Journal of Agricultural Education, 55(2), 16-32.
doi: 10.5032/jae.2014.02016

A Comparison of Student Engaged Time in Agriculture Instruction

Phillip A. Witt[1], Jonathan D. Ulmer[2], Scott Burris[3], Todd Brashears[4], and Hansel Burley[5]

Abstract

Teacher and student behaviors in the classroom have been linked to student achievement. The hands-on, real world experiences which students are offered through career and technical education courses provide an opportunity for agricultural education to make contributions to student achievement. The purpose of this study was to compare engaged time during traditional instruction and during the instruction of an inquiry based curriculum (CASE). The target population for this study consisted of students enrolled in animal science courses taught by secondary agriculture teachers. The study employed a quasi-experimental, static-group comparison design. Nine CASE certified teachers represented the treatment group, which were matched with nine traditional agriculture teachers on selected criteria. Student engagement was measured using the Behavioral Observation of Students in Schools. Matched pairs t-tests were used to compare the CASE group and the traditional group on student engagement. Students in the CASE group were found to spend significantly more time actively engaged than those in traditional agriculture courses. From the findings it was concluded that the CASE curriculum and professional development can impact the active engagement of students in the classroom and potentially affect student achievement.

Keywords: Student Engagement, Curriculum for Agricultural Science Education, CASE, BOSS, Engaged Time, Off-Task Behavior

The national emphasis that is placed on student performance in science, technology, engineering and math (STEM) and the requirements of No Child Left Behind have initiated the development of novel teaching strategies, teacher training programs, and curricular resource organizations such as Curriculum for Agricultural Science Education (CASE). In addition, career and technical education (CTE) courses have the potential to integrate coursework, work-based learning experiences and hands-on experience which allow students to develop competencies, skills, and attitudes for success beyond high school (New York City, 2008).

With more than 510,000 students enrolled in agricultural education courses, programs have the opportunity to play a vital role in improving performance in STEM areas. While the

[1] Phillip Witt is the Director of the Nevada Regional Technical Center, 900 West Ashland Street, Nevada, MO 64772, Email: pwitt@nevada.k12.mo.us.
[2] Jonathan Ulmer is an Assistant Professor of Agricultural Education in the Department of Agricultural Education and Communications at Texas Tech University, PO Box 42131, Lubbock TX 79409, Email: jon.ulmer@ttu.edu.
[3] Scott Burris is an Associate Professor of Agricultural Education in the Department of Agricultural Education and Communications at Texas Tech University, PO Box 42131, Lubbock TX 79409, Email: scott.burris@ttu.edu.
[4] Todd Brashears is an Associate Professor of Agricultural Education in the Department of Agricultural Education and Communications at Texas Tech University, PO Box 42131, Lubbock TX 79409, Email: todd.brashears@ttu.edu.
[5] Hansel Burley is a Professor of Educational Psychology and Associate Dean for Academics and Data in the College of Education at Texas Tech University, PO Box 41071, Lubbock TX 79409, Email: hansel.burley@ttu.edu.

current national level of science integration in agriculture curricula is unknown, studies have shown core curriculum integration can have positive effects on student achievement (Parr, Edwards, & Leising, 2009). Furthermore, there has been a great deal of effort to identify the critical instructional variables affecting students' mastery of skills (Shapiro, 2011a). The concept of student engagement and academic engaged time emerged as one of these important factors from Carroll's (1963) model of school learning. This model, shown in Figure 1, makes the hypothesis that, if all other things are held equal, learning can be seen as a simple function of the time a student is actively engaged in learning.

$$Degree\ of\ learning = f\left(\frac{time\ actually\ spent}{time\ needed}\right)$$

Figure 1. Carroll's Model of School Learning

Carroll (1963) identified learning as a function of five factors; aptitude, ability, perseverance, opportunity to learn, and the quality of instruction. Other researchers have built upon the model and agree student learning can be thought of as a function of the amount of time students are actively engaged in instruction (Bloom, 1974; Bloom, 1976; Denham & Lieberman, 1980; Stanley & Greenwood, 1981; Wiley & Harnischfenger, 1974). Fredricks, Blumenfeld, and Paris (2004) reported on several studies that demonstrated a positive correlation between behavioral engagement and student achievement across all grade levels. Other research has reported fewer discipline and behavior issues in classrooms with higher levels of engagement (Finn & Rock, 1997). The results of these studies suggest academic engaged time is an important variable to consider when investigating student academic performance.

There are two factors that account for time spent learning: time allowed and perseverance of the student. The National Education Commission on Time and Learning (1994) described this as net instructional time, which accounts for the time students are actually receiving instruction after deducting the time spent on non-instructional activities. Since this report, there have been few changes to the length of the school day or year (NECTL, 1994). However, the commission believed the way time is used can have an impact on student achievement. The effect of time allowed has been studied by several researchers (Caldwell, Huitt & Graeber, 1982; Goodman, 1990; Karweit, 1983; Karweit & Slavin, 1981). They supported the findings of Dewalt and Rodwell (1988), whose research reinforced the necessity of employing sound instructional delivery techniques to improve achievement in schools. This notion was further supported by Mulholland and Cepello (2006) who found that high quality curriculum, designed to improve teacher candidates' skills in the classroom, had positive effects on engagement and achievement.

Associated with this notion is the concept of perseverance, which is described as the amount of time the student is willing to engage in the learning activity or the percentage of class time actively working in a subject area (Caldwell et al., 1982). It is believed, learners require different amounts of time to learn or master new concepts. Schools generally provide the opportunity for instruction and practice of these concepts, but there are no guarantees students will take advantage of these opportunities. Carroll (1963) posited all students have a point at which they are no longer willing to learn and recognized that many different variables can affect this point. Students' motivation to learn plays a major role in classroom perseverance. Some students might begin to learn and then lose interest while others might be intimidated by the task and never begin. As a result of their findings, Berliner (1980) encouraged teachers to measure understanding, increase clarity, and involve the students to improve engagement instead of using discipline.

Given the development of knowledge surrounding the effects of time in schools, researchers and policymakers have been increasingly focused on student engagement as the key to addressing low achievement, student boredom, and high dropout rates (Fredricks et al., 2004).

In order to continue to advance the knowledge on engagement, it is important there be a common understanding of the terms academic, cognitive, intellectual, institutional, emotional, behavioral, social, and psychological engagement, as found in the literature (Taylor & Parsons, 2011). Fredricks et al. (2004) summarized this research into three clearly defined types of engagement. These three types—behavioral, emotional, and cognitive—are considered to be three unique types of engagement; yet, they have also been used together as a meta-construct.

Behavioral engagement is defined in several ways. The first definition involves positive conduct in schools such as following classroom rules and a lack of disruptive school behavior (Finn, 1993; Finn, Pannozzo, & Voelkl, 1995; Finn & Rock, 1997). Other definitions involve student participation in school sponsored activities (Finn, 1993; Finn et al., 1995). Finally, and most applicable to this study, behavior engagement involves students' involvement in learning and academics such as effort, persistence, and concentration (Carroll 1963; Brich & Ladd, 1997; Skinner & Belmont, 1993). Academic engagement is a concept nested below behavioral engagement, and is referred to as a combination of classroom behaviors indicating a student is involved in instruction.

Emotional engagement refers to the affective component of student engagement. Researchers have defined and measured this as interest, boredom, anxiety, and happiness related to learning (Connell & Wellborn, 1991; Skinner & Belmont, 1993). Students' connection to the school or courses is a large component. Emotional engagement has been largely studied in situations where students are in high-risk environments. Fredricks et al. (2004) reported the majority of studies of emotional engagement utilize student self-report measures that include items "related to school, schoolwork and the people at school" (p. 66).

Cognitive engagement stems from the literature on school engagement involving self-regulated learning. Self-regulated learning can be thought of as rewarding or punishing one's own behavior based on personal goals (Slavin, 2009). Researchers have explored this concept using a variety of methods. Appleton, Christenson, Kim, and Reschly (2006) surveyed participants in Midwest urban school districts using the Student Engagement Instrument (SEI). The SEI was developed by the researchers using an extensive literature review of studies discussing cognitive and psychological engagement. The final version of the SEI contained 30 items measuring cognitive engagement and 26 items measuring psychological engagement.

Results from Appleton et al. (2006) revealed the items on the SEI were valid measurements of students' cognitive engagement in the classroom; however, the SEI tells practitioners very little about what is actually happening in the classroom. These measures are more valuable in identifying students who are at risk for educational failure (Appleton et al, 2006).

Meece, Blumenfeld, and Hoyle (1988) conducted an early study on students' cognitive engagement. They found students' goal orientations, or attitude toward learning, had an impact on the level of engagement. "Students who reported greater intrinsic motivation to learn placed a stronger emphasis on educational goals and learning" (Meece et al., 1988, p. 521). Another interesting finding from their study indicated students' academic ability did not aid in the prediction of students cognitive engagement. In 2007, researchers revisited the Carroll Model of School Learning, calling for policy makers to provide more time for the core academic subjects as a way to improve lagging scores (Resnick, 2007); however, they also recognized that spending more time in the classroom was not enough. Students must be actively engaged in the instruction. This "rate of engagement is influenced by how well structured the teaching is with respect to individual students" (Resnick, 2007, p. 1).

Another important aspect to consider is the impact of time on deep and robust learning of the subject matter. Researchers contend that as teachers are required to teach more and more content, their natural reaction is to move through the material more quickly (Resnick, 2007). Clark & Linn (2003) found when students received less instructional time for the same content, their ability to demonstrate deeper understanding in essay question responses fell dramatically.

Time in school and engaged time is only one piece of the puzzle. The measurement of time does not mirror the cognitive processes in a student's head. "All that we can say with some certainty is that any learning that happens to occur does require time" (Carroll, 1989, p. 27). Engaging students in the classroom is still a challenge for educators. In a study of cognitive engagement, researchers found students did not believe they were responsible for driving their own level of engagement. They consider this action to be the responsibility of the instructor (Erry & Wood, 2011).

Purpose and Objectives

Student engagement has become a valid indicator of institutional excellence among researchers and practitioners (Axelson & Flick, 2011). Additionally, the link between student achievement and engagement has been explored and supported by a number of researchers (Connell, Spencer, & Aber, 1994; Fredricks et al., 2004; Skinner, Wellborn, & Connell, 1990). This study sought to compare engaged time during traditional instruction and during the instruction of an inquiry based curriculum (CASE).

The purpose of this study was to investigate the academic engagement of students enrolled in animal science courses taught with the CASE curriculum and teacher selected curriculum. The following research objective and hull hypotheses were used to guide the study:

1. Compare the engaged time and off-task behavior of students enrolled in traditional animal science courses and students enrolled in CASE animal science courses.
    1. H_0: There is no difference in the total engaged time of students in traditional and CASE animal science courses (H_{0tet}: $\mu_{traditional} = \mu_{CASE}$).
    2. H_0: There is no difference in the active engaged time of students in traditional and CASE animal science courses (H_{0aet}: $\mu_{traditional} = \mu_{CASE}$).
    3. H_0: There is no difference in the passive engaged time of students in traditional and CASE animal science courses (H_{0pet}: $\mu_{traditional} = \mu_{CASE}$).
    4. H_0: There is no difference in the off-task behavior time of students in traditional and CASE animal science courses (H_{0oft}: $\mu_{traditional} = \mu_{CASE}$).
    5. H_0: There is no difference in the off-task motor time of students in traditional and CASE animal science courses ($H_{0oft\text{-}m}$: $\mu_{traditional} = \mu_{CASE}$).
    6. H_0: There is no difference in the off-task verbal time of students in traditional and CASE animal science courses ($H_{0oft\text{-}v}$: $\mu_{traditional} = \mu_{CASE}$).
    7. H_0: There is no difference in the off-task passive time of students in traditional and CASE animal science courses ($H_{0oft\text{-}p}$: $\mu_{traditional} = \mu_{CASE}$).

Methods and Procedures

This study employed a quasi-experimental, static-group comparison design. Gall, Gall, and Borg (2007) define quasi-experimental design as a study lacking random assignment to groups. "This type of experiment, if carefully designed, yields useful knowledge. However, you should be aware of the special problems that can arise when individuals are not assigned randomly to groups" (p. 416). The static-group comparison design is characterized by the use of treatment and control groups, and investigating the differences between them through the use of a post-test.

Population

Nine CASE Agricultural Science-Animal certified teachers were identified to participate in the study. Each CASE teacher was then matched with an agriculture teacher who was not CASE certified. Matches were selected based on location, years of experience, and school size.

Students, of the selected teachers, who were enrolled in animal science classes, were asked to participate in this study. Students were taught by their teacher using one of two different curriculum options, CASE or the teacher's previously selected curriculum. Since the teachers and students were part of intact classroom groups, random assignment was not used at any point in the study to assign a specific curriculum to teachers and students. Gall et al. (2007) identify intact groups as a set of individuals who must be treated as a defined group instead of unique individuals.

Students received information about the study and the need for class recordings. Assent and consent forms were required to participate in the study. Students who did not return both assent and consent were not included. Teachers were instructed to have the non-participants sit outside of the camera view. All protocols were approved by the Human Research Protection Program at Texas Tech University.

Design

While the independent variable in this study was the type of animal science curriculum the agriscience teachers used in their classroom, the dependent variables were academic engaged time and off-task behaviors of students. Shapiro (2011b) defined academic engagement as a combination of two subcategories: active and passive engaged time. Active engaged time is defined as "those times when the student is actively attending to the assigned work" (p. 42). Passive engaged time is defined as "those times when the student is passively attending to assigned work" (p. 43).

The main threat to a study of this type is the challenge of attributing the differences between the groups to the experimental conditions (Gall et al., 2007). Campbell and Stanley (1963) reported it is possible the differences between the groups might have occurred even without treatment. The use of matched pairs is one way of improving the internal validity of the study. Gall et al. (2007) identify internal validity as "the extent to which extraneous variables have been controlled by the researcher, so that any observed effects can be attributed solely to the treatment variable" (p. 642). Threats to internal validity include history, maturation, testing, instrumentation, statistical regression, selection, and mortality (Campbell & Stanley, 1963).

Treatments

The CASE curriculum was developed in 2007 by the National Council for Agricultural Education as part of an effort to implement a national curriculum for secondary agricultural education. The curriculum provides challenging and integrated lessons to enhance the rigor and relevance of agriculture, food, and natural resources (AFNR) subject matter. The primary goal of CASE is to improve math and science education by creating a context for student learning through agricultural education courses. CASE curriculum aligns the AFNR content standards with those of science, mathematics, and English. This study only investigated the effects of the Agricultural Science – Animal (ASA) curriculum.

The CASE model differs from the traditional method of instruction in several ways. CASE works to ensure quality teaching by providing professional development for teachers before they use the curriculum. The CASE Institute is a professional development workshop requiring 80 hours of intense training for each course CASE has developed.

Teachers using traditional animal science curriculum were used as the control group for this study. Traditional curriculum was defined as any curriculum or instructional strategies other than the official CASE curriculum. Newcomb, McCracken, and Warmbrod (1993) explain curriculum in traditional agricultural education classrooms can be very different from program to program. The content is often heavily influenced by the educational philosophy of the agriculture teacher, the expectations of the community, and the educational resources available to the teacher.

Various textbooks and curriculum guides are available to agriculture teachers across the country; however, these are often developed for a specific state or region and must be adapted by the individual teacher (Newcomb et al., 1993).

Instrumentation

For the purposes of this study, the Behavioral Observation of Students in Schools (BOSS) was used in order to collect the needed data. The BOSS was used to describe the academic engagement and off-task behavior of students through the use of direct observation (Shapiro, 2011b). The BOSS consists of five categories of student behavior: active engaged time, passive engaged time, off-task motor, off-task verbal, and off-task passive. The BOSS was designed to observe a target student's behavior and compare it to the behaviors displayed by their peers. For this study, the BOSS was used in a modified manner to describe the behavior of all students in the classroom as opposed to an individual student. Studies have employed the BOSS to observe the academic engagement of entire classrooms instead of only comparing a target student to their peers (Mautone, DuPaul, & Jitendra, 2005; McQuillan, DuPaul, Shapiro, & Cole, 1996; Vile Junod, DuPaul, Jitendra, Volpe, & Cleary, 2006).

The *Academic Skills Problems Workbook* (Shapiro, 2011b) was used to guide the data collection process with the BOSS. Momentary time sampling using 15-second intervals was employed for data collection. Active engaged time (AET) and passive engaged time (PET) are scored using momentary time sampling at the beginning of each 15-second interval. Throughout the remainder of each interval, the partial interval method was used to record the three types of off-task behavior. This means students could only be marked as engaged if the behavior was observed at the beginning of each interval, while off-task behaviors were recorded at any time. It is also important to note multiple behaviors could be marked per interval. For example, a student who is taking notes can be actively engaged at the beginning of an interval, but then be marked off-task verbal for making an unrelated comment to another student during that same interval.

A student was randomly selected to serve as the first student to be observed in each class session. After the first student was observed for the 15-second interval, the observation was conducted on the second student in the class for their 15-second interval. The observation was rotated around the room until all of the participating students had been observed and then the rotation started again with the first randomly selected student. The rotation continued until the course had ended for the day.

Shapiro's (2011b) descriptions of student behavior were used to guide the coding process. AET is defined as those times when the student is actively attending to the assigned work. Examples include reading aloud, writing, raising a hand, or talking to a teacher or peer about the assigned material. PET is defined as those times when the student is passively attending to assigned work. Examples include listening to a lecture, looking at a worksheet, reading assigned material silently, or listening to the teacher or a peer about assigned work.

Non-engagement is categorized into three individual types of behavior: off-task motor, off-task verbal, and off-task passive. Off-task motor behaviors (OFT-M) are defined as any instance of motor activity that is not directly associated with the assigned academic task. Examples of OFT-M include any out-of-seat actions not assigned, aimlessly flipping pages of a book, manipulating objects not related to the academic task, touching other students or objects, and fidgeting in one's seat for at least three consecutive seconds. Off-task verbal (OFT-V) behaviors are defined as any audible expressions not permitted or not related to the assigned task. Example of OFT-V include whistling, humming, talking to others, making unauthorized comments or remarks, and calling out answers when not asked by the teacher. Finally, off-task passive (OFT-P) behaviors are defined as times when a student is passively not attending to an assigned academic activity for at least three consecutive seconds. Examples include sitting quietly during unassigned time, looking around the room, staring out the window, or passively listening to other students talk about issues unrelated to assignments.

Validity and Reliability

Gall et al. (2007) discuss the concept of validity and reliability through the lens of classical test theory. Classical test theory makes the assumption that each individual has a true score for a given measurement. The score actually observed is a product of the individual's true score and a certain amount of measurement error. The validity and reliability of those tests can be used to mitigate the amount of error in the observed scores of the participants.

While the BOSS was developed by Shapiro (2011b) to assess the academic engaged time of students in the classroom, currently there is no published data on the convergent validity of the BOSS as a measure of classroom engagement. However, it has been shown that the BOSS is successful in discriminating students with ADHD from their nondisabled peers, demonstrating good discriminant validity (Volpe, DiPerna, Hintze, & Shapiro, 2005). Researchers have used the instrument in a number of studies to determine the academic engagement of students in the classroom and deemed it valid (Hintze & Matthews, 2004; Mautone, DuPaul, & Jitendra, 2005; McQuillan, DuPaul, Shapiro, & Cole, 1996; Spanjers, Burns, & Wagner, 2008).

For this study, one researcher observed all of the videos and scored the BOSS. When one observer scores all videos, the potential for error is compound across all of the data collection. Intra-observer reliability is the estimate of one person's consistency of scoring. The intra-observer reliability was calculated prior to beginning data collection through the use of a pilot test. A video of a college class was viewed by the rater who scored the BOSS and the same video was viewed and scored again two weeks later. The researcher's intra-observer reliability for the video was calculated as .98 (Pearson correlation coefficient).

Data Collection

Participating teachers were sent a Flip video camera, 16 GB flash drive, and detailed directions for recording their classes. Teachers were instructed to record three class periods of their animal science course and then return the equipment and videos using a prepaid mailing label. There was no set recording schedule for the videos in order to allow flexibility for busy schedules.

The use of video cameras to conduct observation in the classroom can create ecological validity concerns. Ecological validity refers to the ability to generalize conclusions due to environmental conditions created by the researcher. The Hawthorne effect refers to a situation where the experimental conditions, such as the presence of a video camera, can change behavior of subjects (Gall et al., 2007). If teachers or students change their behavior as a result of the presence of the video camera, the findings might not be representative of the environment when the camera is not present. In order to mitigate the Hawthorne effects, the researcher was never present in the classroom and participants were reminded that normal classroom behavior should be recorded.

Frank, Juslin, and Harrigan (2005) reported that studies using video equipment can maintain good levels of ecological validity. They recommend turning off the red recording light and placing the camera out of the line of sight, which were both used in this study. The use of repeated recordings also increases the ecological validity by wearing away the novelty of the camera (Gall et al., 2007). Babad (2005) stated ratings of videotaped classrooms are less biased than self-report measures of students, further supporting the use of video recording in this study.

Upon receiving the videos from teachers, the researcher completed the observational instrument selected for the study according to Shapiro's (2011b) guidelines for the instrument. An audible timing device notified the researcher of each new interval. In addition to the audible signal, the timer kept track of the number of intervals so the researcher was aware of the specific interval of each observation. Data were entered into Qualtrics, an online survey tool, to eliminate any inconsistencies in data entry. Analysis of data was conducted using the Statistical Package for the Social Sciences (SPSS) version 18.0 computer program for windows. The alpha level for all statistical tests was established a priori at .05.

Data Analysis

Frequency counts and percentages were used to describe the occurrence of each type of student behavior: AET, PET, OFT-M, OFT-V, and OFT-P. Total academic engaged time was calculated by adding the total number of occurrences of AET and PET. Total time off-task was calculated by adding the total number of occurrences of OFT-M, OFT-V, and OFT-P. Percentage of total academic engaged time and time off-task were also calculated. Each type of student behavior, engaged and off-task, is an independent observation, resulting in an independent total percentage for both categories. As a result, hypothesizes were developed for all seven categories of data.

In order to test the null hypothesizes, paired samples *t*-test were calculated to compare data within total engaged time, total off-task time, and each of the five types of student behavior. Calculations of effect size were conducted using a Microsoft Excel® spreadsheet designed specifically for calculating Cohen's *d* from *t*-tests (Thalheimer & Cook, 2002).

Results and Findings

Descriptive Data

In order to describe students' on-task behavior, the researcher totaled the occurrences of AET and PET from the three observations. This total was divided by the total number of intervals observed to find the percent of time-on-task. Students in the traditional courses displayed on-task behavior during an average of 67.23% (*SD* = 5.68) of the intervals, while CASE students displayed on-task behavior during an average of 62.45% (*SD* = 7.52) of the intervals (see Table1). Similarly, the percentage of off-task behavior was calculated by combining the percentage of intervals OFT-M, OFT-V, and OFT-P observed and dividing by the total number of intervals. The researcher found students in the traditional courses were off-task for an average of 40.46% (*SD* = 5.19) of intervals, while student in the CASE courses were off-task 44.03% (*SD* = 7.86) of intervals.

Table 1

Percent of Engaged and Off-Task Behaviors for Students (*n* =*18*9)

Behavior	*M*	*SD*	Range (Min-Max)
Traditional (*n* =9)			
AET	20.09	8.97	5.34-36.72
PET	47.14	8.17	36.17-58.02
Total Engaged	67.23	5.68	58.81-77.54
OFT-M	20.80	4.15	17.62-30.77
OFT-V	14.67	5.58	8.33-24.61
OFT-P	4.98	2.04	1.96-8.40
Total Off-Task	40.46	5.19	32.80-48.15
CASE (*n* = 9)			
AET	30.25	7.12	19.10-37.46
PET	32.24	8.54	19.31-43.72
Total Engaged	62.45	7.52	46.55-71.28
OFT-M	23.48	5.07	17.96-32.07
OFT-V	16.68	4.48	10.24-25.86
OFT-P	3.87	2.31	1.22-8.63
Total Off-Task	44.03	7.86	35.21-61.55

Note. Engaged and off-task are independent of each other and will not total 100% if combined.

Students taught by traditional agriculture teachers spent the largest percentage of intervals passively engaged (M = 47.14, SD = 8.97), which ranged from 36.17 to 58.02%. This was followed by off-task motor, with a mean of 20.80% (SD = 4.15) of the intervals. Students in this group spent the least amount of intervals passively off-task, with only 4.98% (SD = 2.04) of intervals.

Students taught by CASE certified teachers spent the largest percentage of intervals passively engaged (M = 32.24, SD = 8.54). This was followed closely by active engaged time, which had a mean of 30.25% (SD = 7.12). Students in this group spent the least amount of time passively off-task, with only 3.87% (SD = 2.31) of intervals in which this behavior was observed.

Hypothesis Testing

The first null hypothesis stated there was no difference in total engaged time between the two groups (see Table 2). No differences were found between traditional and CASE students' time on-task (t = 2.09, p = .07). Null hypothesis one was accepted and therefore was held as tenable. However the difference represents a large effect size (d = .76)

Table 2

Comparison of Student Time On-task (*n* = 18)

Group	*n*	*M*	*SD*	*t*	*p*
Traditional	9	67.23	5.68	2.09	.07
CASE	9	62.45	7.52		

The second null hypothesis stated there will be no difference in the active engaged time of students in courses taught by traditional agriculture teachers and those taught by CASE certified teachers (see Table 3). The results indicated that students in CASE courses (M = 30.22, *SD* = 7.12) spent significantly more time (*t* = -2.50, *p* = .04) actively engaged than those in traditional courses (*M* = 20.09, *SD* = 8.97). This difference represents a large practical effect (*d* = 1.25). The null hypothesis was rejected and therefore not held as tenable.

Table 3

Comparison of Student Engaged Time (*n* = 18)

	Traditional (*n* = 9)		CASE (*n* = 9)			
Behavior	*M*	*SD*	*M*	*SD*	*t*	*p*
AET	20.09	8.97	30.22	7.12	-2.50	.04*
PET	47.14	8.17	32.24	8.54	4.11	.01*

The third null hypothesis stated there will be no difference in the passive engaged time of students taught by traditional agriculture teachers and those taught by CASE certified teachers. The results indicated students in traditional courses (*M* = 47.14, *SD* = 8.17) spent significantly more time (*t* = 4.11, *p* = .01) passively engaged than those in CASE courses (*M* = 32.24, *SD* = 8.54), representing a large practical effect (*d* = 1.78). The null hypothesis was rejected and therefore not held as tenable.

The fourth null hypothesis stated there will be no difference in the total time off-task of students in courses taught by traditional agriculture teachers and those taught by CASE certified teachers (see Table 4). The results indicated there was no difference (*t* = -1.33, *p* = .22) between students in traditional courses (*M* = 40.46, *SD* = 5.19) and those in CASE courses (*M* = 44.03, *SD* = 7.86). Although the difference was not significant, it did represent a medium-sized effect (*d* = 0.53). The null hypothesis was accepted and therefore held as tenable.

Table 4

Comparison of Student Off-task Behavior (*n* = 18)

Group	*n*	*M*	*SD*	*t*	*p*
Traditional	9	40.46	5.19	-1.33	.22
CASE	9	44.03	7.86		

The fifth null hypothesis stated there will be no difference in the off-task motor time of students in courses taught by traditional agriculture teachers and those taught by CASE certified teachers (see Table 5). The results indicated there was no difference (*t* = -1.18, *p* = .27) between students in traditional courses (*M* = 20.80, *SD* = 4.15) and those in CASE courses (*M* = 23.48, *SD* = 5.07). The difference represented a large-sized effect (*d* = 0.73). The null hypothesis was accepted and therefore held as tenable.

Table 5

Comparison of Student Off-task Behavior (*n* = 18)

	Traditional (*n* = 9)		CASE (*n* = 9)			
Behavior	*M*	*SD*	*M*	*SD*	*t*	*p*
OFT-M	20.80	4.15	23.48	5.07	-1.18	.27
OFT-V	14.67	5.58	16.68	4.48	-1.17	.28
OFT-P	4.98	2.04	3.87	2.30	1.76	.12

The sixth null hypothesis stated there will be no difference in the off-task verbal time of students in courses taught by traditional agriculture teachers and those taught by CASE certified teachers. The results indicated there was no difference (t = -1.17, p = .28) between students in traditional courses (M = 14.67, SD = 5.58) and those in CASE courses (M = 16.68, SD = 4.48). The difference was found to be a small sized effect (d = 0.40). The null hypothesis was accepted and therefore held as tenable.

The seventh and final null hypothesis stated there will be no difference in the off-task passive time of students in courses taught by traditional agriculture teachers and those taught by CASE certified teachers. The results indicated there was no difference (t = 1.76, p = .12) between students in traditional courses (M = 4.98, SD = 2.04) and those in CASE courses (M = 3.87, SD = 2.30). The null hypothesis was accepted and therefore held as tenable. The difference was found to be a medium effect size (d = 0.51).

Conclusions, Implications and Recommendations

Conclusions: Descriptive

The students in both CASE and traditional courses spent the majority of their time on-task. Students were on-task for an average of more than 60% of the intervals. However, the ratio of on-task to off-task behavior was less than 2:1. Students in both groups were found to be off-task for more than 40% of the intervals. The majority of this off-task behavior was found to be cases of motor activity. The findings about students' time on-task versus time off-task differ from the literature on this subject. Most studies of traditional classrooms indicate a range of 70% to 96% time on-task (DuPaul et al., 2004; Hintze & Matthews, 2004; Spanjers, Burns, & Wagner, 2008).

Implications: Descriptive

Shapiro (2011a) describes time on-task as the most significant observable behavior when using the BOSS instrument. Given the links between student achievement and engagement rates (Greenwood, 1991; Resnick, 2007), the levels of academic engagement could be areas of concern. However, caution must be used when evaluating videos of student behavior due to the lack of ability to observe the entire classroom situation (Stigler, Gallimore, & Hiebert, 2000). Students who did not agree to participate in the study or who were not captured on camera were not included in the researcher's observations. The opportunity to score only the students who were recorded could have an effect on the results. The researcher noticed audible instances of on- and off-task behavior from students out of view of the camera that might have impacted the results of this study. It is also important to reiterate that students can be engaged and off-task in the same interval.

Animal science can be a course with a high amount of integration. If a scientific class has engagement of about 60%, could other classes be higher or lower? Also, students might not have a strong emotional engagement to the scientific content, which could impact the academic engagement.

Conclusions: Hypothesis Testing

Statistical analysis indicated the use of the CASE curriculum had a significant impact on student academic engagement. While no differences were seen in the amount of time on-task of students in CASE and traditional courses, the way in which time was distributed varied. Students in CASE courses were found to spend significantly more time actively engaged than students in traditional courses. CASE students spent just over 10% more intervals actively engaged.

Conversely, students in traditional courses were found to spend significantly more time passively engaged in their courses. The difference between the two groups indicated nearly 15% more intervals passively engaged for students in traditional courses. When looking at the amount of time students spent off-task, no significant differences were found. Students in both groups spent nearly the same percentage of intervals in each of the three categories of off-task behavior. However, off-task motor activity did have a large practical effect size.

Implications: Hypothesis Testing

The differences in engaged time for students is a point of interest. Fredricks et al. (2004) reported behavioral engagement measurements such as this are correlated highly with student achievement scores. CASE curriculum students did not exhibit more time on-task in this study. However, levels of active engagement were higher. These increased levels were possibly a result of the use of the CASE curriculum. Carroll's (1963) Model of School Learning and Shapiro (2011a) suggest students who spend more time actively engaged are more likely to learn the material and perform better on subsequent assessments of content knowledge. While students' gains in behavioral engagement were found in this study, Velez, Lambert, and Elliot (2012) found no changes in CASE students' cognitive engagement. To date, no studies have been found that investigated students' emotional engagement when using the CASE curriculum.

An increase in active engagement may lead to opportunities for student off-task behavior. Creating an environment with active engagement may require teachers to create more structure for students to reduce the opportunities for off-task behavior. A casual observation of the classrooms indicated more activities in the CASE classrooms that required students to be out of their seats at stations or labs, the activities could lead to students being more off-task motor as they moved around the classroom.

Recommendations for Practitioners

High School Teachers. Finn and Rock (1997) found that discipline problems and behavior issues are reduced with higher levels of engagement. Behavior issues can stem from off-task behaviors. While it was found the CASE curriculum can improve the active engagement of students, the amount of time students spent on-task was below the levels observed in core subject classrooms. It is recommended that agriculture teachers continue to increase the level of engagement in their classrooms to reduce the level of off-task behavior. This becomes a challenge when scientific curriculums have a large amount of laboratory and activities. Since laboratory activities tend to have down time, such as students waiting for results or as one student looks in a microscope their partners wait, it is recommended that teachers use their training in planning, to anticipate down time and create activities to fill time that could become off-task behavior. As Erry and Wood (2011) found, if teachers do not create engagement, students will not create the engagement on their own.

Teacher Educators. Mulholland and Capello (2006) found that curriculum designed to improve teachers' skills in the classroom had a positive effect on engagement and achievement. It is recommended that teacher educators strengthen pre-service teacher instruction on engagement and laboratory/activity management. While the total engagement between the two groups was not different, the active engagement was higher in the CASE classrooms. The CASE teachers had completed in-service training on the CASE curriculum, but this may be due solely to the design of the curriculum. It is recommended that teacher educators included engagement in the in-service training they conduct. It is also recommended that the developers of the CASE Institutes include opportunities for discussions on reducing downtime and increasing active engagement.

Recommendations for Further Research

Given the small population of this study and the limited generalizability, the study should be replicated with a larger population. This will continue to develop the body of knowledge surrounding academic engagement of students in those courses. Studies should be conducted to investigate the impact of engagement and curriculum on student achievement in agricultural education. Other variables that impact achievement, such as cognitive behavior, should be studied in relation to student engagement. As students become familiar with inquiry-based learning, they adjust to the daily requirements, it is recommended that programs that have adopted pathways of inquiry-based classes be studied to better understand the impact that student conditioning can have on engagement.

References

Appleton, J. J., Christenson, S. L., Kim, D., & Reschly, A. L. (2006). Measuring cognitive and psychological engagement: Validation of the student engagement instrument. *Journal of School Psychology, 44*, 427-445. doi: 10.1016/j.jsp.2006.04.002

Axelson, R. D., & Flick, A. (2011). Defining student engagement. *Change: The Magazine of Higher Learning, 43*(1), 38-43. doi: 10.1080/00091383.2011.533096

Babad, E. (2005). Nonverbal behavior in education. In J. Harrigan, R. Rosenthal, & K. Scherer (Eds.), *The new handbook of methods in nonverbal behavior research* (pp. 283-311). New York, NY: University Press.

Berliner, D. C. (1980). Using research on teaching for the improvement of classroom practice. *Theory into Practice, 19*(4), 302-308.

Bloom, B. (1974). Time and learning. *American Psychologist, 29*(9), 682-688. doi: 10.1037/h0037632

Bloom, B. S. (1976). *Human characteristics and school learning.* New York, NY: McGraw-Hill.

Brich, S., & Ladd, G. (1997). The teacher-child relationship and children's early school adjustment. *Journal of School Psychology, 35,* 61-79. doi: 10.1016/S0022-4405(96)00029-5

Caldwell, J.H, Huitt, W. G., & Graeber, A. O. (1982). Time spent in learning: Implications from research. *The Elementary School Journal, 82*(5), 471-480. doi: 10.1086/461282

Campbell, D. T., & Stanley, J. C. (1963). *Experimental and quasi-experimental designs for research*. Boston: Houghton Mifflin.

Carroll, J. B. (1963). A model of school learning. *Teachers College Record, 64*(8), 723-733.

Carroll, J. B. (1989). The Carroll model: A 25-year retrospective and prospective view. *Educational Researcher, 18*(1), 26-31. doi: 10.3102/0013189X018001026

Clark, D., & Linn, M. C. (2003). Designing for knowledge integration: The impact of instructional time. *The Journal of the Learning Sciences, 12*(4), 451-493. doi: 10.1207/S15327809JLS1204_1

Connell, J. P., & Wellborn, J. G. (1991). Competence, autonomy, and relatedness: A motivational analysis of self-system processes. In M. Gunnar & L. A. Sroufe (Eds.), *Minnesota Symposium on Child Psychology* (23, pp. 167-216). Chicago, IL: University of Chicago Press.

Connell, J. P., Spencer, M. B., & Aber, J. L. (1994). Educational risk and resilience in African-American youth: Context, self, action, and outcomes in school. *Child Development, 65,* 493-506. doi: 10.2307/1131398

Denham, C., & Lieberman, A. (1980). *Time to learn: A review of the beginning teacher evaluation study.* Washington, DC: National Institute of Education.

Dewalt, M. W., & Rodwell, F. G. (1988). Effects of increased learning time in remedial math and science. *Spectrum, 6*(1), 33-36.

DuPaul, G. J., Volpe, R. J., Jitendra, A. K., Lutz, J. G., Lorah, K. S., & Gruber, R. (2004). Elementary school students with AD/HD: Predictors of academic achievement. *Journal of School Psychology, 42*, 285-301.

Erry, R., & Wood, G. (2011). Lessons from a student engagement pilot study. *Australian Universities Review, 53*(1), 21-34.

Finn, J. D. (1993). *School engagement and students at risk.* Washington, DC: National Center for Education Statistics.

Finn, J. D., Pannozzo, G. M., & Voelkl, K. E. (1995). Disruptive and inattentive-withdrawn behavior and achievement among fourth graders. *Elementary School Journal, 95,* 421-454. doi: 10.1086/461853

Finn, J. D., & Rock, D. A. (1997). Academic success among students at risk for school failure. *Journal of Applied Psychology, 82,* 221-234. doi: 10.1037/0021-9010.82.2.221

Frank, M. G., Juslin, P. N., & Harrigan, J. A. (2005). Technical issues in recording nonverbal behavior. In J. Harrigan, R. Rosenthal, & K. Scherer (Eds.), *The new handbook of methods in nonverbal behavior research* (pp. 283-311). New York, NY: University Press.

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research, 74*(1), 59-109. doi: 10.3102/00346543074001059

Gall, M. D., Gall, J. P., & Borg, W. R. (2007). *Educational research: An introduction*. Boston, MA: Pearson Education.

Goodman, L. (1990). *Time and learning in the special education classroom*. Albany, NY: State University of New York Press.

Greenwood, C. R. (1991). A longitudinal analysis of time to learn, engagement, and academic achievement in urban versus suburban schools. *Exceptional Children, 57*, 521-535.

Hintze, J. M., & Matthews, W. J. (2004). The generalizability of systematic direct observations across time and setting: A preliminary investigation of the psychometrics of behavioral observation. *School Psychology Review, 33*(2), 258-270.

Karweit, N. (1983). *Time on task: A research review* (Report No. 332). Baltimore, MD: Center for social organization of schools.

Karweit, N., & Slavin, R. E. (1981). Measurement and modeling choices in studies of time and learning. *American Educational Research Journal, 18*(2), 157-171.

Mautone, J. A., DuPaul, G. J., & Jitendra, A. K. (2005). The effects of computer-assisted instruction on the mathematics performance and classroom behavior of children with ADHD. *Journal of Attention Disorders, 9*(1), 301-312. doi: 10.1177/1087054705278832

McQuillan, K., DuPaul, G. J., Shapiro, E. S., & Cole, C. L. (1996). Classroom performance of students with serious emotional disturbance: A comparative study of evaluation methods for behavior management. *Journal of Emotional and Behavioral Disorders, 4*(3), 162-170.

Meece, J. L., Blumenfeld, P. C., & Hoyle, R. H. (1988). Students' goal orientations and cognitive engagement in classroom activities. *Journal of Educational Psychology, 80*(4), 514-523.

Mulholland, R., & Cepello, M. (2006). What teacher candidates need to know about academic learning time. *International Journal of Special Education 21*(2), 63-73.

National Education Commission on Time and Learning (NECTL). (1994). *National education commission on time and learning briefing paper.* Washington, DC.

New York City, Mayoral Task Force on Career and Technical Education Innovation. (2008). *Next-Generation Career and Technical Education in New York City*. Retrieved from http://schools.nyc.gov/NR/rdonlyres/DAC6F4E0-D1A6-4B0A-809C-CB9DA61988A8/72746/NYCCTE723lowres.pdf

Newcomb, L. H., McCracken, J. D., & Warmbrod, J. R. (1993). *Methods of teaching agriculture*. (2nd ed.). Danville, IL: Interstate Publishers.

Parr, B., Edwards, M. C., & Leising, J. G. (2009). Selected effects of a curriculum integration intervention on the mathematics performance of secondary students enrolled in an agricultural power and technology course: An experimental study. *Journal of Agricultural Education, 50*(1), 57-69. doi: 10.5032/jae.2009.01057

Resnick, L. B. (2007). Time to learn. *Research Points, 5*(2), 1-4.

Shapiro, E. S. (2011a). *Academic skills problems: direct assessment and intervention*. (4th ed.). New York: the Guilford Press.

Shapiro, E. S. (2011b). *Academic skills problems workbook*. (4th ed.). New York: The Guilford Press.

Skinner, E. A., & Belmont, M. J. (1993). Motivation in the classroom: Reciprocal effects of teacher behavior and student engagement across the school year. *Journal of Educational Psychology, 85*(4), 571-581. doi: 10.1037/0022-0663.85.4.571

Skinner, E. A., Wellborn, J. G., & Connell, J. P. (1990). What it takes to do well in school and whether I've got it: A process model of perceived control and children's engagement and achievement in school. *Journal of Educational Psychology, 82*(1), 22-32. doi: 10.1037/0022-0663.82.1.22

Slavin, R. E. (2009). *Educational psychology: Theory and practice* (9th ed.). Upper Saddle River, New Jersey: Pearson

Spanjers, D. M., Burns, M. K., & Wagner, A. R. (2008). Systematic direct observation of time on task as a measure of student engagement. *Assessment for Effective Intervention,* 33(2), 120-126. doi: 10.1177/1534508407311407

Stanley, S. O., & Greenwood, C. R. (1981). *Code for instructional structure and student academic response (CISSAR): Observer's manual.* Kansas City: University of Kansas, Bureau of Child Research, Juniper Gardens Children's Project.

Stigler, J. W., Gallimore, R., & Hiebert, J. (2000). Using video surveys to compare classrooms and teaching across cultures: Examples and lessons from the TIMSS video studies. *Educational Psychologist, 35*(2), 87-100.

Taylor, L., & Parsons, J. (2011). Improving student engagement. *Current Issues in Education, 14*(1), 1-33.

Thalheimer, W., & Cook, S. (2002). H*ow to calculate effects sizes from published research: A simplified methodology*. Retrieved from http://www.worklearning.com/ Catalog/index.htm.

Velez, J. J., Lambert, M. D., & Elliot, K. M. (2012). High school students' perceptions of their yearlong CASE experience. *Proceedings of the American Association of Agricultural Education, Western Region,* 1-16.

Vile Junod, R. E., DuPaul, G. J., Jitendra, A. K., Volpe, R. J., & Cleary, K. S. (2006). Classroom observations of students with and without ADHD: Differences across types of engagement. *Journal of School Psychology, 44*, 87-104. doi: 10.1016/j.jsp.2005.12.004

Volpe, R. J., DiPerna, J. C., Hintze, J. M., & Shapiro, E. S. (2005). Observing students in classroom settings: A review of seven coding schemes. *School Psychology Review, 34*(4), 454-474.

Wiley, D. E., & Harnischfeger, A. (1974). Explosion of a myth: Quantity of schooling and exposure to instruction, major education vehicles. *Educational Researcher, 3*(4), 7-12. doi: 10.2307/1175988