yet utilized experiential learning activities during their classes. These teachers identified their role during students' learning experiences as that of facilitator, responsible for creating experiences and guiding students throughout the learning process. However, this same study found "class enrollment, time, supervision and management of student activities, modifications in teaching style, and maturity level of students" (p. 36) were challenges faced by agriculture teachers designing learning experiences.

Purpose and Objectives

The purpose of this study was to describe secondary agriculture teachers' perceptions regarding their ability to address student-based and lesson-based aspects of experiential learning, operationalized for this study as "experiential learning attributes", during lessons in agricultural laboratories. The student-based and lesson-based attributes utilized in this study were drawn from the facets identified in Wilson and Beard's (2003) learning combination lock, as well as from the additional facets derived from further research. In order to achieve this purpose, the following objectives were created:

1. Describe teachers' perceptions regarding the importance of planning for experiential learning attributes in agricultural laboratories.
2. Describe teachers' perceptions regarding their ability to address experiential learning attributes in agricultural laboratories.
3. Determine the relationship between teachers' ability to address experiential learning attributes in agricultural laboratories and access to specific agricultural laboratories.
4. Determine the relationship between teachers' ability to address experiential learning attributes in agricultural laboratories and their perceptions of the importance of experiential learning attributes when planning lessons in agricultural laboratories.

Methods

This study was conducted through the use of a nonexperimental, descriptive survey design. The population for this study was all secondary agricultural education teachers in the United States; however, since no sampling frame for the entire population exists, the electronic survey instrument was sent to a simple random sample of the accessible population, derived from the members of the National Association of Agricultural Educators (NAAE) (N=7650). Considered to be the national professional organization of secondary agricultural educators, NAAE has the largest, most current database of contact information for the population (Shoulders & Myers, 2011). Calculated from the population size and using a 3% level of precision and 95% confidence interval, a sample size of 933 was determined to be appropriate (Dillman, Smyth, & Christian, 2009).

A researcher-developed electronic questionnaire was constructed. Teachers responded to dichotomous items asking whether they had access to specific agricultural laboratories, including an apiary, aquaculture laboratory, biotechnology/science laboratory, field crops, food science laboratory, forestry laboratory, garden, greenhouse, landscaping laboratory, livestock/equine laboratory, meats laboratory, mechanics/carpentry/welding laboratory, nursery /orchard/grove, small animal/veterinary laboratory, turf grass management laboratory, and vineyard. The verbiage included "access to" to include all laboratories teachers might use, including those not owned by the school. The questionnaire also contained Likert-type items with a five-point scale designed to collect participant responses regarding the level of importance they felt various student-based and lesson-based attributes held when planning lessons in agricultural laboratories. Possible responses ranged from "extremely unimportant" to "extremely important". The experiential learning attributes were developed from Beard and Wilson's learning combination lock (2006), as well as from research pertaining to additional aspects of experiential learning (Dewey, 1938; Gliem & Gliem, 1999; Joplin, 1981; Reis & Kahler, 1997; Talbert & Balschweid, 2004; Vygotsky, 1978; Zull, 2002) (Table 1). Lesson-based attributes are those facets of experiential learning considered to be under the direct control of the teacher, while student-based attributes are those facets brought into the experience by the student.

Table 1

Alignment between Experiential Learning Attributes and Tumblers/Previous Research

Experiential Learning Attribute	Alignment to Tumbler/Source
Lesson-based Attributes	
Actions required in an activity	The milieu
Creating student-centered learning	The milieu
Duration of activity	The milieu, Joplin (1981)
Environment/setting	Places and elements
Following scientific inquiry processes	Ways of learning
Social responsibility/control of actions	The milieu; Dewey (1938)
Student ownership	Dewey (1938)
Use of real societal problem	Ways of learning
Use of senses	The senses; Zull (2002)
Student-based Attributes	
Background knowledge of students	Dewey (1938)
Developmental readiness of students	Vygotsky (1978)
Family involvement in student learning	Talbert & Balschweid (2004)
Student attitude regarding the subject	Emotions
Student learning styles	Forms of intelligence
Student overall mood/emotions	Emotions
Type of motivation students respond to	Zull (2002)

Teachers also responded to five-point Likert-type scales that focused on the frequency with which the teacher was able to address the student-based and lesson-based attributes when planning lessons for the agricultural laboratories. Possible responses ranged from "never" to "always". Item wording was revised following the recommendations of a panel of five university faculty members considered to be experts in agricultural and experiential learning, which examined items for face and content validity. Further alterations were made following recommendations from three cognitive interviews conducted with individuals with teaching experience in secondary agricultural education.

A pilot test was sent to 12 current secondary agriculture teachers, who were then removed from the sampling frame. Coefficients of reliability were calculated for each of the questionnaire items, and ranged from .87 to .96. Based on Santos' (1999) criterion for acceptable reliability coefficients to be above .70, each of the items' alpha score was deemed to be acceptable.

The sample was sent the instrument link via email. Multiple contacts were utilized to increase response rate, including an initial invitation and reminders at 7, 14, 18, 24, and 28 days (Dillman et al., 2009). Because teachers' emails were associated with schools, reminder dates accounted for weekends and holidays. Three hundred and fifty-five responses were recorded, leading to a response rate of 38%. Cronbach's alpha was also calculated *post hoc* for each item to determine reliability, and were found to be between .80 and .95.

Nonresponse error can occur in studies with response rates of less than 100% (Miller & Smith, 1983). A simple random sample comprised of 15% of nonrespondents was called in order to "double dip" and compare their responses to those of initial respondents (Gall, Borg, & Gall, 1996; Lindner, Murphy, & Briers, 2001; Miller & Smith, 1983). However, of the entire sample of nonrespondents, only one individual was able to be reached and agreed to provide responses; 52 individuals had incorrect contact information or were no longer serving as agriculture teachers at that school, and 30 were unable to be reached after numerous attempts. Therefore, the results cannot be generalized beyond the respondents included in this study. While this lack of generalizability is considered a main limitation within this study, the lack of a more accurate national database made efforts to generalize beyond the respondents impossible. Results reported in this study can be utilized to gain insight and inform the profession into respondents' perceptions of the level of importance they felt towards different student-based and lesson-based attributes in planning lessons in agricultural laboratories and the individuals' perceived ability to incorporate the attributes into laboratory lessons.

The respondents' demographic data are displayed in Table 2. Eleven respondents did not supply their gender, but over half of the answering respondents were male (*n* = 208). The greatest percentage of respondents reported having between six and ten years of teaching experience, although a large range in length of teaching experience was evident in the responses. Thirteen respondents did not supply information regarding their teaching experience. Eighty-seven percent of respondents had either a Bachelor's or Master's degree, although eight respondents did not supply their education information. The vast majority of respondents taught in rural settings (*n* = 249), while urban settings held the fewest number of respondents (*n* = 29). Eleven respondents did not supply their community information. The respondents reported having access to a range of agricultural laboratories, as is shown in Figure 2.

Table 2

Demographic Data of Respondents

Demographic	*f*	%
Gender		
Male	208	60.8
Female	134	39.2
Years of Teaching Experience		
1-5	67	19.7
6-10	94	27.7
11-15	52	15.3
16-20	37	10.9
21-25	36	10.6
26-30	29	8.5
31-35	16	4.7
Over 35	9	2.6
Level of Education		
Associate's	3	1.0
Bachelor's	148	42.9
Master's	152	44.1
30 hours above Master's	37	10.8
PhD	2	1.0
EdD	3	1.0
Community		
Urban	29	8.5
Suburban	64	18.5
Rural	249	73.0

Note. Totals may not reach 100% due to rounding.

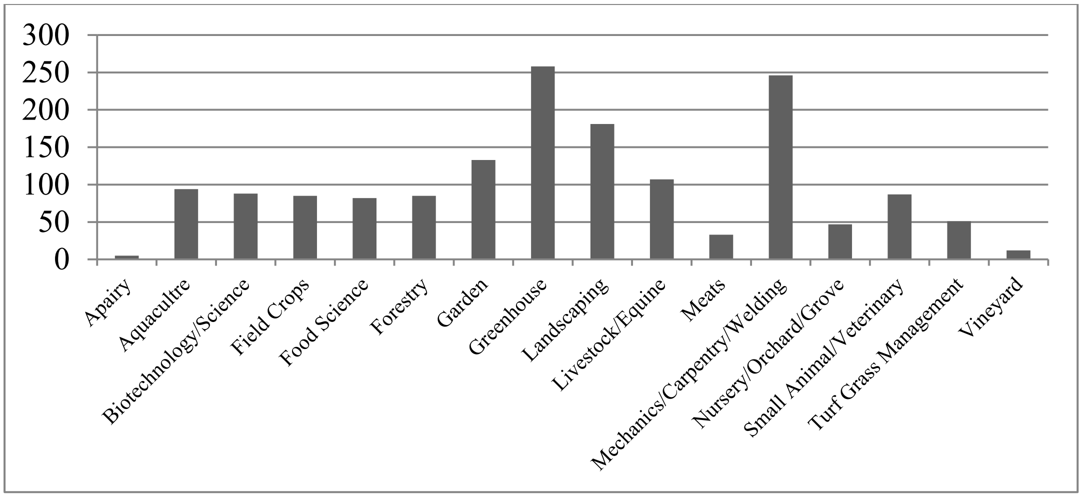

Figure 2. Facility availability of respondents.

Greenhouses and mechanics/ carpentry/ welding facilities were the most prevalent. Seventy-three percent of the respondents (n = 258) reported having access to a greenhouse, while 69% (n = 246) reported having access to a mechanics/carpentry/welding facility. Apiaries (n = 6, 1%) and vineyards (n = 12, 3%) were the least common types of facilities available to respondents.

Data were collected via Qualtrics and analyzed using descriptive methods, including frequencies, means, standard deviation, and correlations where appropriate through SPSS. Magnitude of the correlations was reported using Davis's convention (1971). Relationships between .01 and .09 were reported to be negligible, those between .10 and .29 were low, and those between .30 and .49 were moderate.

Findings

The Importance of Planning for Experiential Learning Attributes

Objective 1 sought to describe teachers' perceptions regarding the importance of planning for experiential learning attributes in agricultural laboratories. Teachers indicated their perceptions regarding nine lesson-based attributes and seven student-based attributes associated with experiential learning on a five-point Likert-type scale ranging from "extremely unimportant" to "extremely important". Table 3 displays average scores for each experiential learning attribute.

Table 3

Average Level of Importance Teachers Perceived for Experiential Learning Attributes

Experiential Learning Attribute	*M*	*SD*
Lesson-based Attributes		
Student ownership	4.15	1.28
Creating student-centered learning	4.07	1.23
Actions required in activity	4.01	1.14
Social responsibility/control of actions	3.99	1.19
Environment/setting	3.96	1.12
Use of real societal problem	3.94	1.20
Use of senses	3.84	1.16
Following scientific inquiry processes	3.73	1.01
Duration of activity	3.72	1.08
Student-based Attributes		
Type of motivation students respond to	4.09	1.17
Student learning styles	3.99	1.18
Student attitude regarding the subject	3.88	1.12
Developmental readiness of students	3.85	1.06
Family involvement in student learning	3.78	1.09
Student overall mood/emotions	3.76	1.03
Background knowledge of students	3.67	1.06

Note. 1 = extremely unimportant, 2 = somewhat unimportant, 3 = neither important nor unimportant, 4 = somewhat important, and 5 = extremely important.

Average scores indicated teachers felt all lesson-based and student-based attributes were important to incorporate when planning experiential learning activities in agricultural laboratories. Teachers perceived, on average, that *student ownership* in the laboratory activity was the most important lesson-based experiential learning attribute (*M* = 4.15), while *duration of the activity* was rated the least important of the lesson-based factor when planning experiential learning in laboratories (*M* = 3.72). The teachers perceived incorporating *types of motivation to which students respond* was the most important lesson-based attribute in experiential learning activities in laboratory settings (*M* = 4.09), while incorporating *background knowledge of the students* had the lowest rating of importance of the lesson-based attributes (*M* = 3.67).

Teachers' Ability to Address Experiential Learning Attributes

Objective 2 sought to describe teachers' perceptions regarding their ability to address experiential learning attributes in agricultural laboratories. Respondents were asked to indicate the degree to which they are able to address experiential learning attributes in agricultural laboratories on a Likert-type scale ranging from "never" to "always". Table 4 displays average scores for each experiential learning attribute.

Table 4

Teachers' Perceived Ability to Address Experiential Learning Attributes

Experiential Learning Attribute	*M*	*SD*
Lesson-based Attributes		
Actions required in activity	4.20	0.68
Creating student-centered learning	4.04	0.71
Duration of activity	4.00	0.67
Student ownership	3.97	0.73
Environment/setting	3.95	0.74
Social responsibility/control of actions	3.86	0.77
Use of real societal problem	3.84	0.77
Following scientific inquiry processes	3.72	0.80
Use of senses	3.62	0.71
Student-based Attributes		
Type of motivation students respond to	3.83	0.70
Student learning styles	3.76	0.72
Student attitude regarding the subject	3.49	0.71
Background knowledge of students	3.46	0.91
Developmental readiness of students	3.36	0.87
Student overall mood/emotions	3.34	0.75
Family involvement in student learning	3.03	0.90

Note. 1 = never, 2 = seldom, 3 = sometimes, 4= often, and 5 = always.

Average scores indicated teachers felt they were able to address each of the experiential learning attributes with some level of frequency. With regard to lesson-based experiential learning attributes, teachers reported they were able to address *actions required in the activity* most often (M = 4.20), while they were able to address *students' use of their senses* during activities least often (M = 3.62). With regard to student-based attributes, teachers reported they were able to incorporate *types of motivation to which students respond* most often (M = 3.83), while they were able to address *family involvement in student learning* least often (M = 3.03).

Relationship between Teachers' Ability to Address Experiential Learning Attributes and Agricultural Laboratories

Objective 3 sought to determine the relationship between teachers' abilities to address lesson-based and student-based experiential learning attributes and their access to specific agricultural laboratories. Pearson's point-biserial correlations were calculated to compare the variables, as is displayed in Table 5.

Table 5

Correlations between Teachers' Ability to Address Experiential Learning Attributes and Access to Agricultural Laboratories

Variables	Pearson's r	Magnitude
Use of senses		
Food Science	.19	Low
Aquaculture	.17	Low
Forestry	.12	Low
Small Animal/Veterinary	.12	Low
Duration of activity		
Field Crops	-.14	Low
Environment/setting		
Livestock/Equine	.12	Low
Nursery/Orchard/Grove	.11	Low
Landscaping Area	-.15	Low
Student Ownership		
Aquaculture	.13	Low
Actions required in activity		
Livestock/Equine	.11	Low
Creating student-centered learning		
Landscaping Area	.14	Low
Biotechnology/Science	.12	Low
Garden	.12	Low
Meats	.11	Low
Family involvement in student learning		
Apiary	.13	Low

When examining teachers' abilities to address the experiential learning attributes and the access they have to different agricultural laboratories, only low correlations were evident. Food science laboratories resulted in the highest correlation (r = .19); teachers with access to food science laboratories felt they were more able to address the *use of senses* experiential learning attribute. Two low negative relationships were evident: teachers with a field crop laboratory felt less able to address the *duration of the activity* experiential learning attribute (r = -.14), while teachers with access to a landscape area felt less able to address the *environment or setting* attribute (r = -.15).

Relationships between Teachers' Ability to Address Experiential Learning Attributes and their Perceptions of their Level of Importance

Objective 4 examined the relationship between teachers' ability to address experiential learning attributes in laboratories and their perceptions of the importance of attributes when planning lessons in agricultural laboratories. Table 6 displays Pearson's correlations and levels of magnitude between the two variables for each experiential learning attribute.

Table 6

Correlations between Teachers' Ability to Address Experiential Learning Attributes and their Perceptions of their Level of Importance

Experiential Learning Attribute	Pearson's r	Magnitude
Lesson-based Attributes		
Following scientific inquiry processes	.30	Moderate
Duration of activity	.27	Low
Actions required in activity	.26	Low
Student ownership	.25	Low
Use of real societal problem	.22	Low
Creating student-centered learning	.21	Low
Environment/setting	.17	Low
Social responsibility/control of actions	.16	Low
Use of senses	.14	Low
Student-based Attributes		
Background knowledge of students	.18	Low
Student learning styles	.17	Low
Developmental readiness of students	.15	Low
Student attitude regarding the subject	.11	Low
Family involvement in student learning	.11	Low
Student overall mood/emotions	.09	Negligible
Type of motivation students respond to	.08	Negligible

Positive relationships were found between teachers' abilities to address each of the experiential learning attributes and their perceptions of the attributes' importance when planning activities in agricultural laboratories; teachers who were more able to address an attribute had higher perceptions of the attribute's importance. A moderate correlation was found between the two variables with respect to *following scientific inquiry processes* (r = .30), while negligible correlations were found with respect to *student overall mood/emotions* (r = .09) and *type of motivation to which students respond* (r = .08). The remaining correlations were low, ranging from .27 (*duration of activity*) to .11 (*family involvement in student learning*).

Conclusions

Teachers felt all assessed experiential learning attributes derived from Wilson and Beard's (2003) learning combination lock and experiential learning research were important to incorporate when planning experiential learning activities in agricultural laboratories. Teachers' assertion that giving students ownership in the laboratory activity was the most important lesson-based attribute is supported by previous research which found teachers viewed their role during experiential learning as that of facilitator, responsible for guiding student learning experiences (Arnold et al., 2006). Their claim that *duration of an activity* was the least important lesson-based attribute may be a reflection of the lack of research in this area, as no recommendation has been made as to the most effective duration of a learning experience (personal communication, T. G. Roberts, 2010). With regard to student-based attributes, teachers felt incorporating *types of motivation to which students respond* was most important. Because incorporating intrinsic motivation is considered to enhance student engagement (Zull, 2002), teachers may deem this attribute as important because it reduces the likelihood of students being off-task during laboratory experiences. Teachers reported *incorporating students' background knowledge* as the least important lesson-based attribute.

While teachers indicated they were able to address each of the attributes with at least some degree of frequency, teachers reported they were able to address *actions required in the activity* and *types of motivation students respond to* most often. These results are not surprising, as teachers are largely responsible for guiding the actions during activities (Beard & Wilson, 2006) and the increased engagement associated with the incorporation of intrinsic motivators (Zull, 2002). Teachers were able to address *students' use of their senses* and *family involvement in student learning* least often. Represented in Beard and Wilson's learning combination lock (2006), the senses provide a means for students to internalize their experiences, thereby impacting student learning considerably. Low positive and negative correlations were found between specific laboratories and teachers' ability to address seven experiential learning attributes, including *use of senses*, *duration of the activity*, *actions required in the activity*, *family involvement in student learning*, *student ownership*, *creating student-centered learning*, and *environment/setting*. Access to specific laboratories was associated with between 1.2 and 3.6% of the variance in teachers' abilities to address attributes. Shoulders and Myers (2011) found specific facilities were associated with teachers' perceptions regarding the planning required during laboratory activities, which supports findings that teachers may plan activities in specific laboratories differently.

Positive relationships ranging from negligible to moderate were found between teachers' ability to address each of the experiential learning attributes and their perceptions of the attributes' importance when planning activities in agricultural laboratories. Teachers' perceptions of specific experiential learning attributes' importance was associated with between 0.6 and 9.0% of the variance in their ability to address these attributes during laboratory lessons.

Recommendations and Implications

Considering the notion that experiential learning is a foundational component of agricultural education (Roberts, 2006), results finding that teachers felt each of the assessed experiential learning attributes was important to consider when planning lessons in agricultural laboratories is encouraging, implying that teachers acknowledge the importance of including various facets into student learning experiences. Results stating teachers held *duration of an activity* as least important suggest teachers may not carefully control the length of learning experiences in laboratories based on student learning. Secondary education settings are increasingly seeking methods to maximize the effectiveness of their time with students in an effort to increase achievement, making the duration of laboratory activities a crucial component to lesson planning. Because no one duration is recommended to maximize a learning experience (personal communication, T. G. Roberts, 2010), teacher educators should work with teachers to help them recognize student mastery and alter the duration of laboratory experiences as necessary in order to ensure laboratory activities lead to student learning but are not perpetuated unnecessarily.

Teachers also reported *incorporating students' background knowledge* into laboratory lessons was less important than other student-based experiential learning attributes. All experiences are influenced by those preceding them, implying incorporation of background experiences into current experiences is critical in order to help students connect previous knowledge with new knowledge (Kolb, 1984). This research suggests incorporation of background knowledge should be of great importance when planning learning experiences. Teacher educators should provide training for teachers to help them incorporate students' previous experiences into laboratory lessons in a manner that will not dictate excessive behavioral change on the behalf of the teacher, as "modifications in teaching style" was previously identified as a challenge to utilizing experiential learning in agricultural education (Arnold et al., 2006).

The importance of the senses in interpreting experiences (Beard & Wilson, 2006; Zull, 2002) suggests consideration of how experiences incorporate the senses is an important attribute when planning learning experiences. However, teachers reported they were able to address *students' use of their senses* least frequently when compared to other lesson-based experiential learning attributes. Although low, the positive correlation between teachers' perceptions of the importance of using the senses during laboratory activities and their ability to incorporate the senses into their planned activities suggests an increased perceived value in the use of the senses may help teachers incorporate senses into their learning experiences. Teacher educators are therefore encouraged to help teachers see the value in incorporating the senses into laboratory learning experiences, as well as help them find methods for doing so.

Family involvement in learning was also reported to be least frequently incorporated into laboratory experiences. Because of the high level of impact family values can have on students' motivation to become involved in agricultural education experiences (Talbert & Balschweid, 2004), teachers should be encouraged to include family in laboratory experiences. By including family members that may have previous experience in laboratories, teachers may also be able to utilize their expertise to help educate students, thereby reducing management responsibilities seen as a challenge to incorporating experiential learning into lessons (Arnold et al., 2006).

Specific laboratories were found to have different relationships with teachers' ability to address specific experiential learning attributes, implying differences in laboratory settings may play a role in how teachers are able to incorporate various aspects of experiential learning. Because each of the experiential learning attributes can enhance learning experiences (Beard & Wilson, 2006), it is recommended that future research be conducted to determine the factors of agricultural laboratories that allow for or prohibit the use of experiential learning attributes. By gaining a better understanding of how various aspects of agricultural laboratories play a role in the use of experiential learning attributes, teacher educators can assist teachers in addressing more facets of experiential learning in a greater variety of agricultural laboratories.

Although low in effect size, the positive correlations between teachers' perceptions of the level of importance of experiential learning attributes and their ability to address them in laboratory lessons suggest that increasing the value teachers see in these attributes may help them incorporate them into their lessons. Additionally, previous results finding interviewed teachers were not familiar with experiential learning (Arnold et al., 2006) further support the need for teachers to undergo training in this instructional method. By increasing teachers' awareness of and familiarity with experiential learning and its various attributes, teachers may be more likely to incorporate experiential learning facets into their laboratory lessons.

An increased focus on experiential learning attributes can be supported through research and education utilizing Beard and Wilson's learning combination lock (2006). Utilized as the theory for this study, the tumblers in the learning combination lock provide teachers, researchers, and teacher educators with a starting point for the exploration of experiential learning attributes beyond the learning cycle (Kolb, 1984), and should be further investigated as a sound theoretical framework for conducting research in agricultural education.

While implications from this study do not suggest drastic alterations from current ideals and methods in agricultural education, generalizations regarding the results of this study should not be made past the respondents. Further research in experiential learning can help clarify teachers' use of the various aspects of experiential learning and laboratory settings. Therefore, it is recommended that this study serve as a foundation for future research utilizing more accurate statewide databases, increasing generalizability to individual states' agriculture teachers.

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