

Adoption Of Technology And Social Media In The Post-Secondary Agricultural Classroom Before And As A Result Of COVID-19

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Abstract

Coronavirus 2019 (COVID-19) disrupted daily life on a global scale. Arguably, those involved in education were among the most affected by COVID-19 as mandated school closures demanded an abrupt shift to online classrooms. To maintain continuity, educators were required to integrate technology and new methods of communication into their classrooms, especially for disciplines with applied concepts, such as agricultural sciences. The diffusion of innovation theory provides the framework for our study, which evaluated post-secondary agricultural faculty adoption and plans for continued use of social media for teaching as a result of COVID-19. Agricultural faculty reported an increase in the use and frequency of use of computers, smartphones, or tablets for teaching as a result of COVID-19. We did not observe the same increase for most social media channels (i.e., Facebook, Instagram, Twitter); however, there were major shifts in the use of YouTube and LinkedIn as a result of the pandemic. When asked about plans for use after COVID-19, faculty indicated they would be using social media in their classrooms where they were not before, especially YouTube and LinkedIn. These data indicate COVID-19 impacted post-secondary agricultural faculty use of technology and social media for teaching with potential long-term impacts.

Introduction

At the end of December 2019, a respiratory illness eventually identified as Coronavirus 2019 (COVID-19) gained public awareness as it spread across the globe. On March 11, 2020, the World Health Organization declared this viral outbreak a global pandemic. Circumstances surrounding COVID-19 affected the health, economy, and everyday life for an estimated 99% of the global population; these effects were also felt across all levels of our education system (Quezada et al., 2020). In the United States, K-12 and higher education institutions abruptly suspended face-to-face and made the mandatory switch to online instruction where information was communicated through technology (Code et al., 2020). This placed tremendous stress on educators and students as there was minimal time to prepare for and transition to a safe and alternative form of instruction. While school closures and online learning are not unfamiliar, their forced adoption has never happened on a scale of this magnitude within such a short time frame (Quezada et al., 2020). The forced adoption of online instruction demanded faculty integrate technology and methods of communicating into their classrooms to ensure continuity of education amidst social distancing guidelines.

Higher education students have diverse demographic backgrounds. It is estimated that, between 2018 and 2019, there were 21.9 million students enrolled in colleges and universities in the United States. Of those enrolled students, 11 million were between the ages 18-24 and an additional 6.1 million were over the age of 24 (Bustamante, 2019).

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Currently, people within this age range are those who have rapidly adopted social media and use it frequently (Pew Research Center, 2020). Because the technologically savvy student is continuing to evolve and social media usage does not appear to be declining, colleges and universities are adding more online tools, including social media, to tailor instruction to student demands (Cramer, 2013).

Social media has previously received attention as an educational tool for college students. Specifically, Facebook has been the focus of much research (Irwin et al., 2012; Li and Pitts, 2009; Magro et al., 2013; Mazer et al., 2007), likely due to the high percentage of college students who frequent the site. In 2017, 97% of college students at a United States university reported having a Facebook account (Alhabash and Ma, 2017). Despite this, in a study of undergraduates in a business-related course in the southwestern United States, only 16% of students reported they had used Facebook in previous classes for projects or assignments (Magro et al., 2013). Amongst those students, the primary use of Facebook was for identifying and communicating with project or study group members (Magro et al., 2013), implying few instructors used Facebook in their courses. Students in this study suggested Facebook could be used in the classroom to facilitate communication between groups and exchange information about upcoming class-related materials (Magro et al., 2013), demonstrating that students feel social media may be a substitute for traditional approaches and learning management software already employed by higher education institutions.

In a literature review, Tess (2013) explored the role of social media in the post-secondary classroom. Ultimately, they were unable to recommend if social media should be integrated into coursework due to a lack of consistent, empirical research. They summarized existing literature stating that, although most educational institutions have infrastructure that supports social media's presence, instructors have been slow to adopt these tools as part of their curriculum. A more recent review, focused on the use of Facebook (Chugh and Ruhi, 2018), highlighted the benefits of Facebook for teaching and learning, including increased teacher-student and student-student interaction, increased convenience of learning, improved student performance, and higher student engagement. In line with Tess (2013), they also called for a need for more empirical research.

Theoretical Framework

The Diffusion of Innovation (DOI) theory outlines the process by which an innovation is communicated through certain channels over time among members of a social system (Rogers, 2003). Within the context of DOI, an innovation is defined as an idea, practice, or object that is perceived as "new". Similarly, communication is described as creating and sharing information amongst individuals to reach a mutual understanding. Most innovations are characterized by a lack of predictability, structure, and information (Rogers, 2003) and this can make adoption difficult, even if the advantages seem obvious. This unpredictability can affect the timing and rate at which an individual adopts an innovation. Depending on how

quickly or slowly an individual adopts an innovation, they are classified as innovators, early adopters, early majority, late majority, or laggards (Rogers, 2003). Overall, the DOI theory and adoption of innovations is influenced by several extrinsic and intrinsic factors including: 1) the relative advantage the innovation provides over the idea, program, or product it replaces; 2) the compatibility the innovation is with values, experiences, and needs of the adopter; 3) how difficult it is to understand or use the innovation; 4) the extent to which the innovation can be trialed before it is adopted; and 5) the extent to which the innovation provides tangible, observable results (Rogers, 2003).

Individual adoption of an innovation can be voluntary or forced based on whether an individual adopts the innovation before or after their organization does (Zhou, 2008). Individuals who are not forced to adopt an innovation are voluntary adopters while those who have no choice in adopting an innovation are forced adopters (Ottow, 2016). When individuals are faced with an innovation that conforms to their attitudes and beliefs, they are more likely to respond positively and voluntarily adopt that innovation (Heidenreich and Talke, 2020). An example of voluntary adoption that relates to our study is the increase in students enrolled in online courses at higher education institutions prior to COVID-19 (National Center for Education Statistics, 2017). These students chose to enroll in online courses and, thus, are voluntary adopters of this innovation. Similarly, it was estimated that, in 2009, approximately 25% of faculty members were teaching an online course (Mayadas et al., 2009; Seaman, 2009). Before COVID-19, some faculty embraced online instruction, while others were slower to adapt (McQuiggan, 2012). The faculty that were slower or resistant to adopt online instruction likely represent those who were forced adopters of the online classroom as a result of COVID-19.

When COVID-19 was declared a global pandemic, higher education institutions quickly transitioned from face-to-face to online instruction, exemplifying large-scale forced adoption of online teaching as an innovation. For faculty to meet instructional expectations quickly and effectively, social media platforms may be the "golden ticket" as they have potential to provide students meaningful, connected learning experiences (Delello et al., 2015). While many faculty have embraced social media on a personal level, concerns exist when using social media for classroom instruction (Moran et al., 2011). Given the prevalence of social media in our daily lives, the presence - albeit, limited - of social media as an educational tool in the post-secondary classroom before COVID-19, and heavier reliance on technology to communicate in an online environment, an investigation of adoption of social media by faculty in response to COVID-19 is warranted. Specifically, faculty teaching online courses with practical or applied concepts, such as those under the umbrella of agricultural sciences, may rely on social media to provide tangible examples and visuals that accompany other course content. Social media adoption within the context of the DOI model has been discussed (Gizem Koçak et al., 2013) but not explored in relation to the COVID-19 pandemic.

Purpose and Objectives

The purpose of this study was to assess faculty adoption of social media in the post-secondary agricultural classroom in response to COVID-19. To accomplish this purpose, the following objectives were addressed:

1. Determine the frequency of faculty use of technology such as computers, smartphones, and tablets before and as a result of COVID-19.
2. Determine the adoption and frequency of faculty use of social media for teaching before and as a result of COVID-19.
3. Determine what social media channels were not regularly utilized in courses prior to COVID-19 but will be incorporated into future courses.

The purpose and objectives of this study align with the National Research Agenda of the American Association for Agricultural Education which identified assessments of the impact of digital technologies as educational tools in face-to-face and online learning as high priority research questions for 2016-2020 (Roberts et al., 2016). The use of social media is ubiquitous in our society and is becoming more heavily utilized in higher education (Tess, 2013). By addressing the above stated purpose and objectives, we aim to add to the growing repository of literature on the use of social media in higher education with a specific interest in how the COVID-19 pandemic affected adoption by faculty and instructors teaching agricultural sciences.

Methods

This study was part of a larger study that employed a mixed-methods approach to data collection, facilitated through an electronic survey-based questionnaire. The questionnaire was designed to assess the impact of COVID-19 on teaching in agricultural-based disciplines at the post-secondary level. The Texas State University Institutional Review Board approved this research as exempt (#7380) and all participants were provided written informed consent prior to participation. The population of interest was faculty and instructors who held a formal teaching appointment based in agricultural sciences during the COVID-19 pandemic (spring 2020, summer 2020, fall 2020) at colleges and universities across seven southern states. Our participants were identified by searching college and departmental websites in the target states, conducted in summer 2020. Using a total population of 1,795 faculty and instructors, a sample size of 317 with a 95% confidence level and ± 5 confidence interval was calculated.

Data was collected using a researcher-developed instrument that contained five sections. Section 1 consisted of nine questions including personal and institutional demographics. Section 2 consisted of three questions related to formal, informal, and non-formal training in teaching. Section 3 consisted of seven questions related to the use of technology, including electronic devices, software, and social media, before and as a result of COVID-19. Section 4 consisted of fifteen questions related to teaching

experiences during COVID-19, including questions related to course and career impacts. Finally, Section 5 included eight questions related to future training and professional development in relation to online teaching. The data presented here are from Sections 1 and 3.

Following the recommendations of Gates et al. (2018) on establishing a face-validated instrument, we identified a panel of experts outside of the research team and participant group. The panel included ten Agricultural Education faculty with expertise in survey design and online teaching. The panel assessed the questionnaire for face, content, and construct validity. Based on initial panel recommendations, we revised the questionnaire and resubmitted it for further review until the final version was approved by the panel.

To establish reliability, the questionnaire was piloted by Agricultural faculty from multiple disciplines who were not part of the research team, participant group, or expert panel. We sent 14 faculty a prenotice informing them of the pilot study. Three days later, we sent them a link to the questionnaire. Within seven days, we received six completed questionnaires, yielding a response rate of 43%. One week after the survey was distributed, a reminder was sent to the non-respondents. Within two weeks, two additional faculty responded for a total response rate of 57%. Data from the pilot study were coded and entered using the Statistical Package for the Social Sciences (SPSS) 25.0 software. We calculated a Cronbach's alpha reliability coefficient ($\alpha = 0.790$) which, based on interpretations provided by George and Mallery (2003), was good.

Our questionnaire was available to participants from early September to mid-October 2020. Dillman et al. (2014) recommends the use of a five-points of contact data collection model, including a prenotice, the questionnaire, a reminder, a second reminder, and then the invocation of a special procedure during a five-week window. Using Qualtrics, we sent a prenotice to 317 participants. Three days later, we sent an email containing the link to access the questionnaire. Over the next three weeks, we sent three reminder emails to non-respondents. These reminder emails were sent weekly on Wednesday mornings to allow participants time to respond at the beginning of the workday. Two hundred and fifty-five participants provided usable data along with eighteen participants who did not teach in the spring of 2020. This resulted in a response rate of 86.1%. With a response rate exceeding 85%, no additional procedures were used to account for non-response error, following recommendations of Lindner et al. (2001).

Using SPSS 25.0, data were analyzed using descriptive statistics and measures of central tendency to report the frequency and percentage of faculty use of technology and social media for teaching. We also reported the frequency and percent of faculty planning to incorporate social media platforms in the classroom in the future as a result of COVID-19. Additionally, descriptive statistics were calculated for the demographic characteristics of the participants and their institutions of employment.

Results and Discussion

Demographics of our sample population, their academic credentials, and their institutions of employment are presented in Tables 1 and 2. There were more male (62.6%) than female (37.4%) respondents. The sample population had a close distribution in birth year with 1946-1964, 1965-1980, and 1981-1996 each representing 23.1-38.0% of respondents. White or Caucasian was the overwhelming ethnic identity (81.9%), followed by Asian (4.6%), Hispanic or Latino (4.2%), and Black or African American (3.5%). The majority of respondents held a doctoral degree (84.6%) and were employed at 1862 Land-Grant (52.2%) or Regional institutions (30.3%). Most respondents were Full Professors (34.6%), Assistant Professors (26.4%), or Associate Professors (25.2%) and varied widely in their experience teaching in higher education; 22.4% had taught 2-5 years, 19.0% more than 30 years, and the remaining 41.4% somewhere in between. As this questionnaire was developed for and sent to agricultural faculty, most of our respondents taught Animal Science (20.8%); Crop and Soil Sciences (14.5%); or Agricultural Education, Extension, Leadership, and Communication (13.7%). The remainder were distributed between Other (16.9%); Agricultural Economics and Business (11.0%); Horticulture (7.5%); Nutrition and Food Science (7.1%); or Natural Resource and Wildlife Management (5.1%). Our goal was to target respondents in the southern United States. Accordingly, the majority of our respondents were employed at institutions in Texas (55.9%), Arkansas (14.6%), or Georgia (13.8%).

We asked respondents how many hours they spent on their computer, smartphone, or tablet for their teaching appointments prior to and as a result of COVID-19 (Table 3). There were dramatic shifts in the use of these technologies for teaching; these shifts overwhelmingly indicate that, as a result of COVID-19, faculty are using their electronic devices at higher frequencies. This is apparent by the percent of faculty reporting they used these technologies less than one hour per day: 7.3% before COVID-19 and 2.9% as a result of COVID-19. The frequency categories that reflect more frequent daily use all had a higher percentage of respondents as a result of COVID-19 versus before. For example, only 1.5% of faculty spent 12 to 16 hours using these technologies before COVID-19 as compared to 7.3% as a result of COVID-19. This increased use of technology is likely due to the shift from face-to-face to online instruction and reflects new responsibilities and a greater workload for faculty.

As institutions were forced to shift from face-to-face to online instruction, faculty were forced to adopt different forms of technology to continue teaching. Table 4 displays faculty use of smartphones, tablets or iPads, and computers for teaching before and as a result of the COVID-19 pandemic. Overall, we observed major shifts in faculty use of these technologies for teaching, evidenced by reductions in the percent of faculty reporting that, as a result of COVID-19, they never use smartphones or tablets and iPads for teaching. We also observed shifts in the frequency of usage in categories that represent more heavy or frequent usage. For example, as a result of COVID-19, faculty using

Table 1. Demographics of the sample population

	Frequency	Percent
Gender identity		
Male	159	62.6
Female	95	37.4
Date range born		
1981-1996	59	23.1
1965-1980	94	36.9
1946-1964	97	38.0
1928-1945	4	1.6
Prefer not to disclose	1	0.4
Ethnic identity		
Asian	12	4.6
Black or African American	9	3.5
Hispanic or Latino	11	4.2
White or Caucasian	212	81.9
Other	6	2.3
Prefer not to disclose	5	1.9
Highest degree		
Doctoral	219	84.6
Masters	33	12.7
Bachelors	3	1.2

smartphones for their teaching needs more than once an hour per day increased from 14.2 to 33.2%, tablets or iPads from 3.0 to 9.0%, and laptops or desktop computers from 51.2 to 71.3%. This constant use of technology by faculty was necessary to maintain communication and facilitate instruction amidst the pandemic; we hypothesize this heavier reliance on technology will likely remain a permanent characteristic of teaching agricultural sciences in higher education in the post-COVID-19 landscape.

Although we observed COVID-19 caused major shifts in faculty use and frequency of use of technology for teaching needs, we did not observe the same overall shifts in the use of social media (Table 5). This indicates that, overall, faculty did not voluntarily adopt social media as an innovation to overcome education and communication barriers presented by COVID-19. This is in line with previous data (Roblyer et al., 2010) that indicate most faculty use familiar technologies, such as email, and are less likely to adopt and use social media for teaching and communication with students than their students are. Most of our respondents reported never using Facebook, Instagram, Twitter, TikTok, SnapChat, or LinkedIn for teaching prior to COVID-19 and still reported never when asked about using as a result of the pandemic. These data suggest that the use of these social media platforms in the post-secondary agricultural classroom was limited prior to COVID-19 and was not affected by circumstances surrounding the pandemic. Our data parallel that of Manca and Ranieri (2016) who reported that an overwhelming majority of faculty representing many disciplines do not use Facebook (82%), Twitter (95%), or

Table 2. Academic demographics of sample population and institution

	Frequency	Percent
Academic title		
Full Professor	88	34.6
Associate Professor	64	25.2
Assistant Professor	67	26.4
Lecturer	10	3.9
Instructor	20	7.9
Adjunct	5	2.0
Years teaching in higher education		
2	14	5.7
3	15	6.1
4	11	4.5
5	15	6.1
6-8	30	12.1
9-11	23	9.3
12-14	22	8.8
15-19	19	7.6
20-24	31	12.4
25-29	20	8.0
30+	47	19.0
Institution classification		
1862 Land-Grant	131	52.2
1890 Land-Grant	20	8.0
Regional	76	30.3
Private Four-year College or University	11	4.4
Two-Year College	13	5.2

	Frequency	Percent
State institution is located		
Alabama	11	4.3
Arkansas	37	14.6
Florida	4	1.6
Georgia	35	13.8
Louisiana	19	7.5
Mississippi	6	2.4
Texas	142	55.9
Courses taught		
Agricultural Education, Extension, Leadership, and Communication	35	13.7
Agricultural Economics and Business	28	11.0
Agricultural Engineering, Systems, and Mechanics	9	3.5
Animal Science	53	20.8
Crop & Soil Science	37	14.5
Horticulture	19	7.5
Natural Resource and Wildlife Management	13	5.1
Nutrition and Food Science	18	7.1
Other ^z	43	16.9

^zAdvising, Facilities Operator/Manager, Judging Coach, Alumni Relations, Curriculum Specialist

Table 3. Daily time faculty spent on electronic devices for teaching appointments

	Prior to COVID-19		As a result of COVID-19	
	Frequency	Percentage	Frequency	Percentage
Less than 1 hour	15	7.3	6	2.9
1 to 2 hours	28	13.6	16	7.8
2 to 4 hours	63	30.6	13	6.3
4 to 6 hours	43	20.9	46	22.4
6 to 8 hours	28	13.6	45	22.0
8 to 10 hours	17	8.3	30	14.6
10 to 12 hours	6	2.9	20	9.8
12 to 16 hours	3	1.5	15	7.3
16+ hours	3	1.5	14	6.8
	206	100	205	100

Table 4. Frequency of faculty use of electronic devices for teaching appointments

	Prior to COVID-19		As a result of COVID-19	
	Frequency	Percentage	Frequency	Percentage
Smartphone				
Never	37	18.8	23	12.3
Once a month	14	7.1	8	4.3
Once a week	17	8.6	19	10.2
Once a day	53	26.9	36	19.3
Once an hour	48	24.2	39	20.9
More than once an hour	28	14.2	62	33.2
	197	100	187	100
Tablet or iPad				
Never	93	55.4	78	47.0
Once a month	16	9.5	8	4.8
Once a week	13	7.7	19	11.5
Once a day	35	20.8	36	21.7
Once an hour	6	3.6	10	6.0
More than once an hour	5	3.0	15	9.0
	168	100	166	100
Laptop or Desktop				
Never	0	0.0	1	0.4
Once a month	2	0.7	0	0.0
Once a week	8	3.0	6	2.2
Once a day	37	13.9	15	5.6
Once an hour	57	21.3	38	14.2
More than once an hour	109	51.2	149	71.3
	213	100	209	100

LinkedIn (91%) in their courses. Despite this, previous research indicates that some educators implemented social media applications in the agricultural classroom before COVID-19. For example, faculty teaching Agricultural and Resource Economics at North Carolina State University reported using Twitter by creating tweets related to current events and course lectures (Kiesel et al., 2020). Prior to the COVID-19 pandemic, researchers stated that the next generation of students are “digital natives” and will be comfortable integrating social media into online and face-to-face classes (Kaplan and Haenlein, 2016). Although our data indicate social media was not adopted for teaching before COVID-19, it is likely this adoption will become more important in the future as the knowledge and evolving communication style of the emerging generation of students may necessitate it.

The most noticeable change in faculty use of social media for teaching was YouTube. Before the pandemic, YouTube was the social media channel most often used in the classroom by our respondents; only 34.3% of our respondents reported never using YouTube, which shifted

to 29.7% as a result of COVID-19. Interestingly, this contrasts previous data indicating 61% of faculty do not use YouTube for teaching (Manca and Ranieri, 2016). In that study, respondents represented many disciplines whereas, in ours, respondents represent agricultural sciences only. The disparity between these data may be explained by discipline, where agricultural sciences faculty are more likely to adopt YouTube in their courses, or by timing, as their study was published in 2016 and perhaps YouTube has become a more popular teaching tool in recent years.

We also observed shifts in the frequency of YouTube usage. Prior to COVID-19, 9.1% of faculty reported using YouTube once a day; after the pandemic, 22.4% reported once a day usage, a two-fold increase. Snelson (2011) reported that, although there has been research on the use of YouTube for teaching and research in agricultural sciences, it is limited relative to other disciplines. As agricultural sciences is often characterized by a hands-on approach to learning, we hypothesize the shift to more faculty using YouTube as a result of COVID-19 reflects their need for videos that include content which would

Table 5. Frequency of faculty use of social media channels for teaching

	Prior to COVID-19		As a result of COVID-19	
	Frequency	Percentage	Frequency	Percentage
Facebook				
Never	115	60.2	110	61.5
Once a month	25	13.1	19	10.6
Once a week	18	9.4	18	10.1
Once a day	25	13.1	23	12.9
Once an hour	5	2.6	7	3.9
More than once an hour	3	1.6	2	1.1
	191	100	179	100
Instagram				
Never	160	87.9	146	86.4
Once a month	5	2.8	3	1.8
Once a week	5	2.8	7	4.1
Once a day	11	6.0	10	5.9
Once an hour	1	0.6	3	1.8
More than once an hour	0	0.0	0	0.0
	182	100	169	100
Twitter				
Never	160	87.0	148	87.0
Once a month	8	4.4	4	2.4
Once a week	2	1.1	5	2.9
Once a day	13	7.1	10	5.9
Once an hour	1	0.5	3	1.8
More than once an hour	0	0.0	0	0.0
	184	100	170	100
TikTok				
Never	176	100.0	161	98.2
Once a month	0	0.0	1	0.6
Once a week	0	0.0	2	1.2
Once a day	0	0.0	0	0.0
Once an hour	0	0.0	0	0.0
More than once an hour	0	0.0	0	0.0
	176	100	164	100
SnapChat				
Never	171	97.2	158	96.3
Once a month	1	0.6	0	0.0
Once a week	2	1.1	1	0.6
Once a day	0	0.0	3	1.8
Once an hour	0	0.0	1	0.6
More than once an hour	2	1.1	1	0.6
	176	100	164	100

Table 5 con't. Frequency of faculty use of social media channels for teaching

	Prior to COVID-19		As a result of COVID-19	
	Frequency	Percentage	Frequency	Percentage
LinkedIn				
Never	120	65.2	105	60.7
Once a month	28	15.2	29	16.8
Once a week	27	14.7	26	15.0
Once a day	8	4.4	12	6.9
Once an hour	1	0.5	1	0.6
More than once an hour	0	0.0	0	0.0
	184	100	173	100
YouTube				
Never	68	34.3	57	29.7
Once a month	56	28.3	33	17.2
Once a week	53	26.8	49	25.5
Once a day	18	9.1	43	22.4
Once an hour	3	1.5	7	3.7
More than once an hour	0	0.0	3	1.6
	198	100	192	100
Other ²				
Never	14	60.9	15	55.6
Once a month	1	4.4	0	0.0
Once a week	4	17.4	3	11.1
Once a day	4	17.4	4	14.8
Once an hour	0	0.0	2	7.4
More than once an hour	0	0.0	0	0.0
	23	100	27	100

²Other was open-ended; responses included email, Google, GroupMe, Moodle, Remind 101, WhatsApp

otherwise be experienced in a laboratory or field setting. For example, faculty teaching animal sciences may stream a video of farmers palpating a cow to check for pregnancy. Prior to COVID-19, students may have experienced this by attending a face-to-face laboratory; this would make the use of YouTube unnecessary. It is likely that COVID-19 forced our respondents to explore new avenues for teaching and they discovered previously untapped educational value in YouTube. Our respondents are not alone in using YouTube to share or view content amidst COVID-19; Basch et al. (2020) and Szmuda et al. (2020) documented the widespread use of YouTube to disseminate information about COVID-19.

Despite our data that indicate limited use of most social media platforms in the post-secondary agricultural classroom prior to and as a result of COVID-19, Table 6 indicates that faculty who did not utilize social media for teaching prior to the pandemic intend to incorporate it into future courses, including face-to-face, moving forward. In line with the above data, we observed the greatest response for YouTube; 47.0% of faculty who did not use

YouTube before the pandemic will be integrating it into their future courses. The use of YouTube in higher education is a recent and growing trend due to low-cost digital recording tools, easily accessible streaming software, and the ability to provide visual media for expression and communication (Orus et al., 2016). Ultimately, our respondents' adoption of and intent to adopt YouTube aligns with one of the factors affecting adoption of innovations under the DOI theory, compatibility. Specifically, how compatible an innovation is with the adopter's values, experiences, and needs will affect its adoption (Rogers, 2003). Indeed, YouTube is the second most visited site in the United States, behind Google (Alexa, 2020). We hypothesize this familiarity and ease of access made our respondents view YouTube as compatible with their values, experiences, and needs, resulting in high adoption and intent for future adoption.

Second to YouTube, LinkedIn was the social media channel that the most faculty (12.8%) reported not using for teaching prior to COVID-19 but intend to adopt as a result of the pandemic (Table 6). This was surprising because

Table 6. Social media faculty did not use prior to COVID-19 but will incorporate in future courses

	Frequency	Percent
Facebook	14	9.4
Instagram	12	8.0
Twitter	14	9.4
TikTok	9	6.0
SnapChat	11	7.4
LinkedIn	19	12.8
YouTube	70	47.0
	149	100

LinkedIn is generally considered a platform exclusively for job seekers or professionals wanting to connect with others in their field. Student adoption of LinkedIn, especially at the undergraduate level, is low. Cramer (2013) reported that only 0.88% of students in a 1000-level agricultural course at a southern land-grant institution had a LinkedIn profile. Accordingly, research on LinkedIn as an educational tool are limited. Cooper and Naatus (2014) suggested ways to incorporate LinkedIn in business courses; some of these concepts may be applied to agricultural sciences, especially in Agricultural Economics and Business courses. It would be interesting to conduct follow-up research that reveals why and how agricultural faculty will use LinkedIn in their classrooms.

Although the majority of literature focuses on the use of Facebook in higher education, we observed limited use of it for teaching by our respondents. Prior to COVID-19, only 39.8% of respondents used Facebook with some frequency and this minimally changed as a result of the pandemic. Further, only 9.4% of respondents who did not use Facebook prior to COVID-19 intend to integrate it into future courses. These data were interesting because Facebook can be used to make working groups of students or send individual or group messages. Further, as mentioned above, Facebook is a popular social media website for college students; 94.1% of students enrolled in a 1000-level agricultural course had a Facebook account (Cramer, 2013). This level of popularity and, thus, familiarity indicates Facebook may be easily integrated into existing curriculum. Barriers to adoption of Facebook in the post-secondary classroom include a lack of privacy or invasion of personal life (Manca and Ranieri, 2016). When asked about their perceptions of Facebook in education, 53% of faculty and 23% of students agreed that Facebook is for personal and social needs, not education (Roblyer et al., 2010). Overall, data from Roblyer et al. (2010) indicate that students are more open than faculty to use Facebook in courses and that faculty are more likely to use traditional technologies, like email, to communicate.

Our data align with the perception that Facebook should be isolated to personal and social needs (Roblyer et al., 2010) while also underlining the need for faculty instructing online courses to connect with their students using social media. As presented in Tables 5 and 6 and discussed above, there was little difference in the percent of faculty using Facebook (39.8%) versus LinkedIn (34.8%)

for teaching prior to the COVID-19 pandemic. However, more faculty not using LinkedIn before COVID-19 intend to incorporate it in courses moving forward, as compared to Facebook – 12.8 versus 9.4%, respectively. LinkedIn profiles and communications tend to be exclusively professional and personal details are rarely shared. As faculty report communication barriers as one of the major reasons they are not satisfied with online teaching (Walters et al., 2017), perhaps LinkedIn can provide an interface for communication between faculty and students without threatening personal privacy for either party.

Cao and Hong (2011) reported that, to promote faculty use of social media, it is critical to address their concerns and educate them about the benefits of using social media with tangible examples and evidence. This relates to one factor of the theory of DOI, relative advantage, which is the degree to which an innovation is perceived as better than that which it supersedes (Rogers, 2003). Perhaps training faculty how to integrate social media in courses while also addressing their privacy and related concerns will enhance voluntary adoption of this innovation as a teaching tool in online classrooms. We recommend research on faculty's willingness to attend social media-centric workshops during teaching and education conferences, such as the Annual NACTA Conference, then following up with participants to evaluate workshop effectiveness in promoting social media adoption for teaching.

Albeit limited, our respondents reported that, as a result of COVID-19, they intend to integrate Instagram (8.0%), Twitter (9.4%), TikTok (6.0%), and SnapChat (7.4%) in their classrooms moving forward. These data demonstrate there will be an increase in the use of social media in the post-secondary agricultural classroom. Because COVID-19 forced educational institutions to abruptly shift from face-to-face to online instruction in March 2020 and our survey was administered from September to October 2020, it is possible that faculty did not have adequate time to integrate social media into their courses as they were already facing time constraints and a heavy workload to transition content online. At the time of writing, faculty are more experienced with online teaching and may be better equipped to adopt social media for teaching in future courses. Two of the five factors that influence adoption of an innovation within context of the DOI model are trialability, the degree to which an innovation may be experimented with on a limited basis, and observability, the degree to which results of an innovation are visible to others (Rogers, 2003). As faculty become more experienced in their online classroom and have more time to adapt and improve upon their courses, they may trial technological innovations, such as social media, and adopt them in future semesters. Similarly, observing other faculty or even students use social media to communicate in an online environment may encourage voluntary adoption of this innovation. Accordingly, a follow-up study to evaluate the long-term effects of COVID-19 on social media adoption in the post-secondary agricultural classroom is warranted.

Summary

The spread of COVID-19 in early 2020 abruptly shifted faculty's approach to teaching. We are hopeful that we will eventually settle into a "new normal". Faculty will return to campuses with new insights and pedagogical approaches; these will reflect "lessons learned" as a result of the forced adoption of online teaching. Data presented by Code et al. (2020) illustrate that the pandemic underlined the essentiality to effectively teach online and use technology as tools to educate the next generation of students. Indeed, the forced adoption of online teaching as a result of COVID-19 has likely changed the future of agricultural education and the education system as a whole.

Our study demonstrates an increase in faculty use and frequency of use of technology for teaching. These data also indicate there is a lag in the voluntary adoption of social media in the post-secondary agricultural classroom, but we can expect this adoption, especially that of YouTube and LinkedIn, to increase in the future.

Given the newness of the COVID-19 pandemic, the literature surrounding the impact on education is emerging and continuously evolving. Our data adds to this growing repository and informs future research which we recommend should focus on the use of social media as an educational tool in the post-secondary agricultural classroom.

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