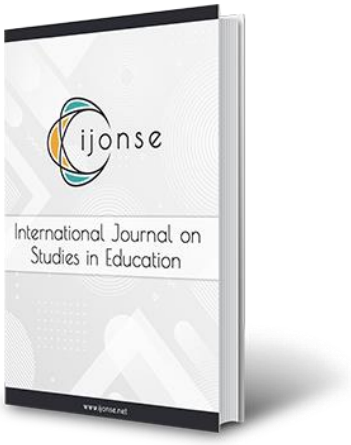

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How Can Teachers Support Writers in the 21st Century? A Look at Digital Learning Communities

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Abstract

The focus of this quasi-experimental study was to determine how using digital learning communities that incorporate technology and meaningful feedback affects students' writing achievement and if students' familiarity with technology impacts their achievement level. This research also examined the relationship between student performance and familiarity with technology. Two third-grade classrooms participated in an 8-week intervention. The experimental group participated in the digital learning community while the comparison group participated in traditional pen-paper writing. Pre- and post- writing samples in addition to a 9-criteria rubric were used to assess the learners' academic writing skills. A 12-question survey was conducted to explore students' experience with technology. A paired samples t-test, a Pearson correlation, and ANCOVAs were used to analyze the data. The findings show that successful integration of technology, student experiences, and explicit feedback had significant effects on the treatment group in increasing their writing achievement. Results indicated that students did not have to be familiar with technology to be successful with the intervention. Additionally, the students who started with a lower self-efficacy score tended to make more gains.

Introduction

According to the United States Department of Education [U.S.DE] (n.d.), technology can change teaching. This change in teaching can create a link between teachers and their students using resources meant to improve instruction and individualize learning. Whyte (2017) suggests that digital learning tools may include platforms for collecting student samples, providing feedback, and collaborating and sharing resources.

Many components should be considered when investigating digital learning tools' effects on student writing. For this study, we were particularly interested in examining Google features such as google classrooms, google docs, etc., which provide a platform for creating a writing learning community to deliver real-time collaboration and meaningful feedback. We were interested in examining: (1) the use of digital learning communities (DLC) to provide useful feedback, (2) if participation in the DLC increased writing achievement more than traditional pen and paper, (3) the relationship between student performance and familiarity with technology, and (4) the growth of special education students when participating in a DLC.

Theoretical/Conceptual Framework

Bandura proposed Social Learning Theory by considering how both environmental and cognitive factors interact to influence human learning and behavior (1977). He explains that human behavior is learned through observation and modeling. Humans can observe others and form ideas of how new actions should be performed, and this information is stored to be retrieved when the behaviors are reencountered, particularly if those actions become part of the student's procedural memory (Cuevas, 2016A). Hill et al. (2009) deliver a more contemporary perspective on Social Learning Theory. Knowledge can be built through web-based learning environments while students engage in activities and receive feedback. Through this framework, educators can hope to motivate students through the observation of models and interactions with others which in turn will increase student perceptions and understanding of the world around them. Yet numerous reviews (Cuevas, 2015, 2016B, 2017; Cuevas, et al., 2023; Pashler, et al., 2009; Scott, 2010) and empirical studies (Cuevas & Dawson, 2018; Rogowsky, et al., 2015, 2020) have questioned whether instructors use the most effective methods and are sufficiently guided by the cognitive science on learning. In relation to Bandura's work in the face-to-face setting where observation and modeling took place, this research attempts to ascertain whether digital learning communities could guide the way for improved self-efficacy, social interactions, and the effects it can have on student communications through writing. The historical and theoretical impacts connect how technology can be incorporated into the classroom. Part of an educator's job in the 21st Century is to encourage students to learn how to use technologies effectively for their learning.

According to the Technological Pedagogical Content Knowledge [TPACK] Framework by Koehler et al. (2014), specific technological tools such as hardware, software, applications, associated information literacy practices, etc. are best used to instruct and guide students toward a better, more robust understanding of the subject matter. Studies testing the use of technological packages designed to enhance learning have supported this (Cuevas, et al. 2012; Doster & Cuevas, 2021). This concept was further explored by Van Leeuwen and Gabriel (2007) as they investigated the integration of technology and the writing process in a primary classroom. They noted that not only do students' perceptions change but so does the teacher's role. Teachers' attitudes and practices regarding information and communication technologies (ICT) directly influence learning. There is a bridge between the use of technology, social interactions through feedback, and the impact on learning. In one review, Hepplestone et al. (2011) studied technology's potential to increase student engagement with feedback. But their findings report that the number of studies centered on the use of technology to support the production and delivery of feedback and student engagement was limited. According to Hepplestone et al., students can gather feedback at their discretion, which allows them to respond to their input in their ways. In relation to this study, Hepplestone et al. help connect the importance between technology, social interaction through feedback (either between teacher-student or student-student), and modeling (use of digital tools and location of materials).

Technology can provide students and educators with many creative outlets in the educational setting such as blogs, wikis, google docs, word documents, photos, videos, voice recordings, presentations, spell check, word prediction, digital reminders, and simulations (Bangert-Drowns, 1993; Blau et al., 2020; Gault & Cuevas, 2022; Hannel & Cuevas, 2018; Hutchison, et al., 2016; Moore & Cuevas, 2021; Peterson-Karlan & Parette, 2007). At this point,

though, researchers and educators are still unsure of the level and impact that technology can have on learning. Many varying opinions suggest digital learning tools can support writing improvements in the classroom (Cochran-Smith, 1991; Daniels, 2004; Nobles & Paganucci, 2015) and others who are cautious about the idea (Blahous et al., 1997; Perterson-Karlan & Parette, 2007; Purcell et al., 2013). It is understood that technology and web-based tools provide access to a wide range of information and more interactive learning environments. Using digital learning communities goes further than just composing a writing piece independently and submitting it for feedback. With the integration of technology in writing, educators can model, practice, revise, make suggestions, and provide feedback to build mastery and strength in student writing at the elementary level.

Review of Related Literature

Writing instruction and curriculum vary between grades, schools, districts, counties, states, and even countries. Some schools have a mandated program that is to be taught with fidelity, some have more flexibility with how to teach, and others do not have a specific program. The review highlights the present literature and the following emerging themes: what writing instruction consists of, the integration and role of technology, and the effects of teacher and peer feedback in the elementary setting.

Writing Instruction

Writing is complex and requires students to tap into their prior knowledge to produce writing that conveys meaning. Research suggests that modeling must occur in all facets of writing for students to be successful (Block & Peskowitz, 1990; Coker et al., 2016; Dahlström & Boström, 2017; Datchuk et al., 2019; Erikson, 1992; Graham et al., 2017; Haug & Klein, 2018; Koutsoftas, 2018; Langone & Willis, 1994; MacArthur, 1996; Nichols, 1996; Owston & Wideman, 1997; Price et al., 2015). The facets of writing include but are not limited to the writing process and the characteristics educators expect to see in writing samples. Writing is much more than merely sharing a story or conveying a message, and Rietdijk et al. (2018) explain that writing is vital to students because it is a tool that enables them to connect and participate in their communities, obtain understanding, and present what they have learned. In the study conducted by Rietdijk et al., they found that only 40% of their sample of teachers ($N = 58$) were modeling the writing process, and 36% were teaching writing strategies. It is essential to consider all of the aspects that educators ask of their students, such as the writing process and the characteristics that make up a written product. It is a tool to communicate.

Integration of Technology

The research suggests that technology could assist with the cognitive load (Englert et al., 2005) that educators are then placing on their students during the writing process. The study by Englert et al. revealed results that showed higher levels of performance when they were writing under the experimental variable (web-based scaffold), which was statistically superior ($p < .05$) to the performance of paper-pencil conditions. Hutchison et al. (2016) note that technology users can maximize their use of digital tools when they make use of both traditional and digital literacy skills. Students need to incorporate the tools and variety of communities to learn how to interact with others to

get the most out of their learning. Ebadi and Rahimi's (2017) research shows that the experimental group outperformed the control group with statistically significant data (p = .004) which demonstrates that integration of Google Docs and editing as tools can support the development of writing. So, it could be argued that the online peer editing using Google Docs was a more effective instructional practice than in peer-editing in the face-to-face classroom.

Researchers Zioga and Bikos (2019) studied grade 5 students and their ability to produce written products through Google Docs. Results showed a statistically significant difference (p < .001) between pre- and post- tests in the majority of the writing rubric categories. The integration of digital tools and appropriate classroom instruction can improve student writing quality by promoting writing skills, as supported by MacArthur et al. (1995). Van Leeuwen and Gabriel (2007) further suggest that using a word processor may facilitate meaning-making as students and teachers interact within a process writing approach. More specifically than that, we have tools to foster collaboration through peer review and teacher feedback (Purcell et al., 2013).

The Role of Feedback

Educators and students can interact with one another, whether it be teacher-student or student-student, in face-to-face or virtual settings. As seen within the writing process, students are expected to revise their written work through interactions with other students and teachers. Though studies have shown that revision is a misunderstood aspect of the writing process, the ability to adjust is a sign of a good writer and an expectation in the 21st century (MacArthur et al., 1995; Rietdijk et al., 2018). We can help close the gap of misunderstandings that occur by increasing the feedback that we provide to our students through technology. Researchers have found that teachers can use technology to give practical and efficient feedback (Blankenship & Margarella, 2014). Educators must build the classroom environment up to be supportive of social interactions (Tankersley & Cuevas, 2019) and teach students how to give and receive feedback and see the value in revising and getting feedback from others (Cutumisu et al., 2017; Zheng et al., 2015).

By incorporating technology into writing, educators can provide students with many outlets to accept feedback. Li et al. (2010) found a significant relationship between the quality of peer feedback the students provided and the quality of overall writing. Diab's (2011) research showed that there was no significant difference between the two groups on the first draft but there was a statistically significant difference (p <.01) between the control and the experimental in favor of the experimental on the second draft (after treatment).

Therefore, students who engaged in peer-editing were able to improve the content and organization of ideas in their revised drafts. Students can share work, talk about their writing, respond to each other's strengths and weaknesses, and produce final written products. Not only should students understand the writing process, but they need to be taught the specific uses that technology can provide and the benefits of feedback from the teacher or peers.

It is also important to note that some research suggests that online communications might also lead to unpleasant

learning experiences and outcomes in traditional face-to-face classrooms (Hill et al., 2009; Zhou, 2012). Students and teachers might feel uncomfortable sharing knowledge, or students may not contribute equally to the assignment (Blau & Caspi, 2009). Educators can determine if and how digital learning communities and feedback can be incorporated into the 21st-century classrooms are of great value and deserve more exploration.

Gaps in the Related Literature

Researchers in the field suggest much more research and evidence be collected to determine the effects of digital tools on learning. The following gaps illustrate areas of concern that still need to be explored to effectively determine digital learning communities' effects on writing at the elementary age.

There is a lack of focus on elementary grades in the United States. Six studies took place outside of the United States, which limits the generalizability of the research as writing instruction and beliefs vary from country to country (Dahlstrom & Bostrom, 2017; Datchuk et al., 2019; Li et al., 2010; Rietdijk et al., 2018; Van Leeuwen & Gabriel, 2007; Zioga & Bikos, 2020). Some of the research conducted in the elementary grades took place with minimal relation to technology use. For example, several studies were conducted only examining writing characteristics void of technology (Block & Peskowitz, 1990; Graham et al., 2017; Rietdijk et al., 2018). Other studies were conducted in the middle and upper grades (Blankenship & Margarella, 2014; Blau & Caspi, 2009; Cuevas, et al., 2014; Martin & Lambert, 2015; Nichols, 1996; Nobles & Paganucci, 2015; Purcell et al., 2013; Russell & Cuevas, 2014; Wolfe et al., 1996) and even in teacher education (Cuevas & Russell, 2017). While those studies produced evidence on literacy and technology, their study effects are inapplicable to this study as writing expectations vary significantly from elementary to upper grades. Five studies support the research presented here and produce evidence related to integrating technology to improve student writing (Daniels, 2004; Li et al., 2012; Owston & Wideman, 1997; Van Leeuwen & Gabriel, 2007; Zioga & Bikos, 2020).

Additionally, there is limited research that supports using technology as a tool to provide feedback in the elementary grades. If any benefits of integrating technology have been reported, they are small with little to no reported correlation to writing improvement. Some studies demonstrated the use of technology-supported feedback (Blankenship & Margarella, 2014; Datchuk et al., 2019; Martin &Lambert, 2015; Nobles & Paganucci, 2015; Purcell et al., 2013), but the only one took place in an elementary classroom setting (Datchuk et al., 2019).

Scaffolding has been shown to benefit student learning (Cuevas, 2012), and writing with scaffolded support such as Google Docs can provide an environment where students work together to develop and improve their writing skills for the twenty-first Century. This study will look more closely at Google Docs as a scaffolding tool to instruct students in writing and how teachers can use the application to encourage peer collaboration and feedback with students and teachers to improve their work in the third-grade classroom. Students will be able to receive writing instruction in the classroom, work on documents both independently and collaboratively, and use feedback to make revisions and improvements to increase their writing achievement. The goal is to determine how using digital learning communities that incorporate technology and meaningful feedback affects students' writing achievements and if students' familiarity with technology impacts their achievement level.

Research Questions

This study's overall focus was to examine the use of technology and, more specifically, Google Classroom and Google Docs as a scaffolding approach to improve writing in elementary grades. This study also examined the impact of social interaction through feedback (teacher and peer) and how that played a role in the writing process. For this study, the combination of technology in Google platforms and digital feedback were defined as a "digital learning community (DLC)." This community used the Google platforms as scaffolding tools to support the writing process and provide teacher and peer feedback to improve student writing. Four research questions helped guide this study toward that focus:

1. Can the digital learning community deliver useful feedback to improve student writing from pre- to post-writing samples?
2. Does participation in the digital learning community increase writing achievement more than traditional pen-paper writing?
3. As defined by writing achievement scores, is student performance correlated with their familiarity with technology?
4. Do special education students show more growth than general education students when exposed to this digital learning community?

The first question's purpose was to determine if the independent variable of writing instruction involving social interaction through teacher and peer feedback as the instructional strategy could be used to deliver useful feedback to improve student writing. The purpose of the second question was to determine whether the digital learning community increases writing achievement more than traditional pen-paper instruction as measured by pre-and post-writing samples. The third question's purpose allowed us to explore the experiences students had with technology to identify whether there was a relationship between familiarity with technology and writing achievement gains. The fourth question's goal was to determine if there was an educational impact on special education students when involved in a digital learning community.

Method

Contextual Factors

The study took place in a suburban county located in north-central Georgia with a rapidly growing population size of 244,252 people. This county employs over 6,000 staff members and serves 49,800+ students across 21 elementary schools, 10 middle schools, 5 high schools, and 3 creative education academies. In this district, 15 of the 29 schools have student populations that are majority-minority, where the number of White students is less than the combined number of Hispanic, American Indian, Asian and African American students. The median household income is $104,687 and approximately 5.1% of the population is below the poverty line.

The study was conducted in a public elementary school. The school was ranked 1st among the 21 other elementary schools in the district at the time of the study. The school had 1,184 students and a student/teacher ratio of 18:1. The demographics that represent the school, grades Kindergarten-5th grade were as follows: 71% Asian/Pacific

Islander, 19% White, 3% Black, 4% Hispanic, 2% Multi-racial, and 1% American Indian/Alaskan. The school population was comprised of 2% who were economically disadvantaged (ED), 12% who were students with disabilities (SWD), and 12% who were English language learners (ELL).

Participants

The participants were students from two 3rd grade classroom with a total sample size 45 students. The first class (Class A) was made up of 31 of students, 15 boys and 16 girls. This specific classroom A was a mixed ability class ranging from students with disabilities to on-level to gifted students. There were 7 special education students, 10 gifted and talented students, and 7 speech/language support students.

The second class (Class B) was made up of 14 students, 8 boys and 6 girls. Classroom B was also a mixed ability class with 1 special education students, 0 gifted and talented students, and 2 speech/language support students. Class A was the experimental group that received the treatment and participated in the digital learning community. Class B was the comparison group that did not receive the treatment and participated in traditional pen-paper writing.

Materials and Measures

Materials

All subjects received pre- and post- writing prompts within the same genre of writing that were included in the 3rd-grade writing curriculum. Subjects were provided with writing checklists that they had access to throughout the 8-week period. The writing checklist was directly related to the writing scoring rubric created by Calkins et al. (2013). See appendix A for the checklist and appendix B for the rubric. The experimental group took part in the digital learning community and had access to Google classroom and Google doc platforms. In addition to the Google platforms, students also had access to spell check, text-to-speech, and other tools consistent with word processing software. The comparison group used pen and paper for the writing assignments as well as had access to dictionaries and thesauruses.

Measures

In order to measure writing achievement in students, a pre- and post- test writing prompt was administered. The pre-test was given to provide a baseline for existing knowledge while the post-test provided data on writing achievement. Both writing samples were scored using rubrics by Calkins, et al. (2013). Rubric scoring was done by adding up scores from components of a student's writing to find a raw score (0-44 points), then converting that raw score into a scaled score (1-4).

The criteria were divided into 3 categories: structure, development, and language conventions. The structure category consisted of the following 5 subcategories: overall, lead, transitions, ending, and organization. The development category consisted of 2 subcategories: elaboration and description. The language conventions

category consisted of 2 subcategories: spelling and punctuation. All writing samples were scored by two teachers to ensure interrater reliability.

Student experiences with technology were measured by the Computer Access and Familiarity Survey (CAFS) written by the National Assessment of Educational Progress (NAEP, 2019), at the beginning of the study. The survey can be found in Appendix C. This 12-question survey examines the access students had to various electronic devices, the level of familiarity and comfort students had with technology and the variety of ways in which they interacted with technology for both personal and school use. The CAFS contains 3 constructs identified by Kitmitto, et al. (2018) which include access, familiarity, and self-efficacy. The subconstructs measure home access and school access, instruction, computer use, tablet use, and self-efficacy. The reliabilities are as follows: home access is 0.43, school access is 0.39, instruction is 0.63, computer use is 0.74, tablet use is 0.85 and efficacy is 0.73.

Kitmitto, et al. (2018) reported that there were lower reliability coefficients than desired in the access domain, therefore for the purpose of this study we omitted the access domain questions which include questions 1, 9, 10, and 16. By omitting these items with low coefficients, we retained the constructs that showed stronger reliability. This omission does not affect research question #3, as we were still able to measure familiarity and self-efficacy through the other 12 questions. The survey consisted of multiple choice, yes/no, and Likert scale items that included positively and negatively worded items to ensure reliability. The survey was administered through the Google forms platform and took approximately 10-15 minutes to complete. It was read aloud to participants to lessen any language demands that this survey may have required from students. The survey was scored and cataloged using a 5-point scale scoring system. Point totals were then averaged together for each of the two constructs.

Procedures

The research was conducted when narrative writing was being taught. The writing block was approximately 45 minutes per day for five days a week for a period of eight weeks for a total of 41 class periods (including a day for pretesting and CAFS survey) and approximately 30 hours of instruction. The curriculum and pacing guides are included in the writing curriculum (Calkins, 2013) which both teachers followed to maintain consistency. The projected pacing guides are located in Appendix D and Appendix E for the comparison and treatment groups, respectively. Both teachers used the provided manual and similar instructional materials (presentations, interactive notebooks, checklists, rubrics, etc.). Specific writing instruction included mentor texts, read-alouds, modeling, and independent writing time.

Both the comparison group and the treatment group were given the Computer Access and Familiarity Survey (CAFS, 2019) to understand the participants' levels of familiarity, comfort, and interactions with technology. Additionally, both groups were also given a writing pre-test that consisted of a writing prompt. All participants were given a checklist of characteristics to be included in their writing (see Appendix A) and a rubric (see Appendix B) so that they understood the grading expectations. Following the pretest, teachers provided instruction

on the writing unit (vocabulary, processes, concepts, exemplars, etc.). Throughout the unit, students received another writing prompt that they drafted, edited, and revised during the course of the 8 weeks. At the end of the writing unit, students took a writing post-test.

Procedures for Comparison Group

The comparison group completed the CAFS survey and pretest writing sample prior to the start of the unit. Participants received writing instruction from their homeroom teacher throughout the eight-week unit. The pacing guide for the Comparison Group is depicted in Appendix D. Teacher and students used the instructional and supplemental materials as cited by Calkins, et al. (2013). All writing including drafts and final copies were written using pencil and paper format. Any teacher and peer feedback that took place also occurred on paper and orally. Participants had access to paper dictionaries and thesauruses. Throughout the unit, participants and the teacher took part in conferencing and peer editing using the Calkins checklist and rubric. Participants were instructed to conduct their feedback with randomly assigned partners, and they used different colored writing utensils to make suggestions and comments. At the end of the unit, participants completed the same post-test writing sample as the treatment group. The homeroom teacher graded both the pretest and posttest writing samples, and then a second scorer rated the writing samples using the same rubric.

Procedures for Treatment Group

The treatment group completed the same CAFS survey and pretest writing sample at the beginning of the unit. At the beginning of the 8 weeks, students were added by the teacher to a Google Classroom which served as the digital learning community. Participants then completed the pretest using Google docs. Writing instruction was delivered by the homeroom teacher for the entire eight weeks. The pacing guide for the Treatment Group is depicted in Appendix E. Teacher and students used the same instructional and supplemental materials as the comparison group. All writing including the pretest, drafts, revisions, and posttest were written using the Google docs platform, which was a part of the digital learning community. Students had access to online Google tools such as spell check, word prediction, speech-to-text, etc. Participants in the treatment group also took part in conferencing and peer feedback, but this took place throughout the entire writing process and eight-week unit and was provided through Google docs. Students were randomly assigned partners and used the Calkins, et al. (2013) checklist and rubric to facilitate feedback. At the end of the unit, participants completed the posttest writing sample. The homeroom teacher graded both the pretest and posttest writing samples, and then a second scorer rated the writing samples using the same rubric.

Results

The first research question was created to determine if the independent variable of writing instruction that involves social interaction through teacher and peer feedback as the instructional strategy can be used to improve student writing. Data were evaluated by running a paired samples t-test which allowed us to compare the pre-test of the experimental group to the post-test of the experimental group. The data showed that there was a statistically

significant improvement among the experimental group (n = 31) from the pre-writing (M = 2.193, SD = .459) to post-writing sample (M = 2.661, SD = .416), $t(30)$ = -5.839, p < .001. Results confirm that the experimental group's writing did improve throughout the study. Descriptive and inferential statistic tables are shown below in Tables 1 and 2.

Table 1. Mean Score Difference between the Experimental Groups Pre- and Post-writing Scores

		M	N	SD	SEM
Pair 1	ExpPre	2.1935	31	.45966	.08256
	ExpPost	2.6613	31	.41607	.07473

Table 2. Statistical Significance of Mean Score Difference between Experimental Groups Pre- and Post-writing Scores

		Paired Differences							
					95% Confidence Interval of the Difference				Sig. (2-
		M	SD	SEM	Lower	Upper	t	df	tailed)
Pair 1	ExpPre - ExpPost	-.46774	.44601	.08011	-.63134	-.30414	-5.839	30	.000

The second research question aimed to determine whether the digital learning community increases writing achievement more than traditional pen-paper instruction as measured by pre and post-writing samples. Data were evaluated by running an ANCOVA analysis. The ANCOVA analysis allowed researchers to compare the performance of the comparison and treatment groups on the dependent variable (post-writing achievement) while controlling for the covariate (pre-test scores).

The difference between the two groups was significant, $F(1, 42) = 9.76$, $p = .003$. The effect size ($\eta^2 = .189$) was considered large. These results indicate that the intervention group showed more growth than the regular writing instruction. Means and standard deviations for post-writing analyses can be found in Tables 3, 4, and 5.

Table 3. Between Subjects Factors

		Value Label	N
Group	1.00	Comparison	14
	2.00	Treatment	31

Table 4. Descriptive Statistics

Dependent Variable: PostWriting			
Group	M	SD	N
Comparison	2.2143	.37796	14
Treatment	2.6613	.41607	31
Total	2.5222	.45171	45

Table 5. Tests of Between-Subjects Effects

Dependent Variable: PostWriting						
Source	Type III SS	Df	MS	F	Sig.	ηp 2
Corrected Model	4.002 [a]	2	2.001	16.889	.000	.446
Intercept	3.863	1	3.863	32.610	.000	.437
Pre-Writing	2.075	1	2.075	17.512	.000	.294
Group	1.156	1	1.156	9.758	.003	.189
Error	4.976	42	.118			
Total	295.250	45				
Corrected Total	8.978	44				
a. R Squared = .446 (Adjusted R Squared = .419)						

The third research question was designed to explore the experiences that students have with technology to identify if there is a relationship between familiarity with technology and writing achievement gains. The first Pearson Correlation was run to determine the association between treatment students' familiarity survey scores and their gains. For achievement gains and familiarity with technology, no relationship was found. These results show that the familiarity survey scores and achievement gains were not significantly correlated, $r(29) = -.08$, $p = .682$.

Descriptive and inferential statistic tables are shown in Tables 6 and 7.

Table 6. Descriptive Statistics

Descriptive Statistics			
	M	SD	N
Familiarity	3.5161	.47265	31
Gain	.4677	.44601	31

Table 7. Correlations

Correlations			
		Familiarity	Gain
Familiarity	Pearson Correlation	1	-.077
	Sig. (2-tailed)		.682
	N	31	31
Gain	Pearson Correlation	-.077	1
	Sig. (2-tailed)	.682	
	N	31	31

Additionally, a second Pearson Correlation was run to determine the association between treatment students' self-efficacy survey scores and their gains. For achievement gains and self-efficacy with technology, a negative correlation was found. The results show that the self-efficacy survey scores and achievement gains were significantly and negatively correlated, $r(29) = -.42$, $p = .019$. Descriptive and inferential statistic tables are shown

below in Tables 8 and 9.

Table 8. Descriptive Statistics

Descriptive Statistics			
	M	SD	N
Gain	.4677	.44601	31
Self-Efficacy	2.9903	.43921	31

Table 9. Correlations

Correlations			
		Gain	Self-Efficacy
Gain	Pearson Correlation	1	-.419*
	Sig. (2-tailed)		.019
	N	31	31
Self-Efficacy	Pearson Correlation	-.419*	1
	Sig. (2-tailed)	.019	
	N	31	31
*. Correlation is significant at the 0.05 level (2-tailed).			

The fourth research question was designed to investigate if there was an educational impact on special education students when involved in a digital learning community. An ANCOVA analysis was run to determine if the special education students in the treatment group showed more growth than the general education students in the treatment group when exposed to this type of digital learning community while controlling for the pre-writing scores. The Special Education students (M = 2.417, SD = .376) did not score significantly different than the General Education students (M = 2.720, SD = .410) in the treatment group. The difference between the two groups was not significant, $F(1, 28) = .171$, $p = .682$. Descriptive and inferential statistic tables are shown in Table 10, Table 11, and Table 12.

Table 10. Between-Subject Factors

		Value Label	N
SpEdGenEd	1.00	SpEd	6
	2.00	GenEd	25

Table 11. Descriptive Statistics

Dependent Variable: PostWriting			
SpEdGenEd	M	SD	N
SpEd	2.4167	.37639	6
GenEd	2.7200	.41028	25
Total	2.6613	.41607	31

Table 12. Tests of Between -Subjects Effects

Dependent Variable: PostWriting						
Source	Type III SS	df	MS	F	Sig.	ηp 2
Corrected Model	1.245 [a]	2	.623	4.416	.022	.240
Intercept	3.422	1	3.422	24.269	.000	.464
Pre-Writing	.800	1	.800	5.674	.024	.169
SpEdGenEd	.024	1	.024	.171	.682	.006
Error	3.948	28	.141			
Total	224.750	31				
Corrected Total	5.194	30				
a. R squared = .240 (Adjusted R squared = .185)						

Discussion

The study aimed to examine how using digital learning communities that incorporate technology and meaningful feedback affects students' writing achievements and whether students' familiarity with technology impacts their achievement level. There was an indication that successful integration of technology, student experiences, and explicit feedback had significant effects on the treatment group in increasing their writing achievement. Findings were consistent to some degree with other studies that have investigated the use of specific Google Docs technology with feedback to support student writing, but differences in grade level or genre of writing were present (Ebadi & Rahimi, 2017; Zheng et al., 2015; Zioga & Bikos, 2020).

Concerning research question 1, it was determined that there was a significant improvement from pre-writing to post-writing among those in the treatment group who took part in the digital learning community. Therefore, it can be concluded that digital learning communities can deliver effective feedback to improve student writing. When writing instruction involves teacher or peer feedback as the instructional strategy, student writing is likely to improve. The social interactions and feedback that students participate in during the writing process may have an impact on subsequent writing abilities. Students not only are learning from each other, but they are also modeling for and supporting their peers, which could be enticing for learners in the classroom.

In relation to research question 2, it was found that the treatment group who received the intervention did show significantly more growth than the regular instruction received by the comparison group. This suggests that student participation in the digital learning community can increase writing achievement scores more than traditional pen-paper writing. This finding supports the use of technology as an effective teaching tool that can benefit student learning and interaction through feedback. This finding was consistent with those of Ebadi and Rahimi (2017), who indicated that the learners who used the digital learning platform outperformed those students using traditional methods, which resulted from the features that digital platforms can provide, such as collaboration and editing.

Due to the large effect size found in the current study, it can be suggested that the real-world impact of digital

learning communities and the influence on writing achievement can be substantial. These results align with the study that Jesson et al. (2018) conducted while identifying effective practices in improving student writing through digital learning environments. Similar to the results of this study, Jesson et al. concluded that the supportive nature of the digital learning environment enabled learners' access to tools, resources, and skills that scaffolded their learning.

Next, the data from research question 3 and the CAFS survey demonstrate that the intervention worked for all students regardless of their familiarity with technology. Students' familiarity scores and their writing gains showed no relationship. Results from table 7 indicate that students did not have to be familiar with technology to be successful with the intervention, which is beneficial when implementing this tool in the classroom with students of varying needs and achievement levels. Students were not limited by their access and expertise with technology and can successfully use the digital learning environment to improve their writing. It is encouraging to see studies such as this one and that of Jesson et al. (2018), who sought to address underachievement and promote change through digital tools. Jesson's research suggests that students may not be as limited by their access to technology to encourage gains in writing as initially assumed. The findings of this current study provide some data showing that participants did not need to be as familiar with technology to utilize effective instruction when provided with digital access.

Additionally, the students who started with a lower self-efficacy score tended to make more gains, indicated by the fact that students' self-efficacy scores before the intervention were negatively correlated with their gain scores. This analysis suggests that the students who did need the most help benefitted most from the intervention. It can be concluded that low self-efficacy was not a limiting factor. Due to the interaction in the intervention, students tended to overcome low self-efficacy to make more significant gains. These findings contrast those of Chea and Shumow (2014) in which they examined university students but found that students who already had higher self-efficacy tended to increase more because they were learning for improvement and understanding.

Finally, research question 4 allowed us to explore and examine whether or not the Special Education students would show more growth than the General Education students when exposed to this digital learning community. There was no significant difference between the groups, with the General Education students scoring no different than the Special Education students. This evidence suggests that the Special Education students did grow enough to maintain pace with the General Education students. Still, they did not outperform them in overall writing achievement. The findings must be deemed inconclusive because the sample size of the Special Education students was not enough for us to be able to draw meaningful conclusions.

Limitations

There are several limitations in the present study that should be considered. First, one analysis examined the Special Education students as the grouping variable within the treatment group and only contained 6 participants. Such a small sample size is not considered optimal and limited the findings related to research question 4. Second, the duration of the study had the potential to reduce the observed effects. While a more prolonged study may have

more pronounced effects, or effects could fade over time, we know from the data and findings that the 8-week period was adequate to produce effects for some of these variables. An increase in the Special Education student sample size and replication of the study would provide more distinct findings. Third, there was potential for a teacher effect that could have impacted both the comparison and treatment group. Finally, the Computer Access and Familiarity Survey (CAFS), written by the National Assessment of Educational Progress (NAEP, 2019), contained low reliability scores for some constructs. Even though those constructs were omitted, the overall effectiveness of the survey was not ideal. The scoring of survey questions also required additional steps to catalog scores accurately.

Future Research and Implications

There is reason to conclude that cognitive science should increasingly guide instructional practices (Cuevas, 2019), yet too often this has not been the case. Numerous studies have recently employed experiments to test the effects of instructional interventions with elementary (Dalton & Cuevas, 2019; Moore & Cuevas, 2022) and middle grades students (Jennings & Cuevas, 2021; Liming & Cuevas, 2017). Yet it is clear that future research must be done to determine the value of technology integration and social interactions through feedback in the elementary classroom setting to support writing achievement. Future studies must maintain the integrity of the technology being used and teach participants explicitly how to use the platforms appropriately and the available tools. Jesson et al. (2018), found that classroom practices must include the explicit teaching and modeling of tools and supports within a task so that students see the need and effectiveness of them.

Another consideration is that while this study was focused on technology and feedback was implemented to support learning and social interactions, the writing scoring rubric used did not support the feedback piece, and it could have. Therefore, future studies would benefit from identifying a specific subcategory on the writing rubric and tracking the correlation between the variables to the specific feedback students received. It is crucial to keep in mind the research of Suwantarathip and Wichadee (2014), who found that students in face-to-face feedback groups performed worse than those who had used a digital learning platform process. Further examination of how students are using digital platforms synchronously or asynchronously may impact learning outcomes. Differences in design and task may explain the variety of results.

Finally, future research should assess writing achievement and analyze the types of feedback and ways it was being used. More specific data tracking of the ways students and teachers were giving certain types of feedback would enhance the nature in which teachers would instruct students to provide feedback to support student learning. Tracking this data in the elementary classroom versus a middle-grade class like Zheng et al. (2015), could be used to determine if the suggestions that the teacher or student provided led to a change in the writing or if the writing remained the same; educators could make adjustments based on student writing needs. Since communication and digital literacy are all critical skills of the 21st century, all students should develop to be successful learners. A classroom teacher can use technology integration and social interactions as part of her instruction. Based on the results of this study, it gives reason to expect the students would show an increase in their overall writing achievement.

Conclusion

This study suggests the importance of digital learning communities and social interactions on student learning. Students progressed as anticipated through the use of technology and its ability to enhance writing instruction and writing achievement. Results demonstrated that students' writing who participated in the digital learning community did improve throughout the study. Overall, students participating in the digital learning communities showed significant growth and outperformed those students who were taught through traditional pen-paper instruction.

While the students' familiarity scores and their writing gains showed no relationship, we can conclude that students did not have to be familiar with technology to succeed with the intervention. The digital learning community supports students of all levels. While the technology and feedback provide the building blocks for those students who are still learning the writing process, it also encourages students to try new things and enhance their learning to achieve at a higher level. Through the use of technology and constructive feedback, the evidence found in this study demonstrates that students are able to learn and achieve regardless of their prior writing ability and access to technology.

Declarations and Compliance with Ethical Standards

Funding: This research was not funded.
Conflict of Interest: The research was not grant related. The authors declare that they have no conflict of interest.
Ethical Approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.
Informed consent: Informed consent was obtained from all required individual participants included in the study.

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Appendix A. Calkins et al. (2013) Writing Checklist

Name: _____ Date: _____

Narrative Writing Checklist

	Grade 3	NOT YET	STARTING TO	YES!
	Structure			
Overall	I told the story bit by bit.	☐	☐	☐
Lead	I wrote a beginning in which I helped readers know who the characters were and what the setting was in my story.	☐	☐	☐
Transitions	I told my story in order by using phrases such as *a little later* and *after that*.	☐	☐	☐
Ending	I chose the action, talk, or feeling that would make a good ending and worked to write it well.	☐	☐	☐
Organization	I used paragraphs and skipped lines to separate what happened first from what happened later (and finally) in my story.	☐	☐	☐
	Development			
Elaboration	I worked to show what happened to (and in) my characters.	☐	☐	☐
Craft	I not only told my story, but also wrote it in ways that got readers to picture what was happening and that brought my story to life.	☐	☐	☐
	Language Conventions			
Spelling	I used what I knew about spelling patterns to help me spell and edit before I wrote my final draft.	☐	☐	☐
	I got help from others to check my spelling and punctuation before I wrote my final draft.	☐	☐	☐
Punctuation	I punctuated dialogue correctly with commas and quotation marks.	☐	☐	☐
	While writing, I used punctuation at the end of every sentence.	☐	☐	☐
	I wrote in ways that helped readers read with expression, reading some parts quickly, some slowly, some parts in one sort of voice and others in another.	☐	☐	☐

Appendix B. Calkins et al. (2013) Writing Rubric

Name: _____ Date: _____

Rubric for Narrative Writing—Third Grade

	Grade 1 (1 POINT)	1.5 PTS	Grade 2 (2 POINTS)	2.5 PTS	Grade 3 (3 POINTS)	3.5 PTS	Grade 4 (4 POINTS)	SCORE
STRUCTURE								
Overall	The writer wrote about when she did something.	Mid-level	The writer wrote about *one time* when he did something.	Mid-level	The writer told the story bit by bit.	Mid-level	The writer wrote the important part of an event bit by bit and took out unimportant parts.	
Lead	The writer tried to make a beginning for his story.	Mid-level	The writer thought about how to write a good beginning and chose a way to start her story. She chose the action, talk, or setting that would make a good beginning.	Mid-level	The writer wrote a beginning in which he helped readers know who the characters were and what the setting was in his story.	Mid-level	The writer wrote a beginning in which she showed what was happening and where, getting readers into the world of the story.	
Transitions	The writer put her pages in order. She used words such as *and* and *then, so.*	Mid-level	The writer told the story in order by using words such as *when, then,* and *after.*	Mid-level	The writer told her story in order by using phrases such as *a little later* and *after that.*	Mid-level	The writer showed how much time went by with words and phrases that mark time such as *just then* and *suddenly* (to show when things happened quickly) or *after a while* and *a little later* (to show when a little time passed).	
Ending	The writer found a way to end his story.	Mid-level	The writer chose the action, talk, or feeling that would make a good ending.	Mid-level	The writer chose the action, talk, or feeling that would make a good ending and worked to write it well.	Mid-level	The writer wrote an ending that connected to the beginning or the middle of the story. The writer used action, dialogue, or feeling to bring her story to a close.	
Organization	The writer wrote her story across three or more pages.	Mid-level	The writer wrote a lot of lines on a page and wrote across a lot of pages.	Mid-level	The writer used paragraphs and skipped lines to separate what happened first from what happened later (and finally) in her story.	Mid-level	The writer used paragraphs to separate the different parts or times of the story or to show when a new character was speaking.	
								TOTAL

	Grade 1 (1 POINT)	1.5 PTS	Grade 2 (2 POINTS)	2.5 PTS	Grade 3 (3 POINTS)	3.5 PTS	Grade 4 (4 POINTS)	SCORE
DEVELOPMENT								
Elaboration*	The writer put the picture from his mind onto the page. He had details in pictures and words.	Mid-level	The writer tried to bring her characters to life with details, talk, and actions.	Mid-level	The writer worked to show what happened to (and in) his characters.	Mid-level	The writer added more to the heart of her story, including not only actions and dialogue but also thoughts and feelings.	(X2)
Craft*	The writer used labels and words to give details.	Mid-level	The writer chose strong words that would help readers picture his story.	Mid-level	The writer not only told her story, but also wrote it in ways that got readers to picture what was happening and that brought her story to life.	Mid-level	The writer showed *why* characters did what they did by including their thinking. The writer made some parts of the story go quickly, some slowly. The writer included precise and sometimes sensory details and used figurative language (simile, metaphor, personification) to bring his story to life. The writer used a storytelling voice and conveyed the emotion or tone of his story through description, phrases, dialogue, and thoughts.	(X 2)
								TOTAL
LANGUAGE CONVENTIONS								
Spelling	The writer used all he knew about words and chunks of words (*at, op, it,* etc.) to help him spell. The writer spelled all the word wall words right and used the word wall to help him spell other words.	Mid-level	To spell a word, the writer used what she knew about spelling patterns (*tion, er, ly,* etc.). The writer spelled all of the word wall words correctly and used the word wall to help her figure out how to spell other words.	Mid-level	The writer used what he knew about spelling patterns to help him spell and edit before he wrote his final draft. The writer got help from others to check his spelling and punctuation before he wrote his final draft.	Mid-level	The writer used what she knew about word families and spelling rules to help her spell and edit. She used the word wall and dictionaries when needed.	

* Elaboration and Craft are double-weighted categories: Whatever score a student would get in these categories is worth double the amount of points. For example, if a student exceeds expectations in Elaboration, then that student would receive 8 points instead of 4 points. If a student meets standards in Elaboration, then that student would receive 6 points instead of 3 points.

	Grade 1 (1 POINT)	1.5 PTS	Grade 2 (2 POINTS)	2.5 PTS	Grade 3 (3 POINTS)	3.5 PTS	Grade 4 (4 POINTS)	SCORE
LANGUAGE CONVENTIONS (cont.)								
Punctuation	The writer ended sentences with punctuation. The writer used a capital letter for names. The writer used commas in dates and lists.	Mid-level	The writer used quotation marks to show what characters said. When the writer used words such as *can't* and *don't*, he used the apostrophe.	Mid-level	The writer punctuated dialogue correctly with commas and quotation marks. While writing, the writer used punctuation at the end of every sentence. The writer wrote in ways that helped readers read with expression, reading some parts quickly, some slowly, some parts in one sort of voice and others in another.	Mid-level	When writing long, complex sentences, the writer used commas to make them clear and correct.	
								TOTAL

Teachers, we created these rubrics so you will have your own place to pull together scores of student work. You can use these assessments immediately after giving the on-demands and also for self-assessment and setting goals.

Scoring Guide

In each row, circle the descriptor in the column that matches the student work. Scores in the categories of Elaboration and Craft are worth double the point value (*2, 3, 4, 5, 6, 7,* or *8* instead of *1, 1.5, 2, 2.5, 3, 3.5,* or *4*).

Total the number of points and then track students' progress by seeing when the total points increase.

Total score: _____

If you want to translate this score into a grade, you can use the provided table to score each student on a scale of 0–4.

Number of Points	Scaled Score
1–11	**1**
11.5–16.5	**1.5**
17–22	**2**
22.5–27.5	**2.5**
28–33	**3**
33.5–38.5	**3.5**
39–44	**4**

Appendix C. NAEP CAFS Survey (2019)

2. When did you first use a **laptop or desktop computer**?

- Ⓐ I have never used one.
- Ⓑ Before I was in kindergarten
- Ⓒ When I was in kindergarten
- Ⓓ When I was in first, second, or third grade
- Ⓔ When I was in fourth grade

VH270002

3. When did you first use a **tablet**?

- Ⓐ Never until this assessment
- Ⓑ Before I was in kindergarten
- Ⓒ When I was in kindergarten
- Ⓓ When I was in first, second, or third grade
- Ⓔ When I was in fourth grade

VH270101

4. When did you first use a **smartphone**?

- Ⓐ I have never used one.
- Ⓑ Before I was in kindergarten
- Ⓒ When I was in kindergarten
- Ⓓ When I was in first, second, or third grade
- Ⓔ When I was in fourth grade

VH270147

5. **On a weekday**, about **how many hours** do you use a **laptop or desktop computer** for doing schoolwork, including homework?

- Ⓐ None
- Ⓑ Less than an hour
- Ⓒ 1 to 2 hours
- Ⓓ 2 to 3 hours
- Ⓔ 3 to 4 hours
- Ⓕ More than 4 hours

VH270148

6. **On a weekday**, about **how many hours** do you use a **tablet** for doing schoolwork, including homework?

- Ⓐ None
- Ⓑ Less than an hour
- Ⓒ 1 to 2 hours
- Ⓓ 2 to 3 hours
- Ⓔ 3 to 4 hours
- Ⓕ More than 4 hours

7. Were you taught any of the following **at school**? Select **one** answer choice on each row.

	Yes	No	
a. How to type on a computer keyboard using the correct fingers	①	②	VH170150
b. How to write sentences and paragraphs using a computer	①	②	VH170151
c. How to edit text using a computer	①	②	VH170164
d. How to search for information on the Internet	①	②	VH170152
e. How to use a tablet	①	②	VH170156
f. How to look up the meaning of a word using a computer	①	②	VH170157

8. Which of the following are true about the ways in which you and your teachers use computers **at school**? Select **one** answer choice on each row.

	Yes	No	
a. In most of my classes there are **laptop or desktop computers** that I can use for schoolwork.	①	②	VH170166
b. In most of my classes there are **tablets** that I can use for schoolwork.	①	②	VH170167
c. There is **Wi-Fi** or some other **Internet connection** that I can use for schoolwork.	①	②	VH170170
d. Most of my teachers use computers when teaching my classes.	①	②	VH170169
e. Most of my teachers require us to use computers in the classroom.	①	②	VH170168

11. **This school year**, how often have you used a **laptop or desktop computer** to do each of the following? Select **one** answer choice on each row.

	Never	A few times	Once every few weeks	About once a week	More than once a week	
a. Write a short paper (less than a page) for school	①	②	③	④	⑤	VH170171
b. Write a paper for school that was longer than a page	①	②	③	④	⑤	VH170172
c. Search the Internet for a school project	①	②	③	④	⑤	VH170174
d. Practice things in **mathematics** that you were having trouble learning	①	②	③	④	⑤	VH170161
e. Practice things in **reading** that you were having trouble learning	①	②	③	④	⑤	VH170177
f. Take a test	①	②	③	④	⑤	VH170175

VH597752

12. **This school year**, how often have you used a **tablet** to do each of the following? Select **one** answer choice on each row.

	Never	A few times	Once every few weeks	About once a week	More than once a week	
a. Write a short paper (less than a page) for school	ⓐ	ⓑ	ⓒ	ⓓ	ⓔ	VH270183
b. Write a paper for school that was longer than a page	ⓐ	ⓑ	ⓒ	ⓓ	ⓔ	VH270188
c. Search the Internet for a school project	ⓐ	ⓑ	ⓒ	ⓓ	ⓔ	VH270184
d. Practice things in **mathematics** that you were having trouble learning	ⓐ	ⓑ	ⓒ	ⓓ	ⓔ	VH270185
e. Practice things in **reading** that you were having trouble learning	ⓐ	ⓑ	ⓒ	ⓓ	ⓔ	VH270186
f. Take a test	ⓐ	ⓑ	ⓒ	ⓓ	ⓔ	VH270192

VH270130

13. Which best describes the way you type on a computer keyboard?

ⓐ I don't know how to type using a computer keyboard.

ⓑ I can type with one or two fingers, but I have to search for where the letter keys are.

ⓒ I can type with one or two fingers, and I know where most of the letter keys are.

ⓓ I can type with all ten fingers when I look at the keyboard.

ⓔ I can type with all ten fingers without looking at the keyboard.

VH270132

14. Would you rather take a test at school using paper and pencil or using a computer?

ⓐ Paper and pencil

ⓑ Computer

VH597760

15. Do you think you would be able to do each of the following? Select **one** answer choice on each row.

	I definitely can't.	I probably can't.	I probably can.	I definitely can.	
a. Write sentences and paragraphs using a computer	ⓐ	ⓑ	ⓒ	ⓓ	VH270229
b. Edit text using a computer	ⓐ	ⓑ	ⓒ	ⓓ	VH270218
c. Use a touchscreen on a computer, tablet, or smartphone	ⓐ	ⓑ	ⓒ	ⓓ	VH270230
d. Look up the meaning of a word using a computer	ⓐ	ⓑ	ⓒ	ⓓ	VH270225
e. Draw a picture using a computer	ⓐ	ⓑ	ⓒ	ⓓ	VH270226

Appendix D. Writing Pacing Guide for the Comparison Group

	Concepts to be covered
Week 1	Pre-test, CAFS survey, what is narrative writing, and generating story ideas
Week 2	Narrowing topics, drafting, setting writing goals, and writing an introduction
Week 3	Introductions, dialogue, and punctuating dialogue
Week 4	Adding in details, word choice, imagery, and transitions
Week 5	Using paragraphs, writing an ending, and editing
Week 6	Brainstorming ideas, drafting, and revising
Week 7	Revising, adding details, and editing paragraphs
Week 8	Revising, editing, publishing, and post-test

Appendix E. Writing Pacing Guide for the Treatment Group

Changes are denoted with an (*)

	Concepts to be covered
Week 1	Pre-test, CAFS survey, what is narrative writing, and generating story ideas *Review teacher feedback from pretest
Week 2	Narrowing topics, drafting, setting writing goals, and writing an introduction *Modeling and practice using Google doc tools
Week 3	Introductions, dialogue, and punctuating dialogue * Review feedback and what it looks/sounds like to give to a peer
Week 4	Adding in details, word choice, imagery, and transitions * Review feedback and what it looks/sounds like to get from a teacher/peer
Week 5	Using paragraphs, writing an ending, and editing *Discuss how to make changes based on feedback given by teacher and/or peers
Week 6	Brainstorming ideas, drafting, and revising *Practice giving and receiving feedback
Week 7	Revising, adding details, and editing paragraphs *Continue giving and receiving feedback
Week 8	Revising, editing, publishing, and post-test *Continue giving and receiving feedback