Future Agriculture Faculty Experiences Using Digital Assessment Tools in an Experimental Classroom

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Abstract

The capacity for effective utilization of technology is increasing in importance in the scholarship of teaching and learning practice in agricultural education. There is scarce literature exploring students' perceptions of the use of digital assessment tools (DATs). This study aimed to explore the experiences and perceptions of graduate students enrolled in a teaching and learning course towards DATs while investigating how the experimental active learning space impacted the way participants experienced DATs. Participants were divided into two focus groups, which, due to the COVID-19 pandemic, were conducted via Zoom. The research used phenomenology as the qualitative approach to answer the research questions. Thematic Analysis was utilized as the method of data analysis. Participants experienced DATs as new opportunities to enhance their assessment practice in educational settings. While recognizing the advantages of DATs, participants perceived new challenges in implementing them, particularly concerns over technology requirements. Participants reported a mixed educational experience in the new classroom. Whereas some participants felt the space was overwhelming and confusing, some students considered that the experimental classroom features made the space more collaborative. Finally, utilizing DATs in an experimental classroom was experienced as a new and enhanced way to adopt assessment tools.

Keywords: Preparing the Future Professoriate, Assessment, Active Learning, Digital Fluency

Internet access and smartphone ownership are growing rapidly around the world. In the early 2000s, half of the U.S adult population was able to connect to the internet while in 2019, 90% of our population could connect to the internet (Pew Research Center, 2019). Recent data exploring higher education students are even more promising. The 15th EDUCAUSE Center for Analysis and Research (ECAR) study of undergraduate students and information technology (IT), one of the largest and longest-running endeavors exploring IT adoption in higher education, confirmed that 99% of students have access to laptops, desktops, or smartphones (Galanek et al., 2018). The adoption of technology has also been evident in educational institutions. Wireless access in classrooms, online library resources, courses and programs, and the use of learning management systems reflect the transition into the information age. Almost two decades ago, the Campus Computer Project, currently the biggest continuing study on the role of computing, eLearning, and IT in America higher education, reported big gains in the proportion of institutions that activated mobile apps and IT services for their students (Green, 2012). In 2019, as the Campus Computer Project survey suggests, IT is ubiquitous across almost everything related to instruction, recruitment, and other campus services offered to students (Green, 2019). Naturally, the global pandemic of COVID-19 accelerated educational IT growth even more.

Digital technologies can support learners and educators in meeting a wide range of goals. Mobile devices allow students and professors to search vast amounts of information; emails permit rapid communication; learning management systems administer educational courses; and e-learning facilitates synchronous and asynchronous learning are examples of the advantages that innovations can provide in delivering educational programs and achieving desired learning outcomes. The practice of assessing learning, too, has been enhanced by new methods of formative and summative assessments relying in digital tools, hereafter referred to as digital assessment tools (DATs).

Formative assessment is viewed by researchers, educators, and policy makers as a powerful means towards student learning (Cizek et al., 2019; National Academies of Sciences Engineering and Medicine, 2018). An appropriate formative assessment gives students the feedback necessary to evaluate the responses provided and then to make adjustments to strategies, knowledge, or beliefs (Bangert-Drowns et al., 1991). Angelo and Cross (1993) in their seminal work in classroom assessment defined the purpose of formative assessment, “to improve the quality of student learning, not to provide evidence for evaluating or grading students;... [they] are almost never graded and are almost always anonymous” (Angelo & Cross, 1993, p.5). Angelo and Cross provide several examples of formative assessment, including Classroom Opinion Polls to assess students’ awareness of attitudes and values, Application Cards for assessing skill in application and performance, Focused Listing for assessing prior knowledge, recall, and understanding and many more.

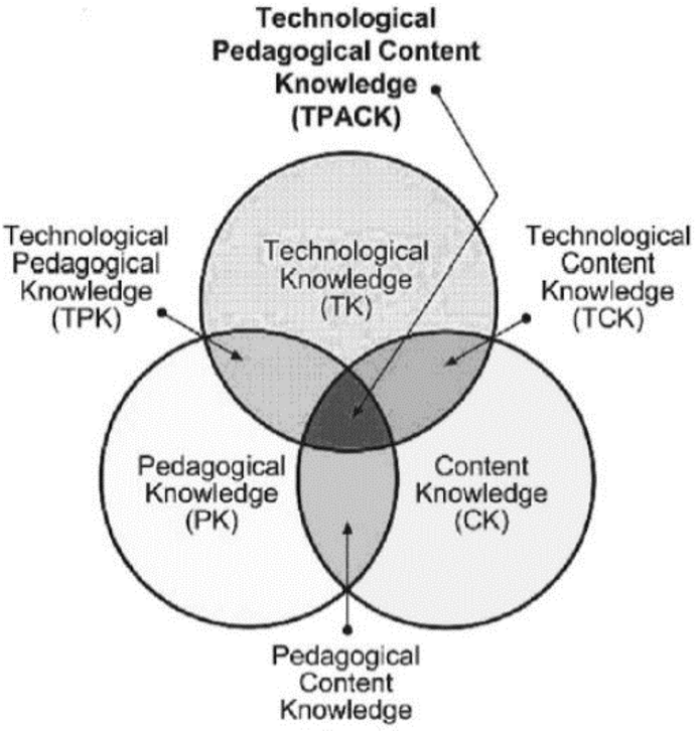
Regarding the effectiveness of assessing learning, studies (van der Kleij et al., 2011) have demonstrated the benefits of DATs over traditional paper and pencil approaches that are particularly relevant in college courses enrolling a large number of students. DATs provide higher test efficiency, more timely feedback, and automated scoring. DATs can facilitate more elaborated and individualized feedback, which has been proven to lead to higher learning outcomes compared with simple feedback regarding the correctness of the answer (van der Kleij et al., 2015; Wang, et al, 2019). Finally, DATs permit the implementation of game-based learning, which has been shown to motivate students to study (Ismail et al., 2019) and has been proposed to be incorporated into pedagogical practices without fear of decreasing student learning and achievement (Bunch et al., 2014). The numerous assessment tools available in the market intends to cater to all tastes. Dyer (2019) introduced 75 digital tools and apps educators can use to support formative assessment. Importantly, the design of many mobile applications that can be adapted to educators’ and learners’ characteristics may have positive effects on the learning process (National Academies of Sciences Engineering and Medicine, 2018).

However, new technologies add new demands on educators. Promoting adoption of digital capabilities that require technology integration in instructors’ classrooms is a complex challenge (Falloon, 2020). Falloon (2020) reported a diversity of frameworks for digital competency development such as SAMR (substitution, augmentation, modification, redefinition) (Puentedura, 2014), the UNESCO ICT (UNESCO, 2011), TPACK (technological, pedagogical and content knowledge) (Mishra & Koehler, 2006), among others, that have been utilized in educator development with technology. As an illustration in agricultural sciences education, Vickrey, Golick, & Stains (2018) suggested the use of the TPACK framework as a guide for researchers studying the integration of technology in postsecondary courses (Figure 1).

Despite the diversity of approaches, Falloon (2020) argued the need to expand the understanding of the competencies required to support students to use innovations. He introduced a new conceptual framework suggesting an expanded view of teacher digital competence (TDC). Built upon the three pillars of the TPACK framework (technological knowledge, pedagogical knowledge, and content knowledge), the TDC framework introduces two new sets of competencies essential to develop digital capabilities among teacher education students. The first set of competencies, located in the left flank of the core competencies (Figure 2), are the personal-ethical competencies. According to (Falloon, 2020, p.12) this set of competencies highlights the importance of understanding what it means to be a good “digital citizen,” considering the impacts of new technologies on society and its environment. The second competencies, located in the opposite direction, are the personal-professional competencies. This set of competencies represent operational competencies that “are essential for assessing the value and worth of participating in online environments and communities,

Figure 1.

Technological, Pedagogical, and Content Knowledge (TPACK) Model (Koehler & Mishra, 2009)



such as professional networks, without leaving behind the commitment to continuous professional learning." (Falloon, 2020, p.13).

The effective implementation of digital technology for learning is fundamental to obtain the expected outcomes. According to the National Academies of Sciences Engineering and Medicine (2018) many factors can affect the impact of a technology when it is used on a large scale, including the characteristics of learners, the sociocultural context, the nature of the affordances the technology provides, the curriculum and materials to be used for learning, the implementation fidelity of technology, and the involvement of instructors and learners in the implementation process. Educators' perceptions of the use of technology in the classroom have also been proposed as an important factor that determines educators' intentions to change their practices (Pierce & Ball, 2009) and the consecutive achievement of expected outcomes (Domingo & Garganté, 2016). Comparatively, Yan et al. (2021) found that educators' view on formative assessment's value was a major factor influencing their intentions to adopt such practice.

Identifying and overcoming the challenges limiting the effective implementation of education technology and assessment is high on higher education agendas. The 2017 Horizon Report positioned Ed Tech adoption as a long-term trend of five or more years-and, specifically, growing focus on measuring learning as a mid-term trend that should be addressed in 2020-2022 (Becker et al., 2017). Furthermore, technology is at the heart of the scholarship of teaching and learning practice in agricultural education. The 2016-2020 American Association for Agricultural Education national research agenda highlighted that "Understanding how educational technologies in the classroom impact the teaching and learning process can help agricultural educators better contribute to growth and sustainability of agricultural systems in the future." (Linder et al., 2016, p. 23) However, there is scarce literature that focuses on exploring future educators' perceptions of the use of DATs and experimental classrooms in agricultural education settings. This information is particularly relevant due to the increasing technology available to graduate students that will become future educators.

Aligning with the literature (Talbert & Mor-Avi, 2019) and trends in higher education, the creation and expansion of available active learning spaces or classrooms has been a priority for the past five years at The Pennsylvania State University. Active learning classrooms are learning spaces designed to maximize the practice of active learning strategies, which include DATs. Active learning is broadly defined to include any teaching method involving learners actively engaging on learning tasks and reflecting on learning beyond watching, listening, and taking notes (Bonwell & Eison, 1991). A meta-analysis by Freeman et al. (2014) evidenced connections between active learning teaching methods and much lower failure rates in university-level Science, Technology, Engineering and Math (STEM) course as well as increasing engagements across disciplines, demographics, and grade levels.

Purpose and Research Questions

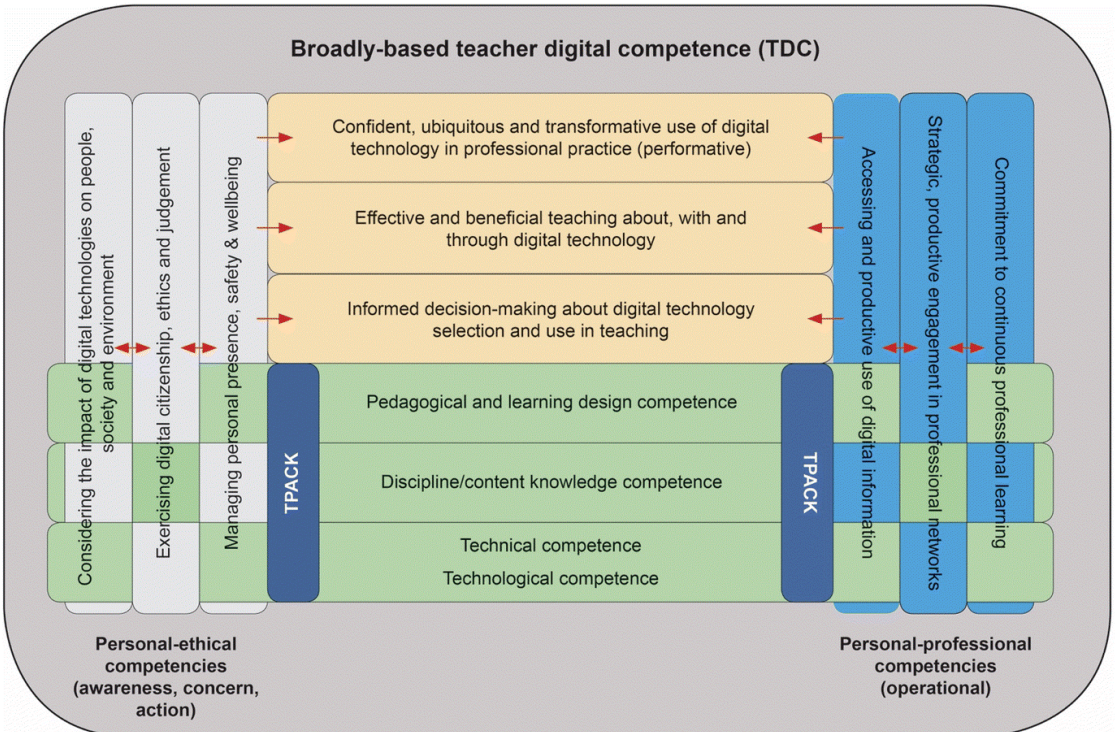
The purpose of this study was to explore the perceptions of graduate students enrolled in a teaching and learning in agricultural sciences course offered by the College of Agricultural Sciences towards DATs. The general research question was: What is it like for future agriculture educators to use DATs in an experimental classroom? The two specific objectives that guided this study were to: (1) examine how do participants perceive DATs, and (2) investigate how learning spaces impact the way participants experience DATs.

Methods

Phenomenology was the method used to answer the research question. As Van Manen (2017) and Patton (2002) recognized, the term "phenomenology" occurs in a confusing abundance of qualitative studies as the terminology has taken several forms (i.e., phenomenological philosophy; phenomenological analysis), a number of terminologies (i.e., transcendental, descriptive, hermeneutic, and interpretive phenomenology), and because it encompasses varying traditions. As a methodology, phenomenology is thought of in this paper as a theoretically-informed framework rather than a technical procedure applied to conduct research, considered here as a method (McGregor & Murnane, 2010). Phenomenology asks for "the meaning, structure, and essence of the lived experience of this phenomenon for this person or group of people" (Patton, 2002, p.104). In this research, the "phenomenon" is the use of DATs in an experimental classroom while "the group of people" is

Figure 2.

Teacher Digital Competence Framework (TDC) (Falloon, 2020)



comprised of the graduate students enrolled in the course.

We used a descriptive (transcendental) phenomenological approach, rooted in Husserl's (1980) ideas about phenomenology as a rigorous science. Unlike interpretive approaches to doing phenomenology, in which the researcher interprets the narrative provided by the participants according to the interpreter's own lived experience, descriptive phenomenology aims to describe the essential structure of the phenomenon in a manner that is free of interpretation (Bradbury-Jones et al., 2009). For this reason, in descriptive phenomenology, as it is in this case, the researchers' biases and preconceptions are neutralized so as not to influence the object of the study (Lopez & Willis, 2004). We will return to this later in the data analysis section.

The experimental classroom that served as the instructional space was in the Agricultural Sciences and Industries (ASI) building room 110 (Figure 3). As part of The Pennsylvania State University's effort to transform education, the experimental classroom opened in fall of 2019 in the ASI building. ASI 110 offers a collaborative learning environment designed to build off prior research of teaching and learning in experimental classrooms that has shown a preference for writing surfaces that promote collaborative and sharable work. ASI 110 provides faculty and researchers an opportunity to further explore nuances in writable surface options. The space also features wireless content-sharing capabilities, allowing both instructor and students to share and project content via digital projection and audio technology situated around the perimeter. ASI 110 can accommodate up to 30 students at a time and includes mobile tables and chairs that support multiple configurations. The combination of flexibility and technology

Figure 3.

Picture of ASI 110 Active Learning Classroom.

in a discipline-agnostic space creates opportunities for research that will inform future learning space design.

The course the participants were enrolled in as a graduate level course focused on teaching and learning in the agricultural sciences. The course had five course goals including: (1) Develop aligned instructional materials appropriate to specific agricultural disciplines, (2) Successfully apply evidence-based teaching practices, (3) Assess established instructional outcomes, (4) Design instruction to support the unique diversity of learners, and (5) Engage in the scholarship of teaching and learning regarding issues facing post-secondary instruction in agriculture. The course met once per week for three hours fifteen times through the semester. A part of the

course experiences and in addition to participation in the course community and related professional development experiences to developing faculty, students were evaluated on the following outputs: (a) a syllabus, (b) a lesson plan, (c) reflection on an authentic teaching experience, (d) development of a scholarship of teaching and learning proposal or instructor pedagogical reference guide, and (e) a teaching philosophy statement.

Sixteen of the 17 students enrolled in the course participated in the study. The participants were from 10 different nationalities. Their majors represented three departments within the College: Agricultural and Biological Engineering, Ecosystem Science and Management, and Agricultural Economics, Sociology, and Education. To participants, this was their first time experiencing the experimental classroom (EC), since the learning space had been opened in the second semester of 2019 before COVID-19.

During every class session in the first half of the 2020 Spring semester, the students were exposed to a digital assessment tool (DAT) that was used to assess their understanding of the topics covered during each previous session. A total of six DATs were covered during the semester. Those DATs were: (1) Kahoot, (2) GradeCam, (3) Mentimeter (the quiz option), (4) Canvas (the quiz option), (5) Socrative, and (6) Google Forms (quiz option). For each DAT, questions were derived from the pre-assigned reading for the current class session from the course test of *How Learning Works: Seven Research-Based Principles for Smart Teaching* (Ambrose, et al, 2010) as well as important class discussion points from the previous class session. Due to the COVID-19 pandemic, students experienced the DATs from their remote locations during the course's remaining sessions. Table 1 indicates where each DAT was experienced. Four DATs were used by the students in the experimental classroom and at the students' remote environments. These tools were: Mentimeter, Socrative, Google Form quiz, and Canvas quiz; the remaining ones were only experienced in the experimental classroom. Table 2 describes the characteristics of the previous four DATs covered twice in the semester using some of Anstey & Watson's (2018) rubric categories for evaluating e-learning tools in higher education.

Data Collection

Two focus groups were conducted with a total of 16 graduate students, eight per group. The students met the study's inclusion criteria as they were older than 18 and were enrolled in a class in an experimental classroom. The method utilized for data collection was modified due to the COVID-19 pandemic. The focus groups were conducted online via Zoom, the platform used to record the sessions and transcribe them verbatim. The data were later cleaned by using both the transcripts and the audio recordings. The Pennsylvania State University Institutional Review Board approved the study protocol before data collection.

Two concurrent focus group sessions were conducted as part of a final class session focused on course reflection. They were moderated by two of the authors, both instructors in the course but neither the PI on the study. A moderator's guide (Figure 4) was provided to each of the focus group facilitators. The document was used to help the moderators keep track of the 50-minute session. The content of the guide included: the research goals, a timing guide, an introduction in which the consent form and the ground rules were described, a question guide, phrases aimed to probe ideas and encourage participants to talk, and a concluding message. Questions were sequenced using Patton's (2002) suggestions of beginning an interview with questions about behaviors and activities, followed by opinions and feelings.

Due to the circumstances dictated aby the covid19 pandemic, the focus group interviews in this research were facilitated with the use of moderators' guides in Zoom sessions. In focus groups, as pointed out by Patton (2002, p. 387): (1) the data collection is cost-effective, (2) interactions among participants could enhance data quality, (3) it is possible to identify the diversity of views as well as shared ideas, and (4) this type of interview tends to be enjoyable for participants. However, the use of focus groups has been described as "not compatible" in phenomenological studies. This method requires that a participant describe his/her essential experience; thus, a group method of data collection would contaminate such experience description (Webb & Kevern, 2001).

Table 1.

Digital Assessment Tools experienced by students

Digital Assessment Tool	Round 1 Location-Week	Round 2 Location-Week
Kahoot	Experimental Classroom-Week 2	-
GradeCam	Experimental Classroom-Week 3	-
Mentimeter-Quiz	Experimental Classroom-Week 4	Students' place-Week 11
Canvas-Quiz	Experimental Classroom-Week 5	Students' place-Week 12
Socrative	Experimental Classroom-Week 6	Students' place-Week 13
Google Forms-Quiz	Experimental Classroom-Week 8	Students' place-Week 14

Table 2.

Description of the DATs covered twice by students

Features	Canvas-Quiz	Google Forms-Quiz	Mentimeter-Quiz	Socrative
Accessibility				
Cost of use	Free	Free	Free Version (FV)	Free Version (FV)
User (Student) Account Required	Yes	No	No	No
Functionality				
Users	Large (2,000)	Large (5 Million cells)	Large (Unlimited)	FV: 50 students
Questions limits	Large (more than 1,000)	Large-(5 Million cells-applies for answers)	FV: Limited to 5 questions 150 characters	1,000 questions 65,000 characters
Number of question types	11	11	5	3
Question timer	No (timer to the entire quiz)	No	Yes	No
Shuffle questions	Yes	No	No	Yes
Import questions	Yes-Bank of questions	Yes-From other quizzes/ forms	No	Yes-From Excel or from another teacher
Answers characters	Large (more than 40,000 words)	32,000 characters Limited to 6 (FV)	70 characters limit	10,000 characters
Shuffle answers	Yes	Yes	No	Yes
Archiving, saving, and exporting data	Export Excel file (student and item analysis) Quiz Summary	Create Spreadsheet (individual and question analysis) Quiz summary	Image and PDF export (FV)	Export Excel file (student and question analysis) Quiz Summary
Technical				
Integration/embedding within a Learning Management System	Yes Link Quiz with course Assignments.	No	No	No
Additional Downloads Required	No	No	No	No
Access	iPhone and Android App Web browser	iPhone and Android App Web browser	iPhone and Android App Web browser	iPhone and Android App Web browser
Offline Access	Courses can be downloaded but quizzes are unavailable			
Social Presence				
Collaboration	Yes	No- Individual participation	No-Individual participation	Yes-Space Race option
Gamification	No	No	Yes	Yes
User Accountability	Yes	Yes	Yes	Yes
Teaching Presence				
Customization	Quiz types (graded or not)	Create various sections	Allows for creation of content presentations	Exit Ticket: quick check exercise at the end of class
Collection of Learning Analytics	Survey types (graded or not)	Get email notifications for new responses	Leaderboard, Live polls, and Word clouds	Email

Figure 4.

Moderators Guide

Research goals

- Investigate how learning spaces impact the ways participants experienced digital assessment tools (DAT)
- Examine perceived ease of use of DATs
- Analyze perceived usefulness of DATs
- Describe participants' intention to implement DAT

Timing guide

- Introduction 5 minutes
  - Consent form
  - Ground rules
- Questions
  - *Experience with learning spaces and DAT* 10 minutes
  - *Perceived ease of use of DATs* 9 minutes
  - *Perceived usefulness of DATs* 9 minutes
  - *Participants' intention to implement DAT* 9 minutes
- Conclusion 3 minutes

Introduction (8 minutes)

Consent form

This is the link to the consent form: https://forms.gle/vu2QjAuiTemoPaeo7

The form works as the informed consent by asking the participants about their interest to participate in the study. It also provides a brief description of the research.

Ground rules

Thank you for joining our focus group discussion. I will be facilitating our discussion today. We are going to be talking about digital assessment tools. We want to hear about your experiences with it. Our session should last 40 minutes. Right now, I want to let you know a few things about what we're doing today.

- We will be recording the session
- There are no right or wrong answers; we want to hear your personal perspectives
- We want to hear from everyone, so don't be shy. On the other hand be considerate of others.
- No official breaks
- Only one person speaking at a time

Question Guide (37 minutes)

The proposed script includes the questions in the suggested order. Note that for some questions I'm including follow up questions when answers are ambiguous. Note that for some questions I am also providing some context. I highlighted in red the questions that we can avoid if we don't have enough time.

Experience with learning spaces and DAT (10 minutes)

1. Let's start talking about the space where we shared class half of the semester: the ASI 110 classroom. When you walked through the doors of ASI 110, what did you see?
   - Probe: What about the space (distribution), the materials?
2. When you were in ASI 110, what devices did you use for the accountability time? Was the same device you used while being at home?
3. What do you think about the way the design and affordances of the ASI 110 classroom impacted your experience with the DATs we covered?

Perceived ease of use of DATs (9 minutes)

4. Now that you have seen how to create a DAT, what do you think about the complexity of implementing DATs in classrooms?
   - Probe: Among the four DAT we covered twice in the course (Socrative, Canvas, Mentimeter, Google Quiz) which one do you think is easier to use? Why?

Perceived usefulness of DATs (9 minutes)

5. What do you believe are the relative advantages of a DAT? Think about the relative advantage as the degree to which a DAT is better than a traditional assessment tool it supersedes.
   - *Probe: What about the disadvantages of a DAT? What is your perceived usefulness of Socrative, Canvas, Mentimeter, Google Quiz?*

Figure 4 Cont.

Moderators Guide

Participants' intention to implement DAT (9 minutes)

6. Now think about yourself as a future teacher. How do you feel about implementing the 4 DATs as a teacher?
    - Probe: Is your intention to use DAT in a class you might teach in the future? Tell me more, if you will, about your experience on that

Other questions (if we have time)

7. How confident do you feel in your ability to use computers in the accomplishment of a task?
    - Probe: For instance, using a software package for data analysis, writing a mail merge letter using a word processor
8. When was the first time you used a DAT? Which assessment tool were you using before?
    - Probe: Which specific DAT did you use first?

Conclusion

Does anyone have anything else they want to add to our discussion today?

Thank you for your time and your support today. Remember that if you have any questions you can contact me.

Moderating the group: Some great ideas!

- Taskmaster:
    - Let's get back to the main point
    - I think we need to move on to the next question
- Encourager:
    - That's interesting
    - That's a great answer
- Probe: (see probing ideas for some questions above)
    - I wonder what the rest of you have to say about that.
    - One thing that I'm surprised no one has mentioned is ____. Does it matter or not?
- Clarifier
    - I recall that some of you mentioned something a little different earlier, and I wonder how things like ____ fit into the picture?
    - Can you tell me a little bit more about that so I'm clear on that

Other research, however, supports that focus groups and phenomenology can work effectively together (Bradbury-Jones et al., 2009; Tomkins & Eatough, 2010). Palmer et al. (2010) developed an interpretative phenomenological approach to focus group data; more recently, Phillips et al. (2018) shared methods for using interpretative phenomenological analysis with focus groups. While previous authors reported the use of group interviews in interpretive phenomenology, the use of focus groups in the descriptive approach has also been supported (Bradbury-Jones et al., 2009).

Coding and Data Analysis

"Phenomenology sets out to grasp these exclusively singular meaningful aspects of a phenomenon or event" (Van Manen, 2017, p. 777). In descriptive phenomenology, reality is considered objective and independent (Lopez & Willis, 2004). Therefore, becoming aware of personal bias and gaining clarity about preconceptions is critical. In phenomenological inquiry, the previous attitude shift is accomplished through the suspension of judgement known as epoche (Moustakas, 1994). Following epoche, the second step in phenomenological analysis is phenomenological reduction, in which the researchers hold the phenomenon up to identify the data in pure form (Moustakas, 1994). The researchers used thematic analysis (TA) using Braun & Clarke (2006) guidelines, in addition to the epoche and bracketing steps (Table 3). TA was chosen as the method of data analysis owing to its flexibility and simplicity. Researchers employed a five-phase coding process.

The first phase, familiarizing with the data, was done parallel with the bracketing step; to this end, both focus group datasets were read twice. In the second phase, the initial codes were generated for which five coding strategies were used: Descriptive; NVivo; Process; Emotion; and Values coding (Miles et al., 2014). Phase three consisted of searching for themes representing some level of patterned meaning within the data set. Finally, phases four and five were merged as one step in the present research, which means that the themes were reviewed and named simultaneously.

Results and Discussion

A total of four themes comprising 51 codes were created employing the software NVivo 12 Plus. The results have been organized based on the identified themes, which include: (1) opportunities of DATs, (2) challenges of DATs, (3) new experiences in the EC, and (4) new enhanced experience of using DATs in an EC. Themes one and two address the research objective one "examine how do participants perceive DATs", and themes three and four addressed study objective two "investigate how learning spaces impact the way participants experience DATs."

Table 3.

Steps in Coding and Data Analysis

Step	Description
1. *epoche*	*epoche* is an ongoing analytical process in which the biases and assumptions held by the researcher are blocked. Clarity about personal biases and preconceptions is gained (Patton, 2002)
2. Bracketing	Bracketing, also called phenomenological reduction, aims to identify the data in pure form (Moustakas, 1994). The goal of bracketing is to focus the analysis on the participants' experiences.
3. Thematic Analysis	Thematic Analysis is a method for analyzing and interpreting qualitative data. Braun & Clarke's (2006) guidelines to use Thematic Analysis were followed in this research.
i. Data familiarization	The transcripts from the focus groups were read twice
ii. Coding	A code is usually a word or a short phrase representing the attribute for a portion of data (Saldaña, 2021). In this research, we used five coding strategies: Descriptive; NVivo; Process; Emotion; and Values coding (Miles et al., 2014).
iii. Themes created	Braun & Clarke (2006, P. 82), described that "themes capture something important about the data in relation to the research question." This research placed the codes into the themes representing patterned responses.
iv. Themes reviewed and renamed	In this research, the themes were reviewed and named simultaneously.

Opportunities of Digital Assessment Techniques (DATs)

Participants experienced DATs as new opportunities to enhance the assessment practice in educational settings. In both focus groups, the speediness of feedback was perceived as a relevant advantage of the DATs. As one participant said, *"I think one big thing with the digital tools is the speediness of the feedback both for the students and for the instructor. So, like they can both, the instructor saves time with not having to sit there and, you know, grade a bunch of papers, and the students can usually pretty quickly see their results."* The previous is consistent with findings suggesting that DATs provide higher test efficiency, more timely feedback, and automated scoring (van der Kleij et al., 2011).

Participants also considered DATs as "just more fun," an attribute stated in both groups, from different perspectives. One of the participants positively experienced the DATs as an opportunity to add variability to the lesson, saying that "For me, I like the fact that it [DAT] was fun because, to me, I felt like it was a break." Correspondingly, another participant perceived the DATs as an opportunity to engage learners in educational settings beyond formal education. The student said, "I honestly think that something like Mentimeter, or something that turns learning into a fun, engaging experience, and then even like Kahoot, like a gaming experience, would even be really fun for this group of adult learners who would be operating in a completely different space than just listening to somebody get a PowerPoint." The previous participant talked about the potentiality of using DATs as a gamified assessment tool to increase adult learners' engagement. This perceived advantage of game-based learning has been reported by other researchers (Bunch et al., 2014; Ismail et al., 2019) as well as by another participant of this study who considered as fun the fact that Kahoot, one of the DATs covered in class, "…felt like a game or like a competition." However, the earlier student also felt that given she considers herself a competitive person, the gamified tool put her in a stressful mindset in which she focused on answering faster. She said that "…sometimes I just click one [response] and would be like, "what did I just answer?" Comparatively, Reed et al. (2020) found that in gamified reading assessments, students focused on gaming strategies rather than on the cognitive skills being assessed, which could potentially be a flaw of these tools.

Challenges of DATs

While recognizing the advantages of DATs, future agricultural educators perceived new challenges of implementing these evaluation strategies. Participants perceived concerns over technology and internet requirements of DATs. One of the participants said that "I think not every student has access to a digital device and that becomes a little bit more hectic because you still have to figure out "okay, is everybody going to be able to access this?" While mobile technology, the internet, and social media use are flourishing, especially among young people, there is still a gap between advanced and emerging economies (Rideout & Robb, 2019; Silver & Cornibert, 2019).

Choosing a DAT that fits students' characteristics was another challenge identified in both focus groups. One of the participants stated that it "…is important to make sure that you check with your students about what would be comfortable for them because if you think you are having fun in like throwing it to them and then they just hate it then you know the process defeats the purpose." In addition, some participants felt overwhelmed due to the several DATs

used in the course. One of the students said that "…if I'm designing a course, I would pick maybe one or two and just stick with them, so that students will always know how to use that." Under those circumstances, participants in both focus groups agreed on introducing just one DAT you are comfortable with before you start using it.

New experiences in the Experimental Classroom (EC)

Participants of both focus groups lived a new educational experience in the EC. One of the students commented that "The setting is completely not what we're used to," while another participant affirmed that "I have never seen that room before." Right after students first walked through the doors of the classroom, curiosity was among their first feelings: "Am I in the wrong room?" was the reaction of one of the participants after seeing the EC; likewise, another student said, "I was like, how does this relate to teaching and learning?" The multiple technologies available in the room and the space arrangement were the classroom components visually identified by the participants in both groups. As an illustration, one participant said, "I mean, the traditional room just have one or two projectors in the front screen, and then it was on every desk [in the EC]." Participants judged their experiences in the EC negatively and positively.

Negative experiences in the EC were reported by three participants in both focus groups that felt the space was overwhelming and confusing. "I saw the picture of a headache; if you can draw an image of what it looks like, that's what it looks like, like all the white everything white, like fluorescent lights, like screens everywhere…And it wasn't just like the first time, it continued," said one of the participants when referring to his first experience in the EC. Regarding being confused in the EC, one participant said, "…sometimes I also get confused, like when we have a lot of screens, and we don't know which one to focus, because suddenly we are like talking about the main screen and then we have to shift our focus from our screen."

Participants also faced new positive experiences in the EC. Unlike the participants who perceived the EC as overwhelming, six students in both groups considered that the EC features made the space more collaborative, mainly due to the ability to project separately in the five projectors available for the same number of students' groups. As one participant said, "if you are working in groups, we have our own screen that we can work with." Furthermore, the flexibility of the space, given the movable furniture, and the classroom setting, were considered as factors that facilitated the teamwork.

New enhanced experience of using DATs in an EC

Utilizing DATs in an EC was experienced by participants as a new and enhanced way to utilize evaluation tools. One participant said, "I think it [EC] made it [DATs] easier, especially when we are working in groups to have all those different screens so that everybody could look at what I guess what we're answering without it being chaotic. It definitely made it easier to have several screens because sometimes you needed to work in groups." The discussion about the use of DATs in the EC was focused on cases in which the assessments were conducted in groups rather than individually. As it was mentioned by another participant who said that "If we compare to EC and another classroom, especially for the DAT, each group can work with the single projector. I think it makes a lot of difference."

Discussion and Conclusions

While faculty continue to be pressed to be effective and functional in the higher education ecosystem as discussed earlier and described by Green (2019), the fundamental importance of effective formative assessment (Angelo & Cross, 1993) for impactful instruction remains present. This study confirms the van der Kleij et al (2011) study that Digital Assessment techniques (DATs) present opportunity for efficiency and timeliness in guiding a students' journey through a course; however, the experimental classroom and the DATs utilized in this study were experienced by participants as a novel phenomenon with positive and negative attributes. Looking at the DATs separately, participants valued their timely feedback, both from a student and a future educator perspective. DATs were also considered as a more fun assessment alternative.

The future agricultural faculty members who were participants in the study expressed concerns after experiencing several DATs in the course. Technology and internet access, as well as the appropriate selection of the tool, were among the main limitations of DATs. This would align with the Technological, Pedagogical and Content (TPACK) Framework presented, underscoring the fact that technological knowledge is not enough for effective implementation, but rather the alignment of understanding of technological capacities to achieve pedagogical goals in relations to specific content is imperative.

Participants' experiences in the experimental classroom (EC) were brand-new. Some participants perceived unfavorable characteristics of the EC such as the lighting and number of screens; however, some participants judged positively the way the components of the EC influenced their teamwork and interactions with their colleagues in the course impacting their development of a community of practice. Finally, participants described utilizing DATs in the EC as a new and enhanced way to use evaluation tools, specifically when working in groups.

To address the potential concerns of faculty developing their Teacher Digital Competence and utilizing new learning spaces like ECs and pedagogical technology tools like DATs, we provide three recommendations to educators for consideration:

- Evaluate new technologies that are intended to be incorporated in the classroom using existing rubrics developed for that purpose (e.g., Anstey & Watson, 2018). Intentional selection of instructional technology will evidence the Teacher Digital Competence described by Falloon (2020).

- Design the course session instructional plans with the characteristics of the learning space in mind. Specifically, utilize the capacity of the learning space available to be novel in how you guide learners to engage in content.
- Finally, as a strategy to avoid overwhelming students, Educators should avoid assumptions of familiarity with the technology by the course participants and incorporate the classroom's technology gradually with consistency.

We also recognize that more questions need to be answered to understand how learning spaces impact the way participants experienced DATs. Future studies should explore how participants individually experience these assessment tools in EC as well as the studies related to the instructional faculty perceptions of efficiency and impact of utilizing DATs in EC.

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