Faculty Perceptions of Online Education and Technology Use Over Time: A Secondary Analysis of the Annual Survey of Faculty Attitudes on Technology from 2013 to 2019

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Abstract
Research on faculty use of technology and online education tends to be cross-sectional, focusing on a snapshot in time. Through a secondary analysis of the annual *Survey of Faculty Attitudes on Technology* conducted by *Inside Higher Ed* each year from 2013 through 2019, this study investigated changes in faculty attitudes toward technology and online education over time. Specifically, the study examined and synthesized the findings from surveys related to attitudes toward online education, faculty experiences with online learning, institutional support of faculty in online learning, and faculty use of technology. Results showed a low magnitude of change over time in some areas (e.g., proportion of faculty integrating active learning strategies when converting an in-person course to a hybrid/blended course) and a large magnitude of change in other areas (e.g., proportion of faculty who believe that online courses can achieve the same learning outcomes as in-person courses). These results reveal that, prior to the widespread shift to remote and online learning that occurred in 2020 because of the COVID-19 pandemic, faculty perceptions of technology and online learning were static in some areas and dynamic in others. This research contextualizes perceptions towards online learning prior to the pandemic and highlights a need for longitudinal studies on faculty attitudes toward technology use going forward to identify factors influencing change and sources of ongoing tension.

Keywords: online learning, educational technology, higher education; *Survey of Faculty Attitudes on Technology*; online learning over time

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Technology was a staple in higher education even prior to the rapid shift to online course delivery during the COVID-19 pandemic (Garrett et al., 2019; Selwyn, 2016) and, prior to the pandemic, faculty were generally expected to incorporate technology into their teaching and learning practices (Weller, 2011). Throughout this paper, the term *technology* refers to the broad use of digital devices and resources for varying purposes while *online education* (or online learning) refers to the delivery of course instruction and materials via the Internet.

While many studies have investigated faculty use of technology in higher education, the preponderance of them tend to be cross-sectional. Such studies offer important insights, but due to their focus on a particular snapshot in time, they yield little information about changing facets of faculty use of technology. As the higher education landscape changes, it is important to gain an understanding of whether and how faculty perceptions change over time and how this impacts their attitudes toward technology. An understanding of faculty attitudes leading up to 2020 is essential for assessing the impacts of shifts to online course delivery in response to the COVID-19 pandemic. The purpose of this study, therefore, is to explore changes in faculty attitudes toward technology prior to 2020.

Since 2013, *Inside Higher Ed* has conducted an annual *Survey of Faculty Attitudes on Technology*, exploring "how professors and campus digital learning leaders view online learning and other aspects of classroom technology" (Jaschik & Lederman, 2019b, p. 5). Each annual report provides a single-year snapshot of faculty perceptions of technology integration and insight into how faculty are incorporating technology into their practices. The 2019 report included trend analyses for several topics, revealing how faculty attitudes and use of technology were shifting over time. These analyses revealed that the percentage of faculty members who have taught online has grown over time, that an increasing proportion of faculty report that online courses are able to achieve equivalent outcomes compared with face-to-face courses, and that the proportion of faculty that always use Learning Management Systems (LMS) to conduct certain administrative tasks has increased over time. Considering that few studies have explored changes over time regarding faculty and technology, this investigation aims to discover what other changes might be revealed if more trend analyses were performed on the data for all years of the *Survey of Faculty Attitudes on Technology*. We begin by situating our study in the literature relevant to faculty use of technology, particularly how it has and has not changed over time. We then describe our methodology for performing a secondary analysis on the results of the *Survey of Faculty Attitudes on Technology* from 2013 through 2019. After detailing our findings, we conclude with a discussion of key findings and their implications.

Review of Related Literature

The literature exploring faculty members' use of technology centers on a few critical themes: faculty perceptions of online education and technology use, major topics related to technology use in higher education, and research exploring faculty use of technology over time.

Faculty Perceptions of Online Education and Technology Use

Previous studies investigating faculty perceptions of online education and technology use have shown that faculty believe that technology adoption will increase workload, that interactions with students will be more challenging in an online environment, and that there is less institutional support for teaching online than teaching in-person. Major (2010) and Wingo et al. (2017) conducted systematic reviews of the literature related to faculty, technology use, and online education. The findings from Major's study also suggest that faculty attitudes may change

over time as faculty gain experience with online education. While the research Major analyzed indicated that faculty may initially feel a sense of trepidation towards the unknowns of teaching online, she identified that the intellectual challenge and creative aspects of the online environment may also result in professional rejuvenation, particularly as faculty overcome previous anxieties. Similarly, Wingo reported that faculty experiences of online environments are associated with positive perceptions of online education.

Other studies reiterate that faculty members experience numerous tensions related to teaching online and their technology use. In particular, these may relate to extra demands on faculty time associated with the flexibility of online education (Birch & Burnett, 2009; Conceição, 2006; Conrad, 2004), the presence of a ubiquitous educational environment impacting their ability to set clear boundaries around working hours (De Gagne & Walters, 2010), and the blurred boundaries between personal and professional uses of technology (Jordan & Weller, 2018; Lemon et al., 2015; Lupton, 2014; Veletsianos & Kimmons, 2013). Faculty have also expressed the desire to maximize the benefits that technology may offer, while minimizing they potential adverse impacts that it may yield, such as for example adverse effects on personal wellbeing (Veletsianos, Johnson, & Belikov, 2019; Veletsianos, 2016). The impact of technology on teacher-student interactions is also reported as being a concern, and faculty members have articulated feelings of ambivalence around how technology influences their communication with students (Hyndman et al., 2016; McSpadden, 2018; Major, 2010; Marzilli et al., 2014).

Major Topics Related to Technology in Higher Education

Annual reports other than the *Survey of Faculty Attitudes on Technology* are useful for understanding the changing contexts that faculty experience as well as the impact of technology on the higher education landscape. For instance, the *Horizon Reports* describe key trends influencing technology adoption in higher education (Adams Becker et al., 2017, 2018; Alexander et al., 2019) and the *CHLOE Reports* describe the changing landscape of higher education (Garrett et al., 2019; Legon & Garrett 2017; Legon & Garrett 2018). The collective findings of these reports indicate tensions between demands for innovation, evolving practices, and effective supports at a time of rapid technological advances.

In reports examining institutional and administrator beliefs and practices, such as the *2019 Campus + Computing Report* (Green, 2019) and the *2019 Survey of College and University Chief Academic Officers* (Jaschik & Lederman, 2019a), authors raise further concerns. Green (2019) reported that institutional leaders who are "very knowledgeable" about digital learning are in the minority. Considering the pressures that institutions face to adapt to student needs (Alexander et al, 2019), a lack of strong understanding among institutional leaders on how to effectively implement digital learning initiatives is likely to impact faculty attitudes on technology adoption. This concern becomes even more pressing in the current context of the COVID-19 pandemic as students, faculty, administrators, and policymakers face numerous emerging uncertainties around the state of education and educational institutions. At the same time, there are indications, certainly now, but also prior to the pandemic, that institutions are actively striving to support faculty in successfully integrating technology into their practices. Jaschik and Lederman (2019a) for instance noted that 90% of the provosts they surveyed reported offering professional development opportunities for faculty to learn how to use technology to promote active learning techniques and student success.

Research Exploring Faculty Use of Technology Over Time

Much of the work described above is cross-sectional, meaning that it represents a singular snapshot of a moment in time, which is typical of the kind of research conducted in the field of educational technology (Barbera et al., 2015). Cross-sectional research makes it "difficult for educational technology professionals to find reliable data on current trends" (Kimmons, 2020, p. 803). Examining faculty experiences and perceptions with online education over time is useful for identifying patterns of use or non-use. The identification and analysis of trends over time facilitates a more accurate and multi-dimensional understanding of faculty technology use than cross-sectional studies. For example, Pachnowski and Jurczyk (2003) explored faculty perceptions of the time burden involved in online teaching over three semesters. In their study, faculty reported that additional time was required for preparation and training in the first semester, but such time pressures eased in the second and third semesters of the study. Veletsianos, Johnson, & Belikov (2019) also found that that faculty experiences with social media are temporal: they shift over time in response to a variety of overlapping individual, social, and cultural factors, such as changes in careers, institutional demands, or technological shifts.

Similar to the present investigation, Allen and Seaman (2007, 2013) surveyed chief academic officers at U.S. post-secondary institutions about various aspects of online learning. At the five- and ten-year mark of this annual survey, they produced special reports with longitudinal findings. As a result of looking at the data longitudinally, they were able to identify multiple significant findings such as a decrease in the number of institutions with no online offerings, an increase in the number of completely online programs, an increase in faculty perceptions at public and non-profit institutions that online teaching requires more time and effort, and a decrease in faculty perceptions at for-profit institutions that online teaching requires more time and effort. Such studies demonstrate the value of analyzing change over time related to online education.

Survey of Faculty Attitudes on Technology

The annual *Survey of Faculty Attitudes on Technology* measured a range of faculty experiences and attitudes in relation to educational technologies and online teaching and learning, including points of tension that are mentioned both in the peer-reviewed literature and other annual reports. The questions included in the survey explored faculty perceptions of quality, faculty experience with different delivery modalities and course design, faculty perceptions of instructional designers and online program management companies, faculty use of technologies, faculty perceptions of institutional support, and faculty concerns associated with issues such as cybersecurity, academic fraud, and open educational resources. The issues addressed in the survey are aligned with the sources of faculty tensions with technology found in the broader literature.

Methods

The *Survey of Faculty Attitudes on Technology* began in 2012 and was conducted by Inside Higher Ed and the Babson Survey Research Group. The format changed in 2013 and the survey has been run by Inside Higher Ed and Gallup since then. This section describes the process used to answer our research question: how did faculty attitudes towards technology change over time prior to the COVID-19 pandemic?

Participants

Each report contained about two pages of aggregate information about the survey participants (Table 1). Information about participants was limited to the data provided in the reports. According to the information provided, the number of survey respondents ranged from 1,671 to 2,799 in various years and included a mixture of full-time and part-time faculty. Respondents were primarily from the United States, although there were some respondents from Canada and Mexico. In 2015, the survey was modified to collect additional information regarding the tenure status of respondents. This was further refined in 2016 to differentiate faculty who were not yet tenured, but in a tenure-track position, from those who were not in a tenure-track appointment. The total percentages for the breakdown of tenure status in 2018 does not add up to 100% due to the rounding of decimals in the report.

Table 1

Type of Faculty Position of Survey Respondents (Percentage)

Year	Participants	Full-Time	Part-Time	Tenured	Not tenured	Tenure-Track	Non-Tenure-Track
2013	2,251	76.8%	23.2%				
2014	2,799	77.5%	22.5%				
2015	2,175	75.7%	24.3%	49.3%	50.7%		
2016	1,671	79.4%	20.6%	52.2%		12%	35.8%
2017	2,360	75.8%	24.2%	46.2%		14.8%	39%
2018	2,129	75%	25%	47%		13%	41%
2019	2,145	76%	24%	49%		12%	39%

Data Collection

The data source used in this study was the annual reports for the *Surveys of Faculty Attitudes on Technology*, conducted by *Inside Higher Education*, between 2013 and 2019, which are the years for which the survey format is consistent, and a core set of questions remain unchanged (Jaschik & Lederman, 2013, 2014, 2016, 2017, 2018, 2019b; Straumsheim et al., 2015). As of July 2022, no further reports have been released. These reports are publicly available via the *Inside Higher Ed* website and provide aggregate data only. Raw data was not available.

Data Analysis

A trend analysis investigates change over time by examining how findings differ from one another at multiple points in time. To perform a trend analysis, we first identified the sections and questions that were consistently included in the survey reports over the time period under investigation. That first step led us to focus on the questions within four sections of the survey that were always present from 2013 through 2019: attitudes about online education,

faculty experiences with online teaching and learning, institutional support of faculty in online learning, and faculty use of technology (these specific items can be found in Tables 2 - 6).

For the identified questions, we looked at the aggregate findings reported as percentages in the reports. We examined whether and how the proportion of affirmative responses to the core questions in these categories changed from year-to-year by comparing the differences in percentage points for each identified question in each year. We also calculated the difference between the 2013 responses and the 2019 responses in relative terms to explore overall change. To observe how the survey changed over time in terms of content and questions asked, we tracked all the new questions that were added each year and which questions were discontinued over time.

Results

We present results focused on each section of the survey under examination: attitudes about online education, faculty experiences with online learning, institutional support of faculty in online learning, and faculty use of technology. We describe how the survey has changed over time regarding that theme. For each question included in our analysis, we provide a table with results from each year and an analysis of how the results have changed over time.

Attitudes About Online Education

From 2013 through 2016, the questions pertaining to attitudes about online education, were part of a section titled "online education quality." In 2017, the name of the section was changed to "attitudes about online education" and the questions pertaining to online education quality gradually disappeared with each new iteration of the survey. Until 2018, this section also contained questions on whether for-credit online courses were comparable to face-to-face courses in different ways (e.g., meeting course objectives, communication and interaction, ability to reach exceptional/at-risk/underserved students, academic integrity). Questions about perceptions toward administrators and vendors who promote technology use, whether technology can lower cost without compromising quality, and use of external vendors also appeared in this section over the years.

Four questions in the "attitudes about online education" section were consistent from 2013 through 2019. Faculty respondents were asked to rate their level of agreement as to whether online courses can achieve comparable learning outcomes to face-to-face courses (1) at any institution, (2) at their own institution, (3) in their department, and (4) in their own classes. The 2019 report included a trend analysis on the first question: "whether online courses can achieve student learning outcomes at least equivalent to in-person courses at any institution" (p. 25). Findings indicate that the proportion of faculty that selected "agree" or "strongly agree" increased over time and the authors noted that faculty have become more positive about the potential of online learning. The report included a graph with the trend analysis which showed a notable rise in the proportion of faculty who indicated agreement from 2017 onward. Less than 20% of respondents agreed or strongly agreed with the question from 2013 through 2016 and 30% or more of respondents agreed or strongly agreed with the question from 2017 through 2019. The remaining three questions (see Table 2) that persisted throughout all years of the survey showed a similar pattern to the trend analysis included in the report.

Table 2

Can For-Credit Online Courses Achieve Student Learning Outcomes That Are At Least Equivalent to In-Person Courses?

	% of faculty members that *agree* or *strongly agree*							
	2013	2014	2015	2016	2017	2018	2019	2013-2019 change
At my institution	26	32	26	25	42	39	38	+46
In my department or discipline	24	28	24	25	36	35	36	+50
In the classes that I teach	25	29	26	28	37	35	38	+52

Overall, the results show sizable changes. The proportion of faculty who agree to some extent that online courses can achieve the same learning outcomes as face-to-face courses grew by around 50% between 2019 and 2019. While the trend analysis conducted in the 2019 report shows that faculty members have become more positive about the potential of online learning in general, this analysis indicates slight variations in specific contexts, such as individuals' own courses, disciplines, and institutions. In any given year, the percentage of faculty that expressed positivity about online learning (with the exceptions of 2017 and with respect to respondents' perceptions relating to their institution) remained less than 40%.

Faculty Experiences with Online Teaching and Learning

Over time, questions about faculty experiences with online teaching and learning became more and more granular. The questions that persisted over time were initially part of a section titled "faculty experiences in online learning." In 2013, the survey asked three questions (Table 3) about respondents' experiences teaching online courses, hybrid courses, and face-to-face courses. The survey also asked whether respondents had taken an online course as a student from 2013 through 2018. This question was not included in the 2019 report and the variation in responses to this question from 2013 through 2018 was minimal.

In 2014, new questions about experiences with converting courses from face-to-face to hybrid (see Table 4) appeared in this section and remained in the survey in future years. The name of the section changed to "experiences in online learning" in 2015 and new questions about the impact of teaching online on the development of pedagogical skills emerged. The section split into two sections in 2017: "effects of online teaching" and "online teaching and design experience." In 2018 and 2019, what had initially started as a single section on "faculty experiences in online learning" evolved into two sections: "online teaching experience" and "course design and use of instructional designers."

The analysis of the responses to the questions that remained constant revealed minimal change over time. Each year the survey asked faculty to respond "yes" or "no" to whether they had ever taught an online course for credit, whether they had ever taught a blended or hybrid course, and whether they had ever taught a face-to-face course. The one area where a considerable change occurred was the proportion of faculty who reported having taught an online course. The proportion of faculty who had taught online steadily increased each year, resulting in

an overall relative increase of 53% from 2013 to 2019 (30% to 46%). As for the proportion of faculty that reported having taught a blended course, despite a temporary increase from 2014 through 2016, the results remained consistent from 2013 (39%) to 2019 (38%). Unsurprisingly, the vast majority of respondents reported having taught a face-to-face course, with results ranging from 95% to 99% each year. Less than half of faculty reported having taught online or blended courses throughout 2013-2019.

Table 3

Faculty Experiences Teaching Online

	% of faculty responding "yes"							
	2013	2014	2015	2016	2017	2018	2019	2013-2019 change
Have you ever taught an online course for credit?	30	33	32	39	42	44	46	+53
Have you ever taught a blended or hybrid course?	39	50	40	43	36	38	38	-3
Have you ever taught a face-to-face course?	95	98	97	99	98	98	98	+3

From 2014 onward, the survey also asked several sub-questions to those faculty who responded affirmatively to having taught a blended or hybrid course. These questions asked faculty about their experiences converting face-to-face courses to blended or hybrid courses. Overall, little change occurred over time in the responses to these questions. Of the faculty who reported having taught a hybrid course, a substantial majority (ranging from 77% to 86%) reported that they had converted a face-to-face course to a blended course (vis-à-vis creating a new course online). In most years, the proportion of faculty who reported a decrease in lecture time in their blended/hybrid course compared to their in-person course ranged between 52% to 55% with a temporary increase to 64% and 65% in 2017 and 2018, respectively. Similarly, the proportion of faculty who reported incorporating more active learning techniques after converting a course from face-to-face to blended ranged from 66% to 69% in most years with a temporary dip down to 58% in 2017 and 54% in 2018.

Table 4

Experiences of Faculty Who Have Converted a Face-to-Face Course to a Blended or Hybrid Course

	% of faculty responding "yes"							
	2013	2014	2015	2016	2017	2018	2019	2013-2019 change
Have you ever converted a face-to-face course to a blended or hybrid course?	n/a	86	79	81	82	78	77	-10
Did lecture time -- including online lecture time -- decrease when you converted from the face-to-face course to the blended or hybrid course?	n/a	53	52	52	64	65	55	+4
Did you incorporate more active learning techniques after you converted from the face-to-face course to the blended or hybrid course?	n/a	66	68	69	58	54	69	+4

Institutional Support of Faculty in Online Learning

The questions focused on faculty perceptions of institutional support were part of the "faculty experiences in online learning" section in the first year of the survey. In 2014, a new section titled "faculty and their institution" emerged to address this topic. The section was renamed "institutional support of faculty in online learning" in 2015. Along with the questions that persisted throughout the years of the survey (listed in Table 5), the "institutional support of faculty in online learning" section also included questions relating to student identity verification and plagiarism in 2017 and 2018. In 2019, an additional section titled "academic fraud" emerged to encompass questions on these topics.

Questions about institutional support for faculty who teach online that continued throughout all the years of the survey focused on compensation, technical support, and policies to protect intellectual property. When asked about the presence of institutional support for online learning, a significant proportion of faculty (often the majority) was either neutral or noted that such support was lacking.

Findings from the eight questions were mixed. Three questions showed a significant decline in perceptions of institutional support over time, and these were generally related to rewards and compensation. The proportion of faculty that believed that their institutions appropriately rewarded contributions made to digital pedagogy fell by 39%. The same drop was reported in the question focusing on whether the institution rewards teaching with technology in tenure and promotion decisions. The proportion of faculty who believe that their institution compensates individuals fairly for the development of an online course also fell by 31%. The data also show a decline in the proportion of faculty who believe their institution's compensation

for online instruction is fair (12%) or that their institution acknowledges the workload associated with online courses (11%). We observed an increase in positive perceptions in two areas: a 11% increase when faculty were asked whether institutions were providing adequate technical support for teaching an online course and a 30% increase when asked whether institutions were providing adequate technical support for creating an inline course. In summary, these results show that while there was an increase in the proportion of faculty who perceived institutions providing adequate technical support, at the same time there was a decrease in the proportion of faculty who believed that they were adequately supported in terms of recognition and compensation.

Table 5

Faculty Perceptions of Institutional Support for Online Learning

	% of faculty responding 'agree' or 'strongly agree'							
	2013	2014	2015	2016	2017	2018	2019	2013-2019 change
Appropriately rewards contributions made to digital pedagogy	36	36	37	32	32	30	22	-39
Rewards teaching with technology (in-person or online) in tenure and promotion decisions	36	29	33	30	27	24	22	-39
Compensates fairly for the development of an online course	32	27	27	26	27	20	22	-31
Compensates fairly for online instruction	40	38	38	40	39	34	35	-12
Acknowledges the time demands for online courses for workload	28	25	26	25	30	22	25	-11
Strong policies to protect intellectual property rights for digital work (2013, 2014, 2015); [Has] Policies that protect faculty members' intellectual property rights for digital work (2016, 2017, 2018)	37	34	37	31	37	30	36	-3
[Provides] Adequate technical support for online courses (2013); adequate technical support for teaching online courses (2014-2019)	47	51	49	47	57	53	52	+11
[Provides] Adequate [technical] support for creating an online course	n/a	40	48	49	54	50	52	+30

Faculty Use of Technology

Questions pertaining to faculty use of technology were part of the section called "use of technology" (2013-2015) and "faculty use of technology" (2016-2019). Some questions that began in the "attitudes about online education" section in 2017 moved to the "faculty use of technology" section in 2018 (e.g., reasons why faculty support or do not support the increased use of educational technologies, whether faculty perceive themselves as an early adopter of technologies). Questions pertaining to use of digital courseware emerged in this section in 2017 with questions relating to the effectiveness of digital courseware added in 2018. We combined these sections for the purposes of the analysis reported below.

The questions about faculty use of technology that were present in all the years of the survey focused on ways in which faculty use their institution's LMS. The 2019 report included a trend analysis for questions on LMS use. Specifically, the report identified whether, and to what extent, the percentage of faculty who indicated that they are "always" using an LMS for certain tasks changed over the years. This analysis found that the proportion of faculty who use their LMS system to carry out particular teaching tasks has mostly increased each year between 2013 to 2019 (see shaded columns in Table 6).

We conducted a similar analysis to compare whether the increase was as pronounced when the percentage of respondents who reported "always" using their institution's LMS was combined with the percentage of respondents who selected "usually" (see unshaded columns in Table 6). We did this exploratory analysis because the subjectivity inherent in "always" and "usually" indicates relatively frequent use such that that they should be considered together. The proportion of positive responses in our analysis also increased over time; however, the magnitude of change over time differed. Overall, we identify that the proportion of faculty reporting using the LMS for particular purposes increased over time; however, we found some substantive differences between our analysis and the analysis in the 2019 report. For example, the rate of change of faculty integrating lecture capture technologies or tracking student attendance is much lower, while the rate of change of faculty using the LMS to identify students who may need support is much higher. Ultimately, these results seem consistent but indicate that some of the change over time shown in the report may be attributed to shifts in intensity of use (i.e., from always to usually and vice versa) rather than changes in activity.

Table 6

Comparison of Change Over Time When Grouping Responses Differently

	% of faculty responding "always"			% of faculty responding "always" or "usually"		
	2013	2019	2013-2019 Change	2013	2019	2013-2019 Change
Share syllabus information with students	76	84	+10	86	90	+5
Track student attendance	24	34	+42	34	44	+29
Record grades	53	71	+34	66	79	+20
Provide e-textbooks and related material	36	41	+34	58	62	+7
Integrate lecture capture	11	19	+72	18	28	+55
Communicate with students	53	51	-4	74	76	+3
Identify students who may need extra help	24	24	0	39	47	+20

Discussion

In an era of technological advances and growth in online learning, our analysis of the annual *Survey of Faculty Attitudes on Technology* suggests that while there is change in numerous areas, the rate of change is sometimes pronounced while at other times relatively static between 2013 and 2019. The results reveal some changes in perceptions over time, with some items showing more change than others. Exploring faculty attitudes toward technology longitudinally has enabled the identification of persistent trends prior to pandemic-induced changes that occurred in 2020 and provides us with historical data to contextualize faculty attitudes towards technology going forward.

Without considering the rate of change, the results above also suggest that negative attitudes towards online learning persists. At no point prior to 2020, did a majority of faculty agree that online courses could achieve student outcomes that were equivalent to in-person courses and, while faculty experience with teaching online increased over time, those with online teaching experience remained in the minority. When considering rate of change however, we observe increased acceptance of online learning, at least as perceptions of quality are concerned. Quality beliefs however need to be contextualized in terms of support. Results shows that less and less faculty feel supported in terms of compensation and rewards for teaching online, while they report observing their institutions providing greater technical support. While it is likely that early adopters of online learning could have possibly received greater support or rewards for being trailblazers at their institution and that this support diminished over time, we find very little evidence in the literature to suggest that rewarding faculty for teaching online has ever been a common institutional practice. Instead, the literature suggests that faculty who either opted to,

or were required to, teach online in the early 2000s reported challenges at the start (Birch & Burnett, 2009; Conrad, 2004). Further, the literature indicates that the motivators among faculty who continued to teach online tended to be intrinsic (e.g., intellectual challenge, professional rejuvenation) rather than rewards-based (Major, 2010). The collective findings that most faculty, and an increasing number of them, including many with no online teaching experience, believe that online learning was associated with poorer outcomes and inadequate compensation is concerning. The issue of compensation and rewards is especially concerning at a time when institutions have expanded their investments into digital platforms of all kinds because of the COVID-19 pandemic.

The data related to LMS use indicate that faculty tended to use their institution's LMS system for primarily administrative purposes (e.g., sharing the syllabus) rather than pedagogical purposes (e.g., identifying students who may need extra support). These finding highlight, once again, the predominant role of these technologies, which appears to be entered on managerial concerns rather than pedagogy (e.g., Veletsianos & Kimmons, 2013). We acknowledge that these findings may not solely reflect faculty attitudes toward LMS use but may be influenced by other factors such as the provision of training for effective LMS use and institutional policies requiring that the LMS be used for certain administrative tasks. Further research is needed to better situate faculty attitudes in institutional and environmental contexts.

It is important to consider whether these trends are likely to persist into the future. As institutions develop their digital learning strategies during and beyond the pandemic, understanding the relevance of these findings within the present context is critical. For instance, knowing that perceptions of institutional support for teaching online were trending downwards regarding compensation and rewards may signal to institutions that progress in these areas is necessary if an institution wishes for more faculty to teach online as part of their strategic plan. To support greater faculty adoption of online learning, more research is needed to better understand what kinds of supports faculty perceive to be necessary and adequate to foster the growth of online education and technology integration in their teaching practices.

Results also show a general improvement in faculty attitudes toward technology over time. The body of research on faculty attitudes towards technology tends to be cross-sectional and focused on identifying sources of tension. The need to conduct longitudinal studies that investigate the factors influencing change (or lack thereof) in attitudes over time remains. When investigating faculty attitudes toward technology, there is also a need to consider the future of higher education, whether it be the near post-pandemic future or the state of higher education several decades from now. Questions that probe the nature of faculty experiences teaching online, their preferences regarding technologies used, and the types of support available to them through their institution might provide insight as to persistent challenges and areas of change or innovation. Questions focused on understanding why faculty feel positively or negatively toward teaching with technology, why they implement certain pedagogical practices in digital contexts, and how these reasons change over time can help us better identify areas where faculty need enhanced support and can offer strategies for improving online learning overall. The COVID-19 pandemic has likely affected faculty perceptions towards technology discussed in this paper. Research that provides a pre- and post-pandemic comparison may be fruitful in assessing the impacts of the pandemic on faculty perceptions and use of technology.

Significantly, this study faces several limitations and readers are cautioned to examine whether the findings presented here reflect their own contexts. For instance, the survey upon which results are based is grounded in the North American contexts and may have limited

transferability. Further, the survey sample changed from year-to-year, and dips or spikes in the results could be attributed to sample changes. As our study was a secondary analysis, we did not have access to the survey instrument or the raw data. Our knowledge of the recruitment process and sample was limited to the information and aggregate data provided in the *Methodology* and *Institution and Personal Demographic* sections of the reports. Finally, these findings, while yielding some insights into faculty attitudes, provide little explanatory power as to the reasons behind the changes observed. Future research into such reasons is both necessary and worthwhile.

Conclusion

The collective findings of the *Survey of Faculty Attitudes on Technology* reports show that faculty attitudes toward technology prior to 2020 show both high and low magnitudes of change. Past research has identified areas of tension reported by faculty regarding technology adoption, but factors mitigating these tensions and influencing change need further investigation. Developing a better understanding of how faculty attitudes toward online learning and technology have changed as well as the influencing factors driving such change will help us to better understand the support that faculty need when using technology in their teaching.

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References

Adams Becker, S., Brown, M., Dahlstrom, E., Davis, A., DePaul, K., Diaz, V., & Pomerantz, J. (2018). *NMC horizon report: 2018 higher education edition*. EDUCAUSE. https://library.educause.edu/~/media/files/library/2018/8/2018horizonreport.pdf

Adams Becker, S., Cummins, M., Davis, A., Freeman, A., Hall, C. G., & Ananthanarayanan, V. (2017). *NMC horizon report: 2017 higher education edition*. The New Media Consortium. https://www.learntechlib.org/p/174879/

Alexander, B., Ashford-Rowe, K., Barajas-Murphy, N., Dobbin, G., Knott, J., McCormack, M., Pomerantz, J., Seilhamer, R., & Weber, N. (2019). *EDUCAUSE horizon report: 2019 higher education edition*. EDUCAUSE. https://library.educause.edu/-/media/files/library/2019/4/2019horizonreport.pdf?la=en&hash=C8E8D444AF372E705FA1BF9D4FF0DD4CC6F0FDD1

Allen, I.E. & Seaman, J. (2007). *Online nation: Five years of growth in online learning*. Sloan Consortium. https://www.bayviewanalytics.com/reports/online-nation.pdf

Allen, I.E. & Seaman, J. (2012a). C*onflicted: Faculty and Online Education, 2012*. Babson Survey Research Group and Inside Higher Ed. https://www.insidehighered.com/sites/default/server_files/files/IHE-BSRG-Conflict.pdf

Allen, I.E. & Seaman, J. (2012b) *Digital Faculty: Professors, Teaching and Technology, 2012*. Babson Survey Research Group and Inside Higher Ed. https://www.insidehighered.com/sites/default/server_files/DigitalFaculty.htm

Allen, I.E. & Seaman, J. (2013) *Changing course: Ten years of tracking online education in the United States*. Sloan Consortium. https://www.bayviewanalytics.com/reports/changingcourse.pdf

Barbera, E., Gros, B., & Kirschner, P. A. (2015). Paradox of time in research on educational technology. *Time & Society, 24*(1), 96-108. doi:10.1177/0961463X14522178

Birch, D., & Burnett, B. (2009). Bringing academics on board: Encouraging institution-wide diffusion of e-learning environments. *Australasian Journal of Educational Technology, 25*(1), 117–134. https://doi.org/10.14742/ajet.1184

Conceição, S. C. (2006). Faculty lived experiences in the online environment. *Adult Education Quarterly, 57*(1), 26-45. doi:10.1177/1059601106292247

Conrad, D. (2004). University instructors' reflections on their first online teaching experiences. *Journal of Asynchronous Learning Networks*, *8*(2), 31-44. http://dx.doi.org/10.24059/olj.v8i2.1826

De Gagne, J. C., & Walters, K. J. (2010). The lived experience of online educators: Hermeneutic phenomenology. *Journal of Online Learning and Teaching*, *6*(2), 357-366. https://jolt.merlot.org/vol6no2/degagne_0610.pdf

Garrett, R., Legon, R., & Frederickson, E. E. (2019). *CHLOE 3 behind the numbers: The changing landscape of online education 2019*. Quality Matters. https://www.qualitymatters.org/qa-resources/resource-center/articles-resources/CHLOE-3-report-2019

Green, K. C. (2019). *The 30th national survey of computing and information technology in American higher education*. The Campus Computing Project. https://www.campuscomputing.net/s/Campus-Computing-2019-Report.pdf

Jaschik, S, & Lederman, D., (2013). *Survey of faculty attitudes on technology*. Inside Higher Ed. https://www.insidehighered.com/special-reports

Jaschik, S., & Lederman, D. (2014). *Survey of faculty attitudes on technology.* Inside Higher Ed. https://www.insidehighered.com/special-reports

Jaschik, S., & Lederman, D. (2016). *Survey of faculty attitudes on technology.* Inside Higher Ed. https://www.insidehighered.com/special-reports

Jaschik, S., & Lederman, D. (2017). *Survey of faculty attitudes on technology.* Inside Higher Ed. https://www.insidehighered.com/special-reports

Jaschik, S., & Lederman, D. (2018). *Survey of faculty attitudes on technology.* Inside Higher Ed. https://www.insidehighered.com/special-reports

Jaschik, S. & Lederman, D. (2019a). *Survey of college and university chief academic officers.* Inside Higher Ed. https://www.insidehighered.com/special-reports

Jaschik, S. & Lederman, D. (2019b). *Survey of faculty attitudes on technology.* Inside Higher Ed. https://www.insidehighered.com/special-reports

Hyndman, N., VanLeeuwen, C. A., & Weeks, L. E. (2016). Technology in teaching family science: What we do and why we do it. *Family Science Review*, *21*(3), 42-57. doi: 10.26536/FSR.2016.21.03.03

Jordan, K. & Weller, M. (2018). Academics and social networking sites: Benefits, problems and tensions in professional engagement with online networking. *Journal of Interactive Media in Education, 1*(1), 1-9. https://doi.org/10.5334/jime.448

Kimmons, R. (2020). Current trends (and missing links) in educational technology research and practice. *TechTrends, 64*(6), 803-809. doi:10.1007/s11528-020-00549-6

Legon, R., & Garrett, R. (2017). *The changing landscape of online education (CHLOE).* Quality Matters and Eduventures Research. https://www.qualitymatters.org/qa-resources/resource-center/articles-resources/CHLOE-report-2017

Legon, R., & Garrett, R. (2018). *CHLOE 2: The Changing Landscape of Online Education: A Deeper Dive*. Quality Matters and Eduventures Research. https://www.qualitymatters.org/sites/default/files/research-docs-pdfs/2018-QM-Eduventures-CHLOE-2-Report.pdf

Lemon, N., McPherson, M., & Budge, K. (2015). Academics doing it differently: Wooing, hooking up and spinning stories. *Journal of Perspectives in Applied Academic Practice, 3*(2), 15-25. https://jpaap.napier.ac.uk/index.php/JPAAP/article/view/129/pdf

Lupton, D. A. (2014). *'Feeling Better Connected': Academics' Use of Social Media*. News & Media Research Centre, University of Canberra. http://www.canberra.edu.au/faculties/arts-design/attachments/pdf/n-and-mrc/Feeling-Better-Connected-report-final.pdf

Maguire, L. L. (2005). Literature review–faculty participation in online distance education: Barriers and motivators. *Online Journal of Distance Learning Administration*, *8*(1), 1-16. https://www.westga.edu/~distance/ojdla/spring81/maguire81.htm

Major, C. H. (2010). Do Virtual Professors Dream of Electric Students? University Faculty Experiences with Online Distance Education. *Teachers College Record, 112*(8), 2154-2208. https://www.tcrecord.org/content.asp?contentid=15946

Marzilli, C., Delello, J., Marmion, S. McWhorter, R., Roberts, P., & Marzilli, T. S. (2014). Faculty attitudes towards integrating technology and innovation. *International Journal on Integrating Technology in Education (IJITE) 3*(1), 1-20. doi :10.5121/ijite.2014.3101

McSpadden, E. L. (2018). An educational paradigm in the midst of shifting: Students' and professors' attitudes toward classroom technology. *Journal of Teaching and Learning with Technology, 7*,(1) 59-69. doi:10.14434/jotlt.v7n1.23368

Pachnowski, L. M., & Jurczyk, J. P. (2003). Perceptions of faculty on the effect of distance learning technology on faculty preparation time. *Online Journal of Distance Learning Administration*, *6*(3), 1-10. https://www.westga.edu/~distance/ojdla/fall63/pachnowski64.html

Selwyn, N. (2016). *Is technology good for education?* John Wiley & Sons.

Straumsheim, C., Jaschik, S. & Lederman, D. (2015). *Survey of faculty attitudes on technology*. Inside Higher Ed. https://www.insidehighered.com/special-reports

Tabata, L. N., & Johnsrud, L. K. (2008). The impact of faculty attitudes toward technology, distance education, and innovation. *Research in Higher Education*, *49*(7), 625-646.

Veletsianos, G. (2016). *Social media in academia: Networked scholars*. Routledge.

Veletsianos, G., Johnson, N., & Belikov, O. (2019). Academics' social media use over time is associated with individual, relational, cultural and political factors. *British Journal of Educational Technology*, *50*(4), 1713-1728. https://doi.org/10.1111/bjet.12788

Veletsianos, G., & Kimmons, R. (2013). Scholars and faculty members' lived experiences in online social networks. *The Internet and Higher Education*, *16*, 43-50. https://doi.org/10.1016/j.iheduc.2012.01.004

Weller, M. (2011). *The digital scholar: How technology is transforming scholarly practice*. Bloomsbury Academic.

Wingo, N. P., Ivankova, N. V., & Moss, J. A. (2017). Faculty perceptions about teaching online: Exploring the literature using the technology acceptance model as an organizing framework. *Online Learning*, *21*(1), 15-35. doi: 10.10.24059/olj.v21i1.761