Journal of Agricultural Education, 61(1), 262-276
https://doi.org/10.5032/jae.2020.01262

Undergraduate Students' Perceptions of Team-Based Learning During an Introductory Agricultural Mechanics Course: A Mixed Methods Study

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Abstract

In higher education classrooms, teacher-centered instruction remains the dominant learning approach. However, as calls have increased for university graduates to demonstrate the ability to solve complex problems, active learning strategies such as flipped classrooms and team-based learning (TBL), have emerged as popular approaches to ensure students possess such skills. The purpose of this mixed methods study was to investigate students' perceptions of TBL in a flipped introductory to agricultural mechanics course. After data collection, the quantitative and qualitative strands were analyzed independently, compared, and then merged to draw meta-inferences. Quantitative findings suggested that students exhibited an overwhelmingly positive view of TBL. Due to the complexity of the qualitative findings, however, they were assigned priority. To understand the intricacies of students' perspectives, we narrated the emergent themes through Brunswick's three zones of judgment: (1) acceptance, (b) non-commitment, and (c) rejection. As a result, we noted more diversity in students' perspectives. However, they remained satisfied with the course overall. Moving forward, we offer recommendations for future research, theory building, and practice in regard to TBL's use.

***Keywords*:** team-based learning; agricultural mechanics; problem solving; flipped classroom; mixed methods

Introduction

One of the most challenging aspects of teaching is fostering a learning environment that meets the needs of diverse learners (Loewenberg Ball & Forzani, 2009). In today's university classrooms, teacher-centered activities, such as lectures, remain the most prevalent approach to teaching and learning (Ewing & Whittington, 2009; McCarthy & Anderson, 2000; McCubbins, Paulsen, & Anderson, 2016). However, existing evidence has demonstrated teacher-centered activities often only encourage students to employ lower levels of cognition (Ewing & Whittington, 2009; McCarthy & Anderson, 2000; Whittington & Newcomb, 1993). To encourage higher-level thinking, advocates have begun to utilize active learning strategies (Allen, Donham, & Bernhardt, 2011; Hanson, 2006). Active learning strategies promote a student-centered learning environment by creating opportunities for students to solve problems in a real-world context (Michealsen & Sweet, 2008; Sibley & Ostafichuk, 2015). Recently, McCubbins, Paulsen, and Anderson (2018) discussed flipped classrooms as an active learning strategy in the preparation of agricultural education teachers to nurture critical thinking skills and reduce the discipline's overreliance on teacher-centered approaches.

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Over the past decade, the flipped classroom approach has gained increased attention in secondary and postsecondary education for its student-centered teaching approach (Barkley, 2015; McCubbins et al., 2018). Such awareness could be the result of teachers' collective efforts to (a) foster higher order thinking, (b) increase motivation and engagement, and (c) equip students with the skills required by future employers (Lamm, Carter, & Melendez, 2014; McCubbins et al., 2018; Tucker, 2012). The transition from teacher-centered to student-centered instruction is critical to the flipped classroom approach (Ewing & Whittington, 2009). Specifically in flipped classrooms, the delivery of content occurs before formal instruction in the classroom environment. Often, students have engaged with the course material through an online format or traditional readings and participate in formative summative assessments (Michaelsen, Knight, & Fink, 2004). Such a strategy allows the instructor to devote less time in class to delivering content and more to conducting activities that empower students to apply their learning (Michaelsen et al., 2004). Similar to a flipped classroom, Team Based Learning (TBL) advances the approach by incorporating collaboration between individuals (Michealsen et al., 2004).

TBL is a modified version of the flipped classroom that was introduced in the late 1970s by Lee Michaelsen at Oklahoma State University (Michaelsen et al., 2004; Sibley & Ostafichuk, 2015). TBL is similar to a flipped classroom in that students must learn content before beginning class (Ewing & Whittington, 2009); however, they are placed in teams to engage in learning activities and applications through a more social platform (Michaelsen & Sweet, 2008). A typical university-level TBL course is structured into 5-7 modules, with each module lasting 1-2 weeks. The students participate in online modules to prepare for class and complete an Individual Readiness Assurance Test (IRAT) to assess their content knowledge (Sibley & Ostafichuk, 2015). Then, students meet with predetermined teams to complete a Team Readiness Assurance Test (TRAT) that seeks to clarify students' questions and concerns regarding the topic (Michaelsen & Sweet, 2008). Due to its social nature, TBL is designed to encourage students to gain declarative and procedural knowledge in a given domain (Michaelsen & Sweet, 2008). To implement TBL, practitioners should consider four essential elements: (1) group formation and management of the teams, (2) accountability, (3) feedback, and (4) assessment (Michaelsen & Sweet, 2008). Further, educators must be willing to transition from the classroom authority role to one that more closely resembles a facilitator. It has been noted that instructors and students can be resistant to this transition (Hains & Smith, 2012); however, if TBL is implemented properly, students and instructors' experiences can be more enjoyable (Sibley & Ostafichuk, 2015).

Although flipped classrooms and TBL emerged over five decades ago, empirical evidence supporting its use has been rather scant in the agricultural education literature. Gardner (2012) utilized a flipped classroom approach in an undergraduate agricultural economics course. For example, before the course, lectures were converted to an online format, which allowed students to view the course's material beforehand. Then, during class, students were engaged in discussions about the course material as well as completed homework and assessments. Results indicated students were satisfied with the course and perceived that the flipped classroom approach helped them achieve mastery of key concepts. Nevertheless, little evidence suggested their perceptions and satisfaction with the approach affected their final grade (Gardner, 2012).

In the context of agricultural teacher education, Conner et al. (2014) investigated undergraduate students' perceptions of flipping a teaching methodology course by transitioning lectures to an online format. This provided a virtual curricular space for students to engage in lesson planning, student-led activities, and a plethora of teaching approaches (Conner et al., 2014). Findings suggested many students were satisfied with the course and perceived that the flipped approach supported their learning, however, some students reported dissatisfaction with the method (Conner et al., 2014). Further,

McCubbins et al. (2016) examined student perceptions after engaging in a capstone course that employed the TBL format. Results indicated students had a positive view of the TBL approach and were satisfied with the student-centered learning environment. It was also concluded that working in teams positively affected the students' motivations to learn and work collaboratively (McCubbins et al., 2016). In another study, McCubbins et al. (2018) reported that TBL supported students' critical thinking skills, motivation, and ability to apply the course's concepts contextually. However, despite recent advances in the literature a need existed to understand university students' perspectives as they engaged in TBL in the context of a laboratory-based agricultural mechanics course.

Theoretical/Conceptual Framework

To investigate students' perceptions of TBL, we grounded this study in the social judgment theory [SJT] (Bruswick, 1952). SJT addresses the ways in which individuals' perceptions and judgments shape their willingness to engage in particular activities. SJT also explains how individuals' perceptions may influence their resulting outcomes. In this study we sought to understand how students' perceptions and judgments of TBL might have influenced their perceived outcomes of the *Introduction to Agricultural Mechanics* course under investigation. In SJT, individuals' perceptions on a topic, issue, or experience are placed on a continuum of acceptance (Hammond, Rohrbaugh, Mumpower, & Adelman, 1977).

The continuum consists of three primary zones: (1) acceptance, (2) non-commitment, and (3) rejection that anchor individuals' views (Hammond et al., 1977). The acceptance zone refers to the state when individuals associate a high level of value during a judgment and perceive incorporating the associated behavior may positively affect their lives (Cooksey, 1996) In the zone of non-commitment, individuals associate some perceived value; however, their commitment remains relative and largely situational (Cooksey, 1996). In the final zone, rejection, individuals do not perceive value and choose to disengage (Hammond et al., 1977). Because the theoretical framework (Brunswick, 1952) was presented on a continuum of shifting progression, we were uniquely positioned to view the shifts, conflicts, and maturation of students' perspectives on TBL during one academic semester. As a result, we sought the diverse views of students on this phenomenon by engaging a range of data sources.

Purpose and Objective

The purpose of this mixed methods study was to describe students' perceptions of TBL in the *Introduction to Agricultural Mechanics* course at Louisiana State University (LSU). This research supports Priority 4: Meaningful, Engaged Learning in All Environments (Edgar, Retallick, & Jones, 2016) of the American Association for Agricultural Education's (AAAE's) National Research Agenda. Specifically, this study addressed how the delivery of "educational programs in agriculture continually evolve to meet the needs and interests of students" (Edgar et al., 2016, p. 38). One research question guided this study: *What were university students' perceptions of TBL during LSU's Introduction to Agricultural Mechanics course in the spring 2018 semester?*

Background of the Study

The *Introduction to Agricultural Mechanics* course was held twice weekly for approximately 110 minutes per session. The Spring 2018 semester was the first time the course was flipped using the TBL format. Despite the new delivery approach, the course's four-pronged foci remained consistent with previous semesters: (a) laboratory safety, (b) agricultural structures (i.e., carpentry), (c) residential electricity/wiring, and (d) small gasoline engines. Content related to the course was provided through LSU's online learning platform, which included: (1) online readings; (2) videos; and (3) supplemental material. In all, the content was divided into eight modules that included: (a) one module focused on

safety, (b) one on agricultural structures, (c) one on electricity, and (d) five concerning small gasoline engines (e.g., tool/part identification, 4-cycle theory/carburation, ignition and governors, cooling and lubrication, and troubleshooting).

Further, we employed Roberts, Stripling, and Estepp's (2010) taxonomy of learning activities (TLA) to guide our design of the course. In its development, the TLA model was created to understand the major approaches to teaching and learning by depicting their relational nature on a continuum of instructional methods and learning interactions (see Figure 1).

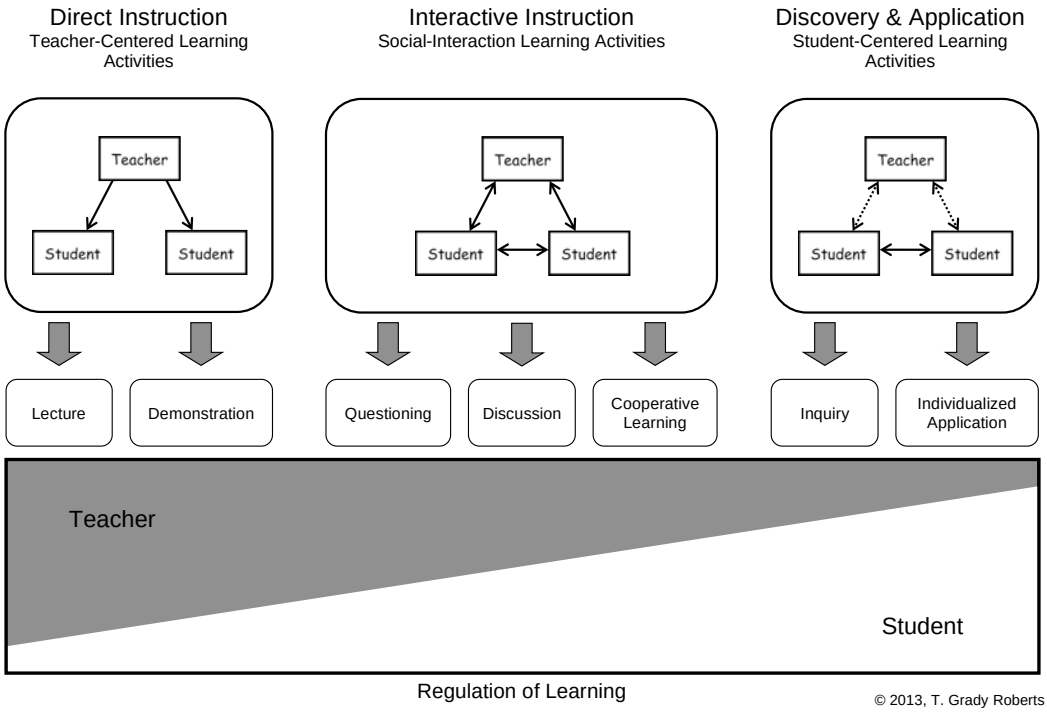

Figure 1. From "A conceptual model of learning activities for college instructors [Abstract]," by T. G. Roberts, C. M. Stripling, and C. D. Estepp, 2010, *NACTA Journal*, *54*(1) Supplement, p. 71. Copyright (2010) by NACTA Journal. Reprinted with permission.

Therefore, the TLA continuum demonstrated how instructors could transition from a teacher-centered to a student-centered approach utilizing techniques such as questioning, cooperative learning, and inquiry-based instruction (Roberts et al., 2010). In this course, TBL was conceptualized as a strategy that scaled Roberts et al. (2010) TLA continuum. For example, lessons in the *Introduction to Agricultural Mechanics* course began with individualized activities (i.e., online readings, videos, presentations). At each session's end, however, students advanced through the TLA model by engaging in application exercises and individual projects. Table 1 presents the parralles of TLA model to the course's TBL activities.

Table 1

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

TLA (Roberts et al., 2010)	TBL Activities
Teacher-Centered Activities	Preparation
Lecture	Out-of-class reading
Demonstration	Out-of-class reading

Table 1

Parallels Between the Taxonomy of Learning Activities and Team-Based Learning Continued…

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, 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, 57*(3), p. 72. Copyright 2016 by the Journal of Agricultural Education.

Guided by the TLA and the principles of TBL, we divided students into teams of four. The students remained in the groups throughout the duration of the course. Each unit of instruction was comprised modules consisting of four major topics (1) safety, (2) structures, (3) electricity, and (4) small gasoline engines, with online modules designed to be completed in one to two hours. After completion of each online module, students completed a battery of formative assessments beginning with an IRAT over the course material. The purpose of the IRAT was to assess students' learning after the completion of the online content. Next, students were administered a TRAT, which was comprised of the same items as the IRAT. The purpose of the TRAT was to allow students to work together to discuss their thinking and arrive at a final consensus regarding their initial answers. Further, the IRATs and TRATs were used to hold students accountable for engaging in the online content. The IRATs and TRATs typically consisted of 15 to 25 items, depending on the module.

One of the central elements of TBL is immediate feedback. To accomplish this, the researchers utilized GradeCam® software. GradeCam® allowed us to create an optical answer sheet for each of the IRAT and TRAT assessments. As students completed the assessments, a smartphone application was utilized to scan students' answer sheets. Then, GradeCam® software scored individual answer sheets to determine the accuracy of students' responses. This allowed us to review results and provide timely feedback. After each instrument was completed, the remainder of the course was dedicated to hands-on, application based activities in the agricultural mechanics laboratory. Therefore, the course was structured to be 25% in-class discussion and tests and 75% application based.

Methodology and Procedures

This study analyzed the perceptions of undergraduate students as they engaged in TBL during an introductory agricultural mechanics course. To accomplish this, we employed a pragmatist lens (Morgan, 2007) to nest our methodological decisions in the convergent parallel, mixed methods design (Creswell & Plano Clark, 2018). Convergent parallel studies aim to draw on different strands of data, quantitative and qualitative, to offer a more complex understanding of the phenomenon (Creswell & Plano Clark, 2018). Due to the nature of this study, collection of the quantitative and qualitative was timed to occur concurrently (Tashakkori & Teddlie, 2003). Thereafter, each strand was analyzed independently, compared, and then merged to draw meta-inferences. As a result, the point of interface between the two strands occurred during analysis and interpretation. Due to the richness of the qualitative strand, however, it was assigned priority a posteriori, i.e., Quan + QUAL (Tashakkori & Teddlie, 2003). We collected data in the quantitative strand by gathering participants' responses to a summative evaluation of the course, which was administered by LSU's Testing & Evaluation Services. In total, eight (n = 8; 47% response rate) students completed the web-based evaluation at the conclusion

of the spring 2018 semester. Meanwhile, Stake's (1995) instrumental case study design was employed to ground our procedures in the qualitative strand. Using Stake's (1995) approach allowed us to gain a deeper, more holistic understanding of students' perceptions of TBL. It should also be noted that the unit of analysis and time bounded the case (Stake, 1995). Specifically, participants' experiences with TBL during the course were limited to one academic semester. Qualitative data were derived from focus group interviews (n = 9), observations, and students' written statements to open-ended items on the summative evaluation of the course.

Role of the Researchers

To own our biases and perspectives (Patton, 2002), it is critical to acknowledge that our engagement varied considerably depending on the strand of data. For example, in the quantitative phase, we maintained a post-positivist position (Charles & Mertler, 2002) in which the phenomenon was assessed through numeric items. In the qualitative phase, however, we attempted to make sense of textual and observatory data using a constructionist (Crotty, 1998) epistemological lens to provide an intricate, contextually situated depiction of the phenomenon. It is also important to reveal that the lead researcher served as the graduate assistant for the course under investigation. As a result, she positioned herself as a participant observer (Patton, 2002) throughout the course's activities. The instructor of record for the course also served as a member of the research team. These insider perspectives (Saldaña, 2015) had the potential to introduce biases into the interpretation of the study's findings. To mitigate such influences, a third researcher, with a background in qualitative research, provided methodological and data analytic guidance during value-laden decision junctures.

Participants

In this investigation, participants (N = 17) were undergraduate students at LSU enrolled in the *Introduction to Agricultural Mechanics* course during the spring 2018 semester. Of the participants, nine were males, and eight were female with an average age of 21 years old. In all, eight majored in agricultural & extension education, three in plant & soil systems, two in animal science, two in mechanical engineering, one in agricultural business, and one in renewable natural resources.

Data Collection and Analysis

In the quantitative strand, data were collected using a web-based course evaluation. Students were sent an email invitation from LSU's Testing & Evaluation Services to participate; then, the lead researcher encouraged students to complete the evaluation by dedicating 15 minutes of instructional time for the completion of the instrument. The course evaluation was comprised of 10 Likert-type items using the following anchors to determine agreement: 5 = *Strongly Agree*; 4 = *Agree*; 3 = *Neutral*; 2 = *Disagree*; and 1 = *Strongly Disagree*. However, only three items were relevant to students' perceptions of the course; therefore, the other items were not featured in this manuscript. On the course evaluation, students also had the opportunity to provide written statements. In all, eight (47%) students completed the web-based instrument.

To recruit students in the qualitative strand, the researchers offered bonus points in the course for participation (n = 9) in a focus group interview. During the interview, the lead researcher used a semi-structured interview protocol to elicit participants' perceptions regarding the use of TBL. During this phase, the researchers also upheld standards of ethical research by concealing participants' identities by assigning them a participant number. The interview lasted approximately 45 minutes and was recorded using an iPhone® application. Then, the lead researcher transcribed the interview verbatim. To analyze the qualitative data, we employed Corbin and Strauss' (2015) constant comparative method. To facilitate this process, we employed Saldaña's (2018) coding

recommendations by which we engaged in (a) open, (b) axial, and (c) selective coding techniques. For example, we began this process by independently open coding the data corpus. Then, during axial coding, we analyzed relationships among the open codes and began to collapse them into categories (Corbin & Strauss, 2015). After this phase, we met to discuss our evidentiary warrants developed as a result of the first two rounds of coding and negotiated discrepancies in our interpretations (Corbin & Strauss, 2015). Finally, we employed selective coding as a way to "think with theory" (Jackson & Mazzei, 2012, p. 6) as we reengaged the data and weaved context and meaning while simultaneously reducing categories into themes. We then narrated the resulting themes through the lens of Bruswick's (1952) SJT.

Qualitative Quality

Before presenting the study's findings, however, it is important to address our techniques for imbuing rigor. In this study, we ensured trustworthiness by grounding our ethical decision-making in Lincoln and Guba's (1985) standards – confirmability, dependability, credibility, and transferability – for qualitative quality. For example, we were explicit about how our biases and assumptions might have influenced our interpretations (confirmability), engaged in multiple rounds of coding and negotiated emergent discrepancies (dependability), ensured findings were contextually grounded and rich in description (credibility), and attempted to mobilize findings that might be considered applicable across contexts (transferability).

Findings

After a separate analysis of each strand of data, we interactively merged (Creswell & Plano Clark, 2018) the results of each. The product of this merger was the development of a matrix (see Table 2) that featured the quantitative results (i.e., means and standard deviations from items on the course evaluation) compared to qualitative findings. The merger of data strands demonstrated the existence of both congruent and discrepant findings. For interpretation, the real limits for the quantitative items were 1.00 to 1.49 = *Strongly Disagree*, 1.50 to 2.49 = *Disagree,* 2.50 to 3.49 = *Neutral*, 3.50 to 4.49 = *Agree*, and 4.50 to 5.00 = *Strongly Agree*. The three quantitative items yielded mean responses of *Strongly Agree*.

Table 2

Linking LSU Undergraduate Students' Evaluations of a TBL Formatted Course to Qualitative Perceptions

M	*SD*	Congruent Statements	Discrepant Statements
		Item 1. Course activities and materials were valuable to my learning	
4.88	0.35	"The readings were very helpful in understanding background knowledge" (FG[a]; Participant #4).	"Personally I hate everything online. I would rather had everything printed" (FG[a]; Participant #3).
		"IRATs were helpful because it made sure that you kept up with the reading materials: (FG[a]; Participant #4).	"Some of the readings were very long and the information was hard to understand" (FG[a]; Participant #7).
		"[TBL] is a lot better than just sitting in a lecture and having to sit" (FG; Participant #4).	"Sometimes it was difficult to collaborate with your group members, especially if they were at different stages of the project" (FG[a]; Participant #8).
		Item 2. This course gave me the opportunity to improve my knowledge and skills in this subject matter	
4.75	0.46	"This is one of the few courses at LSU that has challenged me, really taught me something and that I've enjoyed" (WC[b]).	"For me, I can read the content and it doesn't really mean anything to me." (FG[a]; Participant #8).
		"TRATs also helped to reinforce the material more . . . one of your team members might have been like 'oh, I remember reading this' and they could explain it" (FG[a]; Participant #6.	"I don't like online readings very well, so it made it harder to learn" (FG[a]; Participant #2).
		Item 3. Overall, I would rate this course as excellent	
4.75	0.46	"This is the best type of flipped classroom I have been in. We actually get to do the application rather than just read about it and then learn more in class" (FG[a]; Participant #5).	"It would have been nice to have a clearer understanding of the objectives for each topic and what needs to be accomplished each day" (FG[a]; Participant #1).

Note. 5 = *Strongly Agree*; 4 = *Agree*, 3 = *Neutral*, 2 = *Disagree*, and 1= *Strongly Disagree*. [a]FG indicated that data were obtained from the focus group interviews. [b]WC indicated that data were obtained from students' written comments on the course evaluation.

After merging the data strands, we recognized the need to more intimately investigate the corresponding and conflicting findings. As such, we assigned priority to the qualitative strand and scrutinized the emergent findings further. Using this procedure, we distilled themes that were mobilized through the lens of Bruswick's (1952) three zones of judgment: (1) acceptance, (b) non-commitment, and (c) rejection. When viewed through SJT, the themes reflect the range and complexity of perspectives that students held about the use of TBL in LSU's *Introduction to Agricultural Mechanics* course. Drawing on salient examples from our analysis, the three themes and supporting sub-themes maneuver among and between Bruswick's (1952) zones of judgment to offer variant perspectives on the phenomenon.

Theme 1: The Zone of Acceptance

The first theme illuminated students' optimistic views (Hammond et al., 1977) regarding TBL. For example, the participating students perceived certain aspects of the approach influenced their course-based experiences and learning in positive ways. The aspects that most profoundly encouraged participants to move into the zone of acceptance are narrated through three subthemes: (1) flipped classroom design, (2) teams, and (3) formative assessments.

Flipped Classroom Design. When asked to reflect on the ways in which the flipped classroom approach impacted their learning, participants articulated that the course's structure was more conducive to learning than traditional approaches. For example, Participant #1 stated: "this way [the flipped classroom approach] was a lot more helpful because you can read the content yourself and then in class you get to apply it… [and] the ideas become more concrete." The students also expressed positive views about TBL. Participant #3 maintained:

> I like the interaction between not only the students, graduate student, and professor, but the whole class. Like we all are able to help each other and learn from each other. We are learning the material in a very interactive way that is more than just knowing the course material, but actually about applying what we have learned.

Participant's #2 and #8 indicated they had been involved in a flipped classroom environment before; however, they preferred the approach used in the course under investigation. Participant #2 explained: "This is the best type of flipped classroom I have been in. We actually get to do the application rather than just read about it and take a test and then learn more in class." Further, one student remarked in the written comments section of the course evaluation, "excellent class structure, with emphasis on student participation."

Teams. In accordance with TBL, students were placed on a team at the beginning of the semester. When asked to reflect on whether their teams affected their learning, Participant's #1, #3, and #6 maintained that interactions with their team allowed them to understand alternative perspectives, collaborate, and co-construct new knowledge. Participant #1 elaborated: "I think it was especially helpful for problem-solving because it helped [me] to gain a new perspective and way of thinking that you might not have thought of before." Meanwhile, Participant #5 suggested the greatest advantage of TBL was when his group alternated between student and teacher roles to learn course concepts. Finally, participant #4 posited that she valued TBL because it helped facilitate a constant exchange of ideas and views among group members, which stoked a greater curiosity for the course's content. TBL also appeared to help some participants gain self-efficacy. Participant #4 explained: "my team gave me a confidence booster in my ability to complete projects in this course."

Formative Assessments. Participants also largely agreed that the use of formative assessments (i.e., IRATs and TRATs) were helpful in assisting them to gauge their level of understanding of the course's content and address any deficiencies before applying their learning in a laboratory setting.

Participant #4 explained: "the IRAT's were helpful because [they] made sure that you kept up with the reading materials." Participants also perceived that formative assessments reinforced the course's central concepts and that team-based formative assessments, i.e., TRATs, were beneficial. Participant #6 stated: "the TRAT's also helped to enforce the material more and talk about something [I] didn't understand with [my] teammates. One of your [team] members might have understood a topic better and [they] could explain it to you."

Theme 2: The Zone of Non-Commitment

The second theme highlighted students' perspectives on elements of TBL they viewed as valuable; however, they also articulated these aspects warranted further consideration by instructors. As a result, participants assigned (a) the course's structure and (b) lecture sessions to The Zone of Non-Commitment.

The Courses Structure. Although the majority of participants articulated that TBL had a positive impact on their learning, they also pointed to areas that should be evaluated moving forward. For example, students expressed positive views of the course's web-based elements. However, Participant #3 conveyed: "the only thing I would like different is to have the readings handed out instead of online." However, through our observations, we noted that students expressed a reluctance to complete the course readings regardless of whether the materials were provided online or printed and distributed individually. In this study, students also expressed positive views in regard to the course's flipped structure; however, they suggested that clearer directions and explanations should be provided in the future. For instance, Participant's #4 and #5 explained that such a change might help students have a "clearer understanding" of each lesson's objectives and expectations concerning projects.

Lecture Sessions. The participants also conveyed the reduced focus on lecture-based instruction was a positive attribute; nevertheless, they maintained that some topics were complex and required more reinforcement through in-class discussions. Participant's #3 and #9 also recommended creating more curricular space for "reviewing and reflecting" on course concepts. Participant #1 desired the lecture to occur in a more scheduled fashion, specifically she indicated:

> [We] were told every Monday we were going to have an IRAT and TRAT . . .but with the snow days our schedule got messed up and kind of shifted everything. Before, we knew we would at least have the weekend to review the material before we had our test on Monday. So I think if we could have continued with that type of structure it would have been a lot easier to understand the material better.

Theme 3: The Zone of Rejection

The final theme offered participants' views on aspects of TBL they did not assign value; instead, they articulated such activities should be discontinued. The elements of TBL that students assigned to The Zone of Rejection included: (a) online modules and (b) readings.

Online Modules. Participants suggested the use of the online content delivery method was confusing and lacked clarity. Participant #3 echoed this sentiment: "I hate everything online because it's harder to digest the material." Participant #9 explained, "[the] general organization of course content needs [to be] changed, but don't change the information [in the modules] because it was helpful."

Readings. Participants also conveyed that the course's readings were poorly organized, difficult, and overwhelming. As Participant #8 explained, "some of the readings were too long and was almost hard to understand." Meanwhile, Participant #5 called for a "better organization of the online

materials, and shorter readings. . ." In our observations, we noted that some of the readings covered complex topics and students struggled with comprehending the material. For example, the module related to carburation contained readings that discussed how Bernoulli's principle applies to carburetor theory. Multiple students arrived early to this particular class period to ask questions because they were concerned about the upcoming IRAT. Consequently, their IRAT and TRAT assessment scores were lower than previous modules.

Conclusions

The purpose of this mixed methods study was to describe students' perceptions of TBL in the *Introduction to Agricultural Mechanics* course at LSU. In the quantitative strand, students reported an overwhelmingly positive perception of the method of instruction. However, through the qualitative strand, students articulated more intricate views. As a consequence, we explored participants' variant perspectives through the lens of Brunswick's (1957) three zones of judgment: (1) acceptance, (b) non-commitment, and (c) rejection. The qualitative strand, therefore, reflected the range and complexity of students' perspectives on TBL.

The first theme, The Zone of Acceptance, represented aspects of the course students assigned a high level of value and that positively affected their course-related experiences. The three aspects most significantly influencing their perspectives were: (1) the flipped classroom design; (2) teams; and (3) formative assessments. For example, students articulated that TBL enhanced their problem-solving skills as well as their self-efficacy concerning agricultural mechanics. They also noted that the course's formative assessments, i.e., the IRATs/TRATs, helped them understand the material, which was beneficial before they applied concepts in a laboratory setting. These findings, therefore, support previously reported literature (Garder, 2012; McCubbins et al., 2016, 2018) on the use of flipped classrooms in the context of agriculture.

In the second theme, The Zone of Non-Commitment, students noted elements – the course's structure and lecture sessions – of the approach they valued but deserved further consideration by instructors. For instance, regarding the course's structure, they expressed positive views of the content but suggested that readings should be provided in-print rather than through the course's online platform. Because TBL is a shift from a traditional lecture-based course, it is possible the students' criticisms of the course's structure were based on their apprehension to embrace a more student-centered style (Roberts et al., 2010). On this issue, Hains and Smith (2012) noted that gaining student buy-in can be difficult in flipped courses. Perhaps, therefore, students need additional reinforcement of the course's concepts before applying their learning concretely.

In the final theme, The Zone of Rejection, participants' isolated two factors of TBL they perceived should be disregarded: (1) online modules and (2) readings. As an illustration, the students maintained the course's online modules lacked clarity and organization. The students also conveyed that some of the materials were long and difficult to digest. The criticisms are consistent with the existing evidence (Conner et al., 2011; Strayer, 2007) that reported students are often dissatisfied with aspects of flipped classrooms, but largely value the experience overall.

Implications, Recommendations, and Discussion

Recognizing the need for today's graduates to solve complex problems, work collaboratively, and adapt to evolving contexts (Lamm et al., 2014), this study's findings provided several implications for future research, theory-building, and practice. For example, findings suggested that students' valued TBL. Perhaps such an instructional approach provided the laboratory-based, instructional time required by students to gain competence and self-efficacy in agricultural mechanics. These findings are

noteworthy considering that knowledge and skills in agricultural mechanics remain one of the primary concerns of school-based, agricultural education (SBAE) teachers (Rasty, Anderson, & Paulsen, 2017). As a consequence, we recommend future research investigate the long-term and short-term effects of TBL, especially in the context of agricultural mechanics. Given the findings of this study, we also suggest that future research explore the role of TBL on students' conceptual and procedural knowledge as well as their resulting critical thinking and problem-solving skills. Additional work should also be conducted to examine the effects of TBL on students' content-based knowledge.

In the study, we used Brunswick's (1952) SJT to interpret the study's findings. SJT served as a productive lens to examine the range of students' perspectives on TBL. Nevertheless, it did have some weaknesses. For example, the theory provided little guidance on how to move individuals' judgments out of the zones of non-commitment and rejection. We, therefore, recommend that additional theory-building efforts be conducted to identify the factors that presage individuals to judge whether an activity lacks value and stimulates an associated negative perception. In this investigation, we noted that students' negative views usually emerged as a result of apprehension to embrace a more student-centered instructional approach. Perhaps, future theory-building efforts should, therefore, seek to explain whether factors such as time and intensity more profoundly influence individuals' judgments of a phenomenon.

This study also pointed to several recommendations for future practice. First, university instructors should carefully consider how they structure and organize their online content when using TBL. Further, supplemental videos and other materials could also be created to reduce students' apprehension about complex topics. For example, instructors might create a series of video-related content that expands on concepts. Based on the feedback from participants, we also suggest that university instructors consider using TBL in undergraduate courses, particularly if the course contains a laboratory component. Perhaps such an instructional change could help instill students with the employability skills they need to thrive in the workforce.

Limitations of the Study

Finally, several limitations need to be addressed in this study. First, in the quantitative strand, data were collected through a course evaluation designed and administered by LSU Testing and Evaluation Services. The web-based instrument is used across LSU system to assess students' views on courses. Despite the instrument's widespread use, however, information is not available regarding its reliability. Further, a test/retest reliability approach was not ethical because of the need for student anonymity. Because of these limitations, we chose to collect qualitative data, but as with any naturalistic approach, other researchers might have interpreted the data differently.

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