Examining Student Perceptions of Their Experience in a TBL Formatted Capstone Course

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Abstract

While shown to be less effective than active learning strategies, traditional methods of content delivery in post-secondary classrooms are the most prominent. Flipped classrooms, an example of an active learning approach, have been shown to be effective in long-term student outcomes. Team-Based Learning (TBL), a specific application of the flipped approach, has been linked to an increase in student performance, engagement, and satisfaction. TBL emphasizes the application of content knowledge through structured problem solving and decision making activities. The capstone farm management course at Iowa State University was recently restructured to implement TBL. This course revision sought to emphasize the development of skills necessary for success in an evolving workforce. The purpose of this study was to examine student perceptions concerning their attitudes and beliefs about learning, their motivation to learn, and their professional development through critical thinking. Pretest and posttest measures were compared and showed statistically significant increases across all three areas. These results offer valuable insight for the adoption of student-centered teaching methods, specifically TBL. Further examination of this teaching method compared to traditional teaching methods is warranted and recommended.

Keywords: team-based learning; flipped learning, active learning, capstone course

Introduction and Literature Review

Lecturing and other teacher-centered instructional approaches are frequently utilized in secondary and post-secondary settings (Balschweid, Knobloch, & Hains, 2014; Smith, Rayfield, & McKim, 2015). In a national study of secondary agricultural education programs concerning the effectiveness of instructional activities, Smith, Rayfield, and McKim (2015) found that a majority of agricultural education teachers devoted most of their class time to lecturing. Puzzlingly, those same teachers reported the effectiveness of lecturing to be relatively low (Smith et al., 2015). Balschweid, Knobloch, and Hains (2014) noted many faculty members perceive teaching as lecturing and that sentiment is "…embedded in their schema" (p. 163). Based on this preconception it may be difficult for faculty members to apperceive other methods of instruction. Whittington and Newcomb (1993) recommended that "[p]rofessors make conscientious changes in their current teaching methodology to reach the cognitive levels to which they aspire for their instruction" (p. 61). Implementing active learning techniques, more specifically a flipped classroom model, may prove useful in improving cognitive levels reached and eliminate the sole reliance on lecture methods.

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Flipped classrooms have garnered much attention at all levels of academic instruction in recent years (Barkley, 2015; Bishop & Verleger, 2013). The increased traction of flipped learning in higher education may be explained by a focused effort by instructors to reach higher cognitive levels in student learning processes, increase student engagement, and ensure the development of skills desired by employers (Espey, 2010; Lamm, Carter, & Melendez, 2014; Tucker, 2012). The flipped classroom has also received considerable attention within agricultural education (Barkley, 2015; Conner et al., 2014a; Conner et al., 2014b; Gardner, 2012; McCubbins, Paulsen, & Anderson, 2016). While the popularity may be relatively new, flipped classrooms have existed for several decades in some manner or another (Chen, Wang, Kinshuk, & Chen, 2014). When implementing the flipped approach to teaching, instructors provide basic, introductory content to students prior to a face-to-face class session so that class time is available for meaningful learning activities (Enfield, 2013). Enfield (2013) suggested group discussions, demonstrations, projects, and team building were advantages of the flipped classroom. In the flipped model, students interact with peers and the instructor as they construct knowledge during class time (Bergmann & Sams, 2012; Missildine, Fountain, Summers, & Gosselin, 2013; Kong, 2014). The foundation of the flipped classroom is comprised of constructivist ideologies paired with behaviorist principles; two learning theories that were once viewed as incongruous (Bishop & Verleger, 2013). The material in which students engage prior to class, usually through readings or recorded lectures, fit under the behaviorist principle of direct instruction while the activities carried out during class sessions align with constructivist's views (Bishop & Verleger, 2013).

One of the earlier documentations of the flipped model in the postsecondary setting occurred at the University of Oklahoma in the late 1970s and was called Team-Based Learning (TBL) (Michaelsen, Knight, & Fink, 2004; Sibley & Ostafichuk, 2014). As noted by McCubbins, Paulsen, and Anderson (2016), a consensus on the origins of the flipped learning model is elusive. TBL has been defined as an active teaching method that emphasizes small-group work and the application of content; in stark contrast with traditional methods of passive content reception (Michaelsen, Sweet, & Parmalee, 2011). TBL, when developed, was reportedly an amalgam of mastery learning and cooperative learning principles (Michaelsen, 1992). Though similar to cooperative learning, important characteristics set TBL apart (Michaelsen & Sweet, 2011). Sibley and Ostafichuk (2014) outlined the four elements essential to the TBL method as: 1) properly formed and managed teams, 2) readiness assurance process to ensure preclass preparation (RAP), 3) learning how to apply course concepts, and 4) the importance of accountability. The teams should consist of five to seven students and be determined by the instructor based on set criteria to ensure heterogeneity (Michaelsen et al., 2004; Michaelsen et al., 2011; Sibley & Ostafichuk, 2014). The RAP includes four steps: 1) preclass preparation, 2) individual readiness assurance test (IRAT), 3) team readiness assurance test (TRAT), and 4) appeals (Michaelsen & Sweet, 2011).

Preclass preparation requires students to engage in the instructor-organized course content via readings, videos, and other forms of media prior to attending class. During the first class session of a module, students are assessed individually via the IRAT, and again immediately following via a TRAT (Michaelsen et al., 2004). The TRAT "…unleashes the power of social learning and immediate focused feedback…" (Sibley & Ostafichuk, 2014, p. 11). This is accomplished by allowing students to discuss the questions and through immediate feedback on their answer selection. Immediate feedback is possible by administering the TRAT via an Immediate Feedback Assessment Technique (IFAT) card ("What is the IF-AT?", n.d.). For appeals, students are able to provide a written, scholarly argument to recapture points on missed questions. Students must provide an argumentative statement and supporting evidence from the preclass preparation materials (Michaelsen et al., 2004; Michaelsen & Sweet, 2011; Michaelsen et al., 2011). Following the RAP, a targeted, clarifying instruction session is conducted. Clarifying instruction is geared toward the concepts that may remain unclear to the students (Michaelsen et al., 2004). Remaining

class sessions within the module are for students to apply course concepts via application exercises. Application exercises are designed to present students with a significant problem grounded in a real-world scenario where students work together to make a decision (Michaelsen et al., 2004).

The final component highlighted by Sibley and Ostafichuk (2014) is the importance of accountability. The importance is solidified as students determine the grade-weights for the entire course across three categories: 1) individual performance, 2) team performance, and 3) peer evaluation (Michaelsen et al., 2004). Students are held accountable via the IRAT, TRAT, application exercises, and finally through graded peer evaluations. This teaching approach requires "…a shift in the role of the instructor from dispenser of information to manager of a learning process" (Michaelsen, 1992, p.109).

Despite the lack of consensus on when or where flipped learning began, parallels exist between TBL principles and flipped learning principles. Table 1 depicts the parallels found in the Flipping Principles (Jeffries, 2015) and TBL components (Michaelsen et al., 2004).

Table 1

Parallels of the Flipped Course and Team-Based Learning Model

Flipping Principles	TBL Component
Knowledge transfer moved outside of the class	Pre-class preparation
Application of the content in class	Application Exercises
Peer teaching	Peer discussions during the TRAT
	Intra- and Inter-team discussions during application exercises.
Contextual learning	Application exercises- Should be relevant and real-world.
Assessment reinforces learning	IRAT and TRAT

TBL has been touted as an effective means for improving student performance (Baldwin, Bedell, & Johnson, 1997; Johnson & Lee, 2008) and engagement (Balwan et al., 2015; Kelly et al., 2005). However, implementing TBL requires a focused redevelopment of an entire course's structure (Sibley & Ostafichuk, 2014). Support for the transition from a teacher-centered method to a student-centered method is important. Addo-Attuah (2011) noted the criticality of buy-in from faculty, students, and administration for successful implementation of TBL. That buy-in can often be difficult to achieve when deciding to adopt student-centered instructional practices (Hains & Smith, 2012). Hains and Smith (2012) noted that instructors can be resistant to adopt student-centered teaching methods; administrators may resist the adoption to seemingly allow faculty to focus on research; and students may combat the transition because they are not attuned to the transition of authority within the classroom. Similarly, students may not value working with other individuals based on previous, negative experiences in team settings (Espey, 2010), adding to the difficulty of student buy-in. Conversely, Espey (2010) found that the value students place on working with others increases significantly after a semester of TBL exposure.

Setting

AGEDS 450 –Farm Management and Operation– is a capstone course for students seeking a Bachelor of Science degree in Agricultural Studies from Iowa State University. AGEDS 450 was developed in order to provide students with the opportunity to gain practical farm management skills before leaving college (Murray, 1945). AGEDS 450 is structured around Crunkilton, Cepica, and Fluker's (1997) capstone course framework, defined as "a planned learning experience requiring students to synthesize previously learned subject matter content and to integrate new information into their knowledge base for solving simulated or real world problems" (p. 3). Crunkilton et al. posited that a true capstone experience "…focuses on complete integration of fragmented disciplinary knowledge, permitting students to bring meaningful closure to their academic experiences" (p. 3) and "…provides students with a rich contextual frame of reference for furthering connection between theory and practice often initiated earlier in their academic experiences" (p. 4). A capstone course should ease a student's transition into a chosen career or entry into further academic study (Crunkilton et al.). Through the utilization of a student-managed farm and the capstone course framework, students engage in collaborative research to analyze and synthesize information to make informed decisions in a real-world setting (Paulsen, 2010; Perry, Paulsen, & Retallick, 2015). AGEDS 450 has utilized a committee structure to aid in the development of problem-solving and decision-making skills (Vogel & Steiner, 2004). In the TBL format for AGEDS 450 at the time of this study, teams and committees were used simultaneously. The teams were selected using a criterion-based process to ensure heterogeneity while the committee members were elected from within each team. This nesting of committees within teams allowed for two separate learning networks to form. In this format, teams made decisions for the farm and committees carried out those decisions. For example, if a team decided to recommend the purchase a specific brand of seed for planting, they would present necessary information to all other teams. Then if the team's recommendation was approved for adoption, the crops committee would be responsible for ordering, paying for, and acquiring the seed. Figure 1 depicts the course structure and how teams and committee are distributed.
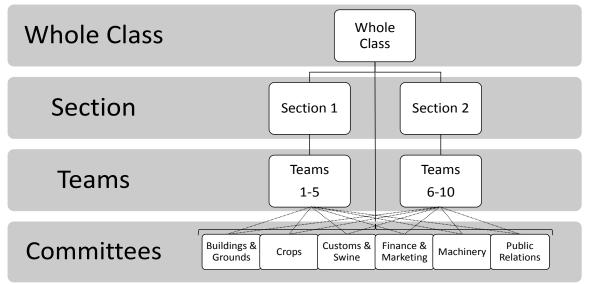

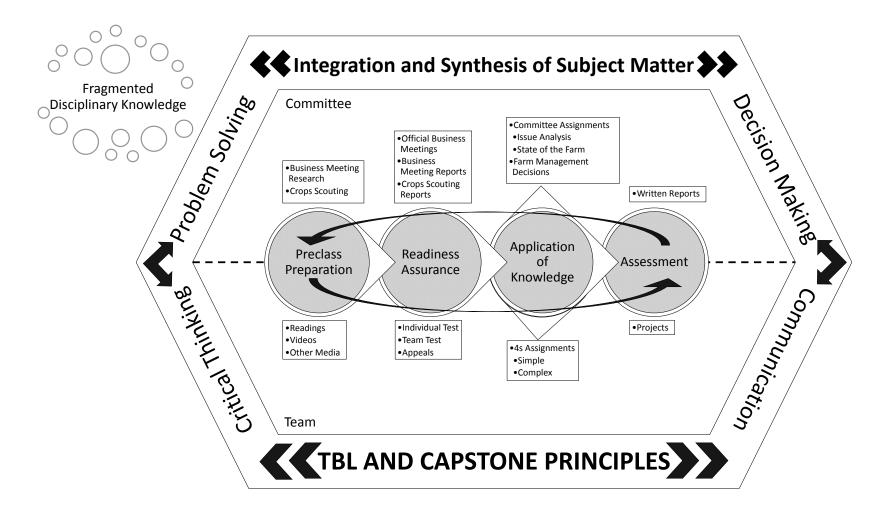*Figure 1.* AGEDS 450 structure with teams and committees.

The conceptualization of the entire AGEDS 450 in TBL format is depicted in Figure 2. Students arrive in the capstone course with fragmented disciplinary knowledge and through the structured activities and emphasis on applying content knowledge in a team-based setting; students

integrate that new and old knowledge in solving practical problems. The border of the model displays the skills that are emphasized throughout the course activities, which includes problem solving, decision-making, critical thinking, and communication. The center of the model contains the core components of the TBL framework, beginning with preclass preparation and progressing to the assessment phase. The top half of the center portion of the model outlines the activities conducted by the committees, while the bottom half outlines the team activities.

The team and committee activities occur simultaneously throughout the semester. Teams engage with the course content before arriving to class (preclass preparation) where they are tested individually and as a team (readiness assurance) over the course content. Teams are then tasked with solving real-world problems through simple and complex application exercises (application of knowledge) before being assessed in the form of projects or exams (assessment). This process is repeated for each module in the course; five to seven modules are recommended depending on individual course needs (Michaelsen et al., 2004).

Committees prepare for class by identifying several preparation activities, which may include: crop scouting, farm safety and building assessments, or equipment maintenance review. This information is included in official business meeting reports. Committees apply their knowledge by carrying out committee responsibilities, and providing information to teams in order to make farm management decisions. Decisions made during the official business meetings are then carried out by the appropriate committee. Assessment of the committees is completed through written reports. This process is repeated as often as necessary for each committee.

Figure 2. Model of the integration of Team-Based Learning and the capstone course framework. Adapted from "Handbook on Implementing Capstone Courses in Colleges of Agriculture," by J. R. Crunkilton, M. J. Cepica, and P. L. Fluker, 1997; "Team-Based Learning Instructional Activity Sequence," by L. K. Michaelsen, A. B. Knight, and L. D. Fink, 2004, Team-Based Learning: A Transformative Use of Small Groups in College Teaching, p. 37. Copyright 2004 by Stylus Publishing.

Theoretical/ Conceptual Framework

Mezirow's (2000) Transformative Learning Theory served as the theoretical framework for this study. The transference of authority within the learning environment may aid in the development of transferable skills for workplace success. Students may consider assuming the responsibility for their own learning as a disorienting dilemma; an essential component of transformative learning. Much of what individuals know and believe is dependent upon the embedded nature of biographical, cultural, or historical contexts. Mezirow further identified the importance of developing decision-making skills by analyzing individual experiences, assessing the specific context of the experience, and working to establish informed meaning and justification for resulting interpretations and opinions in adult education. In adult learning, emphasis must be placed on "contextual understanding, critical reflection on assumptions, and validating meaning by assessing reason" (Mezirow, 2000, p. 3).

Transformative Learning Theory is comprised of three common themes which include "…the centrality of the experience, critical reflection, and rational discourse in the process of meaning structure and transformation" (Taylor, 1998, p. 8). In regard to centrality of the experience, Taylor (1998) espoused that student's experiences are socially constructed, which allows them to be deconstructed and acted upon. Mezirow (1995) noted the beginning of and the subject matter for transformative learning is the learner's experience. Transformative Learning Theory is grounded in the nature of human communication (Taylor, 2007). Taylor (1998) opined that Tennant's (1991) description of a learner's experience offers an incredible deal of congruency with transformative learning. Tennant (1991) stated:

> [Shared] learning experiences establish a common base from which each learner constructs meaning through personal reflection and group discussion… The meanings that learners attach to their experiences may be subjected to critical scrutiny. The teacher may consciously try to disrupt the learner's world view and stimulate uncertainty, ambiguity, and doubt in learners about previously taken-for-granted interpretations of experiences (p. 197).

Critical reflection allows the learner to question assumptions and beliefs that are deeply rooted in their past experiences; while rational discourse is the medium through which transformative learning is promoted and developed (Taylor, 1998).

Mezirow (2000) noted seven factors which must be present in order for learners to fully immerse themselves in rational discourse and included; 1) accurate and complete information, 2) freedom from coercion and distorting self-perception, 3) openness to alternative points of view (empathy and concern about how others think and feel), 4) the ability to weigh evidence and assess arguments objectively, 5) greater awareness of the context of ideas and, more critically, reflectiveness of assumptions, including their own, 6) an equal opportunity to participate in the various roles of discourse, and 7) willingness to seek understanding and agreement and to accept a resulting best judgment as a test of validity until new perspectives, evidence, or arguments are encountered and validated through discourse as yielding a better judgment (p. 14).

Transformative Learning Theory (Mezirow, 2000) seeks to transform frames of reference that are likely based on less reliable assumptions. A frame of reference, as explained by Mezirow (2000), is the structure of individual assumptions that form meaning. "It selectively shapes and delimits perception, cognition, feelings, and disposition by predisposing our intentions, expectations, and purposes" (Mezirow, 2000, p. 16). Mezirow (2000) defined adult educators as those who do not indoctrinate, but create opportunities to shift their authority over the learning

environment. This transition allows passive learners to become collaborative learners, but the traditional power relationships that exist between teachers and learners must be eliminated. When this transition occurs, it allows the learners to become more autonomous within the learning environment (Mezirow, 2000). Many of these notions expounded by Mezirow seemingly align with the TBL format and capstone course framework.

Though originally created as a model for outlining the learning activities within a teaching methods course, the Taxonomy of Learning Activities (TLA) (Roberts, Stripling, & Estepp, 2010) is useful in conceptualizing a transition from teacher-centered activities to more autonomous, student-centered activities, such as with the adoption of TBL. The TLA, depicted in Figure 3, allows instructors to visualize the continuum of learning activities, beginning with teacher-centered activities and moving toward student-centered activities. This transition of learning activities from teacher as authority to autonomous student learners aligns with Mezirow's (2000) description of educators within Transformative Learning Theory.

Mezirow (2000) espoused that educators must strive to transition authority within the learning environment to their students, and when feasible, to create a collaborative learning environment where students become self-directed learners. In regards to the TLA model, teacher-centered activities include lecturing and demonstration; social interaction activities include questioning, discussion, and cooperative learning; and student-centered activities utilize inquiry and individualized applications (Roberts et al., 2010). The theoretical and conceptual frameworks which served as a foundation for this study were operationalized through the implementation of the TBL teaching method in a capstone course. TBL aims to develop high performing teams, capable of applying course content to solve complex, real-world problems while holding themselves and their peers accountable for learning the material (Michaelsen et al., 2004; Michaelsen et al., 2011).
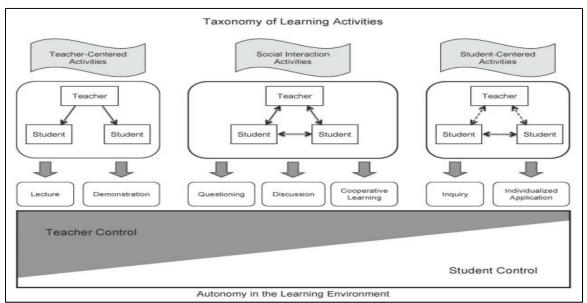

Figure 3. Taxonomy of Learning Activities Model (Roberts, Stripling, & Estepp, 2010)

McCubbins et al. (2016) developed a crosswalk of the activities found in the TLA with activities in TBL. Table 2 displays those parallels. TBL activities are embedded in each section of the continuum developed by Roberts et al. (2010).

Table 2

Parallels between the Taxonomy of Learning Activities and Team-Based Learning

TLA (Roberts et al., 2010)	TBL Activity
Teacher-Centered Activities	Preparation
Lecture	Out-of-class reading (or video)
Demonstration	Out-of-class reading (or video)
Social Interaction Activities	Preparation/ Application
Questioning	Individual and team tests
Discussion	Corrective instruction, application activities
Cooperative Learning	Team tests, appeals, application activities
Student-Centered Activities	Application/ Assessment
Inquiry	Individual application exercises, review
Individual Application	Individual application exercises, individual exam/ Project

Note. From "Student Perceptions Concerning their Experience in a Flipped Undergraduate Capstone Course," by OP McCubbins, T. H. Paulsen, and R. G. Anderson, 2016, Journal of Agricultural Education. Reprinted with permission.

Purpose and Objectives

Following a recommendation from McCubbins et al. (2016), this study sought to explore the impact of exposure a TBL-formatted capstone farm management course had on students' attitudes and beliefs about learning, motivation to learn, and professional development through critical thinking. This recommendation, as well as TBL's implementation as a newly-adopted instructional approach within the course, provided a supportive foundation for the present study. The development of research-based pedagogies and "enhanced understanding of learning and teaching environments…" (Edgar, Retallick, & Jones, 2016, p. 39) is of utmost importance in meeting agricultural education's goal. This study addresses the American Association for Agricultural Education's National Research Agenda Research Priority Area 4: Meaningful, Engaged Learning in All Environments (Roberts, Harder, & Brashears, 2016) and is explicitly aligned with the research priority question three which seeks to explore educational programs that "…continually evolve to meet the needs and interests of students" (Edgar et al., p. 39). Specific objectives of this study were to:

1. Describe student perceptions regarding their attitudes and beliefs about learning, motivation to learn, and professional development prior to completing the TBL formatted AGEDS 450.
2. Describe student perceptions regarding their attitudes and beliefs about learning, motivation to learn, and professional development after completing the TBL formatted AGEDS 450.
3. Determine if there were changes in student perceptions regarding their attitudes and beliefs about learning, motivation to learn, and professional development after completing the TBL formatted AGEDS 450.

Methods and Procedures

This study was part of a larger research project that sought to examine the effectiveness of the TBL pedagogical practice in an undergraduate capstone course. This study employed a non-experimental, pretest—posttest design in order to measure the impact a TBL formatted course had on student perceptions of their experiences. The researcher identified the target population as all students enrolled in the AGEDS 450 ($N = 121$) for the fall 2015 ($n = 61$) and spring 2016 ($n = 60$) semesters. The course consisted of a combined lecture period, and two laboratory sections, in which the students met on the farm once per week (Paulsen, 2013).

The Student Learning Experiences (SLE) survey developed by Bickelhaupt and Dorius (2016) was utilized to measure student perceptions of their experience in previous group projects and the TBL format. The instrument consisted of 35 Likert-type questions and two open-ended questions for feedback on the structure of the course. The SLE is comprised of three constructs representing three learning domains, and included; 1) beliefs and attitudes about learning, 2) motivation to learn, and 3) professional development through critical thinking (e.g., student perceptions of their development of specific critical thinking activities). Two of the 35 items were classified as independent measures as they did not situate within the established constructs. The researchers utilized Qualtrics, a web-based survey program, to collect student perceptions within the three learning domains. A pretest–posttest design was utilized to measure change in students' perceptions within three learning domains. The pretest and posttest instruments varied only in how the questions were targeted. The pretest questions focused on previous experience while the posttest focused on the specific experience within the TBL formatted course. For example, a pretest item stated, "*When a theory, interpretation, or conclusion has been presented in other courses or in previous readings, I try to decide if there is good supporting evidence*," while the posttest was stated as, "*When a theory, interpretation, or conclusion was presented in class or in the readings, I tried to decide if there was good supporting evidence*."

Bickelhaupt and Dorius (2016) established face and content validity by utilizing a panel of experts in survey design and TBL. The instrument was pilot-tested with students ($n = 1039$) enrolled in TBL formatted courses at Iowa State University to measure reliability (Bickelhaupt & Dorius, 2016). After the pilot study, focus groups were conducted with students to further enhance face validity. Following the suggestions of Urdan (2010), the pilot study conducted by Bickelhaupt and Dorius (2016) resulted in construct reliability coefficients deemed acceptable ($\alpha = 0.84 - 0.92$). Additionally, McCubbins et al. (2016) utilized the posttest instrument and deemed the resulting reliability coefficients acceptable ($\alpha = 0.73 - 0.91$). Instruments in the present study were collected from respondents in the fall 2015 ($n = 56$) and spring of 2016 ($n = 54$) for a 91.6% response rate ($n = 110$). Pretest and posttest construct reliability coefficients were deemed acceptable (see Table 3).

Table 3

Reliability Coefficients for Student Learning Experience Constructs

	Post hoc Cronbach's Alpha Observed		Established Posttest Cronbach's Alpha (McCubbins et al., 2016)
Construct	Pretest	Posttest	
Beliefs and Attitudes about Learning	0.97	0.95	0.91
Professional Development through Critical Thinking	0.96	0.93	0.84
Motivation to Learn	0.95	0.75	0.73

After approval from the Institutional Review Board was received, demographic and academic attributes of students were obtained from the Office of the Registrar at Iowa State University (ISU). To describe students' academic attributes, university-specific terminology was used, and is described as follows. Semester credit hours were defined as the number of credit hours in which the student was enrolled during the study. Semester grade point average (GPA) was calculated for the semester in which the study occurred. Cumulative credit hours were defined as the total hours received at ISU, and cumulative GPA was calculated from ISU credits only. Total hours were the sum of all credits including those transferred in from other institutions. Method of entry refers to direct enrollment from high school or transfer from an outside institution. Descriptive statistics were used to describe the student demographic data. To address research objective one and two, measures of central tendency and variability were calculated in SPSS for each construct. For objective three, paired-samples *t*-tests were utilized to determine the significance of differences in student perceptions based upon enrollment in the TBL formatted AGEDS 450.

Regarding educational degree pursuit, the results represent a homogenous sample. Care should be exercised when extrapolating results beyond the students enrolled in AGEDS 450. Data gleaned from this study may provide useful insight for instructors of other courses within colleges of agriculture regarding student perceptions towards TBL.

Results

Most student respondents were male ($n = 85$, 77.3%), between 21 and 25 years of age ($n = 93$, 83.6%), and had direct entry into ISU from high school ($n = 60$, 54.5%). The average number of credit hours students in which student participants were enrolled was 14.11 ($SD = 3.04$). The average cumulative GPA was 2.82 ($SD = 0.48$) and the average composite ACT was 20.84 ($SD = 0.32$).

Objective One

The first objective sought to determine student perceptions regarding their attitudes and beliefs about learning, motivation to learn, and professional development through critical thinking prior to completing the TBL formatted AGEDS 450. Table 4 displays the construct descriptive

statistics for the pretest administration of the SLE instrument. The highest rated construct was Professional Development ($M = 2.56$, $SD = 1.09$) and the lowest was Motivation to Learn ($M = 2.42$, $SD = 1.04$).

Table 4

Pretest Descriptive Statistics for Student Learning Experiences

Construct	*M*	*SD*	*Min*	*Max*
Professional Development through Critical Thinking	2.56	1.09	1.00	5.00
Beliefs and Attitudes about Learning	2.52	0.99	1.00	4.89
Motivation to Learn	2.42	1.04	1.00	4.67

Note. The SLE Instrument utilized two Likert-type scales. 1 (strongly disagree), 2 (disagree), 3 (Neutral), 4 (agree), and 5 (strongly agree). 1 (not at all true of me), 2 (sometimes), 3 (neutral), 4 (mostly), and 5 (very true of me).

Objective Two

Objective two sought to determine student perceptions after completing the TBL formatted AGEDS 450. Table 5 highlights the descriptive statistics stemming from the posttest administration of the SLE instrument. Like the pretest administration, the highest rated construct was Professional Development ($M = 4.34$, $SD = 0.61$) and the lowest was Motivation to Learn ($M = 4.09$, $SD = 0.62$).

Table 5

Posttest Descriptive Statistics for Student Learning Experiences

Construct	*M*	*SD*	*Min*	*Max*
Professional Development through Critical Thinking	4.34	0.61	1.00	5.00
Beliefs and Attitudes about Learning	4.28	0.62	1.00	5.00
Motivation to Learn	4.09	0.62	1.00	5.00

Note. The SLE Instrument utilized two Likert-type scales. 1 (strongly disagree), 2 (disagree), 3 (Neutral), 4 (agree), and 5 (strongly agree). 1 (not at all true of me), 2 (sometimes), 3 (neutral), 4 (mostly), and 5 (very true of me).

Objective Three

To address the third research objective, multiple paired-samples *t*-tests were conducted to compare the means from each of the three constructs from the pretest and posttest administration of the SLE instrument. There was a statistically significant, positive difference in the mean scores for each of the three constructs. The professional development construct had a statistically significant increase from the pretest ($M = 2.56$, $SD = 1.09$) to the posttest ($M = 4.34$, $SD = 0.61$), *t*

(109) = 14.5, *p* < .001, *d* = 0.71. Student perceptions regarding beliefs and attitudes about learning was found to have a statistically significant increase from the pretest (*M* = 2.52, *SD* = 0.99) to the posttest (*M* = 4.28, *SD* = 0.62), *t* (109) = 14.9, *p* < .001, *d* = 0.73 as well.

Table 6

Paired Samples t-test Results of Student Learning Experience Pretest and Posttest (n = 110)

	Pretest		Posttest			95% CI					
	M	SD	*M*	*SD*	Diff.[a]	*LL*	*UL*	*t*	*p*[b]	*df*	Effect Size[c]
Professional Development through Critical Thinking	2.56	1.09	4.34	0.61	1.78	1.53	2.02	14.5	.000*	109	0.71
Beliefs and Attitudes about Learning	2.52	0.99	4.28	0.62	1.76	1.53	1.99	14.9	.000*	109	0.73
Motivation to Learn	2.43	1.04	4.09	0.62	1.66	1.43	1.89	14.2	.000*	109	0.70

Note. CI = confidence interval; *LL* = lower limit; *UL* = upper limit.
[a]Posttest minus pretest; [b]Probability of difference; [c]Mean difference divided by group *SD* (0.02 = small; 0.5 = medium; 0.8 = large).

To determine if there was a statistically significant association between the mean differences and select demographic variables (GPA and credit hours), a correlation was calculated. Since the assumption of normality was not violated, Pearson correlations were computed. There was a slight negative correlation between GPA and the motivation to learn mean difference, *r* (108) = -.26, *p* = .006; attitudes and beliefs about learning mean difference, *r* (108) = -.29, *p* = .002; and professional development mean difference, *r* (108) = -.26, *p* = .027. There were no statistically significant associations between GPA, the number of credit hours taken, and mean difference for each construct. Independent samples *t*-tests were computed to determine differences between mean differences for each construct and select demographic variables (gender and method of entry). No statistical differences were found in those computations.

Conclusions and Discussion

TBL is a significant shift in traditional content delivery techniques. Students receive the content prior to attending a class session which frees most of class time for the application of content knowledge in a team setting. This transition of authority in the learning environment could have served as a disorienting dilemma (Mezirow, 2000) for students. Alongside quantitative measures, student voices were heard through two structured open-ended response questions to examine the benefit of this atypical teaching approach. The evaluation of meaningful learning environments is a convoluted task but is essential to guide learning and engagement (Edgar et al., 2016). The authors conclude that the implementation of TBL within the capstone course framework develops an engaging learning environment in which students assume responsibility for their own learning while working collaboratively to solve real-world problems. This particular application of

TBL contributes to the professional development through critical thinking of students, and strengthens their perceived ability to apply course concepts to situations after graduation.

Across all three constructs, statistically significant increases in student perceptions were observed. These results are encouraging as the need for research-based pedagogical practices are important for instructors of agriculture (Edgar et al., 2016). Furthermore, the pretest and posttest results offer valuable insights on overcoming preconceived notions stemming from past negative experiences in working with other students, similar to Espey's (2010) findings. These findings support the continuation of the TBL instructional approach within AGEDS 450 as well. Like previous research on flipped classrooms in agricultural contexts (Barkley, 2015; Conner et al., 2014a; Conner et al., 2014b; Gardner, 2012; McCubbins et al., 2016), students viewed this TBL formatted course favorably. TBL, in this context, reinforced specific critical thinking abilities, fostered student's motivation to learn the content, aided in the self-perceived ability to connect theory to practice, and widened students' frames of reference. Students felt that the time spent working with groups was beneficial in holding them accountable to various assignments and farm-related tasks.

TBL is a useful approach in transformative learning. Mezirow (2000) discussed the importance of analyzing individual experiences in the process of assessing reasoning and making meaning. As is obvious in the open-ended question responses, this iteration of TBL allowed students to engage with other individuals and negotiate throughout the semester. Through the structure of this course, students questioned their previous assumptions–as they related to the course content and the value they placed on working with others–and engaged in rational discourse to widen their frames of reference (Mezirow, 2000).

Recommendations and Implications

Mezirow (2000) noted the importance of a trusting, social context to nurture transformative learning, which is supported by the current findings as well as previous research (McCubbins et al., 2016). Continual evaluation of student perceptions in this particular course is recommended. It is further recommended that student outcomes be evaluated alongside similar data. Evaluating student performance on exams compared to their perceptions of TBL would be of interest, and could hold significant implications for the instructional approaches employed by faculty members within agricultural education, broadly defined.

As recommended in McCubbins et al. (2016), critical thinking abilities should be measured before and after exposure to TBL. This data could be compared to national norms, similar to what was conducted in Perry et al.'s (2015) work, who recommended the examination of critical thinking in line with active learning strategies. Additionally, comparison of student performance in TBL formatted courses versus traditionally taught (i.e., lecture based) courses within Colleges of Agriculture is warranted. This could potentially expand the significance and utility of the findings from the present study.

We also recommend considerable attention be given to faculty professional development workshops on designing, implementing, and sustaining student-centered frameworks (Balschweid et al., 2014; McCubbins et al., 2016). With consideration of the potential barriers in the adoption of student-centered course design (Hains & Smith, 2012), it is likely time for faculty members within agricultural education to advocate for more emphasis on teaching and learning in the alignment of institutional responsibilities. Traditionally, "effective teaching has continually been hampered by pedagogical constraints, such as time, materials, and ever changing technological advances" (Edgar et al., p. 38). TBL, while not a panacea, provides a solution to the hampering of

effective teaching practices. It is long past time that those charged with teaching students for a changing world quit handicapping those students by the perpetuation of teaching methods known to be less effective.

References

Addo-Atuah, J. (2011). Performance and perceptions of pharmacy students using team-based learning (TBL) within a global health course. *Innovations in Pharmacy*, *2*(22), 1–15. Retrieved from http://pubs.lib.umn.edu/cgi/viewcontent.cgi?article=1036&context=innovations

Baldwin, T. T., Bedell, M. D., & Johnson, J. L. (1997). The social fabric of a team-based M.B.A. program: Network effects on student satisfaction and performance. *Academy of Management Journal*, *40*(6), 1369–1397. doi:10.2307/257037

Balschweid, M., Knobloch, N. A., & Hains, B. J. (2014). Teaching introductory life science courses in colleges of agriculture: Faculty experiences. *Journal of Agricultural Education*, *55*(4), 162–175. doi:10.5032/jae.2014.04162

Balwan, S., Fornari, A., DiMarzio, P., Verbsky, J., Pekmezaris, R., Stein, J., & Chaudhry, S. (2015). Use of team-based learning pedagogy for internal medicine ambulatory resident teaching. *Journal of Graduate Medical Education*, *7*(4), 643–648. doi:10.4300/jgme-d-14-00790.1

Barkley, A. (2015). *NACTA Journal*, *59*(3), 240–244. Retrieved from http://www.nactateachers.org/component/attachments/download/2284.html

Bergmann, J., & Sams, A. (2012). *Flip your classroom: Reach every student in every class every day.* Alexandria, VA: International Society for Technology in Education.

Bickelhaupt, S. E., & Dorius, C. (2016). *Digging deeper into team-based learning evaluation: Survey development.* Unpublished manuscript, Department of Human Development and Family Studies, [STATE] University, Ames, IA.

Bishop, J. L., & Verleger, M. A. (2013). The flipped classroom: A survey of the research. *120th ASEE Annual Conference & Exposition*. Retrieved from http://www.studiesuccesho.nl/wp-content/uploads/2014/04/flipped-classroom-artikel.pdf

Chen, Y., Wang, Y., Kinshuk, & Chen, N.-S. (2014). Is FLIP enough? Or should we use the FLIPPED model instead? *Computers & Education*, *79*(2014), 16–27. doi:10.1016/j.compedu.2014.07.004

Conner, N. W., Rubenstein, E. D., DiBenedetto, C. A., Stripling, C. T., Roberts, T. G., & Stedman, N. L. P. (2014a). Examining student perceptions of flipping an agricultural teaching methods course. *Journal of Agricultural Education*, *55*(5), 65–77. doi:10.5032/jae.2014.05065

Conner, N. W., Stripling, C. T., Blythe, J. M., Roberts, T. G., & Stedman, N. L. P. (2014). Flipping an agricultural education teaching methods course. *Journal of Agricultural Education*, *55*(2), 66–78. doi:10.5032/jae.2014.02066

Crunkilton, J. R., Cepica, M. J., & Fluker, P. L. (1997a). *Handbook on Implementing Capstone Courses in Colleges of Agriculture.* (USDA award # 94-38411-016). Washington, DC: United States Department of Agriculture.

Edgar, D. W., & Retallick, M. S. (2016). Research priority 4: Meaningful, engaged learning in all environments. In T. G. Roberts, A. Harder, & M. T. Brashears (Eds.), *American Association for Agricultural Education national research agenda: 2016-2020* (pp. 37–40). Gainesville, FL: Department of Agricultural Education and Communication.

Enfield, J. (2013). Looking at the impact of the flipped classroom model of instruction on undergraduate multimedia students at CSUN. *TechTrends*, *57*(6), 14–27. doi:10.1007/s11528-013-0698-1

Espey, M. (2010). Valuing teams: What influences student attitudes? *NACTA Journal*, *54*(1), 31–40. Retrieved from https://www.nactateachers.org/attachments/article/110/Espey_NACTA%20Journal%20March%202010-5.pdf

Gardner, J. G. (2012). *The inverted agricultural economics classroom: A new way to teach? A new way to learn?* Paper presented at the Agricultural & Applied Economics Association's Annual Meeting, Seattle, Washington. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.464.6864&rep=rep1&type=pdf

Guest, G. S., MacQueen, K. M., & Namey, E. E. (2012). *Applied thematic analysis*. Los Angeles, CA: Sage Publications.

Habermas, J. (1984). *The theory of communicative action*. Boston, MA: Beacon Press.

Hains, B. J., & Smith, B. (2012). Student-Centered Course Design: Empowering Students to Become Self-Directed Learners. *Journal of Experiential Education*, *35*(2), 357–374. doi:10.5193/JEE35.2.357

Jeffries, B. (2015). *Active learning: What's up with that flipping classroom?* . Retrieved from https://www.aspet.org/uploadedFiles/Divisions_and_Chapters/ASPET_Divisions/Pharmacology_Education/Content/Educational_Assets/1_Doing%20is%20better_Jeffries_150329.pdf

Johnson, T. E., & Lee, Y. (2008). The relationship between shared mental models and task performance in an online team-based learning environment. *Performance Improvement Quarterly*, *21*(3), 97–112. doi:10.1002/piq.20033

Kelly, P. A., Haidet, P., Schneider, V., Searle, N., Seidel, C. L., & Richards, B. F. (2005). A comparison of in-class Learner engagement across lecture, problem-based learning, and team learning using the STROBE classroom observation tool. *Teaching and Learning in Medicine*, *17*(2), 112–118. doi:10.1207/s15328015tlm1702_4

Kong, S. C. (2014). Developing information literacy and critical thinking skills through domain knowledge learning in digital classrooms: An experience of practicing flipped classroom strategy. *Computers & Education*, *78*, 160–173. doi:10.1016/j.compedu.2014.05.009

Lamm, K. W., Carter, H. S., & Melendez, M. W. (2014). Investigating the linkage between intrinsic motivation and project team satisfaction in undergraduate agricultural leadership students. *Journal of Agricultural Education*, *55*(3), 103–115. doi:10.5032/jae.2014.03103

McCubbins, OP, Paulsen, T. H., & Anderson, R. G. (2016). Student perceptions concerning their experience in a flipped undergraduate capstone course. *Journal of Agricultural Education, 57(3), 70-86. doi: 10.5032/jae.2016.03070*

Mezirow, J. (1995). Transformation Theory of Adult Learning. In M. R. Welton (Ed.), *In Defense of the Life World* (pp. 39–70). New York: SUNY Press.

Mezirow, J. (2000). *Learning as transformation: Critical perspectives on a theory in progress*. San Francisco, CA: Jossey-Bass Inc.

Michaelsen, L. K. (1992). Team learning: A comprehensive approach for harnessing the power of small groups in higher education. *To Improve the Academy*, *11*, 107–122. Retrieved from http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1248&context=podimproveacad

Michaelsen, L. K., Knight, A. B., & Fink, D. L. (Eds.). (2004). *Team-Based Learning: A Transformative Use of Small Groups in College Teaching*. Sterling, VA: Stylus Publishing.

Michaelsen, L. K., & Sweet, M. (2011). Team-based learning. *New Directions for Teaching and Learning*, *2011*(128), 41–51. doi:10.1002/tl.467

Michaelsen, L. K., Sweet, M., & Parmalee, D. X. (2011). Team-based learning: Small group learning's next big step. *New Directions for Teaching and Learning*, *116*, 7–27.

Missildine, K., Fountain, R., Summers, L., & Gosselin, K. (2013). Flipping the classroom to improve student performance and satisfaction. *Journal of Nursing Education*, *52*(10), 597–599. doi:10.3928/01484834-20130919-03

Murray, W. G. (1945). Student operation of a laboratory farm. *Journal of Farm Economics*, *27*(1), 185–195. doi:10.2307/1232271

Paulsen, T. H. (2010). Collaborative decision making: A capstone agricultural business management course goal. *NACTA Journal*, *54*(2), 2. Retrieved from https://www.nactateachers.org/attachments/article/398/2010%20NACTA%20Abstracts%20final%20for%20e-publishing.pdf

Perry, D. K., Paulsen, T. H., & Retallick, M. S. (2015). The impact of a capstone farm management course on critical thinking abilities. *Journal of Agricultural Education*, *56*(2), 13–26. doi:10.5032/jae.2015.02013

Roberts, T. G., Harder, A., & Brashears, M. T. (2016). *American Association for Agricultural Education national research agenda: 2016-2020*. Retrieved from http://aaaeonline.org/resources/Documents/AAAE_National_Research_Agenda_2016-2020.pdf

Roberts, T. G., Stripling, C. D., & Estepp, C. M. (2010). *Developing a conceptual model for a teaching methods course.* Proceedings of the 2010 Southern Region American Association for Agricultural Education Research Conference, Orlando, FL. Retrieved from http://aaaeonline.org/Resources/Documents/Southern%20Region/Research%20Conference%20Proceedings,%20Southern%202010.pdf

Sibley, J., & Ostafichuk, P. (2014). *Getting started with team-based learning.* Sterling, VA: Stylus Publishing.

Smith, K. L., Rayfield, J., & Mckim, B. R. (2015). Effective practices in STEM integration: Describing teacher perceptions and instructional method use. *Journal of Agricultural Education*, *56*(4), 182–201. doi:10.5032/jae.2015.04183

Taylor, E. W. (1998). *The theory and practice of transformative learning: A critical review.* Retrieved from http://files.eric.ed.gov/fulltext/ED423422.pdf

Taylor, E. W. (2007). An update of transformative learning theory: A critical review of the empirical research (1999–2005). *International Journal of Lifelong Education*, *26*(2), 173–191. doi:10.1080/02601370701219475

Tennant, M. C. (1991). The psychology of adult teaching and learning. In J. M. Peters & P. Jarvis (Eds.), *Adult education: Evolution and achievements in a developing field* (pp. 191–216). San Francisco, CA: Jossey-Bass.

Tucker, B. (2012). The flipped classroom: Online instruction at home frees class time for learning. *Education Next*, *12*(1), 2–10.

Urdan, T. C. (2010). *Statistics in plain English* (3rd ed.). New York, NY: Routledge.

Vogel, G., & Steiner, C. R. (2004). *Teaching farm management by challenging students to manage.* Paper presented at the Association for International Agricultural and Extension Education annual conference, Dublin, Ireland. Retrieved from https://www.aiaee.org/attachments/article/1053/vogel-carousel.pdf

What is the IF-AT? Retrieved April 25, 2016, from Epstein Educational Enterprises, http://www.epsteineducation.com/home/about/default.aspx

Whittington, M. S., & Newcomb, L. H. (1993). Aspired cognitive levels of instruction, assessed cognitive levels of instruction and attitude toward teaching at higher cognitive levels. *Journal of Agricultural Education*, *34*(2), 55–62. doi:10.5032/jae.1993.02055