Systems Thinking and Hybrid Learning: Findings for Improving Teaching in the COVID-19 Era[1]

K. Carper and C. Friedel
Virginia Tech
Blacksburg, VA

Abstract

The COVID-19 pandemic has created a need for a better understanding of hybrid learning. This study explored the system of hybrid learning at a southern land grant university in an agricultural communications course via a qualitative methodology with a case study approach. Data was collected via four measures: cognitive maps, cognitive map narrations, fieldnotes, and a survey; these provided evidence in defining roles of the teacher, student, and technology within the course. Findings indicated that the student experience of learning was affected by noteworthy course content and face-to-face interactions. Further, students connected the course content and interactions to future implications of the coursework, appreciating how differentiation of learning affected the overall experience. Intentional course design was found to be critical in hybrid learning, noting the key factors of value in face-to-face interactions, online learning, and the blend of online and face-to-face learning. Further, the importance of teacher relationships and feedback were also salient. Finally, the dynamics between the teacher and student were found to be influential to student growth, the learning process, and face-to-face interactions.

Introduction

The Definition of Hybrid Learning: Then vs. Now

Education's learning modalities have continued to evolve with the emergence of new technologies. Land grant universities, because of their continued commitment to providing access to education, have specifically embraced new course deliveries involving technology. One recent example of this is hybrid learning. Since 2011, hybrid learning has been recognized as a delivery mode in academia (Stommel et al., 2020). Hybrid learning is defined as the blending of face-to-face and online learning modalities. At the time of this research, just a few months before the COVID-19 global pandemic, hybrid learning was still considered somewhat new. Now, hybrid learning is something of which nearly every educator in higher education is familiar, but there is still discomfort with the delivery modality. This research explored the connection between systems thinking and hybrid learning through the lens of complexity theory within an undergraduate classroom. These findings have implications for how educators can use hybrid learning as an effective learning modality through the COVID-19 crisis and beyond.

The Trajectory of Hybrid Learning

Face-to-face instruction has been the hallmark of education. In recent years, online learning had started to challenge this norm. Offir et al. (2008) noted that when structure of learning is altered, the results change, particularly noting the change in interaction among the teacher and students. While traditional lecture is still common (Rovai and Jordan, 2004), this delivery of content is evolving as online education increases in prominence (Shachar and Neumann, 2010).

One trend within online learning is the use of flipped learning. In flipped learning, online resources are used in the learning process; however, flipped learning is not limited to online courses. The main principle within flipped learning is that learning can occur outside of the classroom if students are provided proper resources; therefore, it can be used for any course delivery approach. The overarching goal of flipped learning is for class time to be used for application-based activities, instead of instruction (Network, 2016).

Another trend in delivery modalities is blended learning, which is essentially the precursor to what we now call hybrid learning. Blending is the key aspect: teachers should blend

[1]The Virginia Tech Institutional Review Board approved the study protocol and all participants provided written informed consent prior to participation in the study.

online and offline learning within a learning environment (Singh, 2003). Importantly, even prior to COVID-19, it could be argued that nearly all courses in undergraduate and graduate education are blended because of the vast use of online course management systems.

Hybrid learning evolved from the foundation of flipped and blended learning. It can be placed on a spectrum between 100% face-to-face to 100% online, meaning that course design for hybrid learning is highly varied (Rovai and Jordan, 2004). The most basic definition of hybrid learning is an instructional delivery where face-to-face and online learning is blended is some way.

Defining Hybrid Learning at Virginia Tech

Registrar offices at universities require documentation of course delivery modes, in part for accreditation purposes. During the time of this study, at [Southern Land Grant University] hybrid was categorized and titled Distance-Hybrid (SCHEV Instructional Methods, 2020). These were further categorized as 51% to 75%, 50%, or 49% to 2% in the same physical space for the scheduled class time (SCHEV Instructional Methods, 2020). These categorizations are designed by the State Council for Higher Education in Virginia (SCHEV Instructional Methods, 2020). Before the COVID-19 pandemic, hybrid learning was the third most popular learning modality (behind face-to-face and online) controlled by time and accreditation standards.

Purpose of the Study

This study aimed to explore student and teacher perceptions of hybrid learning at a land grant institution, gleaning how these perceptions can help improve hybrid learning course design and pedagogy. Using Fenwick's (2003) complexity theory, the aim was to learn how student engagement with course content affects the system of learning. Using a systems-thinking framework (Meadows, 2008), this study attempted to better define the complex systems within hybrid learning, explaining how their designs affect hybrid learning's use in higher education. Finally, because hybrid learning is relatively new aspect of education (which is even more prominent now due to COVID-19), the goal was to help advance hybrid learning pedagogies.

Research Questions

This case study explored the following questions in an agricultural communications course:

1. What is the teacher's role in the system of hybrid learning?
2. What is the student's role in the system of hybrid learning?
3. What is technology's role in the system of hybrid learning?

Materials and Methods

Case Study Design

This study employed a case study design. Yin (2009) argues that a case study is used to study a certain, real-life context using multiple methods; this occurs without manipulating the participants. In this case, an agricultural communications course was the unit of analysis. This study was defined as a representative case with repetition, meaning that it involved studying the everyday interactions of a class to inform the experiences; this also occurred at two different points in time because there were two Fall 2019 class sections included in the study (Yin, 2009). A systems-thinking framework (Meadows, 2008) was used to better understand the multiple systems within one classroom. Multiple data collection techniques were used, meaning the data analysis aimed to define a merging of the pieces to create a comprehensive understanding of the phenomenon (Baxter and Jack, 2008).

Defining the Population of the Study

This study examined two sections of an agricultural communications course (N = 67), which was an upper-level undergraduate study of professional rhetoric; the main assignments focused on crafting documents used in the workforce. The course for many students was considered a restricted elective, meaning it fulfilled a discourse requirement for some degrees in the College of Agriculture and Life Sciences. Data collection occurred during the Fall of 2019. Of the participating students, there were 5 freshmen, 11 sophomores, 31 juniors, and 20 seniors; 15 of these total students were transfer students to the university. The majority of undergraduates were between 18 to 21 years of age. From these participants, a number randomizer chose 30 students for data analysis.

Course Hybrid Designation

This course was taught with face-to-face course meetings, for one hour and fifteen minutes, one day a week; students completed asynchronous online materials independently. The course fell into the third hybrid category: 49% to 2% of the scheduled class time in the face-to face delivery with the remaining percentage delivered online. It was considered synchronous because the face-to-face aspect of the course has students and the teacher interacting at the same time in the same physical space (SCHEV Instructional Methods, 2020).

Data Collection Procedures

Data collection occurred via four types of measures, as noted in Figure 1. Three of the measures in Figure 1 were class assignments within the course.

Cognitive Maps

The first assignment of the class used for data collection was the cognitive map, which is defined as the "…mental representations of our external environment. Cognitive mapping is the process by which the individual acquires and processes spatial knowledge, thus producing these representations" (Irvine, 2016). The design of this assignment was aimed at allowing students to complete the following process: (1) analyze the prompt, developing mental pictures of answers and (2) represent those mental pictures in a visual form via the map and a verbal form via the narration. The goal was to develop a way to glean insights about the human experience within the course, in an illustrated format, to provide a richness and depth of

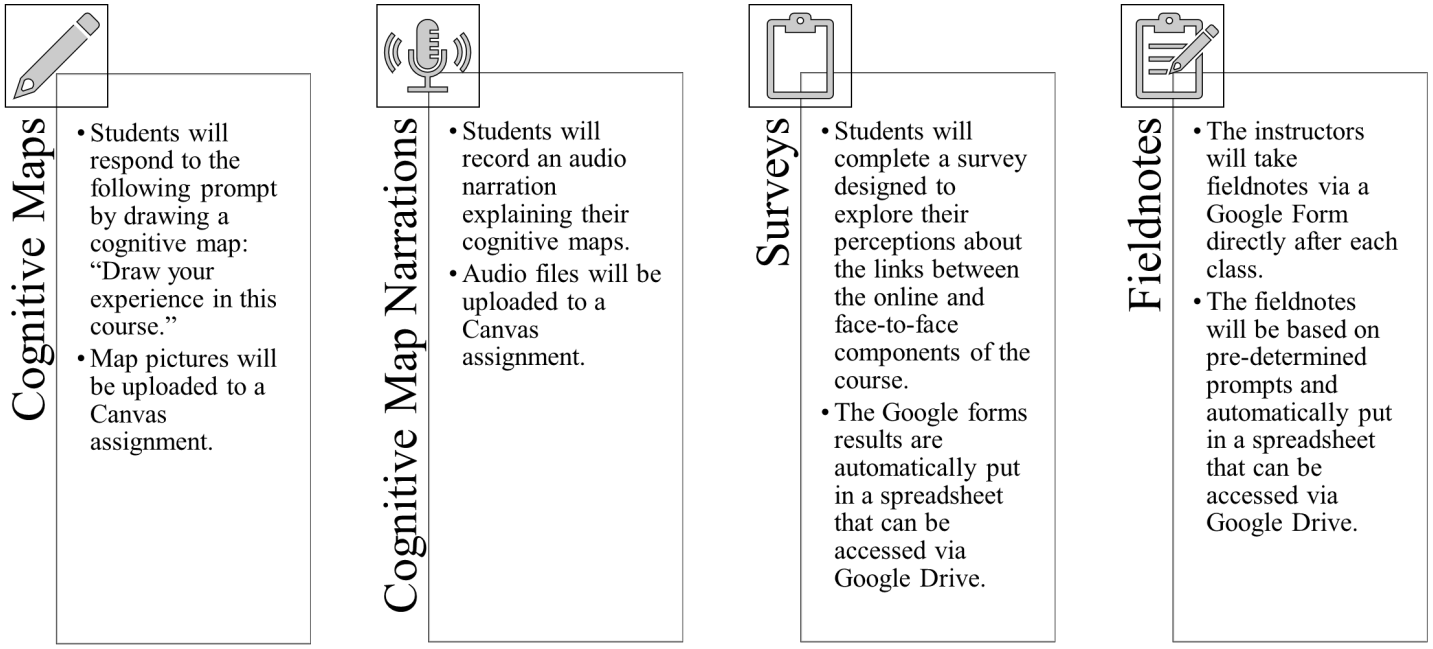

Figure 1: Data Collection Procedures. This figure describes the four data collection procedures of cognitive maps, cognitive map narration, surveys, and fieldnotes. Each labeled data collection measure has a list of the steps students and instructors took to collect each type of data.

the data beyond what quantitative measures can provide. Kitchin (1994) notes how cognitive maps have meaning beyond just spatial relationships, saying the maps "contain social and environmental meaning knowledge." As such, "This information is used to shape our attitudes towards, and perspectives of, the world…" (Kitchin, 1994). The directions for the cognitive map assignment were as follows: 1) Draw your experience in this course. 2) When you are finished, take a picture of your map, and upload the file to this assignment. 3) The answer to all questions you have about any aspect of the assignment is this: "I will not respond to any questions to protect the organic nature of this exercise."

Cognitive Map Narrations

Because the interpretation of cognitive maps can be highly subjective, students were asked to provide a narrative of their cognitive maps to provide student voice and meaning. Eden (1992) discusses how interpretation can vary in cognitive map analysis tactics: "In some cases individuals are participatively involved in validating their own map, and in others the link between data collection and map is managed solely by the researcher or interventionist".

Survey

The third class assignment used for data collection was a fully open-ended, anonymous, free response survey. The goal of the survey was to collect data about the connection between the teacher, student, and technology in the course. Students were asked to respond freely to each prompt, creating insights about the hybrid learning experience. The survey was designed this way because research shows that participants feel less pressure from the research when answering open-ended questions (Reja et al., 2003).

Fieldnotes

The fourth data collection source was fieldnotes taken by the instructors, which were recorded weekly via a Google Form with specific prompt reflections. After each class, the instructors noted their responses. Instructor 1 was in the instructor of record for the course and was Co-PI and lead researcher of this study. Instructor 2, a graduate teaching assistant, was classified as other personnel within the research team.

Data Analysis Process and Software

The data analysis of this research employed explanation building, which is used in case studies to craft an explanation of the specific case being studied (Yin, 2009). This method is used to understand how or why something occurred, allowing an iteration about the case to be created (Yin, 2009). This research utilized Charmaz's Constant Comparative Analysis (CCA) method for data analysis, focusing on the joint creation of knowledge: a development that occurs from the researcher and the participants (Fram, 2013). Additionally, this study used hermeneutic (interpretive) phenomenology, which aims to identify the meanings behind human experiences (Katsirikou and Lin, 2017). Each method will be further explained subsequently here.

CCA is a repetitious process: code, recode, and reduce. This starts by creating open and focused codes; it then moves to creating categories and recording for additional categories. Data emerges via comparison (Fram, 2013). This "compare and contrast" process leads to categories, thus connecting the data elements (Boeije, 2002).

Phenomenology is designed to provide knowledge about a phenomenon through reflective analysis; coding and analysis of qualitative data are organic. The goal behind the data analysis in this study was to glean insights

about the human experience in the hybrid agricultural communications course. Repeated rereading of the data was necessary in this process.

This study used open coding because it is noted as the best way to allow concepts to emerge (Katsirikou and Lin, 2017). The lead researcher analyzed each cognitive map, with intent to understand the map's purpose, elements, and emotions. From these, open codes were created. Next, the lead researcher's interpretation of the map was compared to the student's narration, gauging the unique interpretations; this created additional open codes. During this process, the lead researcher took notes about each map, noting those perceptions versus the student's. All survey responses were reviewed for repeated topics or themes, as well as outliers; open codes were created for these as they emerged.

The open codes were narrowed into focused codes by reviewing all of the data again: first within each individual data measure, and then across all four data measures. The data analysis utilized a qualitative software to aid the process. Once the data analysis was complete, a table was compiled (Table 1), noting the most common focus codes and their frequencies. Finally, using Yin's (2009) standards, a trustworthiness check occurred. Any student whose work was chosen for analysis was asked to review every element used for publication. Nineteen of twenty students responded, agreeing that the content included was acceptable.

Triangulation of the Data

Yin (2009) argues that there are four types of triangulation: data triangulation, investigator triangulation, theory triangulation, and methodological triangulation. When multiple sources are used, data triangulation is achieved (Yin, 2009). This study utilized four different data sources: cognitive maps, cognitive map narrations, surveys, and fieldnotes. All data collected from students occurred via an online course management system used to manage all courses at this university. Out of the four data collection sources, the first three were from students.

Investigator triangulation requires different evaluators (Yin, 2009), which was met in this study using two different instructors providing fieldnotes each week. Theory triangulation occurs when different theoretical perspectives are used within the same set of data (Yin, 2009). Experiential learning, complexity theory, and systems thinking were all used to examine student experiences represented in the data. Methodological triangulation happens when different methods are applied during data collection (Yin, 2009), which was attained with two different approaches to data analysis: Charmaz's Constant Comparative Analysis and hermeneutic phenomenology.

Results

Table 1 summarizes the iterative data analysis process. When read from the bottom up, it highlights the four data measures with the focus code quantities of each. These led to the related categories. The themes at the top of the chart were defined from the categories and focus codes.

Theme 1: Reflection on Student Experience of Learning

Because students were central in three of the data collections measures (cognitive maps, cognitive map narrations, and surveys), there was a constant reflection on the experience of learning. Each cognitive map drawing, narration, and survey answer provided insight into how each student experienced the course. When combined with the instructors' fieldnotes, which noted students' interactions with materials, there was a thorough understanding of the experiences of the students.

Cognitive Maps

Cognitive Map 30 immediately reflected upon the value of the face-to-face connection with a peer by saying, "Haley's in this class? Thank GOD," specifically noting that Haley's presence made class "bearable." Student 30 also reflected upon human connection at the mock job fair: "I was glad that I got to talk to like…the Associate Dean of the college because I knew she was a big deal." This details that personal connections with other humans, particularly those who were perceived as important, were meaningful to students. Overall, Student 30's map and narration highlighted all of the categories in Theme 1. Student 30 valued the importance of face-to-face interactions, an emotional connection to others, and implications for the future via professional development; therefore, the student's role was seen as one of an active participant in face-to-face activities that led to human connection.

Survey

Survey question 7 said, "How do you feel that the FACE-TO-FACE components of this course connect to each other in a meaningful way?" The responses noted varied benefits of the face-to-face meetings. As a whole, students defined face-to-face meetings as a space that aimed to "help make us better writers." Students specifically noted an appreciation for routine: "The in-class meetings are meaningful because it essentially caps off what we learned throughout the previous week. It allows us to ask questions we may have developed." Additionally, students built social and practical skills through collaborating with peers: Overall, these students valued face-to-face meetings for their diverse experiences. Comprehensively, these student responses defined the student's role as the identifier of the course's routine, especially regarding technology and course design, as well as a participant in peer collaboration.

Fieldnotes

Fieldnotes prompt 2 asked, "What specific means or strategies are they using to complete their work?" This prompt allowed instructors to note the differentiated methods used for learning.

The fieldnotes noted 23 different methods of learning summarized in the table below. Table 2 summarized all of the different learning methods identified by Instructor 1 and 2 in the course.

Table 2 highlights how many different methods of learning were used in the course. It is important to note that these methods are only from fieldnotes recorded after face-

Table 1. Progression from Focus Codes to Related Categories to Emerging Themes

Themes			
1. Reflection on Student Experience of Learning	2. Intentional Course Design	3. Dynamics Between Teacher and Student	
Related Categories			
• Emotional Connection • Noteworthy Course Content • Value of Face-to-Face Interaction • Implications for the Future • Different Methods of Learning	• Value of Face-to-Face Interaction • Online Learning • Teacher Relationship and Feedback • Blend of Online and Face-to-Face • Implications for the Future	• Student Growth • Learning Process • Value of Face-to-Face Interaction	
Data Measure Focus Code Counts			
1. Cognitive Maps	2. Cognitive Map Narrations	3. Fieldnotes	4. Survey
Course Content (18)	Course Content (31)	Students (68)	Online (67)
Emotion (10)	Emotion (28)	Engagement (29)	
Knowledge (19)	Knowledge (14)	Knowledge (21)	Hybrid Components Connect (35)
Grammar (17)	Grammar (19)	Grammar (23)	
Job Fair (25)	Job Fair (31)	Teacher (15)	Teacher (58)
Futuristic Thinking (10)	Futuristic Thinking (19)	Futuristic Thinking (6)	Futuristic Thinking (27)
Relationships (13)	Relationships (16)	Relationships (10)	
Ways to Learn (17)	Ways to Learn (3)	Physical environment (14)	
	Feedback (15)	Discussion (13)	Feedback (26)
	Face-to-face (28)	Questions (13)	Face-to-face (89)
	Grades/assessments (19)	Grades/assessments (24)	
	Technology (13)	Technology (7)	
		Groups (27)	
		Time (6)	

to-face meetings, so there were likely additional methods used in the online learning space. Regardless, this defines the teacher's role as a designer of diverse course materials with or without technology, aiming to help the student's role as a learner.

Theme 2: Intentional Course Design

Classified as hybrid course, students only came to class in a face-to-face setting for less than 50% of the time. Still, the instructor had significant control over the course design and implementation of the course content.

Cognitive Maps

Cognitive Map 29 was divided into two sections: "grammar" and "scary real-world stuff." Because this map used the words "scary real word stuff," it illustrates Student 29's concerned linking of course content and the real word. Each arm and example in Student 29's map showed deep content knowledge; each example noted an incredibly specific in-class example or phrasing used by the teacher. This was particularly noteworthy in the branches off of "scary real-world stuff" because the references to the professional writing documents each had key takeaways, explicitly mentioning "consistency," "confidence," "storyteller," and "be personal." These takeaways showed that she was consciously linking the course's content to her future career with specific memories. Overall, this map validated the importance of memorable course content connecting to students' futures. The student's role was to find personal connection with the course content, while the teacher's role was to design diverse methods to achieve this.

Survey

Survey question 6 asked, "How do you feel that the various ONLINE components of this course connect to each other in a meaningful way?" Students' comments about the connection in online components highlighted how students independently progress through online course content. Overall, consistency was noted as a benefit. One student noted the importance of schedule:

Table 2. A Summary of the Different Methodologies Utilized in the Face-to-Face Meetings of the Hybrid Learning Classroom

• Notes on computers or by hand	• Practice as a class and on computers
• Kahoot (online quiz game)	• Canvas quiz
• Direct instruction	• Worksheets
• Review quizzes	• Questions for the teacher
• Lecturing	• Discussion
• Peer Review	• Interviewing
• Talking to experts	• Oral reflections
• Examples	• Creating groups based on similar interests
• Group conversations	• Team work
• Group projects	• Homework
• Quiz	• Review of homework
• Drafts	

"I think that the online components connected with each other there was a similar schedule every week for assignments that were due. It was nice to know that every Sunday and Tuesday there were assignments due. This allowed me to fit these assignments in with assignments from my other classes a lot easier" (Anonymous Survey Response).

Overall, online course design was benefited by organization. The student's role was to understand how the teacher designed the trajectory of the course, specifically noting how technology affects the overall schedule and accessibility of content.

Fieldnotes

Fieldnotes prompt 5 asked, "What would I change to make today's class even better?" This prompt allowed the teacher a space to reflect on the day's class meeting, specifically giving the teacher a space to reflect upon intentional course design decisions.

Instructor 1, the designer and implementer of the course, provided the most reflection, all of which centered around the word "more." She noted a desire for more in the following areas: questions, engagement, communication, storytelling, examples, practice, space, and time. Instructor 1 also mentioned a desire for "more time to review the content" and "more practice as a class." These reflections gave her space to understand how to proceed with improved intentionality. On the contrary, Instructor 2 responded to this prompt with "not much." This showed that her TA perspective did not see as much room for intentional change with course decisions. The teacher's role was to continually monitor the course, noting areas to improve.

Theme 3: Dynamics Between Teacher and Students

Dynamics between the teacher and students are always important in an educational setting; however, when the paradigm of course meeting time is altered to be less than 50% of time face-to-face, this understandably can change these dynamics. Still, the data showed that the dynamics between the teacher and student were critical, even with a non-traditional meeting schedule.

Figure 2: Cognitive Map 9. This figure is a student-drawn cognitive map of two flowers being pollinated by a bee; the perspective is from underground roots up to the two blooms. The roots note foundational course materials in cursive words. A bee pollinates the flowers with the words "Dr. Carper" inside the bee's wings.

Cognitive Maps

Cognitive Map 9 (Figure 2) highlighted the student's artistic talent, demonstrating flower growth as a metaphor for student growth. Student 9's illustrations showed that she perceived the teacher as the biggest orchestrator of student growth. The bottom of the map notes "the roots," which represented the "basic stuff that is the backbone." Going up the map, the bulb was noted as "where everything is put together," leading to "beautiful flowers, which could be in the form of, you know, what our writing creates." The bee in the drawing represented the pollinator. "The bee above the flowers represents Dr. Carper," which was noted by the cursive letters within the bee's wings. Student 9 said, "Beautiful pieces of writing need help," so "The bees comes by, pollinate, you know, helps out the flowers, and then helps make, pretty much, you know, the things to go own." This map represented the importance of the teacher's role as the pollinator, meaning that the teacher was central in helping students grow. A teacher's role, as described by this student, was to help a student keep strong roots, grow

bulbs, and create beautiful flowers.

Survey

Survey question 10 asked, "In this course, how does the instructor engage with you to promote your learning?" Students' responses highlighted different ways in which the teacher could help students' learning processes.

Students regularly noted how much they appreciated feeling valued by a teacher who helped them grow in different ways, such as conversation, questions, feedback, or even email. One student noted the importance of feedback: "My instructor always makes sure to give each of us opportunities to ask questions one on one and always provides us with a great amount of feedback on our work." Students also noted the interactive course design, saying that "The instructor makes us ask questions, play Kahoot, and make sure we speak with both the TA and professor on our assignments before leaving."

Finally, students appreciated practical course content and well-defined expectations. Students appreciated knowing how course content would benefit them beyond the immediate class. Additionally, students benefited from clear expectations: "Our instructor created announcements that explained what was expected of us each week." Overall, student growth was helped through effective communication. The student's role was to understand how the teacher uses technology to design the course's communication.

Fieldnotes

No specific fieldnotes prompt asked about student growth; however, it was central to many responses. Instructor 1 reflected on how to correct after struggle: "Last week's quizzes and homework did not go well, so we started with a thorough review of misconceptions." Another day, Instructor 1 made an in-class decision to affect student growth: "We then started the notes for this week, and due to the low grades, I made students close their laptops to have them paying attention." While it was often noted how negative effects prompted changes, there were also reflections about positive influences to student growth: "Students love when I tell stories" and "Students like visuals." Overall, weekly reflection allowed for a log of what worked and what did not work, allowing the teacher a time to react accordingly.

Hybrid Learning: The Interaction of the Student, Teacher, and Technology

The studied defined three themes: Reflection on Student Experience of Learning, Intentional Course Design, and Dynamics Between Teacher and Students; these themes, as well as the teacher's decision-making role, were illustrated in the conceptual model below. Each of the three components (the teacher, student, and technology) anchor each of the themes, defining how each component and theme connected. While all three components were found to have value, it was the teacher's role in decision-making that had the most influence in the system of hybrid learning; all underlined words represented a theme affected by the teacher's decision-making.

The teacher made many decisions about the delivery of the course content in a hybrid learning setting. In this study, the teacher used the face-to-face meetings as a time to build relationships and to provide feedback; this was noted in all three themes. The teacher also included practical course content to prepare students for jobs, highlighting implications for the future. Additionally, the teacher used different methods in forming the blend of the online and face-to-face components, thus affecting the online learning and the value of the face-to-face interactions. Overall, the teacher's role in course design and delivery affected all three components.

Theme 1 of Reflection on Student Experience of Learning was significant for the student component of the course. An emotional connection to the course content affected the students' experiences. This was highlighted via noteworthy course content, which is where students reflected upon what they most appreciated. The connection with the teachers and peers was also a key factor in the student experience, particularly in the face-to-face meetings. Students also experienced the course content through many different methods. These varied experiences allowed students to relate the course to implications for the future, connecting how the course's design and content was to guide them in their future endeavors.

Theme 2 of Intentional Course Design most influenced the teacher and technology, which was logical because the teacher's course design is impacted by technology due to the hybrid delivery. Technology was understandably used the most in the online learning space; however, it was used less in the face-to-face setting due to the teacher's influence on meaningful human connection. Accordingly, the teacher used both practical, face-to-face experiences and technology to influence students' futures.

Theme 3 of Dynamics Between Teacher and Students specifically emphasized the roles of teacher and student. Out of the three components, the link between the teacher and the students was key. The connection between the teacher and student cultivated the student growth and learning process; these elements were influenced by meaningful connection and regular feedback. While the connections and feedback occurred in both the online and face-to-face settings, the data showed that the face-to-face space was most influential because of how the teacher emphasized furthering these positive dynamics.

Overall, this conceptual model (Figure 3) defines the teacher and student as the primary actors in the hybrid learning system; however, it also stresses how the teacher's decision-making can also influence the system's operation. Even though technology is not noted regularly, it was still seen as a key component because it was central to the online learning space and to the overall blend of the two delivery modalities.

Discussion and Conclusions

Based on the results, the discussion and conclusions were organized by research question.

Research Question 1: What is the Teacher's Role in The System of Hybrid Learning?

Designer of Blended Curriculum

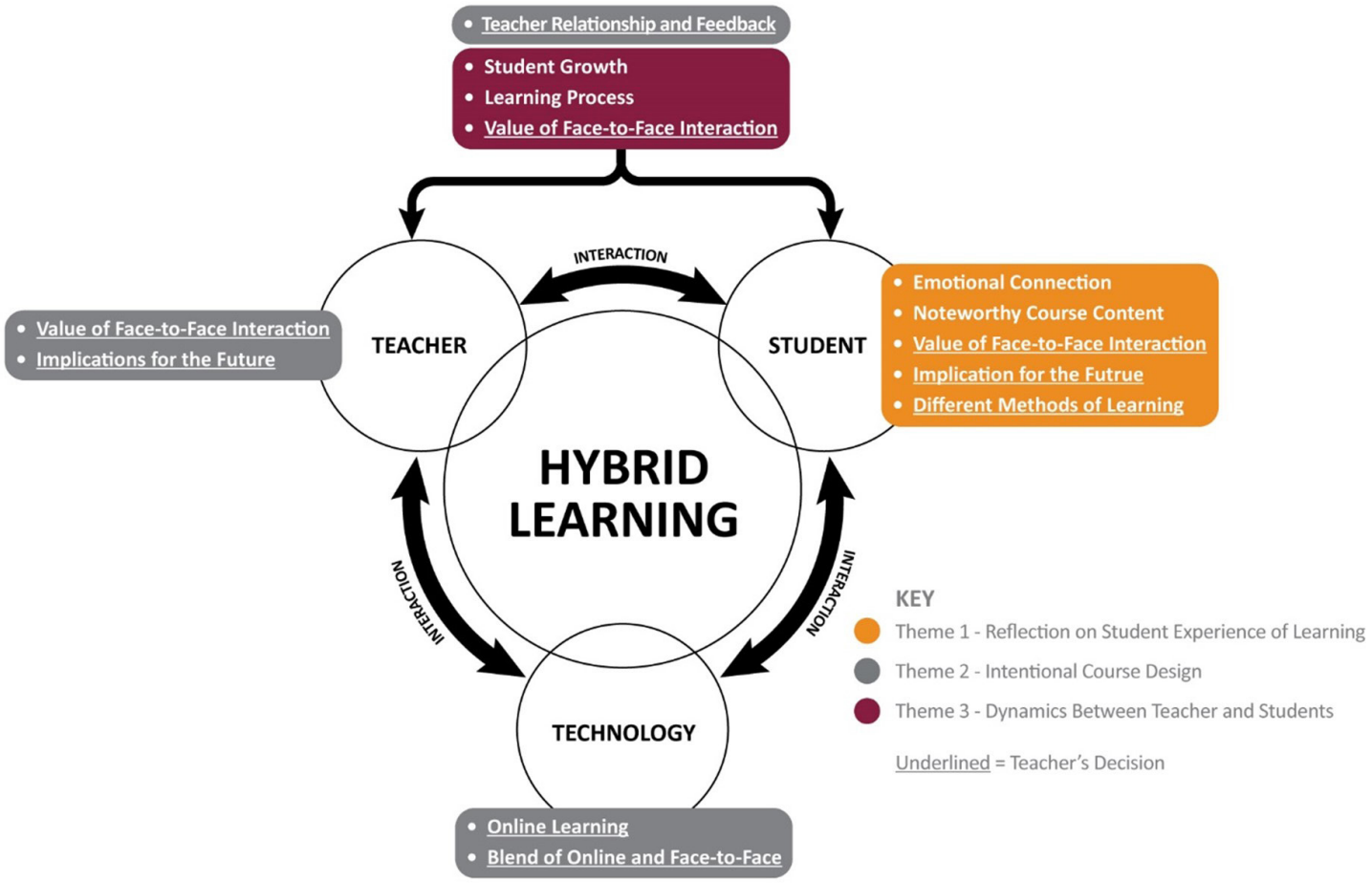

Figure 3: Conceptual Model Showing Study's Findings. This figure summarizes the study's findings, noting the interactions between the student, teacher, and technology within the system of hybrid learning. These components of the system are then connected to the study's three themes, as well as how the teacher's decisions affected the system.

The data from this case study showed that the specific blending of the online and face-to-face components of the course was effective. While technology was rarely mentioned, it was still a large portion of the course. Students used their laptops in all nearly all capacities of the course, interacting with materials via the online course management system, for digital materials in all facets of the class. Ahmed (2010) argues that a teacher's ability to effectively use a learning management system and e-learning technologies is critical to the overall student experience. The results of the study support this same conclusion, as the teacher's blend of the online components was perceived by all students as something that was done well, showing that teacher preparedness is critical to designing blended curriculum. Still, students found the face-to-face course meetings to be the most influential. Students most appreciated interaction with their peers and the teacher as ways to communicate about the learning process, which could occur via different practices: peer review, conversation, or questions. These practices reflected the teacher's pedagogical approach. Voegele (2012) discusses the importance of a teacher's pedagogy in a hybrid learning space, saying that is requires conscious changes in pedagogical approaches. As such, this has large implications for hybrid learning course design. The facilitation of student learning is different in online and face-to-face spaces, but a teacher designing and implementing the course must be aware of how to best blend and serve online knowledge formation with in-class application, which can require changes to pedagogy.

Because the data unequivocally showed a preference for face-to-face learning, a teacher's role as the designer of blended curriculum requires a keen awareness of the impact of the face-to-face meetings, as well as pedagogical approaches to make them effective. This is a trial-and-error process requiring constant reflection; it allows the teacher to discover the best uses of the online and face-to-face spaces.

Curator of Positive Teacher and Student Dynamics

Students in this study consistently reflected upon the benefits of a positive learning environment that encouraged communication with the teacher. Part of the teacher's role as the designer of the blended curriculum played directly into the teacher's role as a curator of the positive teacher and student dynamics both inside and outside of the classroom. The most common positive reflection from students about this dynamic regarded the perceived value of one-on-one interactions, such as conversation, questions, emails, and peer review. Jess et al. (2011) state that "…learning is a collaborative and constructivist endeavour involving students, teachers, and their institutions" (. Mercer-Mapstone et al. (2017) argue that reciprocity between

students and teachers is key because it creates a shared educational experience. As such, it is clear that the teacher should encourage collaboration in the learning process.

Dewey's (1938) philosophy on the human experience also encourages collaboration in the classroom: "All human experience is ultimately social: that it involves contact and communication." As stated previously, the data showed a clear preference for contact via face-to-face interaction, but it also showed an appreciation for regular communication with the teacher. This gives the teacher a large role in developing a community in the classroom. Dewey (1938) also says, "Development of experience comes about through interaction means that education is essentially a social process. This quality is realized in the degree in which individuals form a community group". Social interaction is critical in the learning process; it is the teacher's job to curate this because it best creates an environment conducive to learning. This finding is not new to educational research because the importance of the teacher-student relationship has always been noted, but it is important for hybrid learning teachers to continue with these practices to foster positive dynamics. Within higher education specifically, Hagenauer and Volet (2014) discovered that positive teacher-student relationships affected success in learning, especially regarding "course satisfaction, retention, learning approaches and achievement". These same factors were successful in this course. The easiest way to create positive student and teacher dynamics is for the teacher to commit to practices like greeting students by name as they enter, talking with each student each class, and requiring questions as students leave. These seemingly small gestures create meaningful interactions.

Guider of Face-To-Face and Online Learning

Stereotypically, the teacher is the guider of learning in any class; however, online learning promotes a certain amount of independence in students' learning process, thus challenging this perception. In hybrid learning, where both online and face-to-face learning occurs, the role of the teacher could be somewhat misconstrued; however, the results of this study showed the students still largely appreciated the teacher's guidance in both parts of the course.

No students discussed or noted any negative elements associated with the organization of the online materials of the course. This can be attributed to the teacher's ability to understand and use the learning management system effectively, which Ahmed (2010) argues is necessary for e-learning. Students also noted the value of clear expectations; therefore, the organization and value of online content provides guidance to students regarding how to go about more independent learning. Because of this, the teacher was still providing guidance through technology, but the guidance was occurring in a hands-off manner due to effective course management. Students overwhelmingly preferred the face-to-face class meetings. One of the most common reasons for this was the ability to apply skills learned online while being able to ask questions of the teacher. In this capacity, the teacher was the guider of learning via regular conversation and observation. Further, in this setting, the teacher had the ability to observe all learning. Fenwick (2003) argues that educators need to monitor a system's behavior to know how to guide it. This is especially true with a face-to-face classroom space, where the teacher becomes the interpreter, noisemaker, and mapmaker based on the system's behavior, but it can also be true in the online learning space (Fenwick, 2003). In the online space, the teacher must interpret the learning management design, flow, grading, and feedback based on the online system's behavior. This requires constant reflection from the teacher, noting what is and is not working, making adjustments in real time to improve any issues with the online element of the course.

Research Question 2: What is the Student's Role in The System of Hybrid Learning?

Participant in Relationships with Peers and the Teacher

As the person experiencing learning, the data showed that students appreciated being able to clarify and better understand elements of the course through relationships with both peers and the teacher. These relationships allowed students to learn through asking questions, discussing problems, and comparing work. Further, this study showed that the face-to-face meetings were most helpful to students in their learning process because of the relationships they built. Peer relationships were noted less often than the value of the teacher relationship, but one of the most commonly noted positive attributes of relationships with peers was via peer review. This process allowed students to work with other students of different majors to give feedback on written work. Students appreciated meeting new people, seeing different styles of work, and receiving diverse feedback.

Further, as noted previously, students also appreciated being able to communicate with the teacher about feedback, questions, or concerns. Gillespie (2002) studied the value of the connection between students and teachers, finding that it is critical in supporting the learning process, noting its cyclical nature. Fortunately, the data from this study showed that the positive relationship between the teacher and students was one that reinforced positive feedback and interactions, allowing for a beneficial overall learning experience. One easy way to achieve this is to have a brief, one-on-one interaction with each student. Look at the document, give praise about what looks good, and provide feedback for how to improve.

Learner in Face-To-Face and Online Learning Spaces

Students participated in both face-to-face and online learning spaces of the course. Students preferred face-to-face meetings due to the ability to interact with peers and the teacher; however, online was still mostly seen as positive. Among the challenges with the online space were motivation factors. Students found it easier to procrastinate or forget without a face-to-face meeting. Further, students found online learning to require more independence, which created conflicting opinions. While some students absolutely loved those aspects due to the constant accessibility, others saw them as contributing to forgetfulness. In contrast, students preferred the predictability of the face-to-face meetings. Again, this was largely due to the community

of the classroom through relationships with peers and the teacher because they could get clarification about any online material.

Knoblock (2003) said that "Experiential learning is likely to still be relevant to the needs of teachers and students in the 21st century because it is aligned with the psychological principles that result in significant and meaningful learning." Findings showed significant, meaningful learning occurred in both spaces due to the course design's student experience focus. This requires creating an experiential learning classroom where students are encouraged to talk with peers and the teacher to draft and finalize work.

Author of Practical Materials

Knobloch (2003) says that "Every learning opportunity should begin with the question, 'How will this help me as a successful adult?'" These sentiments were used to design and implement this agricultural communication writing course; the results showed that students appreciated this. Not only did they correctly define the course's purpose in these applications, but they also could accurately define the long-term goals of the course for job preparation. This showed that students connected creation of writing with future opportunities. This requires the teacher to think about their course content beyond the immediate; instead, ask this: how will this assignment serve students in their careers?

Research Question 3: What's Technology's Role in the System of Hybrid Learning?

Physical Classroom

The physical classroom space has always had a large influence on learning. In a review of literature, Hill and Epps (2010) noted three key elements of a classroom: light, noise, and climate. The results of this study showed that the original classroom space was problematic; students had negative feelings about the space. Specifically, all three of those elements were negatively affecting learning in some way. The projector's light was not bright enough, air conditioning was not working, and because of that, the outside noise could be heard because windows had to be opened. Collectively, these were all failed technologies.

Hill and Epps (2010) highlight the structure of a typical classroom today, noting popular technological and audiovisual equipment. One of the most common uses in today's classrooms is a projector. In the original classroom for the course, the failing projector was the biggest issue affecting student learning. The bulb was dying, making the screen very dull and hard to read; many students could not see. As such, this one piece of technology was drastically affecting the classroom experience. Interestingly, due to the hybrid learning course design, students could pull up the exact notes being projected on the screen on their computers, but they still preferred the face-to-face interaction of going over the notes from the projector.

Hill and Epps (2010) also discuss the differences in classroom renovations at the university level, noting that it often is done as funds become available; thus, classrooms can vary. This was the case with the original classroom. It was one that had not been renovated, whereas the new classroom was a recently renovated space. The dichotomy between the two was noted in the data, showing a clear preference for the newer space. The newer space had multiple screens for students to view, as opposed to just the one fixed screen at the front of the classroom. Tondeur et al. (2015) argue that the arrangement of the classroom, especially regarding the positioning of technology, is important. The results from this study confirmed this. This requires teachers to explore their classroom options, pushing for the best physical classroom space.

Online Learning

The online learning space was defined as one that guided independent learning; further, it provided constant accessibility of materials. The feelings regarding the online environment were mixed. While all students found the blend of the online and face-to-face materials to be effective, not all students preferred the online learning space. Much of this was connected to independence. Some students liked the independence provided by time and method of learning; other students felt this allowed them to procrastinate or forget due dates. Rovai and Jordan (2004) confirmed this, arguing that students who have comfort with individual exploration of learning are more successful in an online learning space. It can be assumed that opposite would also be true. Moreover, Derwin (2009) noted "no significant difference" in the quality of online and face-to-face courses. The findings of this study were somewhat blended, much like the course itself. The online course content was seen as well-designed and accessible, but there was a clear preference for the face-to-face meetings of the course, showing a difference in preference of delivery mode. While this may not speak exactly to the overall quality of the course, it did show that students preferred the qualities of the face-to-face meetings. Teachers should design the blend with the interaction emphasis in the the face-to-face meetings, knowing this is where students learn best.

Communication

In this course, technology was used in many different ways, but students specifically noted communication via technology as a positive element. Technology allowed for constant communication inside and outside of the traditional confines of the course. For example, students appreciated the ability to frequently email the teacher with questions. Additionally, students appreciated written feedback via Canvas, the course management system; they also appreciated the organization of course content, feeling that it was well-blended in the online space. Students could access written, online feedback from the teacher to discuss during course meetings; they could also submit written feedback to each other via peer review documents during the face-to-face meetings. Technology also allowed for the organization and preservation of course materials, which aided overall communication. This requires teachers to specifically make time to monitor email and LMS notifications.

Participation

One of the most striking parts of the data from this study was the overall lack of acknowledgment of technology. While

technology was central to every element of the course, it was hardly ever mentioned. The process of learning was discussed in depth, and this process was completely reliant upon technology to occur, but technology itself was rarely recognized. This was particularly interesting because technology was required for participation in the course. Henderson et al. (2015) studied how students engaged with technology on an everyday basis, noting that students used technology for access to the internet, which provided library resources and the learning management system. In this course, access to the internet was critical, as half of the course was completely online; the other half, while face-to-face, required computer use and internet access during class meetings.

These findings highlighted the presence of digital natives within this course. The student population in the course was what Bennett et al. (2008) would define as a group of digital natives, who are people who have had technology immersion throughout their lives, giving them learning preferences that deviate from traditional education structures. Because these students grew around technology, they were highly familiar and comfortable with it, especially in education (Bennett et al., 2008). As such, perhaps the reason that technology was not discussed specifically was simply because it is now seen as an inherent element of learning in higher education, so its presence was no longer new or different, instead making it the norm. More interesting, though, is what Prensky (2010) argued about digital natives: they do enjoy technology, but what they appreciate the most in an academic space is respect from teachers. The findings of this study support that there was a strong relationship among the students and the teacher, which could be why participation in the course was seen more through relationships than through the use of technology.

Summary

This single embedded case study employed systems thinking and complexity theory to investigate hybrid learning in an agricultural communications course. Data was collected in four ways: cognitive maps, cognitive map narrations, instructors' fieldnotes, and a survey. The research questions explored the roles of the teacher, the student, and technology within the system of hybrid learning. This study concluded that all three of the system's components—the teacher, the student, and technology—had diverse impacts on teaching and learning. The teacher's role was central in designing and implementing course materials, curating positive relationships with students, and guiding the overall learning process. The student's role was critical in experiencing the system of hybrid learning as a participant in positive relationships with the teacher and their peers, a learner in the face-to-face and online spaces, and an author of practical materials. Technology played vital roles regarding the physical classroom, communication, online learning, and overall participation. Combined, these roles help to craft the overall hybrid learning experience.

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