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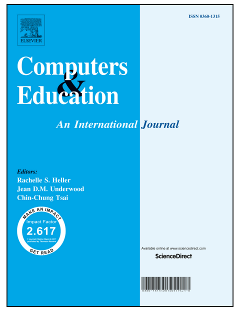

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College Instructors and the Digital Red Pen:
An Exploratory Study Exploration of Factors Influencing the Adoption and Non-Adoption of Digital Written Feedback Technologies

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**College Instructors and the Digital Red Pen:
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Non-Adoption of Digital Written Feedback Technologies**

Abstract: This exploratory study examined a diverse set of college instructors' (*N* = 215) perceptions regarding the pedagogical use of digital written feedback, via a mixed-methodological online survey. The majority of the sample were adopters of digital written feedback, providing eight strengths and six weaknesses for doing so, as well as additional insight on digital written feedback "diets" (i.e., amount, frequency, and duration). Adopters differed from non-adopters in their preferences for digital written feedback to email, handwritten, and video feedback. Adoption decisions were significantly predicted by instructors' perceived ease of use of the technology and by perceived benefits to students.

Keywords: attitudes, college instructors, digital written feedback, preferences, technology adoption

1.0 Introduction

Biggs and Tang (2007) identify feedback as an essential element of the teaching and learning process. In academia, instructors provide students with formative feedback throughout the semester, and they provide summative feedback which assigns an overall grade or evaluation report for their students (Rowe, Fitness, & Wood, 2014). Feedback serves a communicative role that is not limited to learning outcomes. For example, feedback is used to clarify expectations and concepts, provide praise, and communicate care and interest about students' success (Nicol & Macfarlane-Dick, 2006; Rowe, 2011; Rowe, et al., 2014). Instructional feedback is a complex process that serves both functional and relational purposes.

Instructional feedback, broadly defined, is any communicative act or "intervention" that an instructor engages in with a student regarding their performance (De Kleijn, Meijer, Pilot, & Brekelmans, 2014). The goal of instructional feedback is to not only improve students' performance, but to also enhance their understanding of the material. Communication technologies allow this process to become digitized and may change the process of the feedback intervention. Indeed, giving digital feedback may even require different instructional skills—Leibold and Schwarz (2015) state that "the art of giving online feedback is a critical skill for an educator" (p. 34). Digital feedback has traditionally been researched as an aspect of online learning (e.g., Gallien & Oomen-Early, 2008; Leibold & Schwarz, 2015), but this type of feedback is not unique to online learning, as many instructors who teach face-to-face (FtF) courses make use of programs which allow them to provide students with digital written feedback. Word processing software, such as Microsoft Word, allows users' to track changes made to the content and to make comments in electronic documents. Similarly, learning management systems (e.g., Blackboard, Canvas) permit instructors to leave digital written feedback to students. While using communication technologies to provide digital written feedback in the classroom may seem commonplace, little research suggests the rate at which these technologies are adopted, and how or why, they are actually used. More specifically, the purpose of this study is to explore college instructors' usages and perceptions of digital written feedback.

1.1 Instructional Feedback

Before instructional technology was readily available, students turned in tangible copies of their work. The instructor would then retreat to a different location, read the student's work, record feedback on the student's work, and arrive at a grade "by a process mysterious to the student" (Fassler, 1978, p. 186). Research has explored how students react to the proverbial "red pen," taking also into consideration the type of feedback being received. For example, Semke (1984) conducted an experiment across four identical sections of an introductory German language course, manipulating feedback given to students on writing samples with a red pen. The four feedback conditions in Semke's experiment included corrections to writing alone, comments on writing alone, a combination of corrections and comments on writing, and student corrections with only copyediting marks. Results from the study showed that students who received the red pen comments on their writing improved the most—in writing fluency and overall proficiency, and that these results were significantly different from the other feedback groups (Semke, 1984). In a sense, Semke's findings are likely due to the red pen feedback allowing students to better understand how their instructor was processing the work, removing some of the mystery highlighted by Fassler (1978).

The challenge regarding the best way to give instructional feedback is not a new one. Fassler (1978) posed the question, "What is the most efficient and effective way for the teacher's analysis to be communicated?" (p.187). In her foundational article, she presents a number of advantages to providing feedback to students in a face-to-face (FtF) setting. First, she suggests that providing FtF feedback saves the instructor time. More specifically, instructors can communicate more information per minute orally than through writing. Second, Fassler suggests that in a FtF feedback environment, instructors are able to better read their students' nonverbal communication. They are able to assess comprehensibility and emotional responses to feedback. A third benefit that she presents is that students report favoring FtF conferences rather than receiving a piece of paper with red pen on it. Feedback, no matter the mode in which it is delivered (written, video, FtF, or otherwise), is important in higher education. When delivered effectively, feedback can have long-lasting and far-reaching benefits for students, such as improving writing quality, GPA, and perceived learning (Semke, 1984; Kerssen-Griep, Trees, & Hess, 2008; Hattie, 2009). In a synthesis of over 800 meta-analyses, Hattie (2009) suggested that instructor feedback was the strongest contributor to student achievement. Moreover, the benefits of instructional feedback for students are greatly enhanced when learners take an active role in the process (Boud & Malloy, 2013). Longitudinal work by Higgins, Hartley, and Skelton (2002) suggests that learners motivations for seeking feedback are often more intrinsic than extrinsic in nature—that is, that students seek feedback in order to foster a better understanding of academic content than to simply correct their grades. Such a process works best when it builds learners' capacity to make their own judgements about their work, so that they can self-assess their performance (Boud & Malloy, 2013). Because feedback is of high intrinsic importance to students (i.e. Higgins et al., 2002), and it is the strongest factor predicting achievement (i.e., Hattie, 2009), the methods by which instructors deliver feedback are in need of further exploration—especially when new methods of delivering that feedback (such as digital written feedback) emerge that might impact the feedback process.

Evolutions in communication technologies have given instructors methods of feedback delivery that potentially augment the more traditional methods of feedback that an instructor can provide a student. Likewise, scholars have recognized this shift in available feedback technologies. For instance, Vaughan and Uribe (2018) suggested that “we must consider how we can adjust our teaching practices to match the new mediums (stet) we teach in” (p. 13). Most critically for the current study, once instructional feedback can be considered a teaching moment, the emerging communication technologies that instructors use to provide digital written feedback should be examined.

1.2 Adoption of Digital Written Feedback Innovations

Since the emergence of instructional feedback research, emphasis has been placed on the student’s point of view rather than the instructor’s (i.e., Witt & Kerssen-Griep, 2011; Kerssen-Griep & Witt, 2012). This is especially true of delivering digital feedback. A small body of research has examined instructor perceptions alongside student perceptions of feedback. For example, in a mixed methods approach, Borup, West, and Thomas (2015) found no differences in perceptions of quality of feedback whether it was through written text or video. However, end-of-semester interviews revealed that both students and instructors found that written text allowed for more organized feedback and more efficient delivery. Hattie and Timperley (2007) argue that feedback is needed when there is a discrepancy between a student’s current performance, and a desired goal, so the instructor’s role is to provide challenging and specific goals and assisting students through the process of achieving those goals.

Further analysis of both faculty and student perspectives provided evidence suggesting feedback with greater nonverbal cues were perceived as more supportive communication while written feedback contained more specific critiques (Borup et al., 2015). This research supports the notion that different delivery channels provide unique functions and perceived strengths and weaknesses. Even audio feedback has been examined—Shepherd (2011) examined feedback preferences of graduate students in an MBA distance education setting. In this experiment, graduate students were provided with instructional feedback via Word documents and verbal .mp3 files. Prior research framed by media richness theory (see Daft & Lengel, 1984) assumed that students would exhibit a preference toward the richer medium (i.e., those containing more nonverbal cues such as rate, pitch, and tone of vocalics available in an audio recording), but results of Shepherd's 2011 study indicated that there is an overwhelming preference toward written feedback instead. Furthermore, McCabe, Doerflinger, and Fox (2011) surveyed both students and faculty on their perceptions of electronic editing forms (e.g., track changes, digital highlighting, and digital comments). Respondents indicated a preference for digital written feedback due to its convenience, clarity, and amount of feedback (allowing for more detailed feedback in a confined space) compared to paper-based methods. Faculty included in McCabe et al.'s (2011) sample also reported using digital feedback forms for personal use, writing with co-authors, and for communication with publishers/academic journals (along with providing student feedback). While these faculty perceptions of digital feedback are more sparse, student perceptions of digital instructor feedback is studied more frequently. For example, a series of studies explored how students react to face-threat mitigation (FTM) strategies, or feedback that is delivered in a way that minimizes a students' focus on their personal identities, and more on the task that is receiving feedback. These strategies have been found to be perceived positively by students in face-to-face environments, via video feedback, and via digital written feedback (i.e., Clark-Gordon, Bowman, Watts, Banks, & Knight, 2018; Trad, Katt, & Miller, 2014). King, Schrodt, and Weisel (2009) suggest that students expect quality feedback to be useful, clear, and sensitive. Additional work has explored how students receive criticism (e.g., Dannels, Gaffney, & Martin, 2011; Kerssen-Griep & Witt, 2015; King & Young, 2001). While these studies provide a basis for understanding student expectations for, and reception of, feedback, continued work needs to explore instructors' use and rationale for using digital feedback technologies.

Anecdotally, the feedback process seems to have evolved beyond the traditional "red pen" method, with potential advantages of FtF feedback (e.g., such as saving the instructor time and the ability to provide a greater amount of feedback as suggested by Fassler, 1978) also translating into the digital space. Using digital written feedback software programs provide instructors with affordances that writing with pen or speaking FtF do not. Perceived affordances often influence a user's adoption of a communication technology (Fox & McEwan, 2017), and those perceived affordances stem from how certain features of the technology are viewed. With respect to digital written feedback, common features of digital written feedback technologies (such as those built into Microsoft Word and Google Docs) give instructors the capabilities to leave comments, track changes, highlight, stamp, or otherwise "mark up" student work—similar to a red pen. Affordances, then, are the action potentials of these features (Evans, Pearce, Vitak, & Treem, 2016). Two examples of the affordances of these features of digital written feedback technologies (both affordances of communication technology as identified by Evans et al., 2016) are visibility (whether a piece of information can be located and how easily it can be located) and persistence (how long it stays available in a given medium). These affordances can then lead to desired instructional outcomes. For example, increased visibility and persistence of digital written feedback allow instructors to link URLs and web links in feedback for relevant material, creates a lasting record of feedback and making supplemental material more visible than it would be in traditional, hand-written feedback forms (e.g., hyperlinks in annotated comments allow students to immediately locate suggested materials for a given assignment). Moreover, by annotating and marking edits directly in digital written feedback software, instructors can focus student attention on specific problematic aspects of an assignment and provide thought processes parallel to those problematic aspects—in a sense, the instructor can model the very thought processes that they are hoping the student will take up, further demystifying the process of feedback (see Fassler, 1978) by leveraging communication technology to create a space (within the digital documents) for asynchronous out-of-class communication. Additionally, other digital feedback software such as Canvas, Turnitin, or Moodle have features similar to Microsoft Word (such as the tracked changes and annotated comments discussed to this point) which also could lead to the affordances of visibility and persistence for instructors and students, and in turn desired instructional outcomes (See Table 1 for further examples of the relationships between features, affordances, and instructional outcomes).

-- INSERT TABLE 1 ABOUT HERE --

Notably, while the features these technologies offer may stay constant for instructors who use them, their perceived affordances, and therefore instructional outcomes may differ based on the practices implemented by instructors. Likewise, the rates of adoption for these technology might also differ. Therefore, to explore the potential implications of digital written feedback, we first must ask (RQ1): To what extent do college instructors use digital written feedback?

1.3 Individual Differences, Beliefs, and Adoption

Instructors choose to adopt technologies based on their knowledge of the technology, their self-efficacy for using the technology, and their individual beliefs about the technology (Ertmer & Ottenbreit-Leftwich, 2010). The technology acceptance model (TAM; Venkatesh & Davis, 2000) is a theoretical perspective that explains perceived usefulness and usage intentions. TAM claims that behavioral intentions to use a system is determined by two beliefs: perceived usefulness (or the extent to which a person believes that using a technology will enhance job performance), and perceived ease of use (or the extent to which person believes that using the system will be free of effort). TAM has been broadly applied in organizational contexts for both voluntary and mandatory technology adoptions in a variety of industries (Venkatesh & Davis, 2000; Lee, Kozar, & Larsen 2003), but is also relevant in the instructional context. For example, Teo (2010) found that TAM explained nearly 50% of the variance in attitude toward computer usage in pre-service teachers and Gao (2005) found that TAM was successful at predicting instructor's use of a textbook's companion website (that featured supplementary materials for instructors). Notably, while TAM is primarily focused on attitudes toward technology, individual levels of self-efficacy and computer-mediated communication anxiety influence individual adoption and use of technology.

Self-efficacy and technology-related communication anxiety can be paired with the TAM concepts of perceived usefulness and ease of use to better predict if instructors will adopt digital written feedback technologies into their teaching practice. Self-efficacy is defined as an individual's judgment of his/her ability to perform a certain task (Bandura, 1977). Computer self-efficacy (CSE), then, describes an individual's judgment about whether he/she will be successful in using a certain technology on their own (Lai, 2008). Looney, Valacich, Todd, and Morris (2006) suggest that individuals with a greater sense of CSE tend to prefer using technologies to complete academic tasks, such as conducting research, while individuals with low CSE prefer traditional methods, such as traditional lectures. Jacobsen (1998) further suggested that factors which influence faculty's implementation of technology includes self-efficacy. At this point, there is little to no conclusive research that explores the role of CSE in instructors' use of technology when it comes to delivering digital written feedback. However, scholars do suggest that individuals who do not perceive themselves as competent computer users are less likely to use them (Paraskeva, Bouta, & Papagianni, 2008). Research on computer-mediated communication anxiety has rendered similar results.

An additional variable related to an individual's adoption of a technology is their anxiety associated with communicating via said technology (i.e., Holden & Rada, 2011). Specially, an instructors' anxiety over communicating with students via technology would impact their adoption of the technology in the classroom, functioning alongside the predictors outlined in the TAM. Computer-mediated communication (CMC) anxiety is conceptualized as the level of fear or apprehension that an individual experiences regarding the anticipated or actual use of information technology for communication (Brown, Fuller, & Vician, 2004). CMC anxiety is often examined in distance education settings (e.g., Hauser, Paul, & Bradley, 2012) and from the learner's perspective (e.g., Wombacher et al., 2017). Therefore, little is known about instructors' CMC anxiety. However, differences in anxiety or communication apprehension (CA) in general may influence an instructor's preference for digital versus FtF feedback delivery.

In sum, an instructor's preferred method of feedback delivery may be dependent upon their perceptions of the technology as well as their personal beliefs about technology. Therefore, the following research question is posed:

RQ2: Do individual differences and technology acceptance beliefs influence instructors' adoption and use of digital written feedback?

Finally, we borrow from a rational actor perspective applied to communication technology (see Bowman, Westerman, & Claus, 2012) to further probe instructor's perceptions of the relative costs and benefits of digital written feedback—especially given that these perceptions are likely associated with usability and ease of use as suggested by TAM. Such an approach is useful when we consider instructor feedback as a communicative act (De Kleijn et al., 2014) that could be bolstered or hindered through the use of digital tools.

RQ3: How do instructors perceive the (a) costs and (b) benefits of digital written feedback?

2. Method

2.1 Participants and Procedures

Participants (*N* = 215) were recruited using social media, professional listservs, snowball sampling, and personal contacts made by members of the research team (all of whom are instructors at US-based universities). The sample included 76 males, 134 females, and 5 nonbinary/gender-fluid individuals who ranged in age from 22 to 68 (*M* = 38.44, *SD* = 10.38), with the majority identifying as white/caucasian ethnic identity (*n* = 151, 70.23%), with additional representation from LatinX, African American, and Asian respondents. These instructors reported that they were (in descending order, by frequency): associate professors (*n* = 50), assistant professors (*n* = 49), lecturers/instructors (*n* = 37), full professors (*n* = 33), graduate teaching assistants (*n* = 13), adjunct instructors (*n* = 11), departmental chairs/administrative positions (*n* = 6), in postdoctoral positions (*n* = 4), and visiting faculty (*n* = 2), among other field-specific positions (e.g., clinical faculty, information systems assistant; *n* = 10), who had accumulated between 1 and 43 years of teaching experience (*M* = 10.91, *SD* = 8.77). Participants were affiliated with research-focused institutions (*n* = 87), teaching-focused institutions (*n* = 93), and at institutions that equally emphasized research and teaching practices (*n* = 35). As demographic questions were optional for all participants, response rates do not equal to the entire sample size for every demographic question mentioned above. Participants could elect to enter their name for a $100 Amazon.com gift card drawing as an incentive in the study.

After agreeing to participate in the survey, participants were first provided examples of digital feedback, including screenshots of the insert comments and track changes functions, in Microsoft Word. Then, they were asked whether they had ever used digital feedback. For those who answered yes (*n* = 194; 90.2%), they then answered open ended questions regarding feedback preferences, class details, quantity of feedback, strengths and weaknesses, and a series of Likert type scales described below. For participants who did not report using digital feedback (*n* = 21; 9.8%), they were directed to a different series of open ended questions about why they chose not to use this form of feedback, and the same series of Likert type scales described below. The entire survey metric, as well as an anonymized data file and analysis outputs[1], is available online through our project's anonymized Open Science Framework space, at http://bit.ly/OSF_DigitalRedPen_NCA18.

2.2 Instrumentation

2.2.1 Perceived ease of use and usability. To measure the perceived ease of use and usability (PEUU) of digital written feedback platforms, an adapted version of Holden and Rada's (2011) 9-item measure was utilized, using 7-point Likert response options, ranging from *strongly*

[1] All data that could potentially identify participants, including demographic information, was removed from this publicly available data file to ensure the privacy of our participants (as some could connect demographics with other study data, such as courses taught). Further, all items and variable composites are labeled in the data file provided to ensure transparency and replicability of analyses.

disagree (1) to *strongly agree* (7). Participants listed their preferred platform/software in the beginning of the survey for using digital written feedback, with response options such as Microsoft Word, Google Docs, Turnitin, and Canvas, among others. This response was then used as piped text in Qualtrics throughout the survey to modify questions to be about the specific form of digital written feedback software preferred by the instructor (i.e., My interaction with the technology is clear and understandable). This adapted scale was found to be internally consistent (α =.95, *M* =5.79, *SD* = 1.13).

2.2.2 Perceived usefulness. Perceived usefulness of written digital feedback software was measured using a 6-item, 7-point Likert measure (e.g., I find the technology to be useful in my job) from Davis (1989), again using the piped text feature in Qualtrics to adapt the scale to the instructors' choice of digital feedback software to replace "the technology" with their chosen platform. The scale was internally consistent in this study (α = .94, M = 5.8, SD = 1.20).

2.2.3 Attitude toward using technologies. Attitudes towards using digital written feedback technologies was also measured using Holden and Rada's (2011) attitudes towards technologies (AT) measures. This 5-item measure used semantic differential adjective pairs (i.e., "Bad - Good," and "Harmful - Beneficial") set to the stem phrase, "All things considered, my using the technology is ...." The present study modified the wording of this measure for two contexts, asking first how participants perceived their own use of the technology (as an instructor), but also contextualizing the scale to participants perceptions of how using digital written feedback technologies may benefit their students. Both versions of the scale were internally consistent: perceptions of instructor benefit (α = .94, *M* = 6.07, *SD* = 1.00) and perceptions of student benefit (α = .95, *M* = 5.79, *SD* = 1.13).

2.2.4 Computer Mediated Communication Anxiety. Computer mediated communication anxiety was measured using Scott and Timmerman's (2005) 10-item measure (i.e., I look forward to the opportunity to interact with others on the computer) Participants responded using a 7-point scale ranging from *strongly disagree* (1) to *strongly agree* (7). The scale was internally consistent in this study (α = .81, *M* = 4.88, *SD* = .87).

2.2.5 Computer Self-Efficacy. Computer self-efficacy was measured also using Holden and Rada's (2011) scale. The 10-item scale was set to the stem, "In general, I could complete any desired task using any computer/Internet application if …" and participants responded using a 7-point Likert scale ranging from *strongly disagree* (1) to *strongly agree* (7). The scale was internally consistent in the present study (α = .90, M = 5.42, SD = 1.04).

2.2.6 Feedback Preference. To determine the extent to which participants preferred feedback methods, a series of 7-point semantic differential scales were developed for the present study. We asked participants to rate the degree to which preferred office hours, in-class feedback, hand-written feedback, recorded video feedback, and live video feedback compared to digital written feedback. Example stems included, "strongly prefer [technology choice] to email…. Strongly prefer email to [technology choice]," with a 4 representing a neutral orientation towards both methods of feedback.

2.2.7 Digital Written Feedback "Diet". Borrowing from Bowman, Westerman, and Claus' (2012) logic on social media diets being measured as a combination of frequency, amount, and duration, open-ended questions were developed for the present study to assess all three (*M* = 35.2 word response length; greater detail provided in Qualitative Analyses below).

2.2.8 Functionality. To gauge the perceived functionality and appropriateness of digital written feedback in the classrooms of real professors, participants were asked to create lists of the relative strengths and weakness of digital written feedback use (*M* = 27.9 word response length).

2.3 Data Analysis

As a mixed-methodology survey, our data is a combination of answers to both closed- and open-ended survey items. “The term ‘mixed methods’ refers to an emergent methodology of research that advances the systematic integration, or ‘mixing,’ of quantitative and qualitative data within a single investigation or sustained program of inquiry” (Wisdom & Cresswell, 2013, p. 1). Our study is mixed-methods, then, as it integrates both types of data (quantitative data from closed-ended items, and qualitative data from the open-ended items), which were analyzed to answer our three primary research questions. To answer the first research question about the extent to which instructors use digital written feedback, descriptive statistics were used to outline the feedback preferences of the sample. The second research question asked what predictors, including personal factors (i.e., CMC anxiety, computer self-efficacy) and technology beliefs (i.e., perceived ease of use and usability, perceived usefulness, attitudes toward technology) would impact an instructor’s decision to adopt digital written feedback methods. A logistic regression was determined the best way to answer this research question, particularly because of the dichotomous (i.e., those who adopt versus non-adopters of digital written feedback) outcome variable. Third, research question three, which asked what instructors perceived costs and benefits of digital written feedback, participants responded to closed-ended preference questions and open-ended essay questions. The closed-ended questions on modality preference were analyzed using t-tests. The qualitative, open-ended answers were analyzed with an emergent thematic analysis (Braun & Clarke, 2006; Glaser, 1965) to generate themes to describe the pattern of responses in this study, as well as to generate a codebook that could be used in future research regarding technology and feedback.

3. Results

3.1 Quantitative Results

Our first research question asked broadly about the extent to which instructors were using digital written feedback. From our sample, over 90% of respondents (n = 194) adopted digital written feedback technologies, and this distribution broke significantly from an even (50%) distribution, $t(214) = 19.83$, $p < .001$, Cohen's $d = .65$. Of those 194 instructors who gave their students digital written feedback, the most frequently reported software preferred was Microsoft Word (n = 131), followed by Google Docs (n = 17), Canvas (n = 14), Turnitin (n = 9), other tools embedded in learning management systems (e.g., Crocodoc, Moodle, Blackboard; n = 40), and Adobe Acrobat/PDF (n = 4). A chi-square analysis revealed that Microsoft Word was significantly preferred by instructors, $\chi 2\ (5) = 139.205$, $p < .001$, Cramer's V =.48. They reported giving digital written feedback on an average of five assignments per semester (M = 5.14, SD = 4.06), and that they had been using digital written feedback in their courses for an average of 6.17 years (SD = 5.59).

Instructors using digital written feedback reported doing so for classes in 32 different course topics from a wide variety of disciplines such as communication, psychology, sociology, geography, anthropology, English composition, philosophy, public health, chemistry, history, computer science, foreign languages, and business, to name a few. The overwhelming preference for Microsoft Word (described above) could be due to the underrepresentation of mathematics professors in our sample, who would likely utilize LaTeX or LyX for assignments involving equations (only n = 2 participants mentioned LaTeX in the present study, one instructed a course on privacy/security, and the other an argumentation/debate course). Furthermore, digital written feedback may be used more by instructors who teach writing-intensive courses. These courses ranged in enrollment from 1 (independent studies) to 300 (traditional mass lectures; M = 35.7, SD = 44.78, Median and Mode = 25). The majority of the courses were discussion-based (n = 126), followed by lecture-based (n = 114), and lab-based (n = 27). The majority of the courses were being taught at the junior (300-) level (n = 62), followed by freshman (100-) level (n = 44), sophomore (n = 25), senior (n = 15), graduate courses (n = 43), as well as course that cut across levels of students (i.e., those that were offered for both senior undergraduate students and master's students, or those that were advertised at a lower level despite many different levels of students enrolled, n = 26). Twenty-two instructors (11.3%) reported that they utilized a teaching assistant in their course. Approximately 65.33% of the final grades in these courses was based on written assignments (SD = 24.92). Additionally, 62.4% of instructors reported that they gave their students an opportunity to revise and resubmit their written work, while 37.6% reported that their students did not have an opportunity to resubmit work following feedback.

To answer RQ2, which asked to what extent individual differences and technology acceptance beliefs would affect adoption of digital written feedback, a logistic linear regression was run regressing adoption on to six “predictors” (in quotations, given the cross-sectional nature of our data): our two individual difference variables of computer mediated communication anxiety and computer self-efficacy as well as our four measures of the technology acceptance model (perceived ease of use, perceived utility, perceptions of student benefit, and perceptions of instructor benefit). In these analyses, adoption was dummy-coded such that “0” indicated non-adoption, and “1” indicated adoption. The bivariate correlation between these measures are included in Table 2.

--TABLE 2 HERE--

Logistic regression analysis demonstrated that the overall model including our six “predictors” was a significant improvement over the constant model with no predictors, □2(6) = 63.82, $p <$ .001, and explained a substantial amount of variance in the adoption of digital written feedback technologies, Nagelkerke R_2 = .543; a Hosmer and Lemeshow test confirms that the specified model’s estimates are a fit for the observed data, 5 2(8) = 4.25, p = .833. Closer examination of the “predictors” suggests that perceived usability, Exp(B) = 2.76 (95% LLCI = 1.50, ULCI = 5.08), and perceptions of benefit for students, Exp(B) = 2.69 (95% LLCI = 1.33, ULCI = 5.45) both explain significant and substantial variance in an instructor’s adoption of digital written feedback (see Table 2 for full regression results). Odds ratios of this magnitude suggest that a one-unit increase in an instructor’s perceptions of usability increase the odds of an instructor adopting digital written feedback technology by 276%, and increases in perceptions of benefit for students increase the odds of adoption by 269%. Replication of this analysis controlling for participant age, years teaching, semester teaching load, and type of institution (dummy-coding to compare both research and mixed institutions against teaching institutions) revealed no significant effects, and adding these covariates did not alter the results presented in Table 3.

--TABLE 3 HERE--

Notably given the presence of high correlations (> r = .70) between some predictor sets (such as perceived ease of use and perceived usability, as well as perceptions of student and instructor feedback; see Table 2), two additional steps were taken to protect against variance inflation due to multicollinearity. First, we replicated the analyses using a linear regression model, so as to generate both tolerance and variance inflation statistics—doing so reported tolerance scores for those highly correlated pairs ranging from .394 to .485 and variance inflation statistics ranging from 2.06 to 2.54; these scores fall within acceptable ranges for multicollinearity[2]. Second, to consider the potential that the two pairs of measures used in our study may have formed unidimensional rather than multidimensional constructs in this specific application (as combining "predictors" into a single indicator is a simple way to reduce multicollinearity, O'Brien, 2007), principal components analysis was performed on both pairs. Principal components analysis (PCA) was performed rather than confirmatory factor analysis (CFA), because the former allows for an exploration of a unique factor structure in a given dataset, while CFA only allows for a test of the a priori factor structure. In other words, a failed CFA test would not have been able to inform revisions to the scales' factor structures. PCA is also recommended for reducing complexity of regression model predictors (see Park, Dailey, & Lemus, 2006). The outputs of both analysis indicated clearly that perceived ease of use and perceived usability items clustered as expected around separate constructs (i.e., they replicated the *a priori* measurement models), as did perceptions of student and instructor benefit (see OSF project, under file "Data Analysis Files" for complete output). We also note that O'Brien's (2007) suggestion to combine indicators assumes that the measures are conceptually isomorphic, yet extant literature on these TAM indicators (as well as our own factor structure exploration) would not support collapsing the measures—that is, the measures are related-but-unique components of technology acceptance.

Finally to analyze the rational actor perspective central to RQ3, we compared adopters and non-adopters perceptions of how much they would prefer using digital written feedback to other instructional feedback modalities, such as using email, office hours, handwritten feedback, recorded video, live video, and in-class feedback. Welch's *t*-tests (which are more robust for

[2] One possible solution for further reducing multicollinearity is to remove one of the two highly-correlated "predictors" from either pair from our specified regression model. However, doing so had no effect on overall model fit and only a nominal influence on observed variance explained (ΔNagelkerke's R2 = .004 when removing perceived ease of use and usability and perceptions of benefit to instructors); complete outputs available in our OSF project space: http://bit.ly/OSF_DigitalRedPen_NCA18.

unequal group variance due to uneven sample sizes for comparison; Delacre, Lakens, & Leys, 2017) revealed that adopters showed greater preference scores than non-adopters for each modality except for recorded and live video, in which no differences were found (see Table 4). However, perhaps more telling than comparisons between groups is the comparison between each group's average modality preference score and the scale midpoint of 4.00, which would represent no preference (scores less than 4.00 represent preference for the stated modality, and scores greater than 4.00 represent preference for digital written feedback). One-way *t*-tests (also reported in Table 3) revealed that non-adopters preferred office hours, hand-written feedback, and in-class feedback significantly more than digital written feedback. Digital written feedback adopters preferred office hours and in-class feedback to digital written feedback, but they preferred digital written feedback to email, handwritten, and video feedback.

-TABLE 4 HERE-

3.2 Qualitative Findings

In addition to the quantitative analyses above, an emergent thematic analysis (Braun & Clark, 2006) was conducted on adopters' open-ended responses to the relative strengths and weaknesses of digital written feedback—these data helped inform both RQ1 and RQ3. A thematic analysis was chosen for its' theoretical flexibility, and was chosen because as a method for identifying, analyzing, and reporting patterns (themes) within data. A semantic approach was taken with this data set, wherein the themes are identified within the explicit or surface meanings of the data, and the researcher does not look for anything beyond what a participant has written (Braun & Clark, 2006). To begin, the first author of the current study thoroughly read each participant's response sample-wide, with participant's identifying removed from the coding file so as not to influence coding. All data was randomly ordered. To iteratively explore for emergent themes in the data, responses were reduced to utterances, defined here as a complete thought, usually identified with punctuation (comma, period), use of capital words, or double spaces. That said, one participant could have provided multiple utterances. Therefore, the themes were mutually exclusive, but participant responses could address multiple themes if more than one utterance was provided. All participant responses fit into at least one theme. From this point, two rounds of coding occurred. The first involved in vivo coding (Saldana, 2015), to identify commonalities among responses, categorizing them accordingly, and in the words of the participants. A second round of descriptive coding was conducted to link similar themes together, and to reduce the number of overall themes in the data by combining similar topics or that shared the same essence, in a recursive process, making sure all data fit within its' given theme. This inductive-yet-systematic approach (Glaser, 1965) was used by the primary author of this study. Once no new themes emerged, a second member of the research team independently examined the themes to check for face validity, as in the method of Patton (1999). It was then determined that saturation had occurred (with a saturation point of 38 participant responses for the amount analysis, 63 participant responses for strengths, and 56 participant responses for weaknesses).

When asked about the amount of digital written feedback they give to students, to further answer RQ1, five themes emerged from the data: (a) instructors reporting giving 'iterations' of feedback, (b) providing feedback on all aspects of writing (including grammar and line edits), (c) instructors only providing feedback on 'big picture' items or those that related directly to the overall critical thinking and argument behind an assignment, (d) they described tapering the amount of feedback provided throughout the semester (with the most feedback provided in the beginning), and finally, (e) some instructors mentioned an exact amount of feedback, giving a word count or a number of comments (for full themes and frequency counts, see Table 5).

--TABLE 5 HERE--

To further answer RQ3, which asked what the participants perceived the costs and benefits of digital written feedback to be, eight themes emerged as strengths (efficiency/ease, availability/accessibility, greater coherence and detail, handwriting legibility, record-keeping, personalizable, ability to check for plagiarism, and less waste; see Table 6) and six themes emerged as weaknesses (time consumption, lack of learning/blind acceptance of changes, computer access and technology issues, health issues associated with screen use, impersonal, and potential for misunderstanding; see Table 7).

--TABLES 6 and 7 HERE—

4. Discussion

The purpose of this study was to explore college instructors' actual use of digital written feedback, perceptions of the strengths and weaknesses of digital written feedback, and individual differences and technology beliefs that may impact the adoption of digital written feedback. Instructors' perceived usefulness and perceived benefit for students were found to predict the likelihood of adoption of this kind of feedback provision in classroom settings. Additionally, results provide evidence that instructors prefer various modalities for delivering feedback. These findings echo, expand upon, and challenge previous notions about instructional feedback delivery.

4.1 Perceived Affordances of Digital Written Feedback

Research suggests that perceived affordances dictate adoption of certain communicative channels (e.g., Fox & McEwan, 2017; Sundar & Limperos, 2013). In this case, digital written feedback acts as the alternative method from the traditional "red pen." Participants in this study echoed the research on both technological affordances and preferences for delivering digital written feedback. In terms of affordances, participants mentioned the persistence of digital written feedback, insofar as digital feedback can be easily saved, replicated, or recirculated and it may be accessible long after the initial instance of feedback (e.g., "archive record all in one place, which allows grading and feedback at the same time," as one participant mentioned). Additionally, early research highlights a few strengths of FtF feedback, such as being able to read students' nonverbal communication and communicating a large amount of information quickly (Fassler, 1978), participants in the current study confirm the findings of more recent feedback research, which suggests that both students and instructors prefer digital platforms for delivering feedback due to their convenience, clarity, and allowance for more thorough feedback (e.g., McCabe et al., 2011), and reinforced by our participants comments on "ease of use/efficiency" (the most frequently mentioned strength of digital written feedback) and "greater detail and coherence".

Some of the affordances of FtF feedback that Fassler (1978) presented were identified by participants to be affordances of digital written feedback. For instance, the ability to personalize feedback emerged as an overall theme from this study. Some participants described their ability to adjust comments for individual students, "I am more likely to write longer comments/more personal comments when typing than when handwriting." Thus, it appears that instructors are finding ways to bring strengths from FtF feedback into the digital realm. This could be explained by Walther's (1992) notion of social information processing (SIP) theory, which posits that when individuals communicate via CMC, they will find avenues to express nonverbal information, and can do so just as well as those who communicate FtF if given sufficient time. These findings that instructors may be attempting to express nonverbal information in their feedback, but cannot make claims as to how these nonverbal cues may be interpreted by students (i.e., Clark-Gordon et al., 2018). However, other participants reinforced a preference for FtF feedback, as evident in Fassler's (1978) arguments. In sum, a tension seems to have arisen—some instructors see digital written feedback are more personalizable while others view it as impersonal and able to be easily misconstrued. Despite these pitfalls, some instructors seem to use digital written feedback because of its ease or efficiency in terms of their own schedules, or because their students can easily access it online (e.g., "You don't have to wait to the next class to give the paper back"). Moreover, adoption is dependent upon technology beliefs, as suggested by the quantitative findings of this study. Surprisingly, individual differences such as CMC anxiety and CSE did not predict adoption of digital written feedback in this study. However, instructors who believed using digital written feedback would be beneficial to their students and instructors who perceived the technology to be useful, were nearly three times more likely to adopt digital written feedback technologies (perceived usability Exp(B) = 2.76 and perceptions of benefit for students Exp(B) = 2.69) than those who did not perceive the technology as useful or beneficial to their students. Indeed, this finding was corroborated in qualitative findings, as the second most mentioned strength of digital written feedback was its availability and accessibility to students, without necessitating geographic co-location and/or time- and space-bound face-to-face meeting of instructors and students.

4.2 "Renewal" and Digitization of the Red Pen

Next, instructors in this study not only echoed previously identified affordances of digital written feedback, they also identified capabilities of digital written feedback that have not been presented in the literature previously. While digital written feedback has been suggested to be quick, clear, convenient, and easily organized (Borup et al., 2015; McCabe et al., 2011), participants also described digital written feedback as less wasteful (e.g. "better for the environment" or "saves trees" from the perspective of participants) and easier for record-keeping (e.g. "the dog can not eat a student's digital assignment," and "there is an electronic "trail" of assignment/my feedback"). They also suggested that digital written feedback provides them with more tools, such as plagiarism detectors. However, many of the functions and strengths of digital written feedback identified by participants of the present study are not new to instructors. Drawing on Peters' (2008) argument of media as "renewable," many of the affordances associated with feedback technologies, just like any other communication technology, are not completely new, and therefore should not fall victim to classifying the writings of the red pen as 'old,' and digital written feedback technologies as 'new'. As Peters (2008) states, "While various institutions and actors clothe a medium in ever-changing outfits and external forms, the operative idea of a medium as an environment for communicative action connects it back to other similar media throughout time" (p. 22). Therefore, we argue that digital written feedback adoption is a "renewal" of other varieties of feedback modalities, and while participants have highlighted the perceived strengths and weaknesses of these technologies, older mediums for delivering feedback too have their strengths and weaknesses. Our study suggests that it is these perceptions, in tandem with individual difference variables, which determine if a feedback technology is ultimately adopted. Furthermore, even participants who had adopted digital written feedback technologies didn't always prefer it to other forms of feedback. Our results suggest that even adopters of digital written feedback still preferred office hours and in-class feedback to digital written feedback, but they preferred digital written feedback to email, handwritten, and video feedback. This finding demonstrates that modalities of feedback can complement one another, or at least do not supplant or replace each other—findings here are in line with predictions set forth by Media Multiplexity Theory (see Haythornthwaite, 2005). Moreover, that instructors do discriminate between various forms of communication technology when providing students feedback falls in line with the predictions of the technology acceptance model (TAM: Venkatesh & Davis, 2000) in that digital written feedback was seen has having notable strengths, including efficiency/ease and availability/accessibility (from our open-ended data).

4.3 Limitations and Future Research

While all research studies come with limitations, there are a few that are unique to the current study. This study took an individual approach to studying adoption of digital written feedback software. While this study established individual perceptions that ultimately impact adoption of instructional technology such as digital written feedback software, future research should consider studying the influence of colleagues or university-level policies on adoption and later diffusion of feedback technologies to faculty members in university communities. While usefulness and usability are key to TAM, diffusion of innovations theory (DOI; Rogers, 1962) predicts that there are four main elements influence the spread of a new innovation: the innovation itself, communication channels used to discuss the innovation, time, and a social system. While our study took a TAM approach to understanding technology adoption, it is likely that instructor preferences for communication channels (i.e., preferring face-to-face feedback over email and handwritten feedback) are connected to elements of DOI such as their social networks. As Thomas and Sondergeld (2015) argued, teachers often provide feedback in the same way that they were provided feedback as a student. Communication among social contacts who use digital written feedback technologies, as described by DOI, may play a part in the diffusion of digital written feedback technologies. Perhaps, as instructional technology is becoming more widely adopted through diffusion of innovations processes (Rogers, 1962), more unique affordances may be identified, but more likely, more will be co-opted and renewed.

Indeed, more recent updates to TAM attempt to consider the role of social influence (a core concern of DOI) in technology acceptance (see Venkatesh, Morris, Davis, & Davis, 2003). Rogers' (1962) diffusion of innovations theory includes four categories of adopters, determined by the rate at which a new technology is adopted: innovators, early adopters, early majority, late majority, and laggards. Future research should consider the utilizing these categories to examine the breadth and depth of the social diffusion of these instructional technologies.

In addition, this study only considered the instructors' perceptions of digital written feedback. Recognizing that another very important perception of the feedback is likely from the perspective of the student, there could be a potential mismatch between what instructors perceive and what students perceive to be the strengths, weaknesses, and comfort-level with using these digital written feedback technologies. Future research should consider the student-level perception of digital written feedback technologies, student preferences for receiving instructional feedback, and if their adoption was forced due to class requirements, or if they adopted these technologies by choice.

Another potential limitation of this work is that it privileges those participants with technology access. Participants in the present study mentioned this as a weakness of digital written feedback, mentioning that "I must have access to a computer," and "technology sometimes fails." Recent statistics collected from the Pew Center for Internet Research and American Life suggests that roughly three-in-ten adults with household incomes below $30,000 a year don't own a smartphone, and nearly half don't have home broadband services or a traditional computer (Andersen, 2017). Studying digital written feedback use among professors likely has implications for the socio-economic status of college-level instructors and professors, and does not consider the potential implications for those teachers (potentially in K-12 education) and students who do not have access to the technology. In that vein, we should also note that this study was done using an online survey, which might have biased results by including more technologically savvy participants, although to this point we suggest that the remarkable diversity of our sample with respect to discipline, type of institution, academic position, and years spent teaching. On each of these points, we note that ours was an exploratory study designed to generate data on adoption rates and reasons for adopting (or not adopting) digital written feedback software, and future studies should carefully consider sampling frames when elaborating on this work.

5. Conclusion

In academia, instructional feedback is part and parcel of the teaching process. However, little research has examined the gradual transition from the traditional "red pen" to digital written feedback. According to participants in this study, utilizing technology to provide students with digital written feedback is a widely adopted phenomenon, seemingly because of its unique instructional affordances, such as ease of use and ease of access. However, these perceived affordances are just that: perceptions. Thus, TAM may help us understand why using digital technology to deliver feedback seems so shiny and novel when "older" media have similar strengths and weaknesses. To this end, we have found that an instructor's perceived usability and perceived benefit to students predict their adoption of digital written feedback in their curricula, but even so this adoption comes with pros and cons, as might any decision in the classroom. While some instructors argue that digital written feedback technologies offer ease and efficiency to both themselves and their students, others believe the amount of feedback provided can overwhelm students, or allow them to ignore or disregard the feedback they've received. We cannot yet claim that technology aids in instructional feedback, but we can argue that digital written feedback technologies are a popular platform among college instructors to deliver traditional messages that are perceived by adopters as useful, beneficial to students, and efficient for their course load.

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Table 1. Sample Features, Affordances, and Outcomes of Digital Written Feedback

Feature	Affordances	Instructional Outcomes
Track Changes	• Visibility o Different colors of text for different users • Persistence o Changes remain constant through multiple versions of a document	• Models how professor would like students to write and think presently, and in the future • Increased (asynchronous) out-of-class communication
Annotated Comments	• Visibility o Flagged to the side of the document • Persistence o Changes remain constant through multiple versions of a document	• Introduces additional points for critical thinking • Hyperlinking to relevant supplemental materials • Dialogic (asynchronous) out-of-class communication

Table 2. Correlation matrix of variables in logistic regression model.

	PEUU	PU	Instructor AT	Student AT	CMCA	CSE
PU	.729 >.001					
Instructor AT	.465 >.001	.563 >.001				
Student AT	.306 >.001	.417 >.001	.714 >.001			
CMCA	.089 .194	.204 .003	.220 .001	.193 .005		
CSE	.099 .148	.074 .281	.067 .325	.065 .343	.173 .011	
Adoption	.366 >.001	.519 >.001	.404 >.001	.389 >.001	.074 .281	-.069 .311

Note. PEUU = Perceived ease of use and usability, PU = Percieved usefulness, Instructor AT = instructor attitudes toward technology, Student AT = Student attitude toward technology, CMCA = computer-mediated communication anxiety, CSE = computer self-efficacy.

Table 3. Logistic regression results.

	B	Wald	*p*	Exp(B)	95% LLCI	95% ULCI
PEUU	.256	.546	.460	1.28	.666	2.46
Perceived Usability	**1.02**	**10.72**	**.001**	**2.76**	**1.50**	**5.08**
Instructor AT	.113	.111	.739	1.12	.578	2.17
Student AT	**.990**	**7.56**	**.006**	**2.69**	**1.33**	**5.45**
CMCA	.156	.176	.675	1.17	.564	2.42
CSE	-.774	3.54	.060	.461	.206	1.03

Note: Significant regression coefficients presented in bold, for each of interpretation.

Table 4. Comparisons between perceptions of digital written feedback to other modalities, between adopters and non-adopters.

	Welch's t-test (between groups)			One-sample *t*-test (compared to 4.00)	
	Adopters	Non-Adopters	*t*-value (*p*-level)	Adopters *t*-value (*p*-level)	Non-Adopters *t*-value (*p*-level)
Email	2.88 (1.90)	4.29 (1.73)	3.24 (.002)	.754 (.460)	-8.20 (>.001)
Office Hours	4.58 (1.86)	5.76 (.995)	4.63 (>.001)	8.11 (>.001)	4.36 (>.001)
Handwritten Feedback	2.62 (1.87)	5.10 (1.76)	6.08 (>.001)	2.85 (>.001)	-10.23 (>.001)
Recorded Video	2.26 (1.79)	3.14 (2.01)	1.94 (.065)	-1.96 .064)	-13.55 (>.001)
Live Video	2.28 (1.83)	3.05 (1.96)	1.72 (.099)	-2.23 (.038)	-13.08 (>.001)
In-Class Feedback	4.47 (1.82)	5.67 (1.16)	4.20 (>.001)	6.61 (>.001)	3.64 (>.001)

Table 5. Amount of Digital Written Feedback Given

Theme	Description/example	Frequency
Iterative	Participants described giving feedback in iterations, or using a revise and resubmit model with student feedback. (i.e., "each student undergoes revisions (usually one per week) on their projects," and "I gave each student feedback on one draft and again on the final version.")	97 (46.41%)
Feedback on 'everything'	Participants described giving feedback on all aspects of an assignment, including grammar, syntax, and line edits, as well as higher-order comments on arguments, evidence, organization, etc. (i.e., "I will focus on the basic things such as grammar, punctuation, and syntax, as well as more complex and/or structural issues such as argument, use of extant research, etc.")	166 (79.43%)
Feedback on big picture only	Participants described only providing feedback on higher-order issues, such as providing evidence for arguments or only items listed on a rubric. (i.e., "I tried to hit on big points," and "I don't spend much time on grammar or copy editing. My feedback primarily guides student's in further formulating and solidifying their ideas.")	43 (20.57%)
Tapers throughout semester	Participants described giving more descriptive feedback in the beginning of the semester, and then lessening amount of feedback given throughout semester as students' improved and learned expectations. (i.e., "First iterations had a lot more editing and comments than later iterations," and "I provide extensive feedback on early assignments that inform the final project.")	31 (14.89%)
Mentions of specific amount	Some participants mentioned specific amounts of feedback given to students, (i.e., "300-600 words," "30-45 minutes per paper," or "5-6 comments.")	30 (14.35%)

Table 6. Perceived Digital Written Feedback Strengths

Theme	Description/example	Frequency
Efficiency/Ease	Participants described the efficiency of digital written feedback as compared to handwritten feedback. (i.e., "It is easy for me to use," and "Alleviates need to carry large stacks of paper around.")	145 (69.71%)
Availability/Accessibility	Participants described the availability of feedback to their students as being immediate and convenient. (i.e., "Students can hand in and I can hand back work without being co-	131 (62.98%)

	located," and "Grade is immediately posted.")	
Greater Coherence/Detail	Participants described being able to provide better feedback due to the editability and clarity of digital written feedback. (i.e., "concise comments via means to erase (unlike stream of consciousness handwriting)" and "The edits are often clearer…It's easier to tie the comments directly to the word, sentence, paragraph, or section that I'm referencing.")	116 (55.77%)
Handwriting Legibility	Participants described digital written feedback as being easier for students to read and understand. (i.e., "They don't have to decipher my handwriting.")	75 (36.06%)
Keeps records to justify grades/less subjectivity	Participants noted how they used the digital written feedback systems as record-keeping for their courses, and using those records to remain transparent to students in the grading process. (i.e., "allows me to save a copy of my notes/grading in case of conflict.")	55 (26.44%)
Personalizable	Participants described the ability to directly address each student, and having the ability to copy, paste, and adjust comments to students whom had similar areas for improvement. (i.e., "I am more likely to write longer comments/more personal comments when typing" and "can more easily copy-paste similar comments for multiple students.")	29 (13.94%)
Less waste (saves paper)	Participants described using digital written feedback as being a more environmentally conscious choice. (i.e., "environmentally friendly," and "does not waste paper.")	15 (7.21%)
Easy to check for plagiarism	Participants noted that many digital feedback software applications will automatically check for plagiarism issues in student work. (i.e., "automatic plagiarism detectors are available.")	7 (3.37%)

Table 7. Perceived Digital Written Feedback Weaknesses.

Theme	**Description/example**	**Frequency**
Time consuming and too much feedback given	Participants described digital written feedback as time consuming, and potentially problematic for giving students too much and overwhelming feedback. (i.e., "time consuming in terms of file/version saves, emailing, etc." and "It can take longer than using traditional proofreading marks on a paper copy.")	95 (45.97%)
Lack of learning/blind acceptance	Participants described frustrations associated with students not learning from the online feedback due to lack of engagement or accepting changes without paying attention to what they were beforehand. (i.e., "They can simply accept changes and not learn form or reflect on the errors," and	90 (43.27%)

	"accepting all changes without seeing why those changes have been suggested.")	
Computer/Internet Access & Technology Errors	Participants described a weakness of digital written feedback as it may not be accessible to everyone at all times, as well as both instructors and teachers having technology difficulties. (i.e., "I must have access to a computer," "technology sometimes fails," and "internet access needed.")	78 (37.5%)
Health issues associated with screen use	Participants described potential health issues with prolonged computer usage associated with giving digital written feedback. (i.e., "it is probably bad for my eyes to read on the screen so much," and "It's exhausting to stare at a screen for hours on end.")	56 (26.92%)
Impersonal	Participants described an impersonal feeling when providing digital written feedback from the lack of face-to-face or interpersonal interaction. (i.e., "they submit the paper without my presence, I submit feedback without theirs, so we are never focusing on the document at the same time.")	30 (14.42%)
Potential for misunderstanding	Participants expressed concerns with student understanding and reception of the digital written feedback. (i.e., "Possibly unclear comments," and "Can be complicated to understand if not familiar.")	19 (9.13%)

Highlights:

- Mixed methods were used to explore diverse college instructors' (*N* = 215) adoption of digital feedback technologies
- The majority of the sample (90.2%) adopted digital written feedback technologies in their classes
- Adoption decisions were predicted by instructors' perceptions of the technology's ease of use and benefit to students
- Adopters differed from non-adopters in preferences for digital written feedback to email, handwritten, and video feedback