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# Pre-Service Teacher Preparation for Technology Integration in Literacy

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**Abstract**

This case study of a pre-service teacher education course on integrating technology in literacy curriculum focuses upon the following research questions: (1) What experiences do pre-service teachers have integrating technology into literacy curricula and (2) How does implementing a technological inquiry impact their preparation? The 22 pre-service teachers were partnered with in-service elementary teachers who were implementing an inquiry question as part of their professional development. This study focuses upon pre-service teachers' initial reflection forms regarding their level of experience with technology integration prior to the course in their pre-service education and their final interviews reflecting on their experiences working with in-service teachers. The researchers used emergent coding and discuss seven focused and three theoretical codes.

**Keywords:** technology integration, literacy, teacher education, professional development

Teachers are using technology more than ever as they experiment with not only teaching their students digital literacy, but exploring new means of teaching, such as online or hybrid forms of instruction. In other words, the pandemic has heightened the need for teachers to use digital tools as exemplified by the 2021 survey of *What's Hot in Literacy* (Cassidy et al., 2021) finding digital literacy a "very hot" topic. This research suggested that although these digital skills are needed more than ever for teachers, schools often do not have the funding or means to prepare teachers in this area. Further, teachers need direction not only on how to use these tools themselves, but how to meaningful integrate digital tools into curriculum (Howell, 2018; Howell et al., 2021). Research shows that even recent teacher education graduates, often assumed to be *digital natives*, needed training on how to integrate digital tools into their curriculum (Lei, 2009). Thus, the authors address this gap in the research in this study pairing both in-service and pre-service teachers in their quest for technology integration specifically in literacy curriculum and discuss their findings related to teacher education in needed areas of research, theory, and practice. Research on these partnerships and their role in teacher education regarding technology is an especially needed area of research (Nelson, 2017).

This case study focuses upon a pre-service teacher education course at a Midwestern university in the United States related to technology integration in literacy curriculum. This course served mainly undergraduate students majoring in elementary education, who would then be licensed K-6 teachers. We will focus here upon pre-service teachers' experiences being paired with in-service elementary teachers who were part of a larger study (see Howell et al., 2021). The in-service teachers (ISTs) developed an inquiry question asking how they could make writing a more digital, participatory process. The pre-service teachers (PSTs), the focus of this study, were partnered in teams with these ISTs to help the ISTs carry out their inquiry during this

semester long course. The research questions guiding this case study during that partnership and the PST course were the following: (1) What experiences do PSTs have integrating technology into literacy curricula and (2) How does implementing a technological inquiry impact their preparation?

## Theoretical Perspectives

Theoretical perspectives such as new media literacies (NML; Jenkins, 2006) define the literacy skills needed to fully participate in an environment in which new media are fundamental. This perspective suggests the need to move beyond simply accessing technology, although that is still certainly important, and making sure once students have these tools, they are interacting with them in ways meaningful to today's culture. Technology is defined as any application of knowledge for purpose (Williams, 2015). The terms technology and digital tools are used interchangeably to refer to this focus on computer integration. In their original white paper, Jenkins (2006) defined NML skills as the following: play, performance, simulation, appropriation, multitasking, distributed cognition, collective intelligence, judgment, transmedia navigation, networking, and negotiation. Visualization was later added and discusses the need for students to be able to both understand and create visual interpretations of data and is a complement to simulation included in the original eleven (Reilly, 2013). This addition shows that these skills are dynamic and will fluctuate as new media is created and demands new literacy skills. Many of these skills, such as simulation, appropriation, multitasking, and transmedia navigation among others, involve multimodality, a concept important to other theoretical perspectives of literacy such as multiliteracies developed by the New London Group (1996).

Multimodality is understanding and creating meaning across more than one mode, or way of interpreting meaning (Cope & Kalantzis, 2000; Howell, 2018; Howell et al., 2021).

Multimodality and the new media literacies are not inherent to students and must be taught, which is why it is imperative teachers understand these NML skills. The New London Group (1996) developed a specific pedagogical framework for this with multimodality, and Jenkins (2006) also argued new media literacies must be taught with specific "resources and processes" (p. 53). Yet, in schools, both frameworks and the concepts they represent remain largely theoretical (Howell et al., 2021), new media literacies for needing to make more specific connections to formal learning spaces and multiliteracies as researchers often forget its pedagogical application in favor of its focus on multimodality (Alvermann, 2017). Further problematic to students gaining these new media literacies is the field of literacy at large, and thereby how teachers are trained to teach literacy, remains fragmented with research calling for literacy teachers in particular to understand more diverse theoretical perspectives (Parsons & Gallagher, 2016). These perspectives often do not include digital tools as even the standards guiding the preparation of literacy professionals, such as those of the International Literacy Association (2018), do not include digital tools in their standards of foundational knowledge as those focus on reading, writing, language, and connections between literacy and disciplinary knowledge. However, programs that are regarded as distinguished for preparing literacy teachers include "technology infused throughout the program" as one of 14 programmatic features that ranked more highly than others at a statistically significant level (Lacina & Block, 2011, p. 337).

Jenkins (2006) calls for this literacy to take place in a participatory culture. This culture is defined as one in which students learn through creation and social collaboration. This creation is set in a digital culture and therefore often includes the use of digital, multimodal tools. Thus, the professional development (PD) for the ISTs focused upon three essential elements: (a) sustained PD, including the gradual release of teacher inquiry; (b) writing as a social practice; and (c) the

use of digital tools to engage students in writing (see Howell et al., 2021). The gradual release of teacher inquiry meant ISTs learned about inquiry topics during a summer PD, developed their inquiry questions with colleagues and thus had both guided instruction and collaborative learning before they were expected to implement their inquiry independently. Due to their roles supporting these ISTs, the PSTs who were enrolled in the aforementioned undergraduate class learned about these essential elements as they worked to support the inquiry these in-service teachers created. In other words, ISTs created questions during their PD to guide their teaching of how writing and digital tools would be integrated, and the PSTs helped them to implement practice related to these questions during the school year. To enact the other two essential elements, ISTs worked during the implementation of teaching around their inquiry to implement digital tools in ways that would encourage their students to use both social collaboration and creation. Thus, these were also elements PSTs learned about during the course and helped the ISTs to enact. This focus of the study aligned with Jenkins (2006) concept of NML needed in a participatory culture and also focused on overcoming obstacles research shows remain for both pre-service and in-service teachers. For example, research shows teachers, especially those in elementary education, lack the training needed to integrate digital tools effectively into their content areas (Parette et al., 2010), and this integration is something they struggle with once in classrooms (Hutchison & Reinking, 2011; Hutchison et al., 2016).

## Relevant Research

### Expectations of Pre-Service Teachers

Current research shows pre-service elementary teachers expect many challenges in terms of technology integration in their own classrooms, and they have concerns about the problems they will face when they start teaching (Dinc, 2019; Quinn, 1998). Even when encouraged to

experiment with digital tool integration during practicum experiences, many PSTs are still reluctant to actually do so (Bencze, 2010). However, when given the opportunity to evaluate educational technology, such as internet-based resources, PSTs are more likely to use such websites as tools for instruction and communication (Son & Hu, 2014).

In addition, PSTs' self-efficacy toward technology integration in the classroom can increase after having their own inquiry-based learning experiences using technology (Novak & Wisdom, 2018), engaging in practicum student teaching experiences (Al-Awidi & Alghazo, 2012), and being exposed to technology instruction in meaningful contexts (Kaya et al., 2019). On the other hand, some research shows prolonged intense exposure to technology instruction can reduce their confidence over time as PSTs begin to realize how much they still need to learn and keep learning in the future (Lyublinskaya & Zhou, 2008).

In many ways, these findings contradict conventional wisdom about college students and younger teachers. School administrators are increasingly expecting new teachers to be comfortable using technology and, by extension, to effortlessly integrate technology with their instruction based on assumptions all young people have technological proficiencies. However, Lei (2009) surveyed 70 PSTs considered to be *digital natives* about their beliefs, attitudes, confidence, and interest in technology, then evaluated their technological strengths and weaknesses. They found, despite being frequent users and consumers of social/communicative technology, PSTs were unfamiliar with and lacking in experience with content-specific technologies, educational technologies, and technologies to help students with special needs.

**What is Currently Being Done in Pre-Service Programs**

Kleiner et al. (2007) surveyed 1,439 institutions with teacher education programs for information on the types of educational technology training provided to preservice teachers.

They found 90% or more of the surveyed institutions had teacher preparation programs that taught topics related to technology. To a lesser degree, 80% or more taught the application of technology in assessing student achievement and creating or using digital portfolios. However, just 52% covered topics related to teaching via distance learning. Kleiner et al. (2007) reported such topics were most often covered in preservice teachers' methods courses (93%); although 79% of institutions reported they were taught within field experiences. Seventy-one percent of institutions integrated technology education with existing content courses curricula, while approximately 80% offered some version of stand-alone coursework in educational technology.

In an updated examination of trends in technology related coursework in teacher education programs over a ten-year span, Betrus (2012) surveyed 35 institutions and found an increase of 8% in the percentage of schools reporting they integrated technology with other coursework. The types of strategies used to teach such topics in education programs were examined in a review of existing research that found the following:

> Strategies were used to teach technology to preservice teachers, including integrating technology in all courses . . . using multimedia . . . focusing on education faculty . . . delivering a single technology course . . . modeling how to use technology . . . collaboration among preservice teachers, mentor teachers, and . . . practicing technology in the field . . . offering mini-workshops . . . improving access to software, hardware, and/or support . . . and focusing on mentor teachers. (Kay, 2006, p. 389)

A synthesis of qualitative research on approaches to technology integration by teacher preparation programs yielded multiple key themes (Tondeur et al., 2012). The first theme was the alignment of theory and practice—that is, providing preservice teachers with opportunities to

practice the application of theory in meaningful ways. Secondly, PSTs have access to mentors and faculty members that serve as role models. In addition, they are given opportunities to reflect on the role of technology in education. Learning technology by design through collaborative planning was another key theme across teacher preparation programs. Scaffolding authentic learning experiences and shifting from traditional assessment to continuous feedback embodied prevalent approaches to preparing PSTs to integrate technology with their instruction.

***Strengths***

Modified curricula for teacher preparation programs focusing on the development of TPACK, technological pedagogical content knowledge (Koehler & Mishra, 2009), have yielded positive results around topics such as information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving (Reisoğlu & Çebi, 2020). Even more so, opportunities to apply learning shortly after being introduced to new theories and tools while having faculty and mentor teachers as models were reported as significant contributors to increased confidence among PSTs (Reisoğlu & Çebi, 2020).

Nelson and Hawk (2020) examined the changes in values and beliefs of 35 preservice teachers after observing technology integration in their field placement. They found being paired with mentor teachers who frequently used educational technology in their classrooms led to stronger beliefs in the utility of educational technology, indirectly increasing PSTs' intentions to integrate technology with their future instruction—especially those participants who observed mentor teachers with high TPACK.

Bullock (2004) discovered through a case study of two PSTs that mentor teachers who actively collaborated with PSTs to develop and implement lessons enhanced by technology were a significant enabling factor to PSTs' integration of technology with their own instruction. In

addition, regular modeling, encouragement, and support from faculty and mentor teachers were reported as significant enabling factors (Adamy & Boulmetis, 2006; Gunter, 2001). Lastly, research has shown authentic learning exercises, such as collaborative planning and reflection, may also positively influence self-efficacy related to technology integration as well as PSTs' intentions to integrate technology with their future instruction (Banas & York, 2014). Thus, teachers are capable of integrating technology, but this capability is not accidental; rather, it is a product of intentional development, collaboration, and planning.

### *Challenges*

Betrus (2012) emphasized technology is often vetted through public use before making its way into the classroom environment. As a result, the technology used in educational settings lags behind that used by broader society and is unlikely to reflect the most recent technological advancements. The advancement of technology creates a moving target for curriculum designers of teacher education programs.

According to Kleiner et al. (2007), other barriers to embedding technology instruction within teacher preparation programs include faculty members' lack of time (87%), training (83%), and interest (73%). Additionally, and unlike at the institutions themselves, the infrastructure at local schools were reported as a barrier for approximately 30% of teacher education programs. Other challenges reported include "lack of training or skill, time, and willingness of supervising teachers to integrate technology into their [own] classrooms" (p. 12).

## Current Need for Research

Research suggests single technology courses, mini-workshops, technology infused courses, modeling, using multimedia, collaboration (among PSTs, mentor teachers, and faculty), and practice lead to increases in digital tools used in the classroom and access to quality

resources and support are necessary in the university setting as well as in field placements (Kay, 2006). However, determining which of these strategies is most effective is difficult, but results indicate a positive correlation between the number of strategies used and the amount of digital tool use in the classroom.

Additionally, searches for relevant research on PST preparation for technology integration currently yields more studies on the university programs and faculty than the micro-interactions between mentor teachers and PSTs in their field placements—that is, "Less emphasis has been placed on understanding the impact of field placement observations on a preservice teacher's technology integration intentions" (Nelson, 2017, p. 449). Existing research suggests mentors who regularly use technology and encourage their mentees to do the same have a positive impact on PSTs' motivation and willingness to use technology in the classroom (Franklin et al., 2001). However, the nature of mentor-mentee daily interactions, tools/strategies taught and used, and degree of collaboration are important influencers that need to be further explored.

Thus, when considering future teachers' concerns (Dinc, 2019; Quinn, 1998), reluctance to integrate technology (Bencze, 2010), and the resulting increase in willingness (Son & Hu, 2014) and self-efficacy (Al-Awidi & Alghazo, 2012; Kaya et al., 2019; Novak & Wisdom, 2018) for integrating technology when given meaningful experiences, this study addresses a need for how to engage PSTs in technology integration in applied experiences, specifically when applying literacy instruction in fourth and fifth-grade classrooms.

## Method

This study uses a single, common-case study method, which Yin (2014) described by its embodiment of "the circumstances and conditions of an everyday situation" (p. 52). The case of

this pre-service class is common as seen in our literature review in that PSTs are not trained in student teaching experiences specialized in technology integration. The time the PSTs participated in this course, a fall semester, served as the binding of the case, which Yin (2014) defined as boundaries needed in a case to help researchers focus on the unit of analyses.

**Participants**

The class had an enrollment of 22 PSTs. These PSTs were taking this course primarily as part of their reading endorsement in addition to their elementary major. At the Midwestern university where these participants were pursuing their undergraduate degrees, they were required to pursue at least one endorsement in addition to their major in teacher education. The participants were asked in an initial survey to describe their technological ability. The researchers grouped their experience into levels from basic, below average, average, and above average. Of the 22 participants, the largest percentage (41%) of students considered their technology use average, with 27% considering themselves below that and 32% above. While these students are required to have student teaching observations to be admitted into elementary education, and they each receive teaching experience in both dedicated student teaching experiences as well as student teaching integrated in their methods courses, the students are not required to do any student teaching or observation related to technology integration. Those students pursuing a learning technologies minor (five of the 22 participants) would observe a person in a technology role in the school district, but even those students would not necessarily have an opportunity to implement in their own teaching what they observed.

**Data Collection and Analysis**

This study focuses on several assignments collected as part of the undergraduate course for these PSTs. We will focus on students' initial reflection forms regarding their level of

experience with technology integration prior to the course in their pre-service education and their final interviews reflecting on their experiences working with ISTs. The PSTs met with their IST partners at least four times over the course of the semester. This study followed Yin's (2014) recommendation of data triangulation as we include both pre-service teacher written reflections and audio-recorded interview responses. The data was coded using elements of a grounded theory method of coding and constant comparison analysis in which the researchers formed initial, focused, and theoretical codes (Charmaz, 2014; Glaser, 1965). Initial codes were developed independently by both authors focusing on line-by-line coding of PSTs' actions and beliefs. The researchers then met and reviewed initial codes until 100% interrater reliability was attained. Forty initial codes were collapsed into seven focused codes according to emerging themes, and those seven focused codes were further collapsed into three theoretical codes, useful for guiding future teacher education pedagogy. See Table 1 for focused codes leading to theoretical codes, which guide our findings and discussion.

**Table 1**

*Focused Codes Leading to Theoretical Codes*

| Focused Codes | Theoretical Code |
|---|---|
| ● Prior Experience<br>● Theoretical Learning | Limitations of Present Teacher Education Preparation |
| ● Pros of This Course for Pre-Service Teachers<br>● Ways Teachers Helped Teachers | What Worked Well in This Course |
| ● Challenges of This Course for Pre-Service Teachers<br>● Limitations with Teacher Collaborator<br>● Future Implications | Implications for Future Change |

## Findings

The authors will discuss here the seven focused codes formed from the forty initial codes: *prior experience, theoretical learning, challenges of the course for pre-service teachers, pros of the course for pre-service teachers, ways teachers helped teachers, limitations with teacher collaborator,* and *future implications*.

**Prior Experience**

Thirteen initial codes were grouped as these codes relate to the PSTs' experience prior to the course in this study. The codes included the following: *prior technology experience in classrooms, prior experience working in classrooms, prior experience planning lessons, learning to bridge new and previous learning, prior theoretical learning, prior use of technology as reward or recreation, prior focus on content material, prior experience with multimedia project, prior feeling of intimidation with technology, expectations of prior technology experiences, prior pressure from observation, prior regrets of technology use, and students consuming technology prior*. These codes painted an unpleasant picture for both PSTs and students they had worked with regarding technology use. The PSTs described their previous experiences with teaching during their pre-service education as focused on content, with technology included but in a high-stakes environment. Whereas the PSTs were confident in their amount of time spent in the classroom and the teaching experience gained, they did not convey this same familiarity with technology integration. For example, one PST described their practicum experience: "I taught one practicum. I had to research things... I forgot exactly what topic it was, but just some science related things. Other than that, just not too much technology, I guess."

The pressure they instead associated with digital tools came from limited observations in which the PST was supposed to demonstrate their knowledge of content and pedagogy with what seemed to be a nod to technology. This nod was high stakes as it was not the focus, thus

seemingly not as highly valued and for that small contribution was a potential landmine. In other words, technological integration was not worth the risk to the observation of their content or pedagogical knowledge. One PST in particular illustrates this risk when asked about their prior technology integration in their student teaching experience:

Student: If I would have been more risky I would have done something…

Interviewer: You thought of it…it was kind of a risk?

Student: Yeah

Interviewer: You're only in there three times and you don't want to mess up?

Student: Yeah. When I was there they actually had a lot of issues…

The interviewer followed up later with this PST in the same interview after the PST discussed a problematic student use of technology in their previous student teaching experience:

Student: I didn't want to be anybody who started something worse.

Interviewer: A guinea pig?

Student: Yes. Oh, yeah.

Thus, overall, the PSTs were thankful for the opportunity to play with technology in this course not only during their undergraduate class time, but also observing and implementing with their partner ISTs. This experience seemed to help them overcome regrets regarding how they had used technology in previous student teaching experiences which arose in the initial codes *prior regrets with technology use*, *students consuming technology prior*, and *prior feeling of intimidation of technology*. They seemed to regret not letting their students be more innovative and in control with technology. One PST described it:

> Reflecting back on it, it's not really technology integration cause all I was doing was just using it, but the students weren't using it and I wasn't teaching about it, so obviously not a great example of technology integration in that sense.

**Theoretical Learning**

There was only one initial code in this focused code, which was *theories learned in class*; however, this was the second most frequently referenced initial code. This code pictured both success and perhaps room for growth in PST education. The success was the PSTs had clearly learned the theory of TPACK (Koehler & Mishra, 2009). A representative comment of students speaking about previous technological learning and theory is the following describing TPACK: "But that was the only one I've previously learned about." However, students were less aware of theories that applied technology more specifically to their content knowledge, in this case literacy, such as multiliteracies and NML. Students described these theories as being both useful and new perspectives to them. The following are representative PSTs' discussion of theories learned in the course:

(a) "I really like the new media literacies, that was something I've never learned about before, so I think I latched onto that one."

(b) "I just feel like the new media literacies is more up to date. They are more content specific. I don't know. TPACK was just kind of confusing to me."

(c) "We've talked about TPACK, but I don't think I really had a good understanding of TPACK before. This class, kind of what we talked with about our collaborating teachers, but just the idea that the content still has to come first."

Thus, students either gained perspectives more closely aligned to content they were learning or mentioned how they grew in their knowledge of TPACK because of the course and their relationship with their ISTs.

**Challenges of the Course for Pre-Service Teachers**

We found the following seven initial codes that were later collapsed into the challenges focused code: *challenge scheduling and communicating with teacher, need to work with elementary students more, challenge not seeing teacher implement lesson planned, challenge of wanting to meet teacher more, challenge of providing more choice, challenge of wanting more teacher feedback, and teaching teachers priority of content*. These codes presented the challenge of having PSTs join an inquiry that had already been designed by an IST rather than being part of that design process. The ISTs had received four days of PD to design an inquiry regarding integrating technology into their writing curriculum. The PSTs did not join the ISTs until they were attempting to implement this inquiry question in their following fall semester pedagogy. Thus, there were several challenges in getting the in-service and pre-service teachers' schedules and communication aligned and in realizing what their respective priorities were once this scheduling and communication had been resolved. For example, one of the initial codes in this focused code *challenge scheduling and communicating with teacher* was the fifth most frequently coded initial code. Furthermore, while the PSTs enjoyed helping teachers plan lessons and learn digital tools to implement in those lessons, they also expressed a desire to see those lessons implemented with elementary students as expressed in the initial codes *need to work with elementary students more* and *challenge not seeing teacher implement lesson planned*. While some PSTs in their partnerships with the ISTs did get to teach the elementary students, some PSTs only helped the teachers. Eight PSTs discussed wanting to work with the elementary

students more as the following PST discussion represents: “It would've been nice to actually be in the classroom and see how the students reacted because she had nothing but positive things, but it's always nice to kind of see it happen.”

**Pros of This Course for Pre-Service Teachers**

The PSTs under the focused code *pros of this course for pre-service teachers* talked about the value of learning by planning and implementing the inquiry with the ISTs. The initial codes composing this focused code included the following: *learning from seeing technology implemented in classroom, learning to integrate technology, hopes for learning in class, learning new digital tools in course, learning about student ability level, learning about classroom management, learning about educational policy, learning from working with elementary students, learning from seeing how teachers plan with technology, and liking textbook*. While the PSTs did want to see lessons designed with the ISTs implemented with the elementary students more as discussed previously, they did benefit from their partnerships with the ISTs. Two of the most frequently coded initial codes forming this focused code were *learning from seeing technology implemented in classroom* and *learning to integrate technology*, both of which entailed PSTs learning by seeing ISTs doing and, in particular, learning the coordination of technology and literacy. PSTs appreciated seeing ISTs integrate digital tools even if, and perhaps especially when, that integration did not go perfectly. In other words, as the following PST’s discussion highlights, they enjoyed knowing even practicing teachers had to experiment with digital tools, and that experimentation didn’t have to be high stakes nor perfectly successful:

> I think it was a really awesome experience just to see it in an actual classroom. I think that was really beneficial to be able to be in the classroom and see how it was playing out and whether it was successful, or some things weren't successful, and kind of adapting

> because that's a real-life classroom, and that's a real-life instance that may happen. That not everything is going to work and not everything's going to work out the way that you plan, but I think that at the end of the day it's finding those tools that are meaningful, and finding kind of what works, and what doesn't is kind of the task for us as teachers to find out, is what works best for our students and what might not work for other students.

With regard to integrating digital tools and writing, the PSTs especially appreciated the balance of technology and content: "Use the technology to teach the strategy, not the technology, which is something that you talk about in class." Two initial codes, *learning to integrate technology* and *liking textbook* within this focused code included discussion of PSTs learning how to integrate digital tools into writing. The PSTs liked the planning cycle included in Hutchison and Colwell (2015), called the technology integration planning cycle for literacy and language arts, as it helped them focus on the goal of teaching content over technology and helped them to think through not only what tool to use with that content, but why they are using that tool, and how they might have to adapt that tool as technology changes:

> I loved the book, so it was fun to read. And it gave so many resources, and just different types of technology. 'Cause I think that it mostly talked about how, yes, this is like a specific technology. But as time progresses, there'll be a new one, a different version of it. It may not be the same name, but using it more like a resource, that books was really beneficial.

**Ways Teachers Helped Teachers**

Two initial codes, *helping teacher find resources* and *making tutorial videos for teacher,* made up the focused code, *ways teachers helped teachers.* This focused code showed that the relationship between the ISTs and the PSTs was symbiotic, with the PSTs learning from their

hands-on, practical experience from the ISTs as discussed in the previous section, but the ISTs also benefiting from their relationship with the PSTs. The PSTs helped the ISTs often by helping them find digital tools to integrate into their writing units for content-specific purposes and made tutorials regarding these tools. The PSTs seemed to recognize their role in not only learning but being empowered to help ISTs: "So it was almost kind of like we were more of PD with them in a way." The PSTs mentioned finding this utility of their learning not only for themselves but for the ISTs to be a source of motivation:

> I do think it helped aid my learning, just because it gave me more motivation to actually do the readings, especially when it was including technology, because I knew that this was actually helping somebody. So, normally when I would be reading, I was like, oh yeah, that's a cool technology. I'll write it down and explore it later, but now I had more of a reason to explore it right away.

**Limitations with Teacher Collaborator**

Three initial codes, *challenge of teacher not understanding their role*, *challenge of teacher reluctance*, and *challenge working with long-term substitute* composed the focused code of limitations with teacher collaborator. These limitations mainly revolved around both pre-service and in-service teachers not being clear of their role within their partnership. During the summer PD, the researchers told the ISTs that the PSTs would be there to help them and left that role broad for the ISTs to both discuss with the PSTs what their role would be and to allow flexibility for this role. For example, here is an example of how one of the PSTs discussed this limitation:

> I remember I was kind of overwhelmed, because like she didn't really know what was expected of us, and I didn't really know what was expected of her at the same time. But I

think that was like the hardest thing to overcome, but then once we got to that, it was like really good.

To overcome this barrier, some of the PSTs wanted to be part of the summer PD that occurred with the ISTs prior to the start of the PSTs' fall class in which they then helped those ISTs implement their inquiry. However, this was not possible at the time due to scheduling and enrollment of the pre-service course. Another challenge was even during the fall semester, changes occurred such as teachers being absent for various reasons, as illustrated by the initial code *challenge working with long-term substitute*.

**Future Implications**

Three initial codes, *application to future classrooms*, *becoming more open to use at elementary level*, and *learning a new role of teacher* showed key learnings from the PSTs that were then given the focused code of *future implications.* These implications suggested that overall, the partnership between in-service and pre-service teachers was beneficial as it led to the PSTs being more open to using technology with elementary-aged students as well as them learning a more multifaceted role of the elementary-school teacher.

In their final interviews, PSTs were asked the following question: "If I walked into your classroom in five years, and you had your ideal setup what would students be doing with technology and why?" Out of the 27 references in the code *application to future classrooms* that included the answers to this question, the teachers seemed very open to using technology with elementary students. These responses showed PSTs envisioned technology in the hands of students, to have students creating for the purpose of learning content while using digital tools. For example, one PST answered with the following:

> I think I would want to spend a lot of time in the classroom working on using technology for writing as the process. So the pre-writing and the rough drafting and the revising and not only you get computers for one time to type a final paper. I think that that could connect outside of just literacy time.

This response shows that this PST, though she mentions several digital tools prior to this in the interview, is focused on the content goal of students learning "writing as the process." Furthermore, she wants to integrate digital tools not just at the publication stage of this process, as is often the case when digital tools are just thought of as a presentation tool, but, instead, throughout that process. Furthermore, the initial code *learning a new role of teacher* showed that PSTs learned from this experience that they didn't always have to be an expert with digital tools to bring them into the classroom: "I think the main point I took out of there was that we as teachers need to be the facilitator, and I think it said, 'Not the sage on the stage'."

## Discussion

Three theoretical codes emerged from the collapsed focused codes as depicted in Table 1: Limitations of present teacher education preparation, implications for future change, and what worked well in this course.

### Limitations of Present Teacher Education Preparation

Practice and theory were intimately related in this finding. The PSTs felt that they had limited application or practice of technology in literacy experiences in their teacher preparation, and what little they did have was high stakes, typically only in limited observations where technology usage was a box to check on a rubric. This finding emerged from the focused code *prior experience*. The other focused code making up this theoretical code was *theoretical*

*learning*. The teachers generally felt comfortable with TPACK but discussed the relevance of learning theories more specific to their content area of literacy, such as multiliteracies and new media literacies. The picture that emerged from these two focused codes is perhaps best illustrated through a metaphor. The PSTs felt that each use of technology in their pre-service experience was similar to a high beam at an Olympic event. The stakes were high; the reward for trial-and-error low when compared to the cost. These focused PSTs were not going to risk their grade, even though they recognized the value of trying technology out in classrooms. However, what they wanted was reward for their bravery, rather than their perfection. In other words, they needed a practice mat, perhaps even a crash mat, where they could use digital tools in trial and error with ISTs and their students and be allowed to fail, yet learn from that failure. The mat in this case could be theory, which, just as in gymnastics where the beam gets placed higher off the ground and mats get more specific as the gymnasts advance, so should theory be more specific in its application as teachers need to use it for specific content areas. As the teachers got braver in their application, they appreciated different theories and could not only use those theories to guide their practice but push back and revise those theories as they were tested in classrooms.

**What Worked Well in This Course**

Just as PSTs wanted more opportunities for trial and error in classrooms with ISTs and students, they also acknowledge the benefit of working with ISTs, even if their practice with technology integration was not always successful. The PSTs appreciated both the successes of our course, such as learning technology planning tools, but also the failures, such as when their ISTs plans did not always work out perfectly when implemented. This partnership allowed teachers, both pre- and in-service, to focus specifically on technology integration, an area where they had limited previous opportunity. Even PSTs such as Samantha, a senior, with teaching

experience every year of her program, acknowledged she had never actually had an opportunity to plan a lesson focusing on integrating technology. Thus, teaching experience does not equate to technology experience.

**Implications for Future Change**

The theoretical code of implications for future change was composed of the following focused codes: *challenges of this course for pre-service teachers*, *limitations with teacher collaborator*, and *future implications*. Although both PSTs and ISTs expressed gains from their relationship during this course, it could have benefitted from collaboration from the start. The PSTs would have benefitted from designing the inquiry questions with the ISTs in the summer PD. In addition, the PSTs wanted more interaction with the elementary students, which was at times not possible due to conflicts in schedules. Thus, one implication for both research and practice is perhaps integrating the design of PD and pre-service teacher education more closely. Some of these practices are already happening such as holding undergraduate classes in local schools, but more could be done on the PD side. For instance, in this grant, the first author would revise in another iteration to offer a course for undergraduates in the summer that coincided with the ISTs' summer PD and then possibly link that summer offering with the fall course.

## Conclusion

In sum, there are implications for research, theory, and practice from this study. Regarding research, there is a need to further explore how to better integrate PST preparation and IST training. Theory was important in this study as PSTs learned theories that were new to them and because these theories were specific to their content area, the PSTs found them useful. Yet, the PSTs were not learning, nor implementing these theories until late in their education. In general, not enough theory was taught, implemented, and consistently put into practice. Too

much time elapsed between their learning of theory and their application; for example, one PST learned TPACK her sophomore year, yet didn't revisit theory related to technology integration until her senior year. Finally, and perhaps most importantly, we saw the need for practice and pedagogy, and more embracing of trial and failure therein. PSTs learned to appreciate failure in this course and learn from it because they were trying out technology consistently and were rewarded for their bravery rather than their perfection. In other words, PSTs need more low-risk opportunities to implement and plan for technology integration in elementary classrooms.

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# "What Messages or Symbols Make You Feel Empowered?" A Virtual Book Experience with Tristan Strong

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**Abstract**

This co-authored manuscript represents the work of a literacy educator/professor and graduate student in building on online book club experience for upper elementary and middle grades students in the Fall 2020 semester. Kwame Mbalia's Tristan Strong series became the central text for building reading and dialogue with students, and all interactions were in a virtual setting. While the book club approach is not remarkable on its own, the use of digital texts and the demands of the environment presented difficulties and generated implications that the authors hope will be useful for the literacy field.

**Keywords:** online pedagogy, digital literacy, popular series, middle grades instruction, literacy instruction, upper elementary literacy

## Background on Virtual Book Clubs

In the fall of 2020, following a spring and summer of online learning, the authors of this manuscript worked together as a faculty member/graduate student instructional team to co-construct a virtual book club experience for upper elementary/young adolescent students. This work stemmed from our director's vision in the university reading clinic setting for continuing to maintain connections throughout the COVID-19 pandemic. Indeed, the reading clinic has continued to be "plugged in" and online since March 2020, even given the significant challenges in maintaining our engagement with young readers in pandemic times. This collaboration was an extension of our team's common philosophical foundation and willingness to craft new experiences in difficult contexts (Ward et al., 2020).

Virtual book clubs are not a new venture (Chelton, 2001; Sedo, 2003); what was new in our experience was the immediacy of the need for the book club experience in the absence of possibilities for face-to-face instruction in our local school system at the time, as well as on the university campus. We further recognized the potential for building community with an online book club in a socially fragmented context. In the context created by the pandemic, a number of recent publications have explored virtual engagements across levels, including the need to humanize instruction (Budhai et al., 2021), engage in multimodal reflection and composition (Stufft & von Gilern, 2021), and build learning experiences across languages (Setyowati et al., 2021) .

This book club served as one part of a larger plan to continue our work with connecting graduate students and children in clinical experiences to enrich our course content and afford opportunities to practice pedagogy. Previous research has begun to examine creative online teaching methods during the COVID-19 pandemic (Chamberlain et al., 2020), and research has

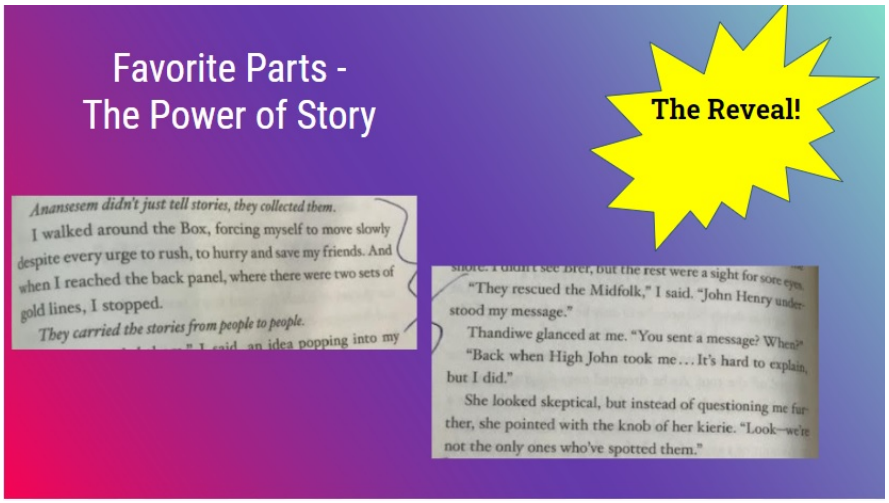
further indicated that virtual book clubs can promote reading growth outside of a regular school schedule (Bare, 2019). Given the at-home setting of instruction, and the need to continue to foster growth and development for students, we worked together to create a model that could be open to change as we read throughout the semester.

## Initial Plans

For initial steps in our plan, we organized our thinking around a sequence of instructional steps, from informal check-ins, including open-ended low-stakes questioning, to modeling responsive reading practice. Beyond these initial ideas, we centered our work in our collaboration with one another, stemming from previous work in online literacy clinic settings. We chose to foreground a high-interest text, *Tristan Strong Punches a Hole in the Sky*, based on the recommendation of one of the students we knew would join the group. This student was, in fact, a central inspiration for this book club. The role of choice continues to be endemic to our common teaching philosophy, and has been noted as an important feature of virtual book clubs (Gardner, 2020).

We met with students one day a week in the afternoons, and Ezra met with one student individually later in the week to work one-on-one and build additional comprehension. We wanted to ensure that all students felt welcome regardless of how much they had been able to read in the previous week. We set goals and markers, with some students meeting and others exceeding those goals. We greeted students for the first 3-5 minutes of the club meetings, and then shared our favorite parts of the previous week's reading. We recognized that connection was a large part of what students were lacking in the context in which we were working, and wanted to build on the sense of invitation we sought in our virtual clinic work. While the faculty

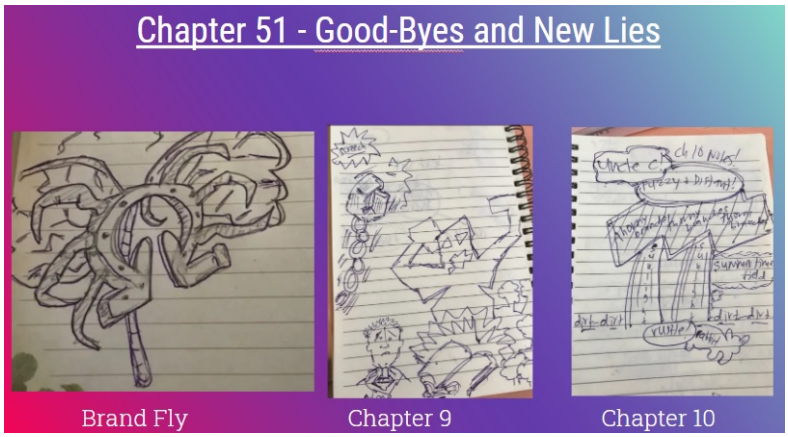
author initiated some of this work, they foregrounded the work of the graduate student facilitator and student audience. Also drawing on Gardner's work, we note that the live and synchronous nature of these meetings were helpful to build connections, and we kept in mind the important nature of highlighting reading activity when we were asynchronous, as well.




We highlighted the importance of the book we were working through, noting the emotional journey of the character, as well as the role the book plays in fostering antiracist education practices. We noted that the book is Coretta Scott King Award winner in our first meeting, and drew attention to its significance with cultural references and how the book works from the Percy Jackson world to include legends from West African and African American traditions. In doing this work, we recognized our positionality as two white scholars, introducing a culturally-relevant and high interest text. This move was again based on the interest of our students, but was also supported by our focus on culturally relevant and culturally sustaining pedagogy (Ladson-Billings, 2014). When reading portions with students, Ezra would display the content on the screen through the Kindle app so that everyone in the club could follow along both on screen and with the printed copy of the book they received.

Building from our clinical work with reading graphic novels in virtual spaces, our next step was about highlighting and noting what stood out to us in the book. We asked open-ended questions to elicit responses from our readers, shared readings of particular chapters, and modelled the practices of annotating and sketching as we read. These annotations and sketches, along with additional media material collected by Ezra, were stored on a Padlet link, which we shared with students at the beginning and end of sessions.

## Building on Practice




We initially began with intentions to use a literature circle approach. What we found was that, given the small size of the group, conversations as a working team led to more rich interaction. The choice to focus on one small group of students was dictated by the response that we received to the invitation to the book club experience, as well as the context for the work. Engaging with students during the school day was limited, as many children in our district and surrounding districts had other virtual work to complete. Our sessions took a more dialogic approach and centered around the plot, as well as in-the-moment prediction and inference work. During the read-aloud portion of our sessions Zoom's chat feature proved to be an affordance of

the setting, as it allowed students to participate in a way that felt lower-risk and did not interrupt the reading. When the authors reached a stopping point in the story where we could pause to discuss, we would read students chat messages aloud and respond to them.

Throughout each session we included several activities which prompted students to discuss different aspects of the book. We used a Google Jamboard to keep track of students' predictions, questions, and ideas about the story. Revisiting our Jamboard each week allowed us to review our previous predictions and questions which sparked discussion about how the story was unfolding and elicited further questioning.

As new characters were introduced, we noted our observations and inferences about them on a google slide, with Ezra transcribing the students' words. We encouraged students to cite evidence from the text when they made inferences about characters feelings and traits. We modelled this by showing highlighted passages from the book and wondering aloud what these quotes might suggest about the characters, sharing our own ideas and asking about our students' opinions.

Near the end of each session, we noted anything mentioned in the book that we wanted to learn more about. This was a space where both students and facilitators could ask questions about cultural and historical references from the text, as well as questions about the story. In the following week, Ezra would research these cultural and historical references and provide educational resources on Padlet, which they would draw students' attention to at the end of the next session.

## Changes in the Plan

When we began the sessions, we quickly realized we would be working with a small group of 3-5 students each week. We also recognized that some students would read ahead, while others were reading along with us in the way that chapters were broken down by week. We shared responses to the text that we created in these virtual settings using the Padlet tool and invited students to do the same.

At first, we checked with student reading progress using an anonymous Zoom poll. When we gathered the trends in how much students were reading, we felt we could discontinue use of this tool. Since some students read several chapters ahead while others followed our suggested reading schedule, we began including summaries of the week's readings at the beginning of each session to refresh students' memory of where we were in the story.

Over time we noticed that students were more likely to engage with material shared during our synchronous sessions than material posted on Padlet. In response to this, Ezra began sharing information about the cultures and history referenced in the book at the end of each session on google slides, while still posting additional resources on Padlet.

We attempted to spotlight videos of Africans and African Americans sharing their own cultures as much as possible both on Padlet and in our sessions. However, this proved to be a challenge and regrettably our Padlet in particular didn't feature as many Black voices as we would have preferred. It was often difficult to locate accessible and free online resources about the history and cultures we were researching that were of quality. The need to find materials written in English also created a challenge, as well as the criteria for materials to be appropriate for school aged children, and by Black creators. Despite these barriers, we were still able to present several videos that met these criteria, including clips of traditional crafts, oral storytelling, folk magic, and an interview with the author, Kwame Mbalia.

When we reached the part of the story in which the protagonists embark on a heroic journey, we created a second Jamboard featuring the map of Alke (the mythological world where the majority of the book is set) from the book. We asked students to read passages that described the characters' trajectory and used Jamboard's pen feature to plot the course of their journey over several weeks of reading. During this process we would pause to discuss sections of their route we had to infer, as well as various features of interest on the map and our predictions about the rest of their voyage. When three characters made an incorporeal journey later in the book, we avoided visual confusion by using a different color to represent their path.

In our first few sessions, Ezra led students in icebreaker activities to build camaraderie among the group such as an artifact hunt based on their identities and interests. At the conclusion of our time together, we also knew that we wanted to craft a meaningful and memorable capstone experience for students. In our final session, Ezra led the students in a Kahoot to share facts about the book and its cultural and historical references. Taking inspiration from the

Adinkra symbols described in the book, which originated from the Akan people of Ghana, students and facilitators also designed and shared their own symbols with personal meanings.


Our audience was relatively stable, but also fluid, and we checked in with students that were missing, just as one might make an attendance call in a typical school setting. Our check-ins came from a place of concern, rather than an authoritarian desire to maintain an attendance policy.

## Implications for Further Practice

Here, we enumerate four centers for continued practice, each worth further consideration if constructing/co-constructing a similar literacy experience for students:

1. Consider the interests/needs of students, regardless of the face-to-face or virtual context.
2. When possible, implement culturally-sustaining and culturally-relevant text choices.
3. Begin with community-building steps to check in with readers and build a warm environment.
4. As with all instruction, shifts may be necessary and plans may change as the group forms and as challenges arise.

## Conclusions/Recommendations

While we had many plans for what this virtual book club would be, the changes that occurred in the fall 2020 semester, including school reopenings and additional work demands placed on students, made flexibility a necessity. Central to this work was the collaboration between our co-teaching team, with Ezra taking a more visible role as the club continued. We furthermore discovered the affordances of additional support between meetings for student attendees who required additional scaffolds. The digital nature of our text, as well as the engaging nature of the author's work, were two assets that we leveraged throughout the book club experience. Future work might focus on expanding the approach we have described with a wider audience, including multiple student groups.

Above all, we wish to retain the invitational nature of this experience, regardless of the possibility of face-to-face formats for reading instruction that may arrive in the next year.

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# A Comparison of Progressive Time Delay to Response Repetition to Teach Sight Words via Tele-education

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**Abstract**

Educational policies emphasize early literacy skills, which includes sight word acquisition. Many studies have assessed sight-word interventions, often with at-risk learners or students with disabilities. However, to our knowledge, no study has directly compared the two following sight word approaches well-documented in the literature: progressive time delay and response repetition. Additionally, considering the significant effects of COVID-19, educators are now required to explore other instructional modalities. Thus, this study directly compared progressive time delay to response repetition for sight word acquisition via a tele-educational platform. Three typically developing children between the ages of 4 and 6 participated. Results demonstrated that both procedures were effective, but progressive time delay was slightly more efficient. We discuss implications of the findings for sight word instruction and tele-educational models moving forward.

*Keywords:* progressive time delay, response repetition, sight words, literacy, tele-education

## Introduction

In the past several decades, educational policies in the U.S. have prioritized literacy skills for students in primary and secondary schools. In 2002, the No Child Left Behind Act (NCLB; No Child Left Behind Act, 2002) was signed into law; which heavily highlighted the importance of teaching literacy. Within this law, two different literacy initiatives were outlined: Early Reading First and Reading First. The Early Reading First initiative aimed to support preschoolers in developing early reading skills before kindergarten. The Reading First initiative focused on using scientifically-validated reading instruction for students in kindergarten through the 3rd grade. Generally, NCLB emphasized reading competencies and quality reading instruction for young learners from preschool through the 8th grade. In 2015, an updated version of the law was signed known as the Every Student Succeeds Act (ESSA; Every Student Succeeds Act, 2015). As part of this new act, an initiative called Literacy Education for All Results for the Nation (LEARN) was established. LEARN widened the focus of previous initiatives by focusing on evidence-based reading and writing instruction for learners from birth to grade 12. Moreover, LEARN emphasized a collaborative and individualized approach to comprehensive literacy instruction by applying principles from Universal Design for Learning (UDL; Every Student Succeeds Act, 2015)

Considering the central role of literacy within the educational system, schools have adopted programs to ensure appropriate instruction and adequate progress for learners. Typically, literacy instruction is embedded into classroom activities through both formal and informal methods. For example, early learners may encounter a print-rich environment that includes books, signs, games, or photos around the room; these environmental stimuli are not necessarily

incorporated into explicit instruction, but may be used to provide relevance to letters and words and increase motivation (Neuman, 2004). At other times, attention may be given to letters, words, and their respective meanings through story-time, writing activities, or play-based interactions (Pyle et al., 2018). Depending on the age of the learner and student-specific needs, particular interventions, reading programs, or curricula may even be implemented by classroom teachers or reading instructors.

As outlined by the National Institute of Child Health and Human Development (2000) there are several key skill areas within the domain of literacy such as phonics, phonemic awareness, vocabulary, fluency, and reading comprehension. One important literacy skill, related closely to the skills of vocabulary and fluency development, is sight word recognition. Sight words are high frequency words that often do not follow typical phonetic patterns (e.g., "who" or "are"). To progress within literacy instruction, learners must learn several sight words. In fact, several common sight word lists, such the Dolch list (Dolch, 1936) or Fry list (Fry, 1980), identify roughly 200-300 commonly used sight words that beginning readers should learn.

To identify effective teaching procedures several different sight word studies have been conducted, mostly with at-risk learners or learners with disabilities (Browder et al., 1984; Bryant et al., 1982; Butler, 1999; Lee & Vail, 2005; McGrath et al., 2012, Thorkildsen & Friedman, 1986; Wolery et al., 1990; Yaw et al., 2011). As one method of teaching, sight word instruction may involve specific teaching packages or curricula. For example, Cullen et al. (2013) used a computer-assisted instructional program known as *Kurzweil 3000* to teach sight words to four fourth graders with mild disabilities. As part of the teaching package, students were required to type, highlight, read, spell, match, and drag words to fill in blanks. All four students attained mastery within 2-7 sessions.

In another study, Crowley et al. (2013) used a combination of Direct Instruction flashcards and a game-like format known as Reading Racetracks to teach words to two elementary-aged boys with autism. Both students demonstrated an increase from average baseline levels of 0% to an averaged range of 66.6% to 100% correct during intervention. Van Norman & Wood (2008) used a peer tutoring intervention that incorporated pre-recorded words to teach sight words to six at-risk kindergarteners. All six participants demonstrated an increase in word recognition between pre- (0% correct) and post-tests (range of 8% to 96% correct).

Other ways to target sight word instruction may include the use of a specific instructional technique, as opposed to a larger teaching package, such as a prompting or error-correction procedure (Alig-Cybriwsky et al., 1990; Barbetta et al., 1993; Koury & Browder, 1986; Rivera et al., 2002; Winstead et al., 2019). One error correction procedure that has been implemented to teach sight words is response repetition (RR; Belfiore et al., 1995; Ferkis et al., 1997). For example, Marvin et al. (2010) used a response repetition procedure to teach sight words to four students with reading delays. All four participants demonstrated an increase in correct responding (up to 90-100%) after introducing the intervention. Another commonly used procedure to teach sight words is progressive time delay (PTD; Browder et al., 2009). Winstead et al. (2019) used a progressive time delay to teach sight words to students with moderate to severe disabilities as well students at risk for academic failure. All six participants mastered the sight words within 5 to 10 sessions.

To determine which procedures are the most effective and efficient, it is important for researchers to compare instructional procedures to one another. In an attempt to better understand the differential effectiveness of certain procedures, many studies have compared specific prompting or error-correction procedures for sight word acquisition. For example, Klaus

et al. (2019) compared progressive time delay to simultaneous prompting to teach three learners with autism sight words. For two learners, both procedures led to mastery and were equally as efficient, while neither procedure was effective for the third learner. In another study, Kodak et al. (2016) compared various error-correction procedures on sight words acquisition for five children with ASD. The conditions included single response repetition, multiple response repetition, differential reinforcement alone for independent responses, demonstrating the correct response after incorrect responses without requiring a student response, and a prompt delay which involved modeling the correct response after an incorrect response along with active student responding. Overall, most of the conditions were effective across learners, but the demonstration condition was the most or second most efficient intervention for four of the participants, while the multiple response condition was the most or second most efficient intervention for three of the participants.

Though literacy skills are typically taught through in-person interactions, the COVID-19 pandemic has required schools throughout the world to consider alternative teaching procedures and modalities. UNESCO (United Nations Educational, Scientific, and Cultural Organization) estimates that between February of 2020 and February of 2022, school closures affected more than 250 million learners around the globe (UNESCO, 2022). Some schools have maintained a certain level of in-person instruction; however, many have adopted either a hybrid or completely remote model (Bonderud, 2021). Although several different terms have been used to described alternative, remote modalities (e.g., distance learning, remote instruction, virtual instruction, e-learning, or telehealth), for this paper, the term *tele-education* will be used to refer specifically to the use of internet and communication technologies (e.g., computers, tablets, or phones) to teach students from a distance (Curran, 2006; Nicolau et al., 2020).

Within the sight-word literature, progressive time delay and response repetition are two of the most common instructional techniques for teaching sight words. However, no study has directly compared these two procedures. Considering the importance of identifying efficacious procedures through direct comparison, as well as the current impact of COVID-19 on instructional modalities, the purpose of this study is to compare the effectiveness of progressive time delay to response repetition on sight word acquisition for three typically developing participants through a tele-educational platform.

## Methods

### Participants

Three neurotypically developing, elementary-aged students participated in this study. Prior to the study, the participants were not assessed for letter identification, word identification, nor phonics skills. However, before the study, the participants' parents did provide anecdotal information regarding their child's general literacy skills.

Luna was a 4.9-year-old girl living in Florida, who was entering kindergarten. At the start of the study, parents reported that Luna could identify letters as well as their corresponding sounds. Before the study, Luna began learning some sight words through preschool and home instruction. During the study, parents reported that she was not involved in any sight words instruction.

Pepper was a 5.3-year-old, girl living in North Carolina. At the start of the study, parents reported that Pepper could identify some letter as well as some corresponding sounds. Prior to the study, Pepper had learned some sight words through preschool and home instruction. During the majority of the study, Pepper was not receiving any sight word instruction from home or

other educational mediums. During the last set of the study, Pepper received some sight word instruction through virtual, kindergarten sessions.

Fran was a 6-year-old, girl living in Georgia. Parents reported that Fran could identify letters and had strong phonics skills. According to parent reports, Fran could identify several age-typical sight words. At the beginning of the study, Fran was not receiving additional sight word instruction. During the second set, Fran began sight word instruction through her in-person, 1st grade classroom.

**Setting and Materials**

The lead researcher (first author) conducted all sessions via telehealth using Zoom™ video conferencing. The researcher presented each sight word as a digital flashcard on a gray background using PowerPoint® software. Each flash card was centered on the slide in size 138 black text, using lowercased Calibri font. Between trials, a gray slide was displayed on the screen. Based on a widescreen display (a ratio of 16:9), each flashcard covered 24% of the slide (e.g., 4in x 6in of a 13.3in x 7.5in slide).

During daily probes (implemented during baseline, intervention, or maintenance), slides were displayed in full screen. During intervention trials, two different PowerPoints covered each half of the screen. The left half of the screen displayed the target stimuli while the right half of the screen displayed the token board. The token board covered 52 % of the slide (e.g., 6in x 8.5in of a 13.3 x 7.5 in slide)

**Targets**

The researcher taught Luna 12 sight words and taught Pepper and Fran eight sight words. The researcher divided the sight words (referred to as subsets) into sets (see Table 1) with each set consisting of eight stimuli (two target stimuli and two control stimuli assigned to the

progressive time delay condition; 2 target stimuli and 2 control stimuli assigned to the response repetition condition,). The sight words were selected from the Dolch list of sight words (Dolch, 1936). To avoid differences in word length as a potential confound, only 4-letter words were selected from the Dolch list.

**Table 1**

*Target Stimuli for Participants*

| | | Set 1 | | Set 2 | | Set 3 | |
|---|---|---|---|---|---|---|---|
| Participant | Stimulus Type | PTD | RR | PTD | RR | PTD | RR |
| | Target | cold | draw | they | make | done | help |
| P1 | | open | work | come | find | with | both |
| | Control | away | ride | read | keep | goes | once |
| | | soon | very | your | want | know | many |
| | Target | look | jump | they | read | | |
| P2 | | want | find | help | open | | |
| | Control | that | away | draw | must | | |
| | | some | make | call | into | | |
| | Target | cold | draw | five | were | | |
| P3 | | grow | very | done | both | | |
| | Control | ride | find | kind | call | | |
| | | walk | take | many | only | | |

*Note:* Participants 2 and 3 completed only two sets.

**Dependent Variables**

The main dependent variable was the number of sets that reached mastery criterion which was determined during probe trials. Mastery criterion was set at 100% correct responding for all trials of a subset for four consecutive daily probes. *Correct responding* was defined as vocalizing the target word within 5s of its presentation. *Incorrect responding* was defined as (a)

vocalizations that did not correspond with the target word within 5s of its presentation or (b) not responding within 5s of presenting the target word.

The second dependent variable was participants' maintenance of skill taught which was also determined by daily probes. The third measure in this study was the efficiency of teaching across the two conditions. Efficiency was measured by the number of sessions for a participant to reach mastery, and the time of intervention for each of the two conditions. Finally, the researchers measured participants' responding during teaching trials (described below). During teaching trials participants could engage in correct responses, incorrect responses, prompted correct responses, or prompted incorrect responses. Correct and incorrect responses had the same operational definition as responding during probe trials. *Prompted correct responses* were defined as stating the target word within 5s of the researcher providing an echoic prompt. *Prompted incorrect responses* were defined as (a) vocalizations - within 5s of the researcher providing an echoic prompt- that did not correspond with the target word or (b) not responding within 5s of the echoic prompt

**Trial Types**

***Probe Trials***

Probe trials began with a gray slide presented in full screen. The researcher then presented a word on PowerPoint and provided the participant with an instruction (e.g., "What word is this?" or "What's this word?"). The participant was given 5s to respond to the instruction. After the participant responded, the researcher provided neutral feedback (e.g., "Ok", "Thanks" or "Alright") regardless of the correctness of the participant's response.
While the researcher delivered neutral feedback, the next PowerPoint slide was simultaneously presented, (i.e., a gray screen with no words), signaling the end of the trial. Though there was no

programmed reinforcement during probe trials, the researcher provided intermittent praise for general attending behavior from the participant (e.g., looking or sitting calmly).

### *Teaching Trials*

During teaching trials, two different PowerPoint presentations were displayed on each half of the screen. The presentation on the left displayed the target words, while the presentation on the right displayed the token board. At the beginning of teaching trials, no words were displayed on the presentation to the left - only a gray screen was displayed. The researcher then presented the target word and provided an instruction (e.g., "What word is this?" or "What's this word?". The researcher gave up to 5 seconds for the participant to respond to the instruction. Consequences for participant responses varied depending on the teaching condition (e.g., in PTD, simple feedback for incorrect responses such as, "No that's not it"; in RR, corrective feedback such as, "No it's _____. Say _____5 times").

### **Daily probes**

Daily probes were conducted during baseline, intervention, and maintenance. During baseline there were a total of 32 probe trials (described above); 8 trials for the progressive time delay condition, 8 trials for the response repetition condition, and 16 trials for the control condition. During the intervention condition there were a total of 24 probe trials (described above); 8 trials for the progressive time delay condition, 8 trials for the response repetition condition, and 8 trials for the control condition. During the maintenance condition there were a total of 24 probe trials (described above); 8 trials for the progressive time delay condition, 8 trials for the response repetition condition, and 8 trials for the control condition.

The daily probe was divided into two portions; the first portion being stimuli assigned to the progressive time delay condition and the second portion being stimuli assigned to the

response repetition condition. The order of these two portions was based on the order of the teaching conditions from the previous session. Finally, the researchers randomized the trial order within each daily probe.

**Baseline and Maintenance**

Each participant completed two baseline sessions before intervention. Maintenance consisted of 3 sessions approximately one week following intervention (range of 6-11 days after intervention, across all participants). During baseline and maintenance, the researcher implemented one daily probe (see above) per session.

**Intervention**

Intervention sessions were conducted 2-4 days per week and lasted approximately 10 mins per session. An intervention session began with the researcher implementing a daily probe, except on the very first intervention session where no daily probe was implemented. Next, the researcher implemented one of the two teaching conditions, followed by a short break (e.g., 1 minute), followed by implementing the other teaching condition. The order of the teaching conditions was randomized prior to the session.

Intervention sessions involved both teaching conditions (i.e., PTD and RR) unless the participants reached mastery criterion on one condition first. The order of teaching conditions was randomized by a coin flip. During intervention sessions, a 3-level token board was used. Tokens were given on a FR1 schedule for independent correct responding. The dark gray, light gray, and yellow sections corresponded to 0 to 10 tokens, 11 to 25 tokens, and 26 to 32 tokens respectively. If the participant earned enough tokens to finish in the yellow section they could earn a “big prize” (e.g., toy, additional recreational time or a highly preferred snack). If the participant earned enough tokens to finish in the light gray section, they could earn a “small

prize" (e.g., small toy, or a small edible). If the participant earned enough tokens to finish in the dark gray section they earned no prize. The prizes were determined based upon discussions with the researcher and the parents of what was preferred to the participant.

**Progressive Time Delay (PTD)**

During the PTD condition the researcher implemented a total of 16 teaching trials (described above). In this condition the researchers implemented a progressive prompt time delay with a 2s time increase. The delay started at 0s and progressively increased by 2s with a maximum delay of 6s. The criterion to move to a more delayed prompt was 2 consecutive correct responses (prompted or independent). The criterion to move a less delayed prompt was 1 incorrect response (prompted or independent). Regardless, of the delay the prompt type that was implemented was an echoic prompt.

The researcher provided praise and a token for independent correct responses from the participant. The researcher provided only praise for prompted correct responses. However, during the first 2 teaching trials for a target stimulus; praise and a token was provided for prompted correct responses. The researcher provided feedback (i.e., "No that's not it") for incorrect or prompted incorrect responses.

**Response Repetition (RR)**

During the RR condition the researcher implemented a total of 16 teaching trials (described above). During this condition the researcher provided no prompts. The researcher provided praise and a token for correct responses. For incorrect responses, the researcher stated, "No it's _____". Say _____ five times" while holding up five fingers. The researcher then bent down each finger as the participant repeated the word. While the participant repeated the target word five times, the target word remained on the screen. After the participant finished saying the

word five times, neutral feedback was provided such as., “OK” or “Alright”. If the participant stated the word more than five times, the researchers stated, “Just five times”. If the participant did not state the word enough times, the researcher stated, “Keep going”. Tokens or praise were not provided for incorrect responses. Analogous to the PTD condition, after each trial, the researcher displayed a gray slide during the inter-trial interval.

**Experimental Design**

This study used an adapted alternating treatment design (AATD) replicated across sets for each participant. Within an AATD, targets are assigned to different sets within different conditions (Sindelar et al., 1985). This design allows for comparisons between different intervention procedures. In this study, a control condition was also included to assess changes in words that were not specifically targeted within intervention

**Interobserver Agreement (IOA)**

During the study, the researcher recorded participant responding on each trial. Post hoc, a second observer recording participant responding for 35% of daily probe sessions (range 31% to 40% across participants) and 33% of intervention sessions (range 31% to 35% across participants). IOA was calculated by dividing the number of agreements (i.e., both observers recording the same response on a trial) by the number of agreements plus disagreements (observers recording different responses on a trial), multiplied by 100. Overall IOA was 98% for daily probe sessions (range 93% to 100% across participants) and 94% for teaching sessions (range 90% to 100% across participants).

**Treatment Fidelity**

A second observer rated the researcher on their correct implementation of the study procedures. For daily probe sessions, correct behavior included 1) Presenting the auditory

instruction (i.e., “What’s this word?”) while simultaneously displaying the visual stimulus (i.e., digital flashcard), 2) allowing up to 5 seconds for the participant to respond, 3) providing neutral feedback (e.g., “Alright” or “OK”) after the participant’s response and 4) terminating the trial by presenting a gray screen. For PTD sessions, correct behavior included 1) presenting the auditory instruction while simultaneously displaying the visual stimulus, 2) providing the appropriate time-delay prompt, 3) waiting up to 5 seconds for the participant to respond, 4) delivering praise and/or a token for correct responses, 5) providing feedback for incorrect responses, and 6) terminating the trial by presenting a gray screen. For RR sessions, correct behavior included 1) presenting the auditory instruction while simultaneously displaying the visual stimulus, 2) waiting up to 5 seconds for the participant to respond, 3) delivering praise and a token for correct responses 4) providing corrective feedback for incorrect responses (i.e., “No it’s_____. Say_____ 5 times”), 5) displaying five fingers and lowering a finger for each response repetition, and 6) terminating the trial by presenting a gray screen. Treatment fidelity was calculated for 35% of daily probe sessions (range 29% to 40% across participants) and 33% of intervention sessions (range 30% to 35% across participants). Correct implementation was 99% for daily probe sessions, 98% for intervention sessions, and 98.5% overall**.**

## Results

### Mastery Criterion and Maintenance

Figures 1-3 display participant responding during daily probes across baseline, intervention, and maintenance. Across the x-axis are sessions and across the y-axis are percentage of correct responding during the probe trials. Stimuli assigned to the progressive time delay condition are depicted by closed circles, stimuli assigned to the response repetition

condition are depicted by open squares, and control targets are depicted by open triangles. Each panel represents a different set.

**Figure 1**

Luna's Probes

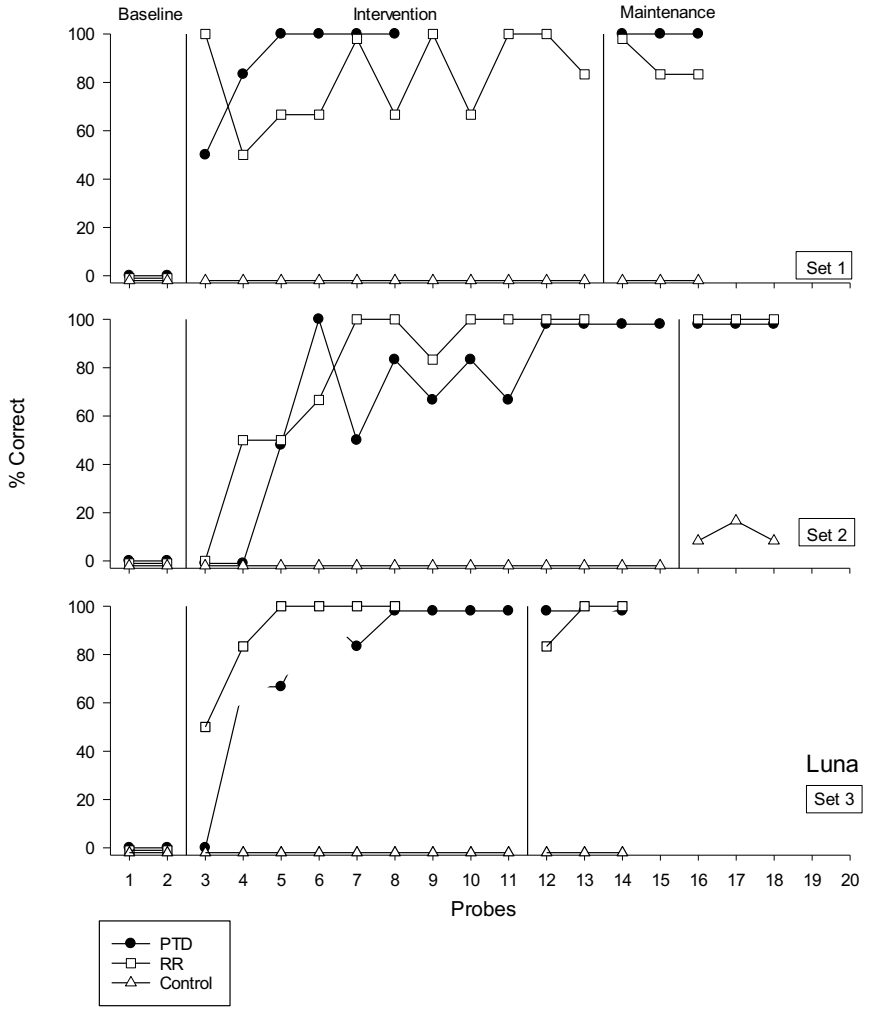


Figure 1: Responding during probe trials across baseline, intervention, and maintenance for Luna. Closed circles denote words assigned to the progressive time delay condition, open squares represent words assigned to the response repetition condition, and open triangles represent words assigned to the control condition.

Figure 1 represents Luna's responding during daily probes. Luna reached mastery criterion on all three sets for the PTD condition and reached mastery criterion for two of the

three sets for the RR condition. For the first set, Luna displayed 0% correct responding on all probe trials across the two baseline sessions. Luna reached mastery criterion first with the PTD condition and the researchers provided an additional five sessions for Luna to reach mastery criterion with the RR condition; however, Luna never reached the mastery criterion for the RR condition. During the assessment of maintenance, Luna's average correct responding was 100% for the PTD condition (100% across sessions) and was 88.9% for the RR condition (range 83.3% to 100%, across sessions). For the second set, Luna displayed 0% correct responding on all probe trials across the 2 baseline sessions. Luna reached mastery criterion first with the RR condition and then reached mastery criterion 2 sessions later with the PTD condition. During the assessment of maintenance, Luna had 100% correct responding for targets assigned to both the PTD and RR condition. For the third set, Luna displayed 0% correct responding on all probe trials across the 2 baseline sessions. Luna reached mastery criterion first with the RR condition and then reached mastery criterion 3 sessions later with the PTD condition. During the assessment of maintenance, Luna had 100% correct responding for targets assigned to the PTD condition, had an average correct responding of 94.4%for the RR condition (range 83.3% to 100% across sessions). Across all sets and across all conditions, Luna's average correct responding for the control condition was 1.8%

Figure 2 represents Pepper's responding during daily probes. Pepper reached mastery criterion on both sets for the PTD and RR condition. For the first set, Pepper displayed 0% correct responding on all probe trials across the three baseline sessions. Pepper reached mastery criterion first with the RR condition and then reached mastery 1 session later with the PTD condition.

**Figure 2**

Pepper's Probes

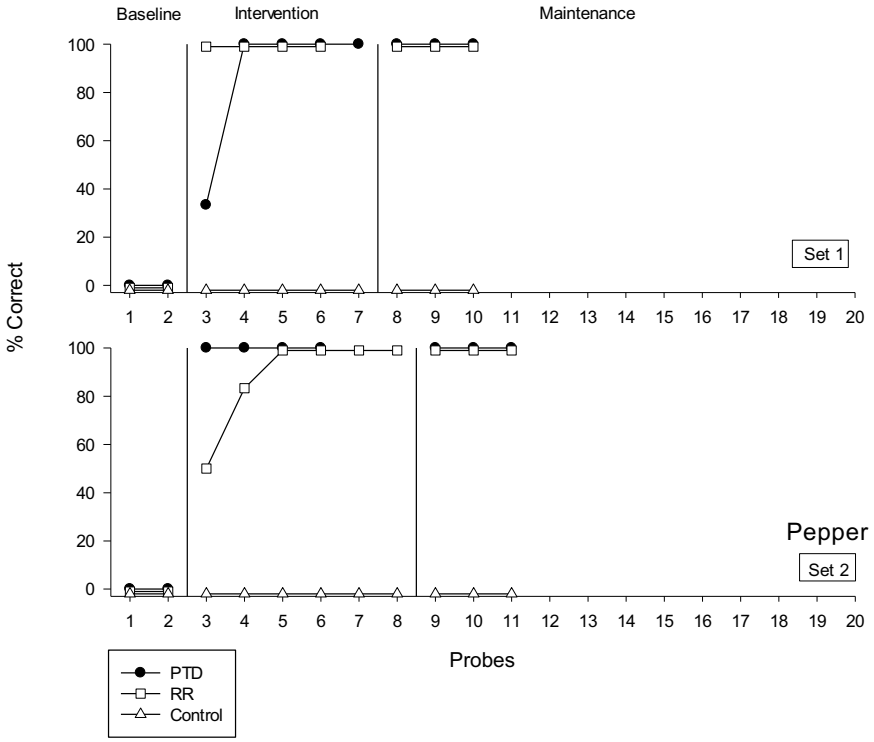


Figure 2: Responding during probe trials across baseline, intervention, and maintenance for Pepper. Closed circles denote words assigned to the progressive time delay condition, open squares represent words assigned to the response repetition condition, and open triangles represent words assigned to the control condition.

During the assessment of maintenance, Pepper had 100% correct responding for targets assigned to both conditions and displayed 0% correct responding for targets assigned to the control condition. For the second set, Pepper displayed 0% correct responding on all probe trials across the 2 baseline sessions. Pepper reached mastery criterion first with the PTD condition and then reached mastery criterion 2 sessions later with the RR condition. During the assessment of

maintenance, Pepper had 100% correct responding for targets assigned to both the PTD and RR condition and displayed 0% correct responding for targets assigned to the control condition.

**Figure 3**

Fran's Probes

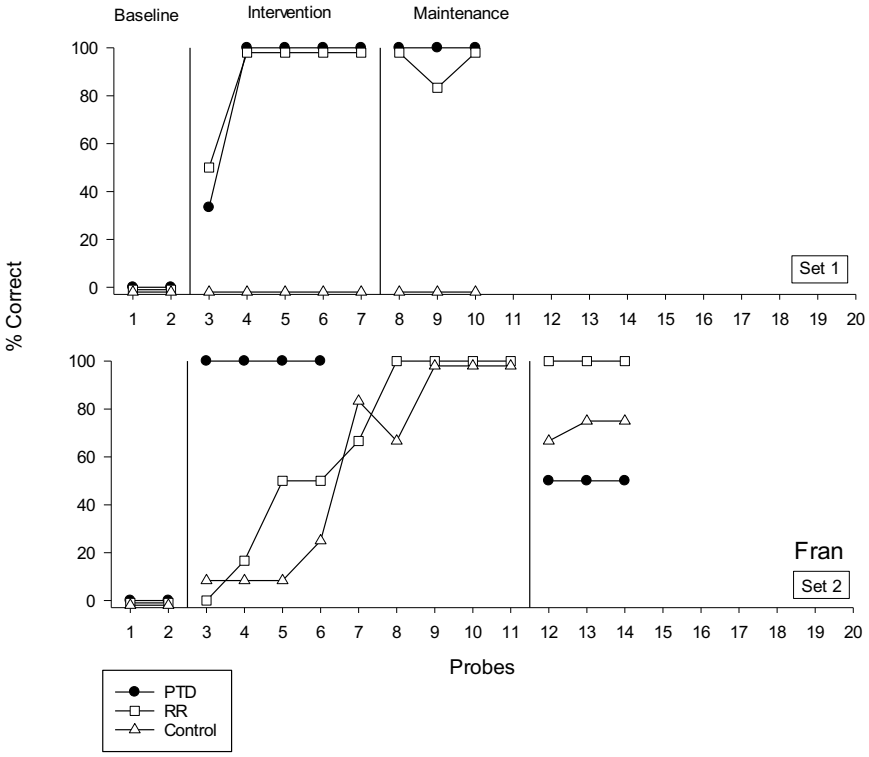


Figure 3: Responding during probe trials across baseline, intervention, and maintenance for Fran. Closed circles denote words assigned to the progressive time delay condition, open squares represent words assigned to the response repetition condition, and open triangles represent words assigned to the control condition.

Figure 3 represents Fran's responding during daily probes. Fran reached mastery criterion on both sets for the PTD and RR condition. For the first set, Fran displayed 0% correct responding on all probe trials across the two baseline sessions. Fran reached mastery criterion within both conditions at the same time. During the assessment of maintenance, Fran had 100% correct responding for targets assigned to PTD, 94.4% (range 83.3% to 100%) correct

responding for targets assigned to RR and displayed 0% correct responding for targets assigned to the control condition. For the second set, Fran displayed 0% correct responding on all probe trials across the 2 baseline sessions. Fran reached mastery criterion first with the PTD condition and then reached mastery criterion five sessions later with the RR condition. During the assessment of maintenance, Pepper had 100% correct responding for targets assigned to the RR condition, 50% correct responding for targets assigned to the PTD condition (50%, across sessions), and displayed an average of 80.6 % (range 66.7% to 100%) correct responding for targets assigned to the control condition. It was confirmed by the researcher that in the middle of the study, Fran began learning the control words in her 1st grade classroom.

**Efficiency**

Table 2 depicts the number of sessions, trials, and total time for each participant to reach mastery criterion for each individual set and across all sets for the two teaching conditions. For Luna, across all three sets and both conditions the PTD was more efficient in terms of sessions, teaching trials, and teaching duration. The PTD was found to be more efficient than the RR condition because Luna never reached mastery criterion on the first set of RR. However, Luna was more efficient on the second and third set of the RR condition in terms of sessions, trials, and teaching time. For Pepper, across the two sets and both conditions the PTD was more efficient in terms of sessions, teaching trials, and teaching duration. However, when analyzing each set there are mixed results in terms of efficiency; with RR are being more efficient in set 1 and PTD being more efficient in set 2. For Fran, across both sets and conditions the PTD was more efficient in terms of sessions, teaching trials, and teaching duration. In Set 1, there was no difference in terms of the sessions and trials to master; but the RR teaching condition was more efficient than the teaching duration for PTD. In Set 2, PTD was more efficient in terms of

sessions, trials, and duration. Thus, across all participants and all sets the data indicate that PTD is more efficient in terms of sessions, trials, and teaching duration.

**Table 2**
*Efficiency Measures for Each Participant*

| Participant | Set | Sessions to Mastery (PTD) | Sessions to Mastery (RR) | # Teaching Trials (PTD) | # Teaching Trials (RR) | Teaching Duration in Hours: Minutes: Seconds (PTD) | Teaching Duration in Hours: Minutes: Seconds (RR) |
|---|---|---|---|---|---|---|---|
| Luna | 1 | 6 | 11* | 96 | 176 | 0:21:11 | 0:37:18 |
| | 2 | 13 | 11 | 208 | 176 | 0:42:09 | 0:28:19 |
| | 3 | 9 | 6 | 144 | 96 | 0:24:43 | 0:14:03 |
| Luna's Total | | 28 | 28* | 448 | 448+ | 1:28:03 (average 0:29:21/set) | 1:19:40+ (average 0:26:33/set) |
| Pepper | 1 | 5 | 4 | 80 | 64 | 0:14:18 | 0:10:11 |
| | 2 | 4 | 6 | 64 | 96 | 0:10:55 | 0:15:13 |
| Pepper's Total | | 9 | 10 | 144 | 160 | 0:25:13 (average 0:12:37/set) | 0:25:24 (average 0:12:42/set) |
| Fran | 1 | 5 | 5 | 80 | 80 | 12:23 | 11:43 |
| | 2 | 4 | 9 | 64 | 144 | 12:57 | 34:38 |
| Fran's Total | | 9 | 14 | 144 | 224 | 0:25:20 (average (0:12:40/set) | 0:46:41 (average 0:23:31/set) |
| Total Across Participants | | 46 | 52 | 736 | 832 | 2:18:36 | 2:31:45 |
| Average Across Participants per Set | | 6.6 | 7.4 | 105.1 | 118.9 | 19:48 | 21:41 |

*Note.* *Indicates conditions in which mastery was not obtained for at least one set.

**Responding During Teaching**

Table 3 displays participant responding during each teaching condition per set and across all sets. For Luna, across all three sets in the PTD condition, 87.4% of her responses were independent correct, 9% were prompted correct, 3.4% were independent incorrect, and .2% were prompted incorrect. In the RR condition, 92.7% of Luna's responses were correct while 7.3% were incorrect. For Pepper, across both sets in the PTD condition, 91.4% of her responses were independent correct, 8% were prompted correct, .6% were independent incorrect, and 0% were prompted incorrect. In the RR condition, 94.8% of Pepper's responses were correct while 5.2% were incorrect. For Fran, across both sets in the PTD condition, 83.2% of her responses were independent correct, 14.8% were prompted correct, 2% were independent incorrect, and 0% were prompted incorrect. In the RR condition, 88.2% of Fran's responses were correct while 11.8% were incorrect. Overall, across all participants, 92% of responses were independent correct in the RR condition compared to 87.3% in the PTD condition.

**Table 3**

*Participant Responding During Teaching*

| Participant | Set | % Independent Correct (PTD) | % Prompted Correct (PTD) | % Independent Incorrect (PTD) | % Prompted Incorrect (PTD) | % Overall Correct (Prompted + Independent, PTD) | % Overall Incorrect (Prompted + Independent, PTD) | % Correct (RR) | % Incorrect (RR) |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 91.7 | 7.3 | 1.0 | 0 | 99.0 | 1.0 | 91.5 | 8.5 |
| Luna | 2 | 89.9 | 7.2 | 2.4 | .5 | 97.1 | 2.9 | 94.9 | 5.1 |
| | 3 | 80.6 | 12.5 | 6.9 | 0 | 93.1 | 6.9 | 91.7 | 8.3 |
| Luna's Average | | 87.4 | 9 | 3.4 | .2 | 96.4 | 3.6 | 92.7 | 7.3 |
| Pepper | 1 | 87.5 | 11.3 | 1.2 | 0 | 98.8 | 1.2 | 93.8 | 6.2 |
| | 2 | 95.3 | 4.7 | 0 | 0 | 100 | 0 | 95.8 | 4.2 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Pepper's Average | | 91.4 | 8 | .6 | 0 | 99.4 | .6 | 94.8 | 5.2 |
| Fran | 1 | 85.0 | 12.5 | 2.5 | 0 | 97.5 | 2.5 | 93.8 | 6.2 |
| | 2 | 81.3 | 17.2 | 1.5 | 0 | 98.5 | 1.5 | 82.6 | 17.4 |
| Fran's Average | | 83.2 | 14.8 | 2 | 0 | 98 | 2 | 88.2 | 11.8 |
| Average across participants | | 87.3 | 10.4 | 2.2 | .07 | 97.7 | 2.3 | 92.0 | 8.0 |

However, when adding in *prompted* correct responses within the PTD condition, the average percentage of correct responses across participants increases from 87.3% to 97.7%. This indicates that on average, in the RR condition, more responses were independent correct while in the PTD condition, more responses were overall correct (prompted and independent correct responses combined).

## Discussion

The main purpose of this study was to compare the effectiveness of two commonly used instructional procedures in sight word instruction. As stated previously, both PTD and RR were effective procedures for teaching sight words. With regards to effectiveness the results showed, with the exception of one set for Luna, that both PTD and RR led to mastery within 4 to 11 sessions. With regards to efficiency, PTD was slightly more efficient in terms of average sessions to mastery, number of teaching trials, and duration of teaching. Third, in terms of independent correct responding during teaching trials the results indicated that on average, participants responded correctly to most trials in both conditions, with slightly higher independent correct responding in the RR condition. Given these results both procedures can be recommended for use within academic settings because both PTD and RR led to mastery of the target words within a relatively short amount of instructional time (i.e., 20 minutes per set).

These findings confirm previous literature that recognizes the effectiveness of both PTD and RR for sight word acquisition (Klaus et al., 2019; Kodak et al., 2016; McCurdy et al., 1990; Worsdell et al., 2005).

In terms of clinical implications, this study provides support to sight word teaching methods commonly referred to as "traditional flashcard drill methods" (Nist & Joseph, 2008). Although it is common for instruction within elementary classrooms to involve a multitude of teaching approaches with different forms of active responding (Cremin & Burnett, 2018), some learners may still benefit from flashcard approaches that utilize a single instructional technique, as demonstrated by this study. Considering that this study involved the use of flashcards with one technique in each condition, caution should be taken to apply the findings of this study to instructional techniques that do involve repeated exposures to flashcards

An additional clinical implication of this study relates to modality—i.e., the use of a tele-educational platform for teaching sight words. With current limitations for in-person instruction due to the COVID-19 pandemic, there is an ongoing need to identify efficacious, user-friendly, remote teaching methods. To the author's knowledge, this is the first study that demonstrated the use of a tele-educational platform to teach sight words to young learners. In addition, the educational tool (i.e., Microsoft PowerPoint®) and videoconferencing platform (i.e., Zoom) used in this study, are two common programs that are readily available for instructors and students with access to WiFi-compatible, screen-based devices. The programs used in this study may be useful for academic institutions around the world as they continue to explore effective tele-educational models. Schools may even adapt instruction by exploring other features within these educational platforms. From a global perspective, it is worth mentioning that not all schools have equal access to digital resources such as WiFi, tablets, or computers (Goudeau et al., 2021). As

such, care and consideration should be given when determining the generalizability of tele-education models to other educational settings. A final clinical implication relates to participant responding during teaching sessions. When comparing percentage of independent correct responses between conditions, all participants had more independent correct responses in the RR condition. This suggests that in some contexts, error correction procedures as opposed to prompting procedures, may be more expedient for acquiring independence with the target skill. On a related note, errorless teaching procedures emphasize early prompting to reduce errors and frustration (Schmeck & Grove, 1976). However, as demonstrated by this study, it is possible that errors along with error-correction procedures may lead to faster skill independence without any accompanied frustration; as noted by the primary researcher there were no visible signs of annoyance throughout the RR condition. In contrast, there were instances of frustration in the PTD condition when the researcher prompted participants immediately before they responded. For example, statements such as, “Hey! I was about to say that.” were made. Hence, for some learners, it may be that error-correction procedures are more effective than prompting procedures for facilitating skill acquisition and reducing frustration during the teaching process.

This study extends upon previous research in three different ways. This is the first comparative sight word study to directly compare PTD to RR. Other sight word studies have compared each procedure to either other instructional techniques or, variations of the same prompting or error-correction procedure (Belfiore et al., 1995; Carrol et al., 2015; Ferkis et al., 1997; Kodak et al., 2016; McCurdy et al., 1990; Worsdell et al., 2005). Considering that this is the first study comparing PTD to RR and the small number of participants involved, further comparisons should be conducted with larger samples. Secondly, this study replicates previous findings in that each respective procedure is an effective approach to teaching sight words

(Winstead et al., 2019; Marvin et al., 2010). Third, unlike many sight word studies in the literature (Browder et al., 2009), the participants in this study were typically developing children with no identified reading delays. This suggests that teaching procedures that have been effective for at-risk students, English language learners, and students with disabilities may also be effective for typically developing students.

Within this study, there are several limitations that should be noted. First, during the study there were some instances of technological interruptions from either the researcher or the participant. Though these moments were highly infrequent, these interruptions extended the teaching time and required some teaching trials to be repeated. Similarly, there were times when participants were distracted by other stimuli within their home (e.g., animals, siblings, or toys in the room). Considering the remote nature of this study and the difficulty of controlling in-home variables, these distractions did sometimes interrupt or extend the teaching time. Because these distractions were not common within and across sessions, the researchers infer that the distractions did not significantly influence the results of the study. However, in the future, attempts can be made to communicate with a parent or guardian about finding a quiet, distraction-free space during the study.

Additionally, this study only included three participants. Due to scheduling difficulties with other potential families, additional participants were not included for this study. Considering the small sample size, the results should be interpreted with caution. The patterns observed may not necessarily be reflective of preferred or effective learning approaches for other students. However, the results demonstrate a potential approach to efficaciously teaching sight words through a tele-education model. Future research can expand on this study by including a

larger sample size. Larger samples sizes would inform educators about pedagogical practices that are effective across a broad group of learners.

Another limitation is that the time interval between sessions was not controlled for. While participants generally had 3-5 sessions per week, sometimes these sessions were more spaced apart, while at other times, there were two sessions within a day for several consecutive days. Within the study, these differences were difficult to avoid as scheduling was based on the child's availability. Still, these differences may have contributed to variable skill acquisition between sets and participants. Future research can control for this variable by standardizing the interval between sessions or creating more stringent parameters.

To incorporate parent input, the researcher asked parents which 4-letter words they would like their child to learn. Nonetheless, this study did not formally assess social validity from either the child or parent. This information would be helpful for determining whether or not parents valued the intervention procedures and the study outcomes. Relatedly, child preference for each intervention was also not evaluated. Future studies could take social validity data and consider child preference for each respective teaching strategy. It may be that learners prefer one teaching strategy over another. Future studies could even consider whether learner preference for a particular strategy is indicative of the most effective or efficient teaching approach for that learner.

Finally, for Set 2 with Fran, the control words were almost mastered. This indicates that for that particular set, variables external to the study were contributing to skill acquisition. As confirmed by the researcher with Fran's parents, Fran began simultaneously learning the control words for Set 2 in her 1st grade classroom. Interestingly, Fran still mastered the words in the RR and PTD condition before she could master the control words. This suggests that the teaching

procedures of this study may have been more effective and efficient than the sight word instruction in Fran's classroom. Future research could more formally compare one or both of these procedures with certain teaching approaches found in school classrooms. Along those lines, future studies can compare larger teaching packages or curricula with regards to literacy skills. This may provide a stronger comparison of teaching approaches most commonly found within educational settings.

This study demonstrated that learners between the ages of 4 to 6 were able to master and maintain sight words via a tele-educational platform. Additionally, each word set was mastered within approximately 20 minutes of instructional time. Considering the importance of early literacy skills and the need to adapt to the current restrictions of the COVID-19 pandemic, this study makes an important contribution to the literature. Although this study specifically focused on sight words, the strategies in this study could be used to teach other early literacy skills such as letter recognition or phonics. It is hoped that future studies will continue to explore effective strategies for teaching literacy skills via tele-educational models. Moreover, it is hoped that future studies will continue to explore ways to teach a variety of academic skills via tele-education.

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# Engagement in Digital Social Reading: Use and Perspectives

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**Abstract**

Digital social reading (DSR) use can support student interaction with and around academic texts. DSR applications also provide affordances that can move individual reading to a more participatory event, facilitating task engagement. Given the central role of both reading and task engagement to learning in higher education, learners' engagement in DSR use warrants attention by educators at this level. Therefore, this article employs an action-research case study framework to explore the constructs of both DSR and task engagement with student-participants in 3 graduate courses across one academic year. Data include both analytic and descriptive data, with a focus on student voice. Findings include action guidelines and implications for future research.

**Keywords**

Engagement, graduate students, social interaction, digital reading, case study

Most teachers have probably at some time used a type of social reading as an instructional strategy. In the past, activities such as "round robin reading" and shared reading were popular forms of social reading. During such tasks, the "social" aspect was generally that students talked about the reading with the teacher or listened to others read. More recently, however, digital social reading (DSR) applications (apps) have provided a different variety of affordances for interacting around and with texts, which means that social reading can have a distinctively different character and can be implemented in profoundly different ways than in the past (Alber & Miller, 2012). According to Zhu et al. (2020), social reading still emphasizes "group sensemaking, knowledge construction, and community building" (p. 262), but DSR use also provides opportunities for a wider array of reading content, diverse types and amounts of participation in reading events, and a transformation of reading as an individual endeavor into a shared one. Although the body of research around DSR use to date is not large, it has produced mostly positive results in regard to students' achievement with DSR use (see, for example, Cao, 2017; Yang et al, 2011; Yeh et al, 2017).

One reason for student success with DSR use is that it may help students experience a greater degree of task engagement in their reading. Given the central role of both reading and task engagement to learning in higher education, learners' engagement in DSR use warrants attention by educators at this level. Therefore, the purpose of this article is to explore the engagement of graduate students in DSR use in higher education classrooms. In this article, we first review the constructs of DSR and task engagement. We next explain the methodology for this classroom-based action research study, followed by a presentation of the study's findings and interpretations. We end by discussing lessons learned and guidelines for future DSR use. This study heeds the call of Zhu et al. (2020) and others to evaluate different aspects of DSR use.

In doing so, it fills a gap in the research around both task engagement and DSR in higher education, and it provides an example of action research at this level.

## Literature Review

As DSR becomes more popular and free apps become easily accessible, more research is being conducted. In this section, we review the literature around DSR by first defining and exemplifying the term. We then address the extant research and link DSR use to task engagement. Finally, we develop research questions around both our classroom-based issues and gaps in the literature that leave those issues unaddressed.

### DSR Definitions and Examples

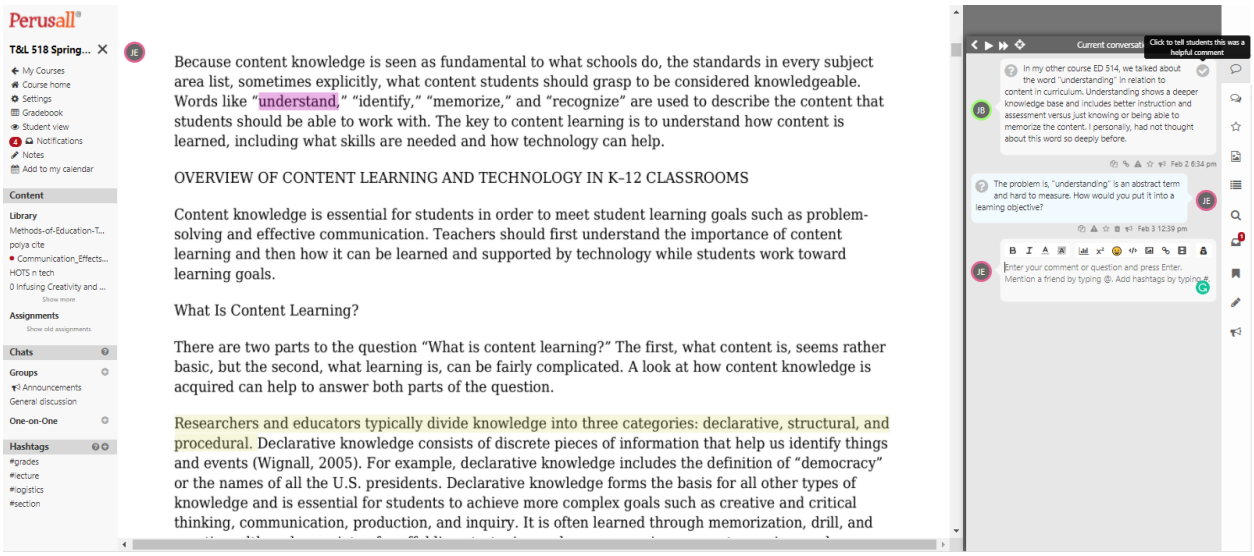
Digital social reading is, "a form of collective reading of digital texts and communication in reader-centred communities in digital networks" (Kutzner et al, n.p.). Blyth (2014) defines it as "the act of sharing one's thoughts about a text with the help of tools such as social media networks and collaborative annotation" (p. 205); he adds that DSR should be considered a part of a participatory culture that moves the solitariness of print reading into a more social practice. DSR use can be public, through the use of a website such as Goodreads (www.goodreads.com), or it can be set for a private group (such as a class) in other apps. In classrooms, depending on the affordances of specific DSR applications, learners can access text synchronously or asynchronously and interact in the margins of those texts.

Although different DSR applications have different affordances, in general they can be used with any digital text, including webpages, .pdfs., and MS Word documents. This means that the focal text can be anything from a chapter in an Open Educational Resource (OER) textbook to a podcast or a graph. DSR apps also can be accessed across or integrated with a variety of technologies, from web browsers and Google Docs to learning management systems like Canvas.

Figure 1 shows a screenshot of the DSR app Perusall integrated within the Canvas learning management system (www.instructure.com).

**Figure 1**

*Perusall in the Canvas LMS*




*Note*: On the left in this figure is a list of all the articles in Perusall for this class and a menu of options. In the center is the reading with student highlights. On the right is the comment box, with two comments in the highlighted item and an annotation menu.

As Egbert and Shahrokni (2021) note, typically, "DSR apps afford students the opportunity to read the content, select parts of the content, and annotate the selected parts. In some apps, the annotations can further be tagged, grouped, highlighted, searched, and filtered" (n.p.). Some apps allow only text-based annotating, while others include multimedia tools such as audio, video, text, and/or images. In some DSR apps, users can reply to comments in threads, making the interaction more focused. Further, some apps have preset types of comments, while others allow users to comment at any length (see Egbert & Shahrokni [2021] for a list of many DSR apps, and Blyth [2014] for a list of affordances of some DSR apps).

Because DSR apps are content-free until a text is chosen, there are many ways to use DSR applications and a variety of possible benefits. For example, Blyth (2014) supports the implementation of Hayle's (2012) 3 types of digital reading: close, hyper, and machine; however, Blyth also notes that when teachers assign these types of reading, they need to be aware of the affordances of each type. In addition, Zhu et al. (2020) state that the main classroom uses of DSR include processing content, supporting thinking, using skills such as argument and inquiry, improving reading comprehension and literacy competences, assisting with instruction and peer-to-peer evaluation, and relating different digital environments. In addition, Egbert and Shahrokni (2021) note that learners can participate in DSR to

> critique literary texts, highlight important points, ask questions, express opinions, summarize, connect to external sources, link text to their own lives, consider other viewpoints, read critically, say what they do not understand, collect vocabulary, save instances of grammar for practice, organize ideas, predict, clarify, and interact with peers, teachers, and others…focus on both language and content, write text reviews, rate texts on a variety of criteria, mark up stories according to plot/ characters/ setting, and so on. (n.p.)

More specifically, using DSR, students might read different texts in small groups to share or all read and comment on one text, depending on the course goals. In another case, the teacher might annotate the text first and then have students compare the teacher and student annotations; the teacher may also choose to stay out of the DSR process completely. Further, language students might read in the target language and then annotate in their first language, while others can be encouraged to express their cultural experiences regarding the text content. Another task could have students read synchronously in class to pick out the main ideas and important

vocabulary of specific paragraphs to discuss and then read more deeply and annotate outside of class.

Most of the literature on DSR states that its use should be focused so that learners know what type of comments to make (e.g., experiential, factual, encouraging), how many comments to make (if there is a minimum or maximum), and when they should make them. In addition, the DSR literature notes that teachers can design DSR tasks to work from and take advantage of the ways that students already use digital tools. Of note, across the literature can be found the caution that, as with any classroom task, DSR tasks require planning and reflection to ensure that they meet the goals for which they were developed.

**Research on DSR Use**

According to Blyth (2014), reading research provides plenty of evidence that note-taking and marking up texts improves comprehension, and it also shows clearly that collaborative digital reading can help students to use strategies such as "predicting content, identifying problems, getting the gist, and synthesizing textual parts into a whole" (p. 212). Many studies exist concerning reading on digital platforms in general (e.g., Amiama & Mayor, 2017; Gil-Flores et al., 2012; Ortlieb et al., 2014), and others of print-based social reading such as book clubs, reader response tasks, and academic classroom reading discussion (e.g., Allington & Swann, 2009; Zhang et al., 2021). There are some studies of social reading on social media platforms around chosen texts, e.g., WeChat Reads (Pianzola et al., 2020), Twitter (Pianzola et al., 2021) and GoodReads (Vlieghe et al, 2016). For example, Li et al. (2021) focused on the relationships among interactivity, social presence, and user satisfaction as a result of DSR use. In this quasi-experimental study, the researchers surveyed 377 random participants who used the WeChat Read platform for DSR. The study found social presence to be key to user satisfaction in

DSR, and more important, that the focus should be on interacting with the text more than interacting directly with peers.

In another study, Zhang et al. (2021) conducted a diary study with 14 volunteer Chinese participants recruited randomly from social networks who read different types of media online. As a result of interviews and diary entries, the researchers built a "Social Reading Journey Model" and concluded that the technology affordances can have an impact on how DSR is conducted and perceived. While their analysis is useful for educators in determining how and why students use DSR outside of class, how this evidence transfers to classroom uses of DSR is as of yet unclear.

In fact, the research on DSR in classrooms is still relatively new. Higher education environments in which DSR has been explored include studies of second language DSR use (e.g., Blyth, 2014; Solmaz, 2021; Thoms & Poole, 2018; Zapata & Mesa-Morales, 2018). There is also a small number of studies of teacher education/professional development (Michelson & Dupuy, 2018; Vlieghe et al., 2016) and online classes (Zhu et al., 2020). However, few if any of these studies address graduate students in regular classes. One study that does so is Vasinda (2020), who conducted a study with 12 graduate student in-service teachers who formed a cohort for their literacy specialist degrees. In groups of three to five, the students chose texts from a curated set. Students were trained and then held responsible for facilitating group study around the shared readings; they set up meeting times, found additional resources, and supported the one-hour sessions. Data sources included observations and reflections, in addition to DSR (Hypothes.is) data. The study found that short texts worked better and that the private DSR work helped the participants to sustain a focus on the course topic. Overall, the study provided evidence that DSR use can start lasting conversations and assist in the construction of

knowledge; however, in this study the DSR was set up with specific structures that may not be used in other contexts, and therefore studies in other contexts may find different results.

Overall, the extant research suggests that how DSR is used is the main factor in how it is perceived by both teachers and students and what / whether students learn from its use. For example, Blyth (2014) provides evidence that groups of 2-4 students are optimal. Further, the literature suggests that follow-up class discussion is crucial. Studies also show that students are more interested in the readings and more likely to do them if they are collaborating and the tool is easy to use (Chang & Hsu, 2011). The current study confirms these guidelines in addition to supplementing them.

**Benefits and Challenges of DSR Use**

According to the DSR literature, benefits of DSR use can include being able to conceptualize in new ways, being able to quickly sort information based on others' marginal annotations, and support for comprehension. Solmaz (2021) notes that research shows that DSR can support not only comprehension but meta-cognitive skills, motivation, and socialization. Vasinda (2020) includes content-knowledge acquisition, support for inquiry-based learning, and "fostering authentic and spontaneous dialogue" (p. 218) as possible outcomes of DSR use. She adds that, as a benefit of DSR use, learners can share ideas in a space where the teacher is a co-learner/ co-inquirer and participants can delve more deeply into group ideas instead of working with traditional teacher-led interaction patterns.

Along with the benefits, however, come challenges. For example, Blyth (2014) notes the arguments about "reliance on crowd-sourced commentary" (p. 203; i.e., anyone can comment) that some critics say is a problem with DSR use; these are beyond the bounds of this discussion but important to understand for those who want to use publicly shared DSR on social media. An

additional challenge to DSR use may include that students need to have or obtain a number of skillsets, including using hypertext, images, video, and so on.

Overall, Li et al. (2021) suggest that DSR is becoming more common because it breaks down barriers like time and access to others. However, they also note that, "perception, use, and effect of digital social reading remain relatively underexplored, with few empirical studies investigating user attitudes toward digital social reading" (p.1). The authors add that studies that focus on participants' cultures are also needed. In addition, the researchers claim that learner engagement in DSR use can mediate outcomes (p. 2); because task engagement can lead to achievement, it seems logical to use a task engagement framework to examine DSR use.

**Task Engagement and DSR Use**

In addition to helping understand how and what students are actually reading, exploring DSR use, as described above, may help to engage students in course texts because DSR can include many of the facilitators that lead to task engagement (TE). Egbert et al. (2021) provide a description of six research-based TE facilitators in their model of task engagement. Essentially, these facilitators and their connections to DSR include:

1. *Authenticity*. This term refers to the perception that the task is connected in some way(s) to real life or is otherwise meaningful to the student. In social reading, authenticity can support TE when the reading itself or the process of reading with others is perceived of by the student as helping to meet their goals, such as succeeding in the course, learning new information, or forming a community of peers. DSR use may also seem authentic to students when they feel like they are conversing with peers who are interested in the same issues or ideas.
2. *Interest*. Interest is a crucial facilitator of TE and can be personal or situational (Schiefele, 2009). Interest refers to positive emotions raised by something that makes a person curious or

amused, or it catches (and keeps) their attention because it is something that they like, perhaps, or that they find satisfying. In DSR use, the text, the process, and even comments by peers can be seen as supporting interest (or not).

3. *Social interaction*. Social interaction, the fundamental idea of DSR, takes place with other people who can respond in creative and authentic ways. The type and amount of social interaction can be facilitators of engagement, but this will vary among interactants. In DSR use, because all participants have opportunities to participate, DSR use can potentially increase this TE facilitator.
4. *Support*. TE is facilitated when learners have the support they need to succeed at the task, including effective feedback. In DSR, the teacher can provide comments, encourage participants beforehand to participate, and provide questions for students to answer. Peers can provide vocabulary support, answer questions, explain, and so on, providing individual support that learners may not receive in the classroom. Links, memes, and videos that support learners can also be posted to some DSR apps.
5. *Challenge*. In order to engage students in DSR use, it is important that the challenge not be the use of the technology but rather the content itself. If students are too challenged by the technology use, they will never get to the reading. That said, if the readings are too challenging for some and not challenging enough for others, there could be varying amounts of engagement based on this facilitator. This indicates that the teacher should model the procedure and technology, making sure along the way that students continue to understand how to use DSR and that no one is falling behind. DSR use can help make the task optimally challenging for those students who do not know where to focus in the reading or have

questions that they want to ask. This idea predicates itself on the notion of students feeling free to participate without embarrassment, though.

6. *Autonomy*. To engage, students need different levels of autonomy. DSR can be used for a required number of posts or students can be given leeway in both how and what to post. However, students may not post if they perceive that the other TE facilitators are not present (e.g., the task is not authentic or interesting). Students have to perceive the facilitators to benefit from TE.

In short, in trying to solve problems such as uneven/unequal reading and participation in classes and of implementing DSR use effectively, it is useful to know how students react to and perceive DSR use, based in part on the TE facilitators.

**Research Questions**

Our classroom experiences and understanding of the literature led to these research questions:

1) How do graduate education students use course-based DSR platforms?
2) How do the students perceive the use of DSR in their classes?

## Methodology

A qualitative methodological framework grounds this proactive action research-based case study. Action research focuses on real-world classroom issues, while case study allows for the deep exploration of the research questions in natural contexts (Baxter & Jacks, 2008). Our case is bounded by three natural, intact graduate courses at the higher education level, including the teacher and students. This design is appropriate for this research because of its focus on complex practices in field-based settings. Further, the study uses both descriptive and numeric data to describe the process and outcomes of DSR use and to provide multiple perspectives of

learners' engagement. This section presents the study participants, data sources and analysis, and methodological limitations.

**Context**

The study took place over two semesters in three separate courses in the College of Education at a major university in the Pacific Northwest. As the course instructor and a professor in the college, I (first author) had taught many classes with diverse students (e.g., international and national, undergraduate, master's, and doctoral, male and female, recent graduates and returning students, and so on). I had noticed that participation among groups was uneven, and that even who had completed and/or understood the readings varied. Looking for a solution, I learned about new social reading apps while glancing through plug-ins in the Canvas learning management system. I was interested in understanding more and using them to try to ensure that all students would have equal access to class discussions and the information in the readings. After some basic searching, I found practical articles that made DSR use sound interesting, and I used DSR in one course. After this I explored DSR apps and co-authored a brief article describing DSR to help me process different ideas available in the literature (Egbert & Shahrokni, 2021). As a result, I become more intrigued in the idea of DSR use as a way for students to interact during the recent pandemic when all instruction was online, and I decided to use it in two courses the following semester. My goal in using DSR in my graduate courses was to engage all of the students in the course texts and with each other. More specifically, I wanted all students: 1) to be engaged to read and comprehend; 2) to have equal opportunities to participate, and 3) to perceive that they were part of the class community through DSR.

Although the literature recommends groups of 3-5 for DSR, this was a whole-class assignment. This is because this was the first DSR use in these courses, the classes were

relatively small, and participants were not required to post much. The DSR use was structured so that students read the assigned text(s) and were required to make at least one substantial comment before class. I posted general questions or comments for each reading to serve as a guide that the students could use to look at the readings if they wanted to. Then, the readings were referred to or discussed in class. In Course 3 (explained below), one student presented on the main theme of the reading(s) each week and incorporated the DSR comments and questions. This left some ideas untouched but main ones discussed deeply. Finally, students were graded simply on whether they participated on a weekly basis or not, since this was the first time DSR was used in each of these classes. All students received the participation points.

**Participants**

During the study period, Course 1 used the Hypothes.is tool to read and annotate practical articles about computer programming/coding in education. This class was very applied. The following semester, Course 2 used the Perusall app to read and annotate articles about digital literacies in a mostly theoretical course. In Course 3, which also used Perusall, students read and annotated 10 text chapters and additional articles they chose about classroom technology integration in a theory-to-practice course. The change of DSR apps between semesters was because the Perusall app integrated easily into the Canvas learning management system being used, and it was an opportunity to explore the use of two somewhat different DSR apps.

Figure 2 presents participant data by course, including the number of participants in each course and the number of texts that were provided in the DSR apps. Other readings were often provided outside of the apps, the thought being that social reading might help with the more difficult readings and/or that students might prefer to read some items on their own without the pressure to respond or share.

**Figure 2**

*Participant Information*

| Course | # of Students | # Texts in DSR | DSR App |
|---|---|---|---|
| **1 (Coding)** | 12 | 14 | Hypothes.is |
| **2 (Digital literacies)** | 18 | 7 | Perusall |
| **3 (Technology)** | 9 | 21 | Perusall |

All of the participating students were studying in graduate programs in education, most in the same program with one or two in each course from a different program. The majority of students in Courses 1 and 2 were international students from many countries who knew each other from previous courses, while Course 3 students were mostly meeting each other for the first time. Students accessed all course sessions synchronously through Zoom, with additional asynchronous tasks throughout the semester. All students provided consent to participate.

The research team consisted of two advanced doctoral students and the first author, who was the instructor for all three courses. One of the students was from Course 2 and joined the research at the end of the semester when I asked if anyone was interested in studying DSR use, and the other joined after the data collection when she expressed an interest in the study. One of the graduate students helped to collect the interview/discussion data, and all team members were involved in data analysis, explained below.

**Data Sources and Analysis**

We employed 3 data sources over the two semesters. These were:

1. *Digital analytics*. While the free version of Hypothes.is that we used did not provide automatic analytics (i.e., numbers for individual items were provided but had to be added by

hand), Perusall provided data such as who read, for how long, what parts of the articles were most read, and how many comments/ questions/ replies/ upvotes students made. Analytic data were captured for each DSR text in each Course. Analytic data were used to help explain how students used DSR.

2. *Student DSR annotations.* The annotations (comments and questions) posted by all students were printed and read, and a coding scheme was developed and normed among the three researchers using some of the data from each course. Codes included: The task engagement facilitators, broken down into subcodes such as topic, reading, and process for the "interest" facilitator and agree, disagree, extension, question a peer, question the teacher for the "social interaction" facilitator; initial comment (topic/content/DSR); extension; and initial question (topic/content/DSR). Teacher annotations were coded as comment, feedback, question, and action request, also divided into sub-topics. Each of us then coded two of the courses individually, parsing meaning units (one topic or idea) before assigning a code. The initial intercoder reliability was 98% for Course 1, 93% for Course 2, and 92% for Course 3. All codes were reconciled through discussion to 100%. These data help to explain the digital analytic data and provide anecdotes to exemplify our interpretations.
3. *Semi-structured focused discussion and field notes*. Because this study began after the first course had ended, focused group discussion around DSR use was only with the two courses held during the second semester. One graduate student researcher led a formal group discussion about DSR on the last day of Courses 2 and 3. As part of the course, the student was well-known to the students and encouraged them to talk. Questions addressed what students thought about the use of social reading, whether and how the students thought it supported their learning, how interesting social reading was (especially compared to

individual reading), how DSR use could be more effective, what challenges they faced, and whether they would recommend social reading. The interviewer asked follow-up questions and made related comments during the discussion process.

During the discussion, the first author took field notes and sent private questions or comments to the interviewer through Zoom chat but did not turn the camera on or participate, in order not to direct the responses. Video of the discussion was recorded in the regular Zoom classroom setting and transcripts were downloaded, edited according to the actual video, then coded by the lead researcher and the second graduate student. A coding scheme was developed based on the task engagement facilitators and other codes that arose from the transcripts. Codes included the 6 task engagement facilitators, statements about the DSR process (positive/negative or change suggestion), preferences (like/dislike), and affordances (features, possibilities). The coders normed the coding scheme with some of the transcript entries. Intercoder reliability for Course 2 was 91% and for Course 3 was 84%; all codes were reconciled through discussion to 100%.

These three data sources allowed us to triangulate and explain both students' use of the DSR apps and their perceptions of that use.

**Methodological Limitations**

There are several methodological limitations with this action-based case study. First, there is a small number of participants, but this also allowed us to look at the groups deeply across the 3 intact courses. Further, no learning outcomes data were collected, which means that the use of DSR cannot be linked to student achievement; future studies may take this focus. In addition, based on the involvement of the researchers within the courses, there may be some bias toward positive outcomes; however, the systematic process of coding and the use of the software

analytics, along with researchers' awareness of this issue, helped to keep the data analysis and reporting as unbiased as possible. Finally, although patterns across the classes can be seen in the data, the findings and interpretations may not apply to any other set of participants or contexts.

## Findings and Interpretations

The findings are presented here thematically, with the analytic and descriptive data integrated to explain how the graduate students used and perceived DSR. All numbers have been rounded to the nearest whole number for ease of presentation. Student comments, when marked, are identified with the letter "S" and numbers that they were given, to conceal their identities. Student comments have not been edited for grammar or word use.

### Student Use of DSR

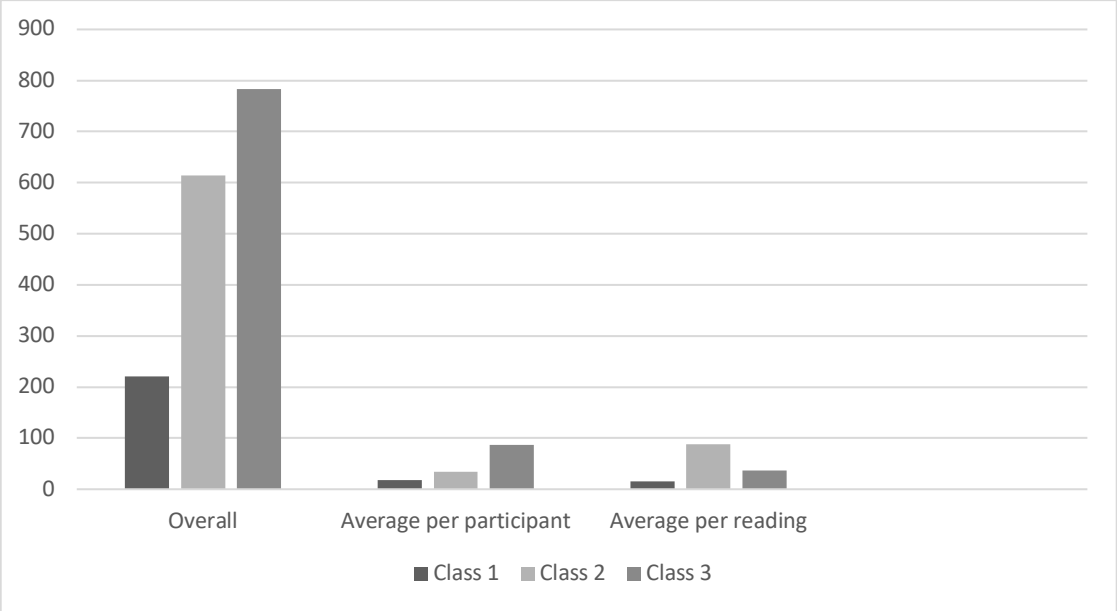
This section presents DSR use data from both the app analytic summaries and the coded annotations. These data are supported by explanatory student comments.

#### *Overall Annotations*

Figure 3 presents a general overview of how students used the DSR apps according to the analytic data. "Overall annotations" indicates the total combined number of comments and questions recorded by the DSR app for the whole course, while "average annotations per participant" is the average of all the annotations during the course divided by the number of students in that course. "Average overall annotations per reading" presents how many times, on average, students annotated each reading.

**Figure 3**

*Annotation Patterns*




In addition to the numbers from Figure 3, Figure 4 includes the "range of annotations" that show the low and high ends of overall annotations by reading (in other words, for Course 2, the text with the least number of annotations received 66, while the most annotations on any text in the course was 109). Finally, the "range of annotations per participant across texts" shows the low and high participations by participant across all of the texts; in other words, on one or more readings at least one participant had no annotations, while on one or more readings at least one participant had 16.

**Figure 4**

*Analytic Data Annotation Results*

| Course | Overall Annotations | Average Overall Annotations per Participant | Range of Overall Annotations by Participant | Average Overall Annotations per Reading | Range of Total Annotations per Reading | Range of Annotations per Participant across Texts |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| **1** | 221 | 18 | 15-25 | 16 | 6-23 | 0-4 |
| **2** | 614 | 34 | 15-68 | 88 | 66-109 | 0-16 |
| **3** | 783 | 87 | 25-145 | 37 | 11-65 | 0-22 |

The numbers and patterns in Figures 3 and 4 indicate that there was a relatively wide range of participation across texts, students, and courses, although some patterns also exist. The smaller number of students in Course 3 had a much larger number of annotations for each reading. Students in Course 2 explained that they would have participated more but they could not read all of the annotations in each reading, respond to some, post their own, and also read the text for complete comprehension. This finding supports the literature's suggestion that smaller groups be used for DSR and that easier readings may produce more annotations. However, whether more annotations are better, and in what way, is unclear. Students in Course 3 also participated much more in total because they had many more DSR texts; however, the nature of the process seemed to make most comments in Perusall relatively short (i.e., they can be difficult to read in the margins and the task might have been seen as pointing out important ideas rather than discussing them in depth). The comments in the Hypothes.is app (Course 1) were generally longer, but there were also many fewer of them. Additional analytic data also show that the shorter texts (e.g., a poster or graphic) garnered fewer annotations than other texts, as might be expected.

The analytic data also showed that, while some students did not participate in specific texts, all students made some contribution to most of the texts in their course; this might be more than some students would do if DSR was not used; it would be interesting to test this assumption. The analytic data by text also imply that students participated in a fairly random way during the semester, not annotating more as they became more used to the process and peers, as the

instructor expected. Further, no pattern in the numeric data was discerned as to why or what determined how often the participants commented, but one student indicated that it depended on how interested she was in the reading. She noted: “I like this class… the texts were so interesting for me that in this case it didn't matter if it was on a screen or on a piece of paper, I get distracted when the topic is difficult, or I don't like it as much as I like this particular topic.” This also speaks to the importance of the task facilitator of interest to DSR participation.

Other students noted reasons for why they did or did not participate. For example, one Course 2 student stated that it was a challenge to follow all of the comments when they were posted at random times and dates during the week. This student also noted that some others posted comments like “Oh, interesting” or “Sure,” which the student felt was not helpful or useful and did not need a response. Another student in Course 2 mentioned that time was an issue in doing the annotations, “because my time is limited, I feel like I cannot read everybody's comment, I cannot think of what everybody's think and it's like, the time constraint drives me crazy.” Other students indicated that time and other obligations often determined when and how they read and annotated. In addition, a student in Course 3 said that since there was no mandatory number of comments, he did not find it imperative to post all of his thoughts. To overcome these issues, one student said that the teacher should “require, like, original comments to be posted by a certain date. And like really follow up on it and say, if you haven't posted an original comment, you're gonna have points deducted…And then you know, the second comment, where you comment on a peer, also have that by a different date.” Student 457 agreed and also noted that “a little peer pressure is helpful” in getting the annotations done.

These data suggest that clearer requirements for both required number, type, and content of annotations might change the conversations, in addition to more well-defined goals developed

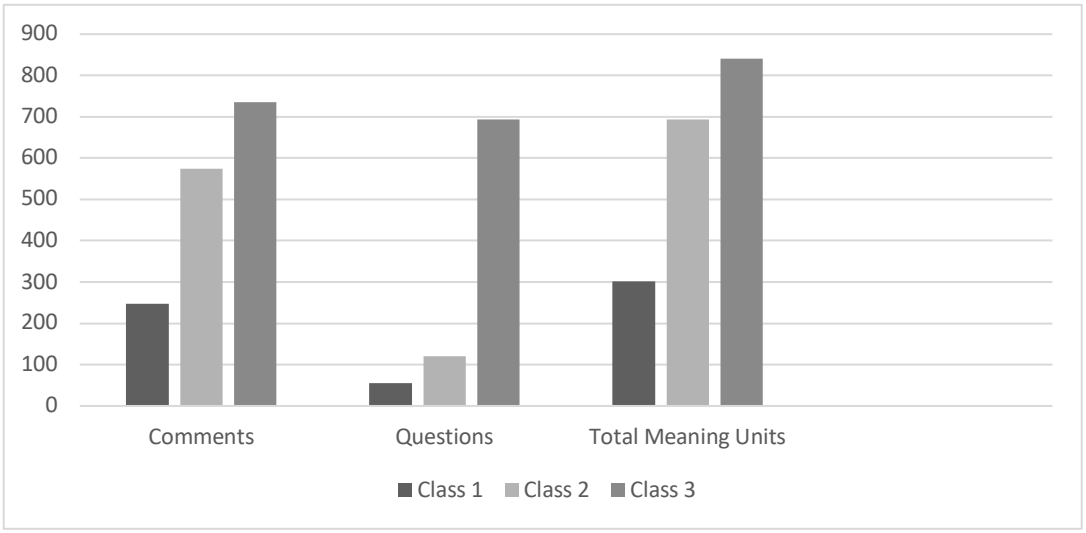
by the instructor and students. These data also suggest that, if a goal of DSR use is to consider ideas deeply, instructors may need to make sure there is room to elaborate in class if it does not happen via the DSR app.

***Comments and Questions***

Figure 5 presents the total number of codes for comments and questions based on the student annotations in the DSR apps. Although the analytic data for questions and comments was provided in the Perusall app (Courses 2 and 3), the app considered any statement with a question mark to be a question, while any statement without a question mark was designated a comment. However, this is not an accurate representation of all of the annotations, some of which had forgotten punctuation, for example, or were rhetorical questions for which no answer was expected (or was given by the asker).

**Figure 5**

*Comments and Questions from Annotations in the DSR Apps (Coded)*




Although the figure shows that there were numeric differences, the percentage of comments to questions out of all annotations was similar across the classes – Course 1 had 18% questions,

while Course 2 had 17% and Course 3 had 13%. The percentage of initial questions, or those not addressed to another DSR user, out of all annotations was 9%, 13%, 7% for Course 1, 2 and 3 respectively). Course 3 students said that they had fewer questions (but more comments) because the readings were easy to comprehend, teacher-friendly, and related to their goals. On the other hand, Courses 1 and 2 dealt with topics that the students had not previously addressed, leading to more statements about what they thought the authors were saying and requests for explanation and support. At the same time, the coded data also indicate that these students commented less on readings that they described as having the most new ideas and vocabulary; this is the opposite of the expectation that social reading would help more with difficult readings and that students would negotiate meaning more. However, more annotations do not necessarily mean more learning, and it might be useful to look at the transfer from the DSR apps to classroom discourse and also measure in some other way what the actual takeaways were from each text. Further, more teacher support and feedback (discussed later) might help students feel more comfortable with commenting on unfamiliar items.

Further, the students' questions in the 3 courses were mostly connected directly to the texts. Students rarely questioned each other's comments unless it was to ask for clarification, rather, they regularly expressed simple agreement with others' comments ("I agree with you!"; 6%, 11%, 12% for Courses 1, 2, and 3 respectively). This indicates maybe some tentativeness or politeness that can interfere with students negotiating meaning in useful ways. The same did not happen as often in the regular classroom discussions using the Zoom application, where students regularly tested each other, provided alternate explanations, and demonstrated their knowledge of their peers. One student suggested that teachers could **"**divide [students] into some different groups according to their reading level or their research interests, so each group will read

different article and then, when we come back to class, we can discuss the article or when they read online, we have the same topic so we can communicate in depth for engaging." Smaller groups, or student-chosen groups, might help with this sense of divide from the other students that online interaction can cause (Nyrop & Stuckey, 2005). The idea of students' perceptions of written/permanent vs. spoken/temporary participation might also be a profitable way to study DSR use.

The data analytics from Perusall also show that, as in Blyth (2014), students made the most (but not a majority of) comments on the first and last paragraphs of the texts; this might have been because these text sections summarize what will be and what was read, and it is a way for learners to understand what the text is about and thereby determine its value and how to read it. Investigating this reading strategy through DSR use might tell us more about graduate student reading and where instructors might usefully provide strategy instruction.

***Most Common Annotations***

Figure 6 provides percentages for the most common types of annotations, which appear to be fairly consistent across the classes.

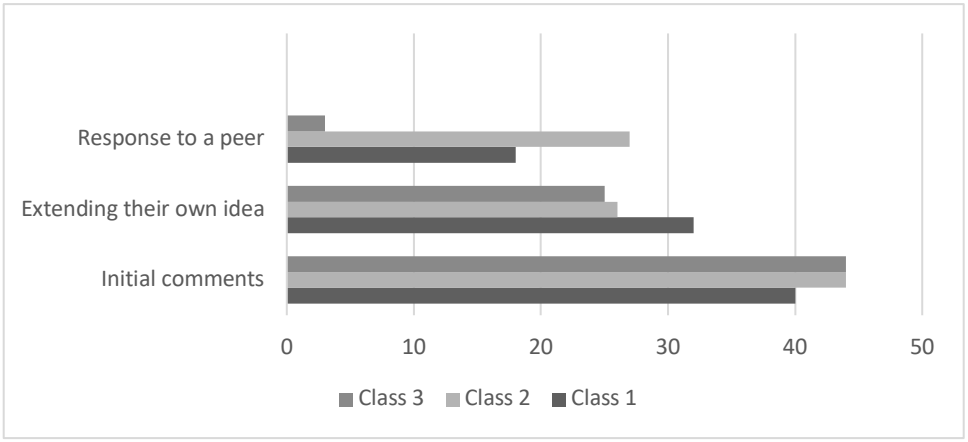
Blyth (2014) noted that DSR use can support distributed cognition, and our study found the same. In other words, students could choose how to read the text and different ways to contribute to group understanding of the text. However, the contributions across the 3 courses did not vary as much as expected. For example, across the courses, an initial comment (starting a new thread) about the reading content was the most common annotation. This was followed by students extending their own idea, and then half the number of responses to other students' ideas. This implies that there was less conversation or interaction around the texts than there were students voicing and explaining their own opinions. One student noted that "…I feel like all

we're really doing is like demonstration writing. we're just trying to show the instructor that we understand the material, we understand what's important in the reading. I don't think we're necessarily like learning from each other." Although this statement was not agreed to by other participants, S4570 noted: "it's just kind of nice to hear a little feedback back so that you're not just reading in a vacuum so it's it is it's not just the personal notes I took that then I question later if they were valuable, is it gives you a little bit of affirmation that. maybe you're looking at the right thing or not looking at the right thing."

Further, in their initial comments (not responding to someone else), students rarely included a statement about the broader topic area, sticking to comments directly related to some aspect of the text. For example, the students would highlight a statement and write "I was a little confused about this statement…" or "I think this means…" almost exclusively, rather than talking about the field of knowledge or more general ideas. This may not be a problem, depending on DSR goals, but it also may not lead to wider conversation. In the 3 classes studied, students may have interpreted this as their assignment; having to highlight specific text in order to comment might also play a role in how the participants focused their comments. Clear instructions and/or questions about transferring and applying the information in a broader sense may have changed this outcome, as may have a more thorough overview of the affordances of the DSR apps which allow students to comment without highlighting.

**Figure 6**

*Percentage of Most Common DSR Annotations (Coded)*




In extending their own ideas, they included both personal experience and academic knowledge gained in other classes/contexts. In the more applied courses, the extensions focused more on application, while in Course 2 the extensions were more about explanations and understandings. Those students who often responded to peers explained, like S18, that "thinking about how other people might perceive the same thing as you is interesting to me, I like to look at that and then also the questions being placed for you to kind of to guide your thinking, while you're reading is also very helpful for me so."

To help DSR meet its goals and engage all students, instruction should focus on facilitating interaction rather than simply posting. This might happen by providing feedback, asking students to address questions that others have, and making sure that the readings are authentic and of interest to the participants; in other words, by incorporating more of the task engagement facilitators or incorporating them in ways that work with the needs, wants, and abilities of the specific class participants. This suggests that the way DSR is used can but should probably not be generic across classes.

***Teacher Participation***

The teacher, in exploring the use of DSR, provided slightly different types of texts but relatively the same overall DSR experiences for each class. For example, in the very applied Course 1, graphics and posters were some of the texts. Questions that the teacher asked in the DSR app about these texts included:

- What do you think about this statement? (about a graphic with a slogan)
- Why is this poster in this section of the course? How does it relate?
- What is the overall argument of this article? Do you agree or disagree? Highlight and comment on at least two aspects that you agree/disagree with.

For Course 2, in which the texts were more difficult theoretical articles and the focus was on thinking deeply about the issues, the teacher asked more general questions, such as:

- Comment on important information, ask about something you're not clear on or question, or add any other kind of annotation that will help to focus this reading for you. How does this article apply to our class? What does it say about literacy? Keep these questions in mind.
- What questions would you ask the authors if you could? Which assertions do you believe require more evidence? Why? What are the most important ideas in this article?

In Course 3, a class in which the focus was on both theory and application, more detailed guiding questions included:

- How is creativity impacted by technology and vice versa? Think about the relationship between the two. How might creativity in technology benefit people in life (socially/ emotionally/ psychologically)? How does the teacher's role affect student creativity regarding technology incorporation?

- How might teachers use a future studies methodological approach to guide the integration of technology into the curriculum? If current technology trends continue, what will the future classroom look like? What is the future of Artificial Intelligence in the classroom? What are the dangers and the possibilities? "School will continue to be viewed as vehicles for solving economic and societal problems and in enabling transformation toward particular futures" (p.8). Do you agree or disagree with this statement, why or why not?

These questions were discussed in class, so the students knew what the focus was whether they actually responded to these questions during DSR or not. Without further analysis, however, it is unclear what differences the guiding questions might have made in students' annotations, especially because they were suggestions rather than requirements. However, even the guiding questions were too much structure for a few students; S5570 said that she did not like that there were questions that she felt she had to respond to that interfered with what she really wanted to say/ask. Another student in Course 2 said that the teacher questions were good for stimulating ideas but should not be required in order to allow students to post their own ideas. For future DSR use, it will be important to consider how participants react to the need for the engagement facilitator of a balance of autonomy and structure and to make sure that students understand whether the questions are required or just suggestions of things to consider in the text.

In addition to initial general questions or instructions about the text, the teacher averaged 2.1 per-text annotations in Course 1, 11 per text in Course 2, and 7 per text in Course 3. Of those annotations, almost all of them in Course 1 were questions about the reading content. In Course 2, the second semester of DSR use, the teacher still asked questions (16 overall) but gave a great deal more feedback (47 annotations). During Course 3, the teacher asked 99 questions about the

reading content and gave feedback 27 times. Feedback depended on the types of issues that students appeared to be having with text comprehension and the questions that they asked directly to the instructor within the DSR app. For example, one exchange in Course 3 was:

> T: Do we believe this as a generic statement?
>
> Only one student answered, noting:
>
> S: This sentence in general is phrased in a weird way to me, but I don't really agree with this statement in the broader scheme of things. Not all students are born into technology. Yes, there is a ton of technology in our world and it is way more prevalent for children to use it, but I don't feel you can say this as a generic statement because it's not true for all.

To a student question in Course 2, the teacher responded, "Someone look it up (online)!" and another student did. While the teacher appeared to be reactive to student comments and questions in the DSR apps, some well-designed balance between guiding, requiring, and supporting, clearly understood by students, might provide a better overall structure for DSR use.

## Perceptions of DSR Use and Engagement

### *Students' General Preferences*

In the discussions at the end of the semester, the students explained their preferences for or against the use of DSR in their roles both as students and as teachers. Although all but one of the students appreciated the use of DSR in general, this preference varied in strength, and the reasons for the preferences were also diverse. For example, S10 said,

> "At first I mean I didn't really like so much about the use of it because I don't because you know I always want to have my own reading, but then after doing it for some times I realized that, I mean, there are some sort of like, you know, benefit that I got from it like, you know, I think I am able to know some other people's perspective on a certain

> paragraph or a certain topic or certain sentence, so it kind of like gives me another input, "oh I didn't think about this," so I think, in that sense it's kind of you know, useful for me"

In other words, this student equates her liking of DSR use to its authenticity. Another student, S3570, stated, "I like what it what it creates after everybody puts the comments, you know, because there are different ideas and you can actually rethink about something that you thought before, when you were reading so that's a good thing, and the conversation that it generates." However, this student added that they prefer to do the discussion in person and did not feel engaged in DSR as much as if the reading discussions were in conducted class. S75 also agreed with this sentiment.

One student, although he preferred not to use the DSR due to both a neurocognitive condition and what he perceived as a "generational gap," commented that, as an older student, he preferred to read on paper. He noted, however, that for the undergraduates that he taught:

> I'm actually using Perusall right now. It's like, you know, against my reason and all but we're doing social media because they're they love it. They're super engaged, they love commenting on each other, emojiing, you know, like everyone else is. It's like their element, so I guess, we need to consider that, when we are using whatever app or platform that that we're using, who is our audience, who, you know, like who are we using this with."

This graduate student recognized the affordances of DSR use to provide a reading forum that his students could use in authentic ways so that he could engage his audience toward goals in his class. He may have a point – that graduate students have different experiences and expectations of coursework. This is additional support for making sure that the goals of the

experience are clear and in keeping with what the participants feel is authentic. As a student in Course 2 noted, “having the conversation between the peers is vital, but “whoa” and “wow” isn’t necessarily the pedagogical goal.”

As in Vasinda’s (2020) study, a number of the students in each course said that they preferred not to read online in general, but only one of them in this study said that they would absolutely not do it if it were not required/graded. Also, this same student found it distracting to read the text the first time with comments on it, so he read it separately and then came back and read the comments. This might be a good process to recommend so that students could understand the gist of the text before they comment. Other students in the 3 courses also talked about the processes they used that helped them to engage in DSR, whether reading alone before participating or turning off highlights until they were done. Students who were not familiar with the affordances of the apps explained that they did not know or had not thought of ways to circumvent issues that they had; this requires fairly thorough acquaintance with the apps and perhaps modeling of some of opportunities and strategies that could be used.

***Engagement Facilitators***

Students were not asked about the facilitators within the DSR apps and they were not mentioned specifically in the reading questions/prompts. However, they were sometimes mentioned in student annotations. Further, while no specific questions during the discussion asked about task engagement facilitators, of the 158 discussion comments, many of them mentioned one or more facilitators. The overall expression was that the courses were experienced differently due to the content and texts but also that the engagement facilitators were an important part of DSR use for the participants as students and as (future) teachers. This section

explains specifically both how participants perceived that the facilitators were integrated into the DSR use and the difference that it made for them.

***Authenticity and Interest.*** In the annotation data, positive comments about the authenticity of the texts were made in each class 39 times in all, while interest in the topic or text content was expressed 5 times in Course 1, 33 times in Course 2, and 24 times in Course 3. Both authenticity and interest during DSR seemed to stem from students' ability to understand the readings and to interacting with peers. For example, S1570 noted that she had the most fun when the class was reading about memes because students were posting funny memes as examples, and she felt this was authentic and what they do a lot of the time. She and several others also said that the use of emojis (an affordance of Perusall) made reading the annotations more interesting. In addition, as in other studies, participants linked many of the annotations to their experiences as teachers, making the text and process more authentic to them since they could apply it or see how others did so.

During the discussions, a Course 2 student said: "On this [app], I could see everyone's comments and questions, and where they were referenced, and feel instantly connected to the paper and feel part of the conversation community." She concluded that this experience was both relevant and authentic for her as a student. Another student commented that she perceived that DSR use was authentic because she thought that the students had the same learning goals, that the social interaction in writing was authentic, and that its convenience made it interesting. If fact, participants in both classes indicated that the texts must be interesting and not difficult to be used authentically for DSR. While explaining this idea, they agreed that DSR should not be used as "a way to make student to read"; that its use must be manageable and meaningful.

Students often linked interest to authenticity in speaking about DSR use. This was demonstrated in comments such as:

"I'm looking forward to what the author has to say about this. "

"I'm retweeting this part."

Further, students asked others to "share this [idea] in class" a number of times or pointed out that they would be interested in discussing some comments further in class. Summarizing her perceptions, S1 stated that "Everyone here pays attention to different things and comments on different sentences. And I think that is what is also very engaging because you are able to see from other teachers and from other opinions some of the things that maybe I didn't pay attention to before." These data show that participants noted their perceived interest and authenticity and believed that DSR use could support these engagement facilitators.

***Interaction.*** Some students mentioned the importance to them of interaction in DSR. For example, S16 noted: "I really love the Perusall because, and this is my first time to use this app, but I found that it easy to use, and I can while is a passage I can communicate with my classmates and show my do I idea or ask my question if someone can't answer my question, so I, I feel that I can get direct feedback and we can discuss the questions and I love the examples." Other students voiced similar ideas, noting, for example, "…sometimes they use their personal examples to answer the questions, so I think it's very interesting." Like Vasinda (2020), our students commented that how others replied made a difference in how the participants perceived one another's contributions and added to them. In the same vein, our students also stated that they liked receiving email notifications from the app when someone responded to their comments; however, some had not set it up this way due to not being informed about this affordance. Students who did not know about this aspect of the DSR apps were disappointed to

only find out about it at the end of the course. For example, S18 explained: "I will make a comment, and then I might not go back in to see the discussion. But maybe alerting me to go back for it..." S10 agreed, noting, "I think it's really useful that notification. For you to go back and then look at what is in there."

Students also noted the benefits of what they considered social interaction. For example, a Course 2 student explained that it "provides affirmation that I'm looking at the right thing." Another said that "the comments that have really helped me to understanding what we talk about in the class and what the other people think." Another student said that, as an international student, she appreciated the socialness of the DSR, noting that "Sometimes we do not understand the sentence structure of the sentence, paragraph, or something like this, so it can help, we help each other to understand the article." In the annotations, students responded to some of their peers' comments with, "I can relate now.." or "I can relate to your experience…" Participants appeared not only to appreciate the interaction around course goals, but personal interaction in the case of these graduate education students seemed to have influenced students' engagement in the DSR as well.

Overall, the students often equated their perception of the social interaction within the DSR apps with the authenticity of the task and course. One student in Course 2, however, asked during class whether, if DSR use is asynchronous, it is actually "social." This raised the question of whether and how DSR use is or can be "social." The class came to the conclusion with the teacher that negotiation of meaning and response to peers is important to have the feeling that one is actually interacting.

***Positive Learning Support.*** Related to interaction, participants agreed during the class discussion that peer and teacher feedback was an important part of the process. They also noted that DSR

affordances supported their learning in several ways, including (as noted above) providing language modeling and support. One international student liked it because she felt she got direct feedback on her reading ideas that she might not otherwise get during a class discussion. Other non-native English students also noted that they like that with DSR use they could check their contributions, such as their typing, which could build student confidence to participate. The location of information in the DSR apps provided another example of positive learning support, according to S21. She said, "When I write stuff on notebook paper, so I end up losing it, so it was nice that you can always go back and the information is still there, and you can see it."

Also about learning support, a student in Course 2 who had used DSR with her students noted that it might be important for the instructor to also provide a more private way for students to ask for help. While this could be accomplished through chat or students could be encouraged to ask in another forum, building trust among the students and making it part of the expectation for DSR use might also be beneficial.

***Challenges and Choice.*** Eighteen comments talked about challenges with DSR use. The majority of Course 2's comments were negative about the challenge of the Perusall tasks but also contained solutions to the issues they faced. For example, S957noted that she had addressed the issue with time by developing a system of going straight to the questions asked to see what other students answered. Another student mentioned a problem not with the app itself but with her use of it. She said that she kept getting notifications on her computer from other apps and would feel like she had to go check them – if she read printed text instead, she would take a highlighter and sit somewhere with fewer distractions. However, she did manage to participate more than any other student.

One student in Course 3 noted that he "found it to be most effective when it had a bit more structure around it"; he noted that "a lot of stuff goes unread and it just kind of in the abyss a little bit." This student suggested that additional "boundaries or rules" would make the DSR use more effective and make this less of a challenge. It would also, however, take away some of the choice that other students desired. For example, a student in Course 3 noted that in DSR use it is important to provide students with "liberty to interact" but balance that with not allowing students to "tag along"; this student acknowledged that this balance is a "fine line" that he felt may be solved in part by making sure that students know that they will be doing something important with the information afterwards, and by suggesting that a simple "I agree" or thumbs up emoticon is not sufficient as a response. To this end, another student expressed appreciation of the requirement in Course 3 to address annotations that peers had made when the students led a reading discussion in class, saying that "there was a point in actually going through someone else's comments." The real challenge, then, might be balancing the needs of all of the students in the courses.

***DSR Process and Changes***

Overall, 40 comments were made in the discussions about the DSR process and possible changes in DSR use. These were useful both from an instructional standpoint and because the participants, studying to become or improve as instructors or professors themselves, had the chance to reflect on their learning and how they wanted to apply this experience in their own teaching.

One student introduced the idea that "I don't think that that like beauty of social reading is achieved in every single class." Students discussed how this might be improved. S18 said, for example, "I think it needs to be structured… [the instructor] really mentioned like, 'Okay, when

you do your presentation, make sure to reference the chapter.' And then people will be like 'Oh, you said this, ok let's talk about it more.'" One solution may be, then, to ask a student to lead each text – asking the questions, maybe in cooperation with the teacher or another student, that fit the course goals and their knowledge. Teacher education students need to learn how to lead discussions, and this might also help the participants focus on the authenticity of such a process.

Another student noted that in other classes "that's just kill me" to both have a lot of readings in a DSR app and have required questions for each of them. He appreciated that in his course in this study he "Just have the freedom to critique the article." Along the same lines, most of the students in Course 3 indicated that whether they would use Perusall again or in their futures as teachers would depend on the goals of their classes. For example, a student in Course 2 commented, **"**what is your goal in using Perusall. Are you trying to improve reading comprehension for students, are you trying to improve student engagement, are you trying to get them to socialize with each other." S657 added that he did not perceive Perusall as necessarily the best tool for all of these goals, and it might be just as or more effective to have students read in whatever way is most effective for them. S135 also noted, "this is a PhD class, I believe every people, they will read an article by themselves they don't need that?" This implies that the teacher may need to provide more specific information about the goals of DSR use and show how and why it is necessary; in addition, allowing graduate students to help develop the DSR tasks could address some of these issues.

## Action Guidelines

There is much more in our data and about DSR use in general to explore. For example, it might be useful to know who responds to whom, what kind of connections students make, what role, if any, culture or language background plays in the process, or what parts of the readings

students actually respond to. However, based on our findings, we agree with Dean's (2016) call for higher education instructors to integrate the use of DSR in higher education. However, this comes with a caveat; as with all instructional tasks, following design guidelines can determine whether the task is effective and for whom. Therefore, we encourage use of the task engagement facilitators and the following guidelines (many of which concur with the extant literature on DSR and are explained below) but adapted for each context and student population:

1. **Develop clear goals**. Both the task engagement literature and our data show that clear goals are essential to any engaging task. Because DSR use can take many foci, it is important to develop tasks that focus on specific goals, whether improving information seeking, developing reading comprehension skills, gaining new knowledge, or building community. Goals should be based on the students who will use the DSR and may address the number of required posts, what type of posts would be useful and /or accepted, what they should contain, and how they will be graded. However, to maintain engagement in the DSR task, this structure must be balanced with student choice. One strategy is to explain and demonstrate the DSR app and then ask graduate students how they feel it might be best used, building on their knowledge and experience both of themselves as learners and as teachers/future teachers.
2. **Teach the app well**. Because the focus is on reading, and not necessarily on the technology, it is logical to focus on the texts. Blyth (2014) decided not to teach the app eComma to his student because he found it easy to use. However, some of his students had trouble using the app, like some of the students in the current study. In order to help students use a DSR app, it is important for them to see it modeled, practice it, and be able to comment on and question the affordances. In this study, students expressed the need to know how to search for

comments and questions, to access emojis and upvotes, to turn on notifications so that they could see when someone responded to their annotation/comment, and how to include different types of media such as videos, graphics, and audio files. Further, according to the field notes, some students also discovered that the Perusall app afforded them the opportunity to take private notes. In addition, in Hypothes.is, the more a piece of text is highlighted the darker it gets, but the teacher did not know this until after the end of the class and therefore could not point it out to the students. Further, S115 wanted the affordance of synchronous chatting with students who might be in the DSR app at the same time. It was there, but the teacher did not mention it. To use DSR apps effectively, the instructor must know them well and be able to help students understand the affordances and why/when they might be used.

Not only affordances, but strategies for using the app might also be addressed. For example, mentioning that students might be distracted by other apps and that they might want to turn off notification while they read could be useful for some. S105 noted that the highlights were distracting when other people did them, and S115 explained his strategy of turning them off until he had made his own highlights.

3. **Provide choices**. The instructor can explain about how cognition is distributed and provide students with multiple ways both to read and respond. For example, students could read the text alone first, and then annotate it. This strategy not only has them read the text more than once, but it might also make it easier to explain their thoughts when they go to annotate. Likewise, students with designated learning issues or preferences should have choices that help them participate but not suffer from reading on the screen; both of the DSR apps used in this study allow for the texts to be downloaded and/or printed, for example. Students might also be given a choice of media or of different texts with the same focal ideas.

4. **Preview the texts**. DSR use does not take the place of effective pedagogy. According to the field notes, students in both classes noted that pre-viewing vocabulary would support comprehension and discussion. While international participants, in particular, felt that DSR use was helpful and that it was easier for them to check their understanding before speaking in class with DSR use, a specific emphasis on pre-reading might help all of the students. Further, it might be useful in some cases, as Vasinda (2020) notes, for the teacher to annotate first in a general way to stimulate the first reader(s), but the challenge here is not to guide the readers to the teacher's interpretation of the reading or what is important in it.
5. **Decide how structured DSR use needs to be**. In the three classes in this study, the students rarely directly asked the teacher for help or information. This worked to an extent, but more direction or explanation might have helped the learners to focus more effectively on desired outcomes.
6. **Follow up every time**. DSR use should not only include a preview but also some kind of debrief to make the process of reading more meaningful and authentic. In this study, DSR use was not a substitute for the kind of deep conversations around issues that students needed and wanted to have. DSR use can be considered as necessary preparation for more in-depth discussion.
7. **Participate**. The students in this study noted that instructor involvement was helpful, not necessarily by setting required questions but as a facilitator of the discussion along the way. If DSR use is considered a course task, then the instructor should be involved. This involvement should consider the needs, wants, and abilities of the students, along with course and task goals.

8. **Make reading groups in large classes**. This can help to provide a sense of control and perhaps a better balance of challenge and support if students can trust their small group members and get to know them. They could also choose to read synchronously if in a small group and have opportunities to make other choices in their use of DSR.
9. **Consider DSR texts carefully**. Not every text needs to be in a DSR app. In this study, students said that they preferred texts that were familiar or through which they could learn without a lot of struggle. Providing content texts that all students can comprehend might enable students to interact more about the ideas.

## Conclusions and Research Implications

This action research has provided a firm grounding for future uses of DSR in these courses. The data show that DSR use in these courses was successful in a number of ways. For example, participants all participated in annotating the texts; although the amount and type of comments differed, no student was left out, as might be the case where individuals read and have no access to the group while doing so. Further, all of the participants perceived task engagement during DSR, although to different extents. The data also show many ways in which the DSR use here can be improved through use of the action guidelines. In agreement with the literature, we found that the digital and interactive nature of DSR can support learning because it affords both a focus on text and an emphasis on content through interaction. However, as with any technology, we learned that the use of DSR must be carefully and mindfully planned to have the most benefit. We plan to continue to refine our use of Perusall in future courses and explore how context, task, and audience may contribute to differences in outcomes.

Although this study has made a contribution to the DSR research, there are many more ways that DSR data can be parsed and analyzed; this study suggests some profitable ways to do

so. For example, future research could look more deeply into what participants actually say, using a scheme like Vasinda's (2020). In addition, language and/or discourse analysis might be useful for explaining student participation more in-depth. Correlating page views, time on task, and comments, or relationships among any of the statistics provided by the DSR apps could also provide useful information. It would also be valuable to understand relationships among DSR app affordances and outcomes. Further, in this study the students' perceptions were only obtained at the very end of the class; none was taken at the beginning or middle to see the progress of students' DSR perceptions and use. Future studies could take this into account. Finally, exploring the comments and participation of international students could be illuminating, and Li et al. (2021) recommend additional cross-cultural studies.

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