

The Effects of Kolb's Experiential Learning Model on Successful Intelligence in Secondary Agriculture Students

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Abstract

Experiential learning is an important pedagogical approach used in secondary agricultural education. Though anecdotal evidence supports the use of experiential learning, a paucity of empirical research exists supporting the effects of this approach when compared to a more conventional teaching method, such as direct instruction. Therefore, the purpose of the study was to examine the effects of an experiential learning approach to instruction on the successful intelligence of secondary agricultural education students, as measured across three domains – practical intelligence, analytical intelligence, and creative intelligence. It was concluded students who received the experiential learning treatment produced higher creativity scores that were domain specific. In addition, they scored higher in their practical use of knowledge when compared to their direct instruction counterparts. However, regardless of treatment, both direct instruction and experiential learning yielded similar analytical knowledge scores. Thus, it was recommended agricultural educators utilize a blended approach of instruction to provide balanced growth in all four modes of learning.

Keywords: agricultural education, experiential learning, direct instruction, successful intelligence, practical skills, creative skills, analytical skills

Introduction and Review of Literature

Education in America has found itself under a great deal of pressure to perform academically. This pressure comes from a barrage of accusations that students simply are not college or career ready. In an executive report by the President's Council of Advisors on Science and Technology (2010), the author shared in the 21st century, the need has never been greater for a world-class Science, Technology, Engineering, and Mathematics (STEM) workforce, but noted the United States now lags behind other nations in STEM education at the elementary and secondary levels. Van Driel, Beijgaard, and Verloop (2001) asserted that delivering academic content as a rigid body of facts, theories, and rules to be memorized and practiced could be a major reason for the lack of science achievement. In addition, this type of exposure to academic content leads to a poor understanding of science concepts, and does not prepare future citizens to understand science in a society that is evolving rapidly. This concern is not isolated to this one document, as various sources have warned that students are ill prepared for both college and careers (e.g., Furgeson, 2004; National Center for Educational Statistics, 2011). Cynthia Schmeiser (as cited in Cavanagh, 2004), Vice President for Development of ACT, shared, "The fact is, American high school students are not ready for college, and they're not ready for work. This message is not getting out" (p. 5).

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The *what* is clear – make a change in American education to prepare students better. The *how*, remains a constant point of debate. Two general approaches to education arise as solutions to educational reform – direct instruction and experiential learning. Direct instruction is known as the most longstanding and comprehensive instructional program in schools today (Begeny & Martens, 2006). Direct instruction is a skill-based instructional technique in which teachers promote sequential development of student competencies by following a scripted instructional routine and providing praise at appropriate times (Becker, 1992; Gersten, Carnine, & White, 1984; Joyce & Weil, 2000; Moore, 2007; Pearson & Gallagher, 1983; Rosenshine & Meister, 1992; Vygotsky, 1978). A breadth of research (Adams & Englemann, 1996; Bock, Stebbins, & Proper, 1977; Watkins, 1997) has provided a strong empirical foundation by which proponents of direct instruction ground their preference.

However, not everyone is fond of direct instruction. Dewey (1916) stated, “Formal instruction, on the contrary, easily becomes remote and dead – abstract and bookish, to use ordinary words of depreciation” (p. 8). If the goal is to develop critically thinking, self-motivated, problem-solving individuals who participate actively in their communities, education must mirror the context in which students ultimately will be placed (Itin, 1999; Resnick, 1987). This more holistic approach, aligned more closely to the goal of readying students for the real world is experiential learning (Kolb, 1984).

Agricultural education exists to produce students who are prepared for college and careers (Roberts & Ball, 2009) and has adopted an experiential approach to learning to meet the goals of the program since its inception in the early 1900's (Baker, Robinson, & Kolb, 2012; Knoblock, 2003; Phipps, Osborne, Dyer, & Ball, 2008; Roberts, 2006). Though a small collection of literature in agricultural education supports the use of experiential learning (Anyadoh & Barrick, 1990; Cheek, Arrington, Carter, & Randell, 1994; Cheek & McGee, 1985; Kotrilik, Parton, & Leile, 1986), none of the studies utilized an experimental design where experiential learning was compared to another method, thus, providing inadequate evidence for basing such a strong commitment to experiential learning. Kirschner et al. (2006) contended, “none of the arguments [against experiential approaches] and theorizing would be important if there was a clear body of research using controlled experiments indicating unguided or minimally guided instruction was more effective than guided instruction” (Kirschner et al., 2006, p. 79). Even advocates of experiential learning (Gass, 2005; Henderson, 2004) have conceded the need to develop more evidence-based models for experiential learning, noting confounding variables as a major barrier to the empirical validation of the theory of experiential learning (Ewert & Sibthorp, 2009).

Despite this paucity of research, a number of studies have provided support for experiential learning. Eyler (2009) purported experiential learning has value that extends far beyond the building of social skills, work ethic, and practical expertise and into a deeper understanding of subject matter, which builds the capacity for critical thinking and application of knowledge in complex or ambiguous situations and supports the ability to engage in lifelong learning.

In subsequent studies, Eyler and Giles (1999) found students involved in an intensive, highly reflective service-learning course showed statistically significant increases in reflective judgment at the end of the course when compared to those in a traditional classroom setting. Steinke and Buresh (2002) synthesized that students have a deeper understanding and more complex working knowledge when they are exposed to experiential learning curriculums. Prior research has shown students involved in experiential curriculums have achieved higher learning outcomes than those in non-experiential courses (Markus, Howard, & King, 1993). However, Kendrick (1996) failed to replicate these findings. Findings revealed students in experiential learning treatments performed at, or below, their peers in more direct courses. Specifically, Kendrick (1996) examined two undergraduate courses; of which one required extensive experiential learning components, and found course grades did not differ between the two groups.

Cohen and Kinsey (1994) noted higher self-reported levels of motivation but showed no statistically significant difference in course performance. Osborne, Hammerich, and Hensley (1998), as shared in a synthesis of research by Steinke and Buresh (2002), included discussion of the effects of experiential learning on creativity. A study utilizing a sample of 92 undergraduate students enrolled in a communication course were assigned randomly to either a traditional lecture, or experiential learning section. Utilizing a Remote Associates Test (RAT), which is a standard measure of creativity, significant differences were found in favor of the experiential treatment.

Specht and Sandlin (1991) utilized a sample of 46 college students in a college accounting class to determine the effect of experiential learning approaches on retention of knowledge. Twenty-two students were assigned randomly to the experiential learning section, while the remaining 24 students in the second section received the standard lecture-based instruction. Through the use of unannounced quizzes, students' performances were assessed following the completion of the lesson and six weeks following the delivery of the instruction. The scores were not significantly different directly following instruction, but were significantly different six weeks following instruction in favor of those who received instruction through experiential learning activities.

Studies also have been conducted to determine the effect of experiential learning on students' affective domains. Utilizing a sample of 283 students assigned to an experiential treatment, including case analysis and team accounting simulations, Stout (1996) administered a questionnaire targeting the affective elements of the course twice to determine stable effects. Findings included: (a) experiential students rated the course highly with respect to its perceived impact on the attractiveness of accounting as a profession, (b) the experiential group impacted the learning process positively, (c) the experiential component of the course was determined to be the most satisfactory to students, (d) the course experience had a salutary effect on career specialization intentions, and (e) student perceptions were relatively stable between the two administrations of the questionnaire (Stout, 1996).

A similar study (Weinberg, Basile, & Albright, 2011) examined the effect of a summer enrichment program, grounded in experiential learning opportunities, intended to increase student motivation in science and mathematics. A sample of 336 students were asked to complete the Science and Mathematics Student Motivation Assessment (SMSMA) following the experiential treatment. The SMSMA measures interest value, utility value, cost value, attainment value, and expectancy for success. Through the use of paired samples *t*-test, it was found students became more interested and developed a higher expectancy for success for mathematics, but reported a lower attainment value following the experience indicating math did not define them as a person. In science, statistically significant gains were found in student interest, perceptions of usefulness, importance of science in defining themselves, and expectations for future success in science.

Abdulwahed and Nagy (2009) conducted one of the only studies that tested Kolb's (1984) experiential learning theory in relation to student performance specifically. The researchers divided 70 engineering students into two groups. One group received the standard engineering based instruction including performance based lab assessments. The second group received a modified curriculum that was designed specifically to match Kolb's (1984) experiential learning cycle. It was suspected the issue of performance was based on the lack of activation in the prehension dimension of the cycle. Following eight weeks of instruction treatments, it was concluded "students who had better activation of the prehension dimension prior to the lab session had more in-depth learning during the hands-on lab session" (Abdulwahed & Nagy, 2009, p. 289).

Consistent with other fields, experimental research in agricultural education seeking empirical support for experiential learning is limited. Specific to agricultural education, the majority of evidence related to experiential learning is found in connection with Supervised

Agricultural Experience Programs (SAE). Research studies consistently found a relationship between involvements in SAE programs and performance on agricultural competence examinations (Cheek et al., 1994; Cheek & McGee, 1985; Kotrilik, Patton, & Leile, 1986). Further, Anyadoh and Barrick (1990) noted a statistically significant relationship between SAE involvement and academic achievement as measured by students' GPA. Though a person might question the moderation of other variables in these studies, it does provide an indication that involvement in the highly experiential component of the agricultural education program could have an effect.

Theoretical and Conceptual Framework

Conceptually, experiential learning undergirded this study. Experiential learning, as defined often by Kolb's (1984) Experiential Learning Theory (ELT), represents a holistic educational structure called for by a number of educational stakeholders (Eyler, 2009). ELT is a synthesis of work from key theorists (Dewey, 1934, 1938, 1958; Freire, 1974; James, 1890; Jung, 1960, 1977; Lewin, 1951; Rogers, 1961) built upon the foundational definition of learning as the "process whereby knowledge is created through the transformation of experience" (Kolb, 1984, p. 38). This transformation of experience occurs in a cyclical fashion as students engage in concrete experiences (CE), reflective observation (RO), abstract conceptualization (AC), and active experimentation (AE) (Kolb, 1984). In this learning process, discourse is resolved through the transformation of new information and the grasping or accommodation into existing schema (Kolb, 1984). Experiential instruction is characterized by: (a) a continuous learning process grounded in experience, (b) a process requiring the resolution of conflicts between dialectically opposed modes of adapting to the world, (c) a holistic process of adapting to the world, (d) learning involves transactions between the person and the environment, and (e) a process of creating knowledge (Kolb, 1984). Learning, when viewed experientially, is more focused on the process than the products, highlighting the development of meta-cognitive skills critical to lifelong learning (Baker et al., 2012). This approach to learning has shown to increase student satisfaction in the course, improve retention of information as measured on examinations, develop a deeper, more complex understanding of concepts, improve practical use of information, and develop meta-cognitive skills useful in all domains (Abdulwahed & Nagy, 2009; Eyler & Giles, 1999; Eyler & Halteman, 1981; Markus, Howard, & King, 1993; Specht & Sandlin, 1991; Steinke & Buresh, 2002).

Theoretically, this study was framed using Sternberg's (1999) Theory of Successful Intelligence. Sternberg (1999) listed three factors of learning that should be considered. The three factors were: (a) analytical intelligence: skills used to analyze, evaluate, judge, or compare and contrast, (b) practical intelligence: skills used to implement, apply, or put into practice ideas in real-world contexts, and (c) creative intelligence: skills used to create, invent, discover, imagine, suppose, or hypothesize. Sternberg (1999) purported that a construct of successful intelligence "better captures the fundamental nature of human abilities" (p. 292). This concept of intelligence stands in contrast to the conventional *g*, or general ability, views of intelligence that Sternberg (1999) described as narrowly based and incomplete. The concept of experiential learning as a teaching method has at times been a difficult treatment to understand fully (Roberts, 2012), and as such, a broader perspective of learning was utilized in this study.

Purpose of the Study

Research supporting experiential learning is inconsistent and lacks breadth and depth (Steinke & Buresh, 2002). Moore (1999) shared,

When it works, experiential education is a fabulous, exciting pedagogy with the power to transform individuals and institutions. But I think we need to take the risk of saying out loud that it does not always work. Our posture of true belief looks like Dorothy's faith in the Wizard of Oz could supply the Scarecrow's brain,

the Tin Man's heart, and the Lion's courage; it obscures our problems and distracts us from doing something about them. (p. 23)

It is in this spirit that a renewed call exists for experiential learning research in secondary agricultural education (Baker et al., 2012; Roberts, 2006). Therefore, the purpose of this study was to examine the effects of an experiential learning approach to instruction, in comparison to direct instruction, on the successful intelligence of secondary agricultural education students.

Research Hypotheses

Three null hypotheses framed the study:

H₀ 1: There is no difference in students' creativity in context between the experiential learning and direct instruction approaches to learning.

H₀ 2: There is no difference in students' practical use of knowledge between the experiential learning and direct instruction approaches to learning.

H₀ 3: There is no difference in students' analytical use of knowledge between the experiential learning and direct instruction approaches to learning.

Methods and Procedures

The population of interest in this experimental design (Kirk, 1995) study was all students enrolled in the participating secondary agricultural education program ($N = 120$). The agricultural education program is located in a rural community with a population of approximately 46,000 people ([www.city-data.com/city/\[city's name\]-\[state's name\].html](http://www.city-data.com/city/[city's name]-[state's name].html)). The entire program was chosen to attempt to query a representative sample of a *typical*, holistic, agricultural education program in [State]. This somewhat isolated population, though limiting in generalizability, provided additional control of nuisance variables associated with varying social contexts of communities and schools. From this population, 80 participants completed IRB consents and assents and agreed to participate in a *Wind Energy Day Camp*. According to the IRB protocol, those not providing full consent and assent were removed from the study. Of the 80 participants, 38 were assigned to the treatment group and 42 to the comparison group. Selected demographics of those participating are displayed in Table 1.

Table 1

Summary of Crosstabulation of Gender and Grade by Treatment Group

Demographic	Experiential Learning		Direct Instruction		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Male	15	39	23	55	38	48
Female	23	61	19	45	42	52
9th	16	42	19	45	35	44
10th	6	16	6	14	12	15
11th	11	29	9	22	20	25
12th	5	13	8	19	13	16

Wind turbine blade design was the content of interest for the experiment. This subject was chosen purposefully as it was congruent with course objectives for agricultural education and

included adequate science, technology, engineering, and math (STEM) concepts. The goal was to provide a full unit of instruction, which typically would be taught over the course of one week in an instructional setting, during a four-hour period to maintain the experimental control. Instruction was delivered in two different treatments – direct instruction and experiential learning designs. A summary of the treatment design is shared in Table 2.

Table 2

Brief Overview of Instructional Plan for Two Conditions of Instruction

Experiential Learning Instructional Approach	Direct Instruction Instructional Approach
Students interacted with six stations related to key concepts of blade design where instructors served as facilitators.	Students received three instructional sessions targeting specific learning goals.
Students were asked to reflect on each station using two questions: (a) What is happening? (b) What does this teach you as you build your own blade design? Instructors facilitated this reflection and provided content expertise.	Instruction was based on a scripted lesson plan focused on developing mastery of the objectives put forth in the plan. This plan included pre-planned discussion questions and learning activities.
Students utilized abstraction sheets to connect their reflective observations to abstract concepts outlined in the objectives. Instructors served as content experts.	Instructors provided critical information followed by a chance for students to practice use of that knowledge in a large group ($N = \sim 5$), smaller group ($N = \sim 2$), and then individually.
Students were allowed to experiment actively with their own conclusions by building and testing a number of blade designs. Instructors served as evaluators and coaches.	Instructors provided immediate and constant praise based on student performance. KidWind® materials were used to demonstrate key principles.

Weiss (2010) stated, “It may be important to randomize teachers to experimental conditions for reasons very similar to the reasons why researchers randomize students to experimental conditions” (p. 384). Based on this suggestion, eight non-researcher instructors were assigned randomly to the two experimental conditions so each condition had a lead instructor and three assistant instructors. Because both direct instruction and experiential learning instructional approaches require feedback, guidance, and support, it was determined four instructors would insure fidelity and potency of the treatment. Each participating instructor received professional development prior to the treatment including identical information related to the content of the lesson and specialized training related to the specific treatment approach.

Successful Intelligence Assessments

The Analytical Wind Energy Assessment (AWEA), a criterion-referenced test based on the selected educational objectives of the blade design instructional unit, served as the main analytical assessment for the study. The assessment was created as a collaborative effort by the researchers and the KidWind® staff and consultants, experts in the field of wind energy engineering, and pedagogical experts in agricultural education. The purpose of the assessment was to capture students’ ability to analyze, critique, judge, compare and contrast, evaluate, and assess concepts

related to the objectives of the lesson. The AWEA included 40 total questions, of which 30 were multiple-choice and ten were matching questions. Each question was noted as correct or incorrect leading to a range of possible scores of 0 to 40. Creswell (2008) suggested researchers should establish both face and content validity on instruments through the review of the assessment by a panel of experts. Experts from KidWind® assessed the AWEA for content validity, suggested changes, and approved the final set of 40 questions. Pedagogical experts assessed the AWEA for face validity and found it appropriate for secondary agricultural education students. In addition to issues of validity, reliability refers to the extent that the scores made by an individual remain nearly the same in repeated measurements (Ary, Jacobs, & Razavieh, 2002). Wiersma and Jurs (1990) suggested eight specific methods to increase the reliability of criterion-referenced examinations, including homogenous items, discriminating items, enough items, high quality copying and format, clear directions for the students, a controlled setting, motivating introduction, and clear directions for the scorer. Each of these suggestions were considered carefully and addressed fully in the development of the AWEA.

Although traditional reliability indices based on internal consistency are not relevant, it is an important indication of reliability in criterion-referenced exams (Kane, 1986; Lang, 1982; Popham & Husek, 1969; Wiersma & Jurs, 1990). The Kuder-Richardson 20 (*KR20*) formula (Cronbach, 1970), a test for internal consistency used commonly with criterion-referenced exams, was used to determine reliability of the AWEA. The two AWEA assessments included the same questions and answers. However, the order of questions and answers were altered. The AWEA produced reliability coefficients (*KR20*) for each AWEA, which were .82 for the pre-test and .90 for the post-test – both above the .50 standard (Kane, 1986).

Sternberg (2004) explained that practical knowledge requires students to apply, use, put into practice, implement, employ, and render practical what they know. The practical assessment used in this study was an authentic assessment that represented the most logical extension of the lesson – to design, build, and test wind blades using materials provided by the instructors. Each student was provided a universal hub and was asked to create a hub design intended to produce the most voltage possible in one hour using a common bank of materials. Each blade design was attached to a model tower containing a small generator, which was placed in front of a fan set at a constant speed. The voltage output was measured using a voltage meter reporting a $\pm 0.5\%$ reliability. Voltage in this study ranged from .00 to 1.89. All variables, aside from the design of the blade, were held constant, and each voltage output was recorded.

Creativity, which is the ability to produce something that is both novel and useful (Sternberg, 1988), also was a variable of interest in the study. In this study, creativity was operationalized as how novel and useful the design of students' wind blades was perceived. Based on Guilford's (1950) proposal that creativity could be measured with a psychometric approach, Torrance (1974) developed the Torrance Tests of Creative Thinking (TTCT). This instrument employed a scoring system for fluency, flexibility, originality, and elaboration. Amabile (1996) explained the complex nature of creativity and explained in light of the many methods for measurement of creativity, it is important to, "specify which domains and elements of creativity are assessed with any particular test" (p. 26). Thus, originality was measured as the indicator of creativity. The TTCT (Torrance, 1974) operationalized creativity as statistical infrequency, which can be calculated and scored objectively.

The measurement of creativity followed Torrance's (1974) originality conventions. First, it was important to identify all the ways students could be divergent in their blade design. Students could alter their designs by changing the blade length, blade pitch, blade shape, number of blades, and materials used to make the blades. An additional category of *elaboration* was included for divergent design elements not comprised within the five categories, making a sixth element. Two pictures were taken of each blade design created by the participants, and were assessed on the six

divergent elements. The purpose of this assessment was to create a frequency of each design element choice, determine a percentage of designs sharing the choice, and create a divergent score for each blade design. Ultimately, a statistical scoring process was utilized to determine the level of divergence of each design ranging from 0 to 3. Each participant's design was scored on the six elements; those scores were added to achieve the overall creativity score utilized in the analysis could range from 0 to 18.

Analysis of Data and Potential Threats to Validity

All data were analyzed using Statistical Package for Social Sciences (SPSS[®]) version 20. Using histograms and P – P plots, as suggested by Field (2009), all dependent variables were distributed normally prior to analysis. Consistent with conventions of experimental design (Kirk, 1995), three null hypotheses were established with an alpha level of .05 determined *a priori*. A multivariate analysis of variance (MANOVA), followed by separate analysis of variance (ANOVA) and discriminant analysis, was used in the analysis (Stevens, 2009). Partial eta squared is the reported effect measure in this study. Cohen (1977) characterized $\eta_p^2 = .01$ as a small effect size, $\eta_p^2 = .06$ as a medium effect size, and $\eta_p^2 = .14$ as a large effect size. These standards were utilized in the analysis of practical effect for multivariate analyses. Campbell and Stanley (1966) identified four categories of threats: (a) statistical conclusion validity, (b) internal validity, (c) construct validity of causes and effects, and (d) external validity. Steps were taken to mitigate each of these threats. Each of the assumptions required when utilizing MANOVA were tenable as each observation was collected independently, data were distributed normally, and Levene's test for the equality of error variances yielded *p* values less than .05.

Findings

Experiential learning mean scores (with standard deviations in parentheses) for creativity, practical, and analytical measures by treatment are reported in Table 3.

Table 3

Summary of Mean Scores for Successful Intelligence Measures by Treatment

Treatment	Creativity ^a		Practical ^b		Analytical ^c	
	<i>M</i>	<i>(SD)</i>	<i>M</i>	<i>(SD)</i>	<i>M</i>	<i>(SD)</i>
Experiential Learning	6.24	(3.28)	.79	(.44)	24.55	(8.40)
Direct Instruction	3.74	(2.20)	.41	(.29)	29.10	(6.76)

^a Creativity scores range from 0 to 18. ^b Practical scores are true voltage measures. ^c Analytical scores range from 0 to 40.

An omnibus multivariate analysis of variance was utilized to address each of the three research questions. Wilk's statistics yielded a statistically significant difference between students' successful intelligence measures involved in the two treatment conditions, $\Lambda = .64$, $F(3,76) = 14.10$, $p = .00$. It is important to note that Wilk's lambda is an index of how variability in the dependent variables is attributable to regression, and thus, is inherently a measure of effect size (Stevens, 2009). In this case, 36% of the variance was accounted for by the dependent variables.

Once statistically significant differences were found, post-hoc procedures were utilized to explore the nature of the differences. Field (2009) recommended following any multivariate analysis of variance with both univariate tests and discriminant analysis to understand fully the nature of the differences. Discriminant analysis further deconstructs the total between associations into additive pieces and produces a structure matrix that purports uncorrelated linear combinations of the dependent variables (Stevens, 2009). Table 2 presents a summary of the two post-omnibus procedures, including univariate analysis of variance for each dependent variable and the discriminant analysis. There was a significant statistical and large practical effect of experiential learning on levels of creativity, $F(1,78) = 16.17, p = .00, \eta_p^2 = .17$; thus the first null hypothesis was rejected. There also was a significant statistical and large practical effect of experiential learning on practical skills, $F(1,78) = 21.97, p = .00, \eta_p^2 = .22$. Therefore, the second null hypothesis also was rejected. No statistically significant difference was found between experiential learning and direct instruction in analytical performance, $F(1,78) = 3.705, p = .06, \eta_p^2 = .05$. As such, the third null hypothesis failed to be rejected.

The discriminant analysis revealed one statistically significant discriminant function, $\Lambda = .64, \chi^2(4) = 33.85, p = .00, \text{canonical } R^2 = .60$, as expected with two treatment conditions. The discriminant function revealed creativity ($r = .61$) and practical skills ($r = .71$) loaded positively on the function while analytical skills ($r = -.30$) loaded negatively on the function (see Table 2). This analysis of the structure matrix further confirmed creativity and practical skills discriminated experiential learning from direct instruction, and analytical skills defined the direct instruction approach.

Table 2

Summary of Analysis of Variance and Discriminant Analysis, Including Creative, Practical, and Analytical Measures

Variable	<i>F</i>	<i>p</i>	Standardized Canonical Discriminant Function	
			Coefficients	Structure Matrix
Creativity	16.17	.00	.52	.61
Practical	21.97	.00	.81	.71
Analytical	3.71	.06	-.36	-.30

Conclusions and Implications

Conclusion 1: Students who were taught experientially had higher creativity scores when compared to those who were taught through direct instruction.

The findings of this study confirm Kolb's assertions that a lack of balance can lead to poor creative integration. In this study, students taught through experiential learning increased their creativity scores by almost three full points. Although the analytical scores were lower for the experiential group than the direct instruction group, the creativity scores were statistically significantly better. This finding, coupled with Kolb's (1984) discussion, begs the question, "Are we aware of the unintended consequences of accountability through high stakes testing?"

Amabile (1996) explained the importance of social and environmental factors affecting creativity, and noted the importance of "openness" in classrooms (p. 206). Openness is defined as "less an approach or method than a set of shared attitudes and convictions about the nature of childhood, learning, and schooling" (Silberman, 1970, p. 208). This open style is viewed frequently

as “a style of teaching involving flexibility of space, student choice of activity, richness of learning materials, integration of curriculum areas, and more individual or small-group than large-group instruction” (Horwitz, 1979, pp. 72-73). Horwitz (1979) reviewed 33 studies examining this open philosophy and practice and found all noted statistically significant gains in student creativity. Perhaps this open style is connected to Kolb's (1984) concept of high integration, growth, and creativity. The description of an open style is congruent with the practice of secondary agricultural classrooms in [State] and across the nation. The experiential treatment in this study fits this description of openness, while the direct instruction treatment was extremely scripted and orderly. This study would make the 34th in Horwitz's (1979) review of literature confirming the positive relationship of openness and creativity.

Could it be the *unstructured* nature of agricultural education classrooms that is criticized most often by administrators and state leaders is actually the most beneficial element of the program? So often educators, researchers, and stakeholders share there is *something* that is developed within agricultural education students that cannot be measured. Possibly, it cannot be measured because the measurements used are too narrowly focused on academic performance. This study confirmed one of the *somethings* produced from experiential approaches to learning is the ability to operate creatively at high levels of integration. Though agricultural education is under direct pressure to become more academic, careful attention should be given to the development of a holistic and balanced approach to learning to avoid the potential unintended consequences of decreased creativity.

Conclusion 2: Students who were taught experientially had higher practical scores when compared to those who were taught through direct instruction.

The findings of this study provide evidence that an experiential approach to learning, as compared to that of direct instruction, yields greater practical use of knowledge taught. Other researchers demonstrated similar conclusions in both liberal education and agricultural education (Eyler & Halteman, 1981; Randell, Arrington, & Cheek, 1993). Dewey (1938) spoke to the importance of practical applications of concepts learned in school. This sentiment sits at the heart of the call for educational transformation producing graduates who are more prepared to handle the real-life problems faced in the workplace (Van Driel et al., 2001).

In agricultural education, this conclusion holds important implications for the dual-purpose role of the program (Roberts & Ball, 2009). Though no longer called vocational, agricultural education has an important role in developing practical career skills as a part of the career and technical education arm of public education. Roberts and Ball (2009) explained the curriculum should be driven partly by the needs of the agricultural industry – practical needs. Is it possible agricultural education has become conditioned to brush off any notion of vocational education, and inadvertently *thrown out the baby with the bathwater*? Should the purpose of education be to prepare students for successful vocational pursuits – agricultural or otherwise? One theme continues to arise – a balanced approach to instruction provides the well-rounded education of students (Kolb, 1984).

Conclusion 3: Students who were taught experientially had similar analytical scores when compared to those who were taught through direct instruction.

Although ocular differences existed, they were not statistically significant. Therefore, this conclusion aligned with research by Specht and Sandlin (1991), which found students in an experiential learning course scored no differently, statistically, than those who participated in a lecture-based format directly following the course. In contrast, literature in agricultural education (Cheek et al., 1994) found a statistically significant and positive correlation between student involvement in SAE projects, often noted as the experiential component, and achievement on the

agricultural class content examination. Roberts (2006) explained the importance of naming the context of a learning experience to understand better the effects and procedures employed. This difference in educational context could be the cause of the conflicting results. The Specht and Sandlin (1991) study was conducted over one full semester, where internalization was sought, the setting was more formal, and the level of knowledge was more abstract in nature. This study was conducted as a one-day, clinical, experiment that focused on both concrete and abstract levels of knowledge, was more student-led, and sought internalization as an outcome. Under Kolb's (1984) premise that all learning is experiential, it may be too broad to only investigate *if* experiential learning is effective in developing successful intelligence. Additional research may be required to extend further into how different *types* of experiences affect students' successful intelligence.

Recommendations for Practice

Although the study found experiential learning improves students' creative and practical skills effectively, and while direct instruction delivered analytical knowledge more effectively, a blended approach is recommended. As shared by Kolb (1984), the goal is a balanced development of all four learning modes. Agricultural educators should utilize Kolb's (1984) ELT as a framework for designing instruction so experiential learning is not a mere notion, but a learning approach requiring careful planning and execution.

Secondary school systems should embrace both highly directive and experiential components of the school curriculum, as this combination produces successful student intelligence most effectively. An attempt to homogenize course and program offerings reduces the opportunities for students to develop cognitive complexity in all four modes. Methods of assessment should be expanded. Traditional knowledge-based examinations measure only a portion of the elements key to successful intelligence. The products of teaching methods like experiential learning will not be captured with this traditional testing technique.

Further, based on the findings of this study, the following recommendations were presented for consideration by post-secondary teacher educators in agricultural education:

Operationalize experiential learning into a teaching framework. Experiential learning is often well defined, but knowing how to deliver instruction in this manner pedagogically, is not addressed adequately. Aspiring agricultural educators must understand how to utilize various teaching methods to guide students through each of the four modes of learning to achieve the results noted in this study. This training should include the development of educators' ability to serve in the facilitator, expert, evaluator, and coaching roles effectively.

Curriculum design should be reconsidered to fit experiential approaches to learning. The vast majority of curriculum resources available to teachers today utilize a direct instruction approach to teaching, which is shown in this study to be inadequate as a stand-alone method. If agricultural education continues to prescribe to experiential learning, instructional support and materials for the myriad of experiences available to secondary agricultural education students must be provided to ensure all four modes of learning are addressed. As Dewey (1938) indicated, experience alone does not constitute learning. Experiences must be planned purposefully by the instructor, be of high quality, and lead to learning to be considered experiential *learning*. In agricultural education, *doing* does not necessarily constitute *learning*.

Recommendations for Research

A number of additional research questions arose as a product of this study. Future research should determine the effect of experiential learning, as operationalized in this study, over a longer period of time in the traditional classroom setting at the secondary level. Specifically, what do

secondary agricultural education teachers perceive about the use of experiential learning over an extended time? How impactful is it in developing the successful intelligence of students? Future research should assess these questions. Also, studies should determine the effect of a blended approach to learning including both direct instruction and experiential learning techniques. In addition, determining how student motivation for the content is affected by either direct instruction or experientially based instruction should be explored. Finally, future research should assess how students' learning styles affect their learning outcomes when exposed to various teaching methods.

Discussion

Throughout the study, the preferred learning approach has been treated as a *this or that* proposal. In reality, the best approach for student learning might be a *both* approach. Sternberg (2002), in an article called *Raising the Achievement of All Students: Teaching for Successful Intelligence*, included an additional element of teaching for memory learning and explained, "teaching for memory is the foundation for all other teaching because students cannot think critically about what they know if they do not know anything" (Sternberg, 2002, p. 386). This study seems to conclude a blended approach of direct instruction and experiential learning is effective in delivering analytical knowledge, while creative and practical elements are taught best using an experiential learning approach. Agricultural education is uniquely positioned such that it has the capacity to provide both direct instruction and experiential approaches to learning, which, as indicated by this study, produce successful student intelligence.

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