THE EFFICACY OF IMPLEMENTING A TECHNOLOGY-MEDIATED DIALOGIC PEDAGOGY TO SUPPORT READING COMPREHENSION IN VIRTUAL AND CO-LOCATED SETTINGS

By

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ABSTRACT

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Text-based discussion within a technology-mediated dialogic discussion (T+DLD) has the potential to engage students in higher-level reading comprehension with upper elementary students. While supported empirically, this approach is still not commonplace, and little is known about its efficacy within a remote setting. The primary aim of this project was to synthesize what is currently known about T+DLD and to explore changes in discussion within a remote setting to support practitioners enacting the approach. This was achieved through a systematic review of the literature on T+DP that analyzed 18 included studies for study quality as well as patterns around study features (i.e., instructional design, environmental factors, task, methodology). Text-based discussion via web-based teleconferencing was studied using a comparative case study using sociocultural discourse analysis to study student discussion in three different training conditions: dialogic only, technology only, and a T+DLD training. A pathway of implementation was then developed to translate research into practice to support teachers in adopting T+DLD. A key finding within this project was that T+DLD builds on the key elements of ground rules for talk, an open task, and student reflection for talk. Additionally, the pedagogical approach of the teacher influences the way technology is used by students. Finally, technology can successfully support T+DLD in both co-located and remote settings. This

dissertation provides recommendations for future research that compares methods of implementation and evaluates the direct impact on reading comprehension.

This dissertation is dedicated to my mom and dad.
Thank you for always encouraging me.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1 - INTRODUCTION

Reading comprehension—the process of constructing meaning that leads to the understanding of a text—is essential for students to succeed in school (Helder et al., 2016). Reading comprehension is complex, involving the active use of many different cognitive processes to construct meaning through interactions between a text and a reader's background knowledge (Garas-York & Almasi, 2017; Rosenblatt, 1978; Tennent, 2015). Despite efforts to address improved reading comprehension, national assessments have highlighted the struggle. In 2019, the National Assessments of Educational Progress (NAEP) showed 65% of fourth-grade students did not meet the proficiency level in reading (National Center for Educational Statistics [NCES], 2019), in which proficiency required students to comprehend the text as well as engage in inferential thinking, analyze narrative components, and provide evidence for ideas (NCES, 2019). Students who do not meet proficiency standards in elementary school are at greater risk of falling further behind their peers for the remainder of their schooling (Foorman & Torgesen, 2001), and are more likely to drop out of school (Rabiner et al., 2016). Therefore, there is a significant need to find methods that impact reading comprehension.

Higher-Level Comprehension

Higher-level comprehension—a level of comprehension that goes beyond a literal understanding to the inferring of implicit meanings—is widely considered to be an essential component for proficient reading (Reniger & Wilkinson, 2009). In order to develop higher-level comprehension, readers draw inferences from textual information and background knowledge to establish global coherence—the understanding of topics that apply to the text as a whole as well as the way they interrelate (Kintsch & Rawson, 2013). Examples of topics contributing to global coherence include story theme, character motivation, and organization of text structure. Global

coherence is essential for understanding an entire text, and is required to form a mental representation (or picture) of the text (Freed & Cain, 2017; Tapiero, 2007). A reader's access to prior knowledge serves as a tool when drawing inferences to fill gaps and restore the overall coherence in their understanding of the text (Diergarten & Nieding, 2016). To determine when to draw an inference, a reader relies on standards of coherence—the criteria used to ensure adequate comprehension of text (Freed & Cain, 2017). When a reader applies improper standards of coherence or lacks sufficient background knowledge to bridge gaps in coherence, their ability to construct global coherence is diminished, as is higher-level comprehension (Kendeou et al., 2014). However, social interaction through the discussion of text provides opportunities for updating mental representations (Johnson, 2017), using discussion as a tool to evaluate and enhance the representations (Reninger & Wilkinson, 2009). In addition, readers can draw new inferences in response to inaccurate or incomplete mental representations identified through discussion (Chi, 2000). In short, readers identify and repair gaps in coherence, leveraging the differing knowledge and skills of the participants in the discussion, leading to higher-level comprehension.

Text-Based Discussion

One way to engage readers in higher-level comprehension is to promote the use of text-based discussion. Text-based discussions are conversations about previously read texts (either read aloud by the teacher or independently by students; Reninger & Wilkinson, 2009). They can occur whole class or in small groups and can be facilitated either by the teacher or the students (O'Connor & Snow, 2017). There is substantial research support showing higher-level reading comprehension is an outcome of high-quality text-based discussion (Duke et al., 2011; Matsumura et al., 2013). For example, McKeown et al. (2009) conducted a study comparing

direct strategy instruction with the use of questioning and discussion with fifth-grade students. In the direct strategy instruction condition, students were instructed in how to use comprehension strategies, such as predicting. The questioning and discussion condition focused on asking many open-ended questions about the text, such as "How does this connect with what we read earlier?" (p. 223). Students in the questioning and discussion group outperformed students in the direct strategy instruction approach. These findings can be attributed to the discussion for which students had to develop responses that required the evaluation of inferences and the updating of imperfect mental models (Chi, 2000).

From a sociocultural perspective, the social context in which the discussion occurs directly influences the cognition and constructed meaning (Serafini, 2012). This extends the work of Vygotsky (1978), suggesting social interactions precede individual cognitive capabilities. From this perspective, knowledge resides both within the individual as well as among members of a community (Mercer et al., 2019), and is constructed through the appropriation of cultural practices (i.e., ways of making sense within a particular context) and artifacts (i.e., verbal signals or material objects) to mediate thinking, facilitated through talk (Wells, 2007). As students engage in discussion, the mediated thinking leads to the construction of knowledge by the individuals. While reading or listening to a text, individuals construct unique mental representations of the text, resulting in differing interpretations (Tennent, 2015). To that end, text-based discussion serves as a space for students to articulate and revise differing interpretations and background knowledge structures, resulting in a co-constructed interpretation (Maine, 2015; Zhang et al., 2015).

However, not all text-based discussion represents a sociocultural perspective. There are three types of text-based discussion frequently used within schools: monologic (i.e., the teacher

asks a question to check for understanding), whole class dialogic (i.e., the teacher asks an opened ended question, then facilitates student discussion), and small group dialogic (i.e., a small group discusses a question or task independent of the teacher; O'Connor & Snow, 2017). Currently, text-based discussion often falls into a monologic script in which the teacher poses questions to students about a text, often seeking a single answer (Peterson, 2019). This teacher-facilitated discussion, often referred to as the "I.R.E." framework, involves teacher initiation (I), student response (R), and teacher evaluation of the response (E; Cazden, 1988). Classroom dialogue based on an I.R.E. framework tends to be low quality and decreases student motivation and quality of engagement while favoring literal comprehension over higher-level comprehension (Garas-York et al., 2013). Conversely, student-directed talk within whole-class and small-group discussions is favorable for promoting higher-level reading comprehension (Applebee et al., 2003), and promotes reasoning ability (Chinn et al., 2001). It also has a reciprocal effect on the teacher through which the facilitation of dialogic discussion influences teacher epistemology, placing an increased value on the collaborative construction of meaning (Nystrand, 2006). Despite the benefits of text-based discussion with a dialogic approach (whether whole class or small group), teachers often have difficulty implementing such types (Alexander, 2017; Johnson, 2017). For that reason, teachers have a need for a pedagogical approach that supports student-directed, dialogic text-based discussions.

Dialogic Teaching

Dialogic teaching is an approach that uses talk as a cognitive tool to intentionally support student thinking, reasoning, and higher-level problem solving (Alexander, 2017; Kim & Wilkinson, 2019). Several principles undergird a dialogic approach to ensure high-quality talk, including using talk as a tool for thinking, providing structure to support promotive action,

engaging in a gradual release of responsibility, using authentic and open-ended questions, building on ideas to develop coherence within the discussion, reflecting on talk and receiving meaningful feedback, justifying ideas and providing examples, and engaging in collaborative construction of ideas (Maine, 2015; Soter et al., 2008). A key component is the notion that not only do participants share and justify perspectives, but they also seek to understand differing ideas, revising or deepening their own viewpoints in doing so (Asterhan et al., 2020). In other words, rather than seeking to share, participants seek to understand, and to create a shared understanding.

Dialogic teaching may initially begin with teacher-led discussions, but it also requires students to engage in high-quality collaborative talk without teacher facilitation (Mercer et al., 2019). In order for students to effectively facilitate their own discussion, they need explicit instruction for talking and thinking collectively (Rojas-Drummond et al., 2014). In an effort to provide a framework for teaching students to facilitate their own discussion, Littleton and Mercer (2013) identified three different types of talk that were prevalent in classrooms: disputational, cumulative, and exploratory talk. Disputational talk is characterized by unproductive talk in which group members make individual decisions without consideration of others. Cumulative talk involves sharing ideas without any kind of evaluation, often with immediate acceptance of ideas. Exploratory talk is generally considered to be the most effective and high-quality kind of talk and involves the critical and constructive evaluation and discussion of ideas as group members work to understand differing perspectives before coming to consensus (Vrikki et al. 2019).

Despite the importance of exploratory talk for developing higher-order thinking, it is rarely observed in classrooms (Mercer et al., 2019). In order to promote this type of talk, a

culture in which students respect and listen to ideas needs to be created by establishing ground rules for talk that set norms (Resnick et al., 2018; Vrikki et al., 2019). These ground rules are an essential cultural tool that can be appropriated by students to structure group interactions, which can facilitate the development of individual cognitive abilities (Wilkinson et al., 2017). One reason this shift in pedagogy from teacher-facilitated discussion to student-facilitated discussion has not occurred yet at scale is the difficulty in supporting numerous simultaneous conversations in a way that promotes exploratory talk (Galton et al., 2009). Either teachers lack the time or capacity to support a dialogic approach, or the necessary changes challenge teacher beliefs and previous experiences (Murphy et al., 2018). Either way, additional support within the classroom setting is important if a systemic change to enact dialogic teaching is to be realized.

Technology-Mediated Dialogic Discussion

Digital devices such as mobile devices or Internet-connected computers can serve as a tool for dialogic discussions of text. Technology is well-suited to disrupt the monologic pattern frequently observed in schools, endorsing a dialogic approach by promoting student thinking through networked or shared screens (Rasmussen & Hagen, 2015). In addition, technology can serve as a mediator of talk, providing artifacts for manipulation (Mercer et al., 2019), as well as a dialogic space to visually represent reasoning (Wegerif, 2007). For example, Mercer et al. (2010) conducted a study to determine whether an interactive whiteboard (IWB) could provide a dialogic space for reasoned discussion of science-based problems with elementary students (ages 9 and 10). After listening to a fictional text with an imaginary animal as a protagonist, a small group of students engaged in a discussion about the best habitat for the creature, using the IWB to access information, consider options, plan actions and make a collective decision. Analysis of video and transcripts indicated the IWB supported the development of a dialogic space as

students were able to readily access information to support decision-making and felt more comfortable contributing and changing annotations on the group brainstorm on the IWB. In addition, the study found the IWB made reasoning visible, which allowed for teacher feedback and support.

This visual representation of reasoning was also prevalent in a study with fourth grade students. To study the relationship between the use of a mobile device running a collaboration app (Group Scribbles) and reading comprehension, Lin et al. (2014) compared changes in reading comprehension between an experimental intervention group and a control group. Participants in the experimental group significantly outperformed the control group on the posttest of reading comprehension. Further analysis of the interactions indicated the technology provided a space to persistently hold ideas being discussed and allowed for students to quickly revise ideas under discussion. Taken together, these two studies suggest digital technology has affordances for a text-based discussion and can provide a dialogic space that visually represents reasoning. However, research regarding the use of digital technology to support a dialogic teaching within the domain of reading comprehension is limited, especially in the elementary setting.

Considering the challenges associated with engaging in dialogic teaching in a traditional classroom, there is much to be learned regarding the approach within a remote learning setting, such as the type of learning typical during the COVID-19 pandemic. During instruction in virtual formats, teachers frequently dominated discussion rather than the typical two-way discussion that might occur in face-to-face settings (Leibiger & Aldrich, 2022). This could be attributed to the tendency for teachers to fall back to familiar pedagogical practices, assimilating technology into past practices (Copland & Garton, 2014). Further, there is insufficient research on literacy

instruction in virtual settings on which teachers can rely. Although there is an empirical base for technology and dialogic teaching (Kershner et al., 2010; Mercer et al., 2010), much of the research occurred within co-located settings (i.e., students physically sitting together). COVID-19 has likely changed the role of remote instruction in schools, making research on virtual and teleconferencing environments all the more important (Twiner et al., 2021). Therefore, more research is needed regarding the efficacy of a dialogic teaching within a remote setting. Furthermore, it is important the pedagogy drives the use of the technology (Mercer et al., 2019), even in remote settings.

Teachers would also benefit from opportunities for professional development on dialogic teaching, whether remote or co-located. For example, in a large study involving fourth-grade students from 78 schools, Alexander (2018) studied the effect of dialogic teaching on curriculum achievement within co-located classrooms. Participating schools were randomly assigned to a control condition or a treatment condition, with the treatment condition schools receiving training and coaching for engaging in dialogic teaching. Students in the dialogic condition outperformed students in the control condition in tests of math, science, and language arts. Mercer et al. (2004) conducted a similar study in which classrooms were assigned to either a treatment or control condition, with teachers in the treatment condition receiving professional development and resources for five lessons to support dialogic teaching. Both the treatment and control classrooms taught the same science curriculum. Elementary students in the dialogic classrooms significantly outperformed the control condition on science tests. These examples highlight the importance of supporting teachers in establishing pedagogical approaches. While keeping the pedagogy at the forefront, teachers also need support for implementing the approach using technology that allows for remote or virtual instruction. DeCoito and Richardson (2018)

suggested learners need support by way of guidance and time before the affordances of technologies will be realized.

Current Project

In order to be successful and literate contributors to our democratic society, students need to not only be able to extract information from texts to construct mental representations but also to draw the inferences necessary to engage in well-reasoned and critical evaluation, and to consider multiple perspectives (Beers & Probst, 2017; Reznitskaya & Wilkinson, 2017). Dialogic teaching is an effective approach for supporting the development of higher-order tools necessary for this level of literacy (Kim & Wilkinson, 2019). However, classroom talk that takes a dialogic approach is still not commonplace, and when talk is intentionally used, it is often low-level (Alexander, 2017). This dissertation seeks to support practitioners in the use of dialogic teaching with text-based discussion, supported by digital technology in either co-located or remote settings, to support higher-level reading comprehension.

Component 1 — Systematic Review of the Literature

Given the evidence for the use of text-based discussion in developing reading comprehension (Applebee et al., 2003), as well as the benefits of mediation by technology for dialogic discussion (Kershner et al., 2010; Mercer et al. 2010), the first component of this dissertation involved a systematic review of the literature. The purpose of the systematic review was to examine the literature on the supportive role of technology for discussion in reading comprehension instruction. The researcher coded studies to clarify the current state of research, inform classroom practice, and identify future research needs. Results were analyzed and discussed to inform the current state of the literature on technology-mediated text-based discussion in reading instruction for elementary students.

Component 2 — Comparative Case Study

Despite the importance of exploratory talk for promoting higher level thinking, it is rarely observed in classrooms (Mercer et al., 2019). This is likely due to the difficulty for teachers to support the quality of discussion in simultaneously occurring small groups (Galton et al., 2009). Additionally, exploratory talk builds upon a constructed dialogic space (Maine, 2015), which is challenging to develop. Little is known empirically about the difficulties of supporting high-quality discussion in a remote setting. The purpose of this component was to explore dialogic text-based discussion within a video conferencing environment. The researcher used a case study approach to observe three training conditions, conducting a sociocultural discourse analysis describe changes. Results were presented to provide recommendations for future research opportunities.

Component 3 — Practitioner Piece

Considering the large amount of empirical support for dialogic discussion in comparison to the relative classroom use, and the associated gap in support for dialogic discussion in remote instruction settings, the research conducted within this dissertation is more likely to impact classroom pedagogy if results are presented in an accessible manner for teachers. The purpose of the third component is to share findings and provide practical applications for the classroom in an effort to promote dialogic teaching to classroom teachers, whether in co-located or remote settings. The article provides a rationale and key attributes for using technology to support text-based discussions. It also shares a replicable framework for classroom implementation.

REFERENCES

REFERENCES

Alexander, R. (2017). *Towards dialogic teaching: Rethinking classroom talk* (5th ed.). Dialogos.

Alexander, R. (2018). Developing dialogic teaching: Genesis, process, trial. *Research Papers in Education*, *33*(5), 561–598. https://doi.org/10.1080/02671522.2018.1481140

Applebee, A. N., Langer, J. A., Nystrand, M., & Gamoran, A. (2003). Discussion-based approaches to developing understanding: Classroom instruction and student performance in middle and high school English. *American Educational Research Journal*, *40*(3), 685–730. https://doi.org/10.3102/00028312040003685

Asterhan, C. S. C., Howe, C., Lefstein, A., Matusov, E., & Reznitskaya, A. (2020). Controversies and consensus in research on dialogic teaching and learning. *Dialogic Pedagogy: An International Online Journal*, *8*, 1–16. https://doi.org/10.5195/dpj.2020.312

Beers, K., & Probst, R. E. (2017). *Disrupting thinking: Why how we read matters*. Scholastic.

Cazden, C. B. (1988). *Classroom discourse: The language of teaching and learning*. Heinemann.

Chi, M. T. H. (2000). Self-explaining expository texts: The dual processes of generating inferences and repairing mental models. In R. Glaser (Ed.), *Advances in instructional psychology: Educational design and cognitive science* (pp. 161–238). Erlbaum.

Chinn, C. A., Anderson, R. C., & Waggoner, M. A. (2001). Patterns of discourse in two kinds of literature discussion. *Reading Research Quarterly*, *36*(4), 378–411.

Copland, F., & Garton, S. (2014). Key themes and future directions in teaching English to young learners: Introduction to the special issue. *ELT Journal, 68*(3), 223–230. https://doi.org/10.1093/elt/ccu030

DeCoito, I., & Richardson, T. (2018). Teachers and technology: Present practice and future directions. *Contemporary Issues in Technology and Teacher Education, 18*(2), 362-378.

Diergarten, A. K., & Nieding, G. (2016). Online emotional inferences in written and auditory texts: A study with children and adults. *Reading and Writing*, *29*(7), 1383–1407. https://doi.org/10.1007/s11145-016-9642-z

Duke, N., Pearson, D., Strachan, S., & Billman, A. (2011). Essential elements of fostering and teaching reading comprehension. In S. J. Samuels & A. E. Farstrup (Eds.), *What research has to say about reading instruction* (4th ed., pp. 51–93). International Reading Association.

Freed, J., & Cain, K. (2017). Assessing school-aged children's inference-making: the effect of

story test format in listening comprehension. *International Journal of Language and Communication Disorders*, *52*(1), 95–105. https://doi.org/10.1111/1460-6984.12260

Foorman, B. R., & Torgesen, J. (2001). Critical elements of classroom and small-group instruction promote reading success in all children. *Learning Disabilities Research and Practice*, *16*(4), 203–212. https://doi.org/10.1111/0938-8982.00020

Galton, M., Hargreaves, L., & Pell, T. (2009). Group work and whole-class teaching with 11- to 14-year-olds compared. *Cambridge Journal of Education*, *39*(1), 119–140. https://doi.org/10.1080/03057640802701994

Garas-York, K., & Almasi, J. F. (2017). Constructing meaning through discussion. In S. E. Israel (Ed.), *Handbook of Research on Reading Comprehension* (2nd ed., pp. 500–518). The Guilford Press.

Garas-York, K., Shanahan, L. E., & Almasi, J. F. (2013). Comprehension: High-level talk and writing about texts. In B. M. Taylor & N. K. Duke (Eds.), *Handbook of effective literacy instruction: Research-based practice K–8* (pp. 246–278). The Guilford Press.

Helder, A., Van Leijenhorst, L., & van den Broek, P. (2016). Coherence monitoring by good and poor comprehenders in elementary school: Comparing offline and online measures. *Learning and Individual Differences*, *48*, 17–23. https://doi.org/10.1016/j.lindif.2016.02.008

Johnson, E. M. (2017). Balancing comprehension and conversation: How elementary teachers manage multiple purposes for text discussions. *Teaching and Teacher Education*, *66*, 325–337. https://doi.org/10.1016/j.tate.2017.05.005

Kendeou, P., van den Broek, P., Helder, A., & Karlsson, J. (2014). A cognitive view of reading comprehension: Implications for reading difficulties. *Learning Disabilities Research & Practice*, *29*(1), 10–16. https://doi.org/10.1111/ldrp.12025

Kershner, R., Mercer, N., Warwick, P., & Kleine Staarman, J. (2010). Can the interactive whiteboard support young children's collaborative communication and thinking in classroom science activities? *International Journal of Computer-Supported Collaborative Learning*, *5*(4), 359–383. https://doi.org/10.1007/s11412-010-9096-2

Kim, M. Y., & Wilkinson, I. A. G. (2019). What is dialogic teaching? Constructing, deconstructing, and reconstructing a pedagogy of classroom talk. *Learning, Culture and Social Interaction*, *21*(July 2018), 70–86. https://doi.org/10.1016/j.lcsi.2019.02.003

Kintsch, W., & Rawson, K. A. (2013). Comprehension. In M. J. Snowling & C. Hulme (Eds.), *The science of reading: A handbook* (pp. 211–226). John Wiley & Sons.

Leibiger, C. A., & Aldrich, A. W. (2022). "Making It Happen": Building relational teaching into the online world of COVID-19. *Libraries and the Academy*, *22*(1), 27–51. https://muse.jhu.edu/article/843035

Lin, C. P., Chen, W., Yang, S. J., Xie, W., & Lin, C. C. (2014). Exploring students' learning effectiveness and attitude in Group Scribbles-supported collaborative reading activities: A study in the primary classroom. *Journal of Computer Assisted Learning*, *30*(1), 68–81. https://doi.org/10.1111/jcal.12022

Littleton, K., & Mercer, N. (2013). *Interthinking: Putting talk to work*. Routledge.

Maine, F. (2015). *Dialogic readers: Children talking and thinking together about visual texts*. Routledge.

Matsumura, L. C., Garnier, H. E., & Spybrook, J. (2013). Literacy coaching to improve student reading achievement: A multi-level mediation model. *Learning and Instruction*, *25*, 35–48. https://doi.org/10.1016/j.learninstruc.2012.11.001

McKeown, M. G., Beck, I. L., & Blake, R. G. K. (2009). Rethinking reading comprehension instruction: A comparison of instruction for strategies and content approaches. *Reading Research Quarterly*, *44*(3), 218–253. https://doi.org/10.1598/RRQ.44.3.1

Mercer, N., Dawes, L., Wegerif, R., & Sams, C. (2004). Reasoning as a scientist: Ways of helping children to use language to learn science. *British Educational Research Journal*, *30*(3), 359–377. https://doi.org/10.1080/0141192041000168968 9

Mercer, N., Hennessy, S., & Warwick, P. (2019). Dialogue, thinking together and digital technology in the classroom: Some educational implications of a continuing line of inquiry. *International Journal of Educational Research*, *97*, 187–199. https://doi.org/10.1016/j.ijer.2017.08.007

Mercer, N., Warwick, P., Kershner, R., & Staarman, J. K. (2010). Can the interactive whiteboard help to provide 'dialogic space' for children's collaborative activity? *Language and Education*, *24*(5), 367–384. https://doi.org/10.1080/09500781003642460

Murphy, P. K., Greene, J. A., Firetto, C. M., Hendrick, B. D., Li, M., Montalbano, C., & Wei, L. (2018). Quality talk: Developing students' discourse to promote high-level comprehension. *American Educational Research Journal*, *55*(5), 1113–1160. https://doi.org/10.3102/0002831218771303

National Center for Education Statistics. (2019). *National assessment of educational progress.* Retrieved from http://nces.ed.gov/nationsreportcard/naepdata/

Nystrand, M. (2006). Research on the role of classroom discourse as it affects reading comprehension. *Research in the Teaching of English*, *40*(4), 392–412. https://doi.org/10.2307/40171709

O'Connor, C., & Snow, C. (2017). Classroom discourse: What do we need to know for research and for practice? In M. F. Schober, D. N. Rapp, & M. A. Britt (Eds.), *The Routledge handbook of discourse processes* (2nd ed., pp. 315–342). Routledge. https://doi.org/10.4324/9781315687384

Peterson, D. S. (2019). Engaging elementary students in higher order talk and writing about text. *Journal of Early Childhood Literacy*, *19*(1), 34–54. https://doi.org/10.1177/1468798417690918

Rabiner, D. L., Godwin, J., & Dodge, K. A. (2016). Predicting academic achievement and attainment: The contribution of early academic skills, attention difficulties, and social competence. *School Psychology Review*, *45*(2), 250–267. https://doi.org/10.17105/SPR45-2.250-267

Rasmussen, I., & Hagen, Å. (2015). Facilitating students' individual and collective knowledge construction through microblogs. *International Journal of Educational Research*, *72*, 149–161. https://doi.org/10.1016/j.ijer.2015.04.014

Reninger, K., & Wilkinson, I. A. G. (2009). Using discussions to promote striving readers' higher level comprehension of literary texts. In J. L. Collins & T. G. Gunning (Eds.), *Building Struggling Students' Higher Level Literacy: Practical Ideas, Powerful Solutions* (pp. 57–83). International Reading Association. https://doi.org/10.1598/0687.03

Resnick, L. B., Asterhan, C. S. C., & Clarke, S. N. (2018). *Accountable talk: Instructional dialogue that builds the mind.* The International Academy of Education (IAE) and the International Bureau of Education (IBE) of the United Nations Educational, Scientific and Cultural Organization (UNESCO). Retrieved from https://unesdoc.unesco.org/ark:/48223/pf0000262675

Reznitskaya, A., & Wilkinson, I. A. (2017). *The most reasonable answer: Helping students build better arguments together*. Harvard Education Press.

Rojas-Drummond, S., Mazón, N., Littleton, K., & Vélez, M. (2014). Developing reading comprehension through collaborative learning. *Journal of Research in Reading*, *37*(2), 138–158. https://doi.org/10.1111/j.1467-9817.2011.01526.x

Rosenblatt, L. M. (1978). *The reader, the text, the poem: The transactional theory of the literary work.* Southern Illinois University Press.

Serafini, F. (2012). Rethinking reading comprehension: Definitions, instructional practices, and assessment. In E. Williams (Ed.), *Critical issues in literacy pedagogy: Notes from the trenches* (pp. 189–202). Illinois State University Press.

Soter, A. O., Wilkinson, I. A. G., Murphy, P. K., Rudge, L., Reninger, K., & Edwards, M. (2008). What the discourse tells us: Talk and indicators of high-level comprehension. *International Journal of Educational Research*, *47*(6), 372–391. https://doi.org/10.1016/j.ijer.2009.01.001

Tapiero, I. (2007). *Situation models and levels of coherence: Toward a definition of comprehension*. Lawrence Erlbaum Associates.

Tennent, W. (2015). *Understanding reading comprehension: Processes and practices*. Sage.

Twiner, A., Littleton, K., Whitelock, D., & Coffin, C. (2021). Combining sociocultural discourse analysis and multimodal analysis to explore teachers' and pupils' meaning making. *Learning, Culture and Social Interaction*, *30*(PA), 100520. https://doi.org/10.1016/j.lcsi.2021.100520

Vrikki, M., Wheatley, L., Howe, C., Hennessy, S., & Mercer, N. (2019). Dialogic practices in primary school classrooms. *Language and Education*, *33*(1), 85–100. https://doi.org/10.1080/09500782.2018.1509988

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes.* Harvard University Press.

Wegerif, R. (2007). *Dialogic education and technology*. Springer. https://doi.org/10.1007/978-0-387-71142-3

Wells, G. (2007). Semiotic mediation, dialogue and the construction of knowledge. *Human Development*, *50*(5), 244–274. https://doi.org/10.1159/000106414

Wilkinson, I. A. G., Reznitskaya, A., Bourdage, K., Oyler, J., Glina, M., Drewry, R., Kim, M. Y., Nelson, K. (2017). Toward a more dialogic pedagogy: Changing teachers' beliefs and practices through professional development in language arts classrooms. *Language and Education*, *31*(1), 65–82. https://doi.org/10.1080/09500782.2016.1230129

Zhang, M., Trussell, R. P., Gallegos, B., & Asam, R. R. (2015). Using math apps for improving student learning: An exploratory study in an inclusive fourth grade classroom. *TechTrends*, *59*(2), 32–39. https://doi.org/10.1007/s11528-015-0837-y

CHAPTER 2 – SYSTEMATIC REVIEW OF THE LITERATURE

Abstract

The collaborative discussion of text is an important method for developing reading comprehension for elementary students. Dialogic teaching uses talk as a tool for the joint construction of knowledge, and digital technology is a particularly supportive tool. However, little is known about the specific application of technology-supported dialogic discussion in elementary reading comprehension. This systematic literature review sought to determine the current state of the literature in an effort to recommend pathways for future research and to inform classroom practice. Researchers found a total of 17 studies of technology-supported dialogic discussion with upper elementary students through the inclusion process, with 10 involving small group discussion, 2 involving whole group discussion, and 6 involving a mixture of small and whole group discussion. Researchers describe the differences in studies across discussion group size, implications for practice, the utility of the studied technology, and the quality of study design.

Systematic Review of the Literature on Digital Technology-Supported Dialogic Discussion to Support Reading Comprehension

Collaborative discussion is an important means of developing reading comprehension for elementary students. According to the Common Core State Standards (CCSS), collaborative discussion about texts should be present in all classrooms beginning right away in kindergarten (NGA/CCSSO, 2010). Within the CCSS, expectations for discussion increase in third grade, and students are expected to engage effectively in small group discussions that are not facilitated by a teacher, to come to the discussion prepared to talk, and to critically explore the ideas under discussion (NGA/CCSSO, 2010). In further support of the need for collaborative discussion, the U.S. Department of Education's What Works Clearinghouse Practice Guide identified the high-quality discussion of text as one of five research-supported recommendations for improving reading comprehension in kindergarten through third grade (Shanahan et al., 2010).

Reading Comprehension

Researchers have studied the role of discussion in developing higher-level reading comprehension. For example, in a study comparing a discussion-based program with a control condition, Rojas-Drummond et al. (2014) facilitated a yearlong intervention in which upper elementary students collaboratively read and discussed texts with an emphasis on establishing coherent mental representations—a semantic understanding beyond literal text recollection (Kintsch, 1998). Students in the treatment condition outperformed students in the control condition in the ability to abstract the gist of texts and generate a coherent mental representation independently, suggesting the collaborative discussions promoted the development of comprehension processes that students were able to apply independently.

Similarly, Lynch and van den Broek (2007) examined how the verbalization of student thinking through think-aloud protocols affected the mental representation of text in individual elementary students. They found verbalization of character inferences was related to the recollection and mental representation of the text. That is, thinking aloud to make inferences about a character's goal was a valuable comprehension process. Thus, promoting discussions in which students share thinking about a text can influence their independent thinking.

Despite the support for including discussion in literacy instruction, many scholars discovered a limited uptake of the instructional practice within schools (Applebee et al., 2003; Galton, 2009; Wilkinson et al., 2017). In fact, discussion is extremely rare in classrooms, often lasting less than 2 min. per class, and generally with only high-performing or privileged populations (O'Conner et al., 2017). Typically, a more transmissive mode of interaction persists in classrooms through which the teacher asks questions with specific answers in mind (Sedova et al., 2016). Researchers hypothesized multiple reasons for the lack of discussion including limited exposure to a discussion-based pedagogy for teachers in pre-service training or as students themselves (Sedova et al., 2016), the complexities associated with changing from questioning for the recollection of facts to reasoning-based discussions (Alexander, 2017), the pressures associated with preparing students for standardized assessments (Aukerman, 2007), and a lack of understanding of the purpose and broader framework for classroom discussion (Howe & Abedin, 2013). If high-quality discussion is an important goal, teachers need to enact an effective pedagogical approach, specifically an approach focused on the construction of comprehension and inference making (Tennent, 2015).

Dialogic Teaching and Reading Comprehension

Dialogic teaching is an instructional approach that leverages the power of collaborative and engaged classroom discussion with the purpose of jointly constructing knowledge and understanding (Mercer et al., 2019). An essential attribute is that discussion is used with intentionality to advance higher-level thinking (Sedova et al., 2014). Embedded within the approach is the notion that not only do students share and justify perspectives, but they also seek to understand differing ideas, revising or deepening their own viewpoints in doing so (Asterhan et al., 2020). Research further highlights this need for students to see value in their own perspective along with the perspectives of their classmates, with discussion serving to negotiate meaning and work towards consensus (Daniel et al., 2005; Mason, 2001). For example, Daniel et al. (2005) engaged upper elementary student in a yearlong intervention of small group discussions based upon on critical questions students generated about a text. Questions consisted of open-ended inquiries designed to draw out differing perspectives (e.g., questions beginning with, "Why do you think…?"). Findings indicated students improved higher-level thinking skills because of the pedagogical approach. Mason (2001) also studied dialogic discussion with fourth-grade students in the domain of science. Researchers found students constructed a joint understanding about science topics in small groups, and students experienced conceptual changes individually. Changes were attributed to high levels of reasoning and arguing about differing perspectives within a small group setting.

Dialogic teaching is built upon the presence of exploratory talk—critical discussion where ideas are actively sought, and disagreement is productive and designed to intentionally change or understand the thinking of others (Barnes, 1992). The necessary conditions for exploratory talk to occur require established ground rules for talk (Mercer et al., 1999), reflection

on the talk processes and application of the ground rules (Phillipson & Wegerif, 2020), and open-ended or partially structured tasks designed to inspire meaningful discussion (McGregor, 2008). When investigating the effects of promoting exploratory talk in the dialogic classroom, researchers demonstrated enhanced problem solving and reasoning ability in students (Mercer et al., 1999; Rojas-Drummond et al., 2014; Topping, & Trickey, 2014; Webb et al., 2017). For example, Wegerif et al. (1999) found elementary students improved individual reasoning ability after engaging in exploratory talk within small-group critical discussions for or against different provided scenarios. Exploratory talk was explicitly taught, modeled, practiced, and reinforced. Similarly, Webb et al. (2017) evaluated the effect of teaching exploratory talk on students' reasoning ability across content areas, as measured by the Raven's test of reasoning and problem-solving ability. Students engaged in class discussions of teacher-provided topics designed to promote exploratory talk (i.e., responses to readings, concept cartoons, word problems). Researchers found a positive relationship between exploratory talk and increases in posttest scores on the Raven's test. This suggests collaborative discussions in which exploratory talk was present led to increases in individual reasoning ability.

Exploratory talk also expands and stimulates the understanding and thinking of readers (Rojas-Drummond et al., 2017). In a study of the impact of small-group discussion on reading high-level comprehension, fourth-grade students participated in lessons on elements of discourse (e.g., questioning, responding) as well as weekly text-based discussions. Across the year, researchers found the discussions contributed to increased exploratory talk as well as increases on individual tests of reading comprehension. As evidenced by these studies, the benefits of dialogic teaching are built upon and necessitate high-quality discussions involving exploratory talk (Alexander, 2017).

Despite its benefits, however, exploratory talk is not always easy to develop. In a systematic review of research on classroom dialogue, Howe and Abedin (2013) found the promotion of exploratory talk is difficult for teachers. One possible reason suggested was the challenge teachers face to effectively scaffold student talk in small groups, especially since it requires careful monitoring on the individual contribution students make to the group discussion. While further teacher training might provide the development of instructional moves that scaffold discussion, Maine (2015) suggested teachers are already inundated with ideas for improving practice. Technology, on the other hand, can be present in each small group. It can initiate and direct group discussion, transferring responsibility to students and embedding the vicarious presence of the teacher's rules, procedures, and established practices—making direct facilitation by the teacher unnecessary (Warwick et al., 2013).

Digital Technology and Dialogic Teaching

Digital technology is particularly supportive of dialogic discussion due to its interactive nature. The technology can create digital artifacts and historical data that represent the emerging shared thinking occurring within the dialogic space (Lin & Kelsey, 2009). These digital artifacts afford new types of thinking as learners publicly share, justify, critique, and reformulate ideas (Mercer et al., 2019). The artifacts can also support or inhibit patterns of action within a dialogic setting, allowing for meaning to be communicated through talk, gaze, and gesture (Hennessy, 2011). For example, Kerawalla et al. (2013) compared classroom dialogue with and without the use of a mediating technology in two elementary classrooms. Within a science unit of study, students participated in eight discussions, followed by eight technology-mediated discussions. Analysis of video recordings indicated the graphical representations afforded by the technology facilitated a higher incidence of exploratory talk and an increase in feedback on contributions.

Sakr (2018) had similar findings when comparing technology as a mediating tool with analog mediating tools (e.g., paper, sticky notes, and charts). In a study of collaborative interaction comparing the use of an iPad with pens and paper with elementary students, Sakr found patterns of interaction were influenced by the modality of collaborative engagement. The novelty of the visual interactions on the iPad helped students maintain focus on the task, and the format of the display enhanced collaborative behaviors due to the portability and size constraints. This suggests the technology provided a structured participation framework conducive to collaboration; technology mediates shared thinking.

Present Study

While digital technology supports the use of exploratory talk, less is known about the role of digital technology in the dialogic discussion of elementary students, specifically in constructing a mental representation. Given the evidence for the use of dialogic discussion in developing reading comprehension, as well as the benefits of mediation by technology, in this systematic review researchers examined the literature associated with digital technology to support dialogic discussion in elementary reading comprehension. The findings could be used to identify the current state of empirical evidence, provide insight to inform classroom pedagogy, and highlight gaps in research literature. With this systematic review, the researchers aimed to answer the following questions: (a) How has technology-supported dialogic discussion been studied? What differences among group size (small group, whole group, mixed group) exist in the facilitation of talk and the design of the task?, (b) What implications for practitioners can this body of research provide regarding the role of the dialogic task, the dialogic processes, and the use of technology?, (c) What is the utility of the included technology for dialogic discussion with

regards to accessibility, practicality, and support for teachers?, and (d) What is the quality of included studies?

Method

Article Selection

This study was situated within the domains of dialogic teaching and technology-supported collaborative learning, and focused on elementary students in general education settings. For the purpose of this study, the authors operationally defined dialogic teaching as instruction involving discussion (e.g., teacher-led or student-led) in either small-group or whole-class settings in which the discourse was a key element to promote learning (Mercer et al., 2019).

To find studies, the authors conducted a keyword search using combinations of words related to dialogic teaching, digital technology, and knowledge construction. One word from each category was used in a search within both the ERIC database via EBSCO and the Proquest databases, using * to search across inflected endings using the following terms:

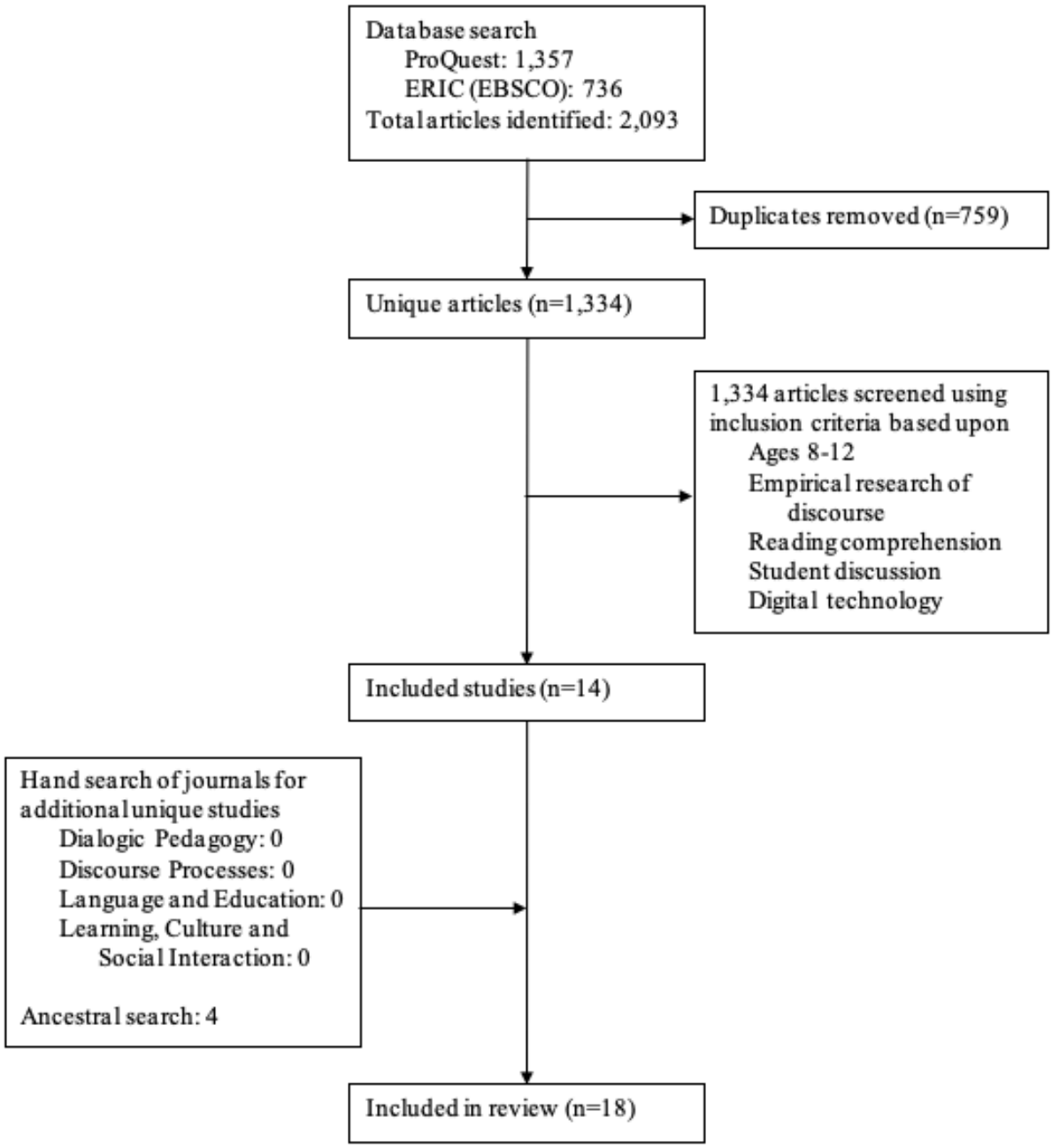
> (dialogic OR "classroom discussion" OR "small group discussion" OR "exploratory talk" OR "philosophy for children" OR "accountable talk" OR "thinking together" OR "classroom dialogue" OR "text-based discussion" OR "quality talk" OR "student talk" OR "classroom talk" OR discourse OR "student discussion" OR dialogue OR "peer collabora*" OR interthinking) AND (computer OR tablet OR "interactive whiteboard" OR IWB OR software OR technology OR iPad OR Chromebook OR laptop OR mobile OR "web-based" OR online) AND (comprehension OR recall* OR retell* OR inferen* OR reason* OR collaborat* OR knowledge OR understanding OR construct* OR "meaning making" OR "literate thinking")

To narrow the results within the database results, the researchers applied the following inclusion criteria to electronically filter: (a) published between 2000 and 2020; (b) appeared in a peer-reviewed journal; and (c) written in English. Searches were conducted with each database, using all possible combinations of keywords. This process of searching with keywords yielded 736 articles from ERIC via EBSCO and 1,357 via Proquest (see Figure 2.1 for a PRISMA like diagram). Additionally, the same keywords were used to hand-search four journals that frequently published studies identified through the database search: *Dialogic Pedagogy, Discourse Processes, Language and Education,* and *Learning, Culture and Social Interaction.* The hand search did not result in the finding of any additional studies.

To further evaluate studies to include, each study was read to evaluate the following inclusion criteria: (a) targeted upper elementary (students from age 8 to 12 or grades 3 through 6) in a formal classroom setting (i.e., traditional classroom) or informal classroom setting (i.e., laboratory setting, after school clinic, or camp); (b) research using discourse in learning as the primary focus of the study, operationalized as oral discussion among students during a learning task; (c) focused on reading comprehension, defined as constructing meaning from a text; (d) involved oral discussion among peers as opposed to teacher-directed question-answer formats of discussion; and (e) use of digital technology (i.e., computer or mobile device such as a tablet or laptop) within a collaborative task. Identified records were imported into the Rayyan systematic review software (Qatar Computing Research Institute) for screening. Studies that did not meet all of the inclusion criteria were excluded from the review. A second coder conducted a blind screening with a 20% sample (N=275), resulting in 95.6% interobserver agreement. In all, the review resulted in the inclusion of 14 articles. Finally, the researchers conducted an ancestral

Figure 2.1

Article Selection Process



search of the reference lists of the 14 included studies resulting in an additional 4 studies, bringing the total to 18 studies.

Coding of Included Studies

The first author read studies meeting the inclusion criteria in their entirety and coded them for both study features and study quality. To determine the reliability of extracted data, a research assistant independently coded a sample of five randomly selected studies included in this review. The research assistant, an early literacy instructional coach with 28 years of experience at a public school district, has a master's degree in literacy. Extracted data and codes were compared, and interobserver agreement was calculated separately for study features (IOA = 82.9%) and study quality (IOA = 88.0%). Any discrepancies were resolved through discussion.

Study Features

To summarize and compare included studies, researchers coded the studies based upon elements of instructional decisions or design, environment, task structure, and methodology.

Instructional Design. Researchers collected descriptions of instructional elements for supporting dialogue regarding ground rules, exploratory talk, and group reflection. In addition, researchers coded the primary facilitator of the group discussion in each study as completely teacher-led, completely student-led, or a combination. Additionally, the time span for the whole study, frequency of the study sessions, and number of minutes per session were noted. Finally, any information regarding the extent to which the study fit within the typically occurring curriculum was documented.

Environmental Factors. Environmental factors within each study were noted. Researchers collected information about the technology or technological tool used in each study, specifically noting the digital device and the software used when available. Researchers coded

group size as whole class discussion, small group discussion, or a combination of the two. The number of students within a discussion group was recorded for each study, as well as any additional information regarding grouping decisions (e.g., combinations of students).

Dialogic Task. Researchers noted the school subject in which the study occurred, and coded the text type used in the study as literary text, informational text, multimedia text, or other. The task structure was coded as prescriptive, partially structured, or open (McGregor, 2008), and any information regarding the creator of the task was collected (e.g., researcher created, teacher created). Also, the function of the technology was coded as directly facilitating or influencing discussion, or providing a space or tool for collaboration or creation.

Research Design. Researchers recorded the grade level or age of students involved, and collected any other descriptions of the participants or school. Researchers coded the approach of each study as experimental or descriptive, and noted the study methodology (i.e., qualitative, mixed-methods, or quantitative). Additionally, researchers coded sources of data as video, transcript, test, survey, interview, field notes, or other source. Researchers summarized the data analysis and the findings for each study. Finally, research questions or aims of each study were collected, main findings were carefully documented, and any affordances of technology identified by the study was documented.

Study Quality

Researchers evaluated each study using a quality criteria checklist. While there are no universally agreed-upon guidelines for quality indicators in systematic reviews, establishing transparency in methods for evaluating quality can reduce bias (Talbott et al., 2018). In order to assess the quality of the included studies, researchers used the standards developed by Risko et al. (2008). The three standards consider: (a) argument; (b) methodology; and (c) findings (Risko

et al., 2008). The standards encompass quality criteria designed to evaluate either quantitative or qualitative studies; all criteria must be met to signify high quality.

Argument. According to Risko et al. (2008), a quality study presents a clear argument linking theory and research as well as a coherent chain of reasoning. To demonstrate, a study must explicate theory and previous research in order to develop a research question, and the research question, purpose or objective must be empirically investigated. Evidence includes clear explanation of how the study builds on previous work, and must explicitly link to previous research, theory, or argument.

Methodology. Risko et al. (2008) suggested high-quality research applies a rigorous, systematic, and objective methodology, and findings are valid, reliable, and relevant to educational settings. To assess the methodology, the study must present experimental methods with enough detail to be replicated in a quantitative study, or followed in the case of data analysis in a qualitative study. This includes a clear explanation of procedures in the intervention, and describes any tools or materials involved. Measurements or observational methods must be reliable, credible, and trustworthy, with several aspects of data collection and analysis provided. Data analysis must be appropriate for the study design, and data must be provided to demonstrate whether statistical assumptions have been met. Additionally, the study must provide a description of the participants (Risko et al., 2008).

Findings. Finally, quality studies present findings, making claims with support from the methods used in the study (Risko et al., 2008). To evaluate the quality of the findings, results and discussions must be consistent with the question or purpose of the study, and whether findings were consistent for the data collected. This is demonstrated by explicit connections to the

research question, relevant theory, data analysis, or other analysis (e.g., discourse analysis; coded field notes).

Results

Information is provided in Appendix A about each of the 18 studies that met all the inclusion criteria. Of the included articles, ten involved small group discussions, two involved whole group discussions, and six studies involved a mixture of small and whole group discussions. Ten studies occurred in the United Kingdom, two in Australia, and one each in Spain, Mexico, Singapore, Cyprus, Israel, and the United States. Students in the included studies ranged in age from 7 to 12 years, with the most frequent ages across studies between 9 and 10 years old.

A total of 64 intact classrooms participated in the 18 studies, with 16 reporting individual participant data for a total of 644 students. Two studies did not report individual participants, and one study did not report the number of classrooms. Seven of the studies involved science topics, seven involved general literacy instruction, one on role models within a religious studies class, two on social studies, and the last a wide range of subject areas. The studies varied in research approach and task design (see Table 2.1). Studies ranged from one single session (e.g., Mercer et al., 2003) to 26 sessions (Aflalo et al, 2018) with a median of 6.5 observed sessions.

Existing Literature on Technology-Supported Dialogic Discussion

The grouping sizes (i.e., small group discussion, whole group discussion, mixture of small and whole group) indicated differing approaches for implementing text-based discussion in the classroom. Nine of the ten studies involving small group discussion involved discussion facilitated by students, with only Knight and Mercer (2014) using a mixture of student and teacher facilitated talk (see Table 2.1). Likewise, nine of the ten studies incorporated the use of

Table 2.1

Study Design and Task Structure

Study	Study Method	Ages	Classes	Duration[a]	Task Creator	Relation to Curriculum	Facilitator	Task Structure[b]	Ground Rules	Group Reflection	Tech[c]
					Small Group						
Druin et al., 2003	Experimental	7-9		Short	Researcher	Novel	Student	Partially Structured	N	N	Specific
Fernández-Cárdenas, 2004	Descriptive	9-10	1	Long	Researcher	Embedded	Student	Partially Structured	Y	N	Generic
Knight & Mercer, 2014	Descriptive	11-12	1	Short	Researcher	Novel	Student & Teacher	Partially Structured	Y	N	Generic
Mercer, 1994	Descriptive	5-13	15	Short	Teacher	Embedded	Student	Open	Y	N	Generic
Mercer et al., 2003	Experimental	10-11	18	Short	Researcher	Novel	Student	Partially Structured	Y	N	Specific
Mercer et al., 2010	Descriptive	9-10	12	Short	Teacher	Embedded	Student	Open	Y	N	Generic
Pifarré & Kleine Staarman, 2011	Descriptive	9-10	1	Long	Researcher & Teacher	Embedded	Student	Partially Structured	Y	Y	Generic
Rojas-Drummond et al., 2008	Descriptive	9-10	2	Long	Researcher	Novel	Student	Partially Structured	Y	N	Generic
Warwick et al., 2010	Descriptive	8-10	12	Short	Teacher	Embedded	Student	Partially Structured	Y	N	Generic
Wegerif, 1996	Experimental	9-10	2	Long	Researcher	Novel	Student	Partially Structured	Y	N	Specific

Table 2.1 (cont'd)

Study	Study Method	Ages	Classes	Duration[a]	Task Creator	Relation to Curriculum	Facilitator	Task Structure[b]	Ground Rules	Group Reflection	Tech[c]
					Whole Group						
Maher, 2012	Experimental	8-11	2	Long	Researcher & Teacher	Novel	Student & Teacher	Partially Structured	N	N	Generic
Nachowitz & Brumer, 2014	Experimental	Grade 6	1	Long	Researcher	Novel	Teacher	Partially Structured	N	Y	Specific
					Mixed Group						
Aflalo et al., 2018	Descriptive	Grade 6	2	Short	Teacher	Embedded	Student & Teacher	Prescriptive	N	N	Generic
Cook et al., 2019	Descriptive	11-12	1	Short	Teacher	Embedded	Student & Teacher	Open	Y	N	Specific
Gillen et al., 2007	Descriptive	7-11	4	Short	Teacher	Embedded	Teacher	Prescriptive	N	N	Generic
Karawalla, 2013	Experimental	9-10	2	Long	Researcher	Novel	Student & Teacher	Partially Structured	Y	N	Specific
Looi et al., 2010	Experimental	Mean =10	2	Long	Researcher & Teacher	Embedded	Student	Open	N	N	Specific
Valanides & Angeli, 2008	Descriptive	Grade 6	1	Short	Researcher	Novel	Student & Teacher	Prescriptive	N	N	Specific

[a]Short refers to 1-5 sessions, Long refers to more than 5 sessions
[b]*McGregor, 2008*
[c]*Specific refers to a program or app designed to support dialogue, Generic refers to a general tool with many uses beyond supporting dialogue (e.g., Word Processor)*

ground rules for talk, with Druin et al. (2003) as the only exception. Two included studies involved discussion as a whole class only without the use of any small group discussion (Maher, 2012; Nachowitz & Brumer, 2014). Both studies were structured for the whole group to facilitate their own discussion (i.e., not directly facilitated by the classroom teacher), although neither study mentioned the use of specific talk rules designed to promote reasoning. Finally, four of the six studies involving a mixture of small and whole group discussion followed a model in which the teacher facilitated whole class discussions and students facilitated small group discussions, with only Gillen et al. (2007) and Looi et al. (2010) relying on student facilitated discussion. In all the mixed-group studies, the whole group discussion served as either an initiating event or reflection that launched or built upon the small group discussion in which students engaged. Two of the mixed-group studies incorporated the use of ground rules within the discussion (Cook et al., 2019; Karawalla, 2013).

Small Group Discussion Task Design

Two of the small group studies involving student-facilitated discussion used an open task (i.e., no structured support; Mercer, 1994; Mercer et al., 2010). Both studied patterns and features of talk as students used technology in dialogic tasks. For example, after observing 15 teachers using a variety of software, Mercer (1994) found the quality of student interaction was influenced by the software design and physical layout of the computer, the way tasks were introduced and reinforced, and the use of ground rules for talk.

Eight of the small group studies included a task characterized as partially structured (i.e., providing some in-task support for effective dialogue among students; Druin et al., 2003; Fernández-Cárdenas, 2004; Knight & Mercer, 2014; Mercer et al., 2003; Pifarré & Kleine Staarman, 2011; Rojas-Drummond et al., 2008; Warwick et al., 2010; Wegerif, 1996). In the

included studies, researchers and teachers structured the teaching by focusing on the dialogic task, the processes associated with talk, and the use of technology. For example, the task used by Mercer et al. (2003) focused on creating decision points requiring agreement from the students in the group before continuing. In this way, the task required all points of view in the group to be considered. Pifarré & Kleine Staarman (2011) structured the talk processes by setting up ground rules, providing students with aligned sentence stems, by reinforcing the ground rules frequently while students were engaged in discussion, and facilitating group reflections on their use of the ground rules. Warwick et al. (2010) studied the ways in which teachers use technology to structure dialogue. They identified affordances of technology that were frequently used by teachers: object manipulation, external memory, provisionality, and embedded cues.

Whole Group Discussion Task Design

Both whole group studies used a partially structured task (Maher, 2012; Nachowitz & Brumer, 2014). Both involved the reading and discussing of text and both involving the reading and discussing of student-created content. For example, Nachowitz & Brumer (2014) designed a task through which students posted thinking about a class novel on an online forum, selecting from potential thought stems to strengthen the response. Then, without any intervention from the teacher, students selected ideas from the forum posts to engage in verbal discussion. The task provided some structure while still leaving the students to make decisions.

Mixed Group Discussion Task Design

Of the six studies involving a mixture of whole group and small group discussion (see Table 2.1), three used a prescriptive or highly-structured task design (Aflalo et al., 2018; Gillen et al., 2008; Valanides & Angeli, 2008). This type of task design directed students to follow practical steps to demonstrate a known solution. For example, in observations of teachers using

an IWB, Aflalo et al. (2018) observed a teacher-created dialogic task in science. The teacher first facilitated a whole class discussion of students preconceived ideas about what the circulatory system is, writing student responses on a PowerPoint slide. After engaging in learning with a digital book, a video, and a presentation, students met in small groups to correct errors on the PowerPoint presentation. Gillen et al. (2008) observed a whole class discussion of the steps for writing a recipe. The teacher asked a series of questions about the steps in the recipe, inviting students to answer. After putting a template on the IWB and giving a copy for students to fill in, small groups collaborated to write their recipe. Valanides and Angeli (2008) structured a task for students to demonstrate conceptual change about light, vision and color, with the software controlling the steps students were required to take to reach the solution. Student discussion at the computer was limited. The researchers argued the students would have benefitted from question and reflection prompts to facilitate discussion as well as a task requiring student collaboration that was integrated within the classroom curriculum.

The three other mixed-group studies involved the use of a partially-supported task (Kerawalla, 2013) or a fully-open task (Cook et al., 2019; Looi et al., 2010). The open tasks provided a description of a problem for discussion without any structured support. One task designed by Looi et al. (2010) asked students to brainstorm different ways to allow light to reach a plant in a deep dark container. Cook et al. (2019) asked students to discuss their impact on the environment on a typical day. Kerawalla (2013) provided a task with partial support using software designed to visualize the use of ground rules. The tool provided visual reminders about and feedback on the use of ground rules during their discussion within the task, such as while students designed a science investigation that represents a fair test.

Role of the Dialogic Task, the Dialogic Processes, and Use of Technology

Indirect Scaffolding through Task Design

Several studies described the process by which teachers influenced student talk, providing indirect scaffolding by way of task design. Warwick et al. (2010) observed teacher-designed IWB tasks that included directions, suggestions, and questions, and found successful interactions were influenced by decisions teachers made about technology use within the task, such as including access to lesson resources or multimedia. Mercer et al. (2010) found teachers indirectly supported discussion through the design of IWB tasks by sequencing and arranging material used by students completing the task. Mercer (1994) found an interaction among the joint activity, the talk, and the computer-based activity. Similarly, Fernández-Cárdenas (2004) as well as Pifarré and Kleine Staarman (2011) designed tasks that influenced student talk, involving the online creation of an informational text related to the curriculum. Using a task designed for students to create a website about Victorian times, Fernández-Cárdenas (2004) found the perceived purpose of the task affected the quality of the talk. Higher quality interactions were associated with groups considering the conventions and values of an authentic audience for their text as compared to groups engaged in discussion to simply create the text.

Druin et al. (2003) studied the role of task design on discussion. They compared tasks involving pairs of students using a digital library of animal facts on a computer with two mice. One task allowed for either computer mouse to click on an object, and the other required 'confirmation collaboration' in which both mice had to click on an object to continue. The results indicated the confirmation collaboration shifted discussion to become more functional, whereas the single selection condition resulted in richer discussion focused more upon the sharing of thinking.

Supporting Dialogic Processes

Most of the included studies included some method for supporting the process of engaging in dialogic discussion, often through some form of ground rules for talk to promote reasoning and exploratory talk. For example, Mercer and colleagues (2010) provided training on and resources from the Thinking Together program before the beginning of the study to allow for teachers to develop awareness and skills in collaborative talk with their students. Teachers spent two lessons developing the ground rules with the students, then began each dialogic teaching lesson reviewing the rules, asking students to pick a tricky rule to provide focus for their talk.

Likewise, Nachowitz and Brumer (2014) explored ways to extend and develop an idea about a text. The intervention consisted of web forum-based discussions as well as face-to-face discussions using the forum posts as a resource. Students frequently engaged in reflection of the process of talk as a method for improving the quality of discussion. They found the intervention was successful in supporting students to analyze and interpret a narrative text and to provide text-based justification for reasoning. Pifarré & Kleine Staarman (2011) found providing students time to reflect independently and write initial ideas before engaging in discussion enabled all members to participate in the dialogic discussion more fully.

Using Affordances of Technology

Several studies highlighted affordances of technology in supporting discussion, facilitating dialogic interactions that changed the nature of the discussion itself. Kerawalla et al. (2013) found the use of Talk Factory—software designed to facilitate the use of ground rules—led to an increase in students challenging and exploring ideas. Looi et al. (2010) found the use of GroupScribbles—software designed to coordinate interaction among students—led to an increase in participation and interaction with ideas.

Two studies explored the mediating function of technology for dialogic discussion to the extent that technological affordances directly influenced talk (Cook et al., 2019; Gillen et al., 2007). These two studies argued affordances of technology provide promising opportunities for mediating discussion in concert with the pedagogical approach of the teacher. To increase exposure to differing ideas and perspectives, Cook et al. (2019) incorporated the browsing of TalkWall posts. Students used TalkWall to widen their dialogic space by considering ideas from outside their group, and deepen their dialogic space by sorting the contributions on the technology. Gillen et al. (2007) studied the extent to which teachers use IWB affordances to reach pedagogic goals. They argued features of technology (e.g., shared representation of content) have potential for influencing the quality of pedagogic dialogue.

Several studies described meditative affordances of technology for talk such as artifacts of group thinking and perspectives for asynchronous individual reflection (Cook et al., 2019), visual representation of ideas and discourse (Valanides & Angeli, 2008), organization of collaborative work (Cook et al., 2019; Valanides & Angeli, 2008), artifacts for manipulation (Gillen et al., 2007), supporting exploratory talk (Kerawalla, 2013), and digital network connections between groups (Looi et al., 2010). See Table 2.2 for a description of affordances presented across studies. According to Cook et al. (2009), affordances are likely contextualized and therefore are not meant to suggest transferability across tools or tasks.

However, the potentially beneficial features of technology are not sufficient in supporting dialogic discussion. Both Mercer et al. (2003) and Wegerif (1996) conducted experimental studies of student interactions around the same program, called ‘Kate’s Choice.’ The software was designed to prompt students to discuss character actions and perspectives, then make collective decisions about what the character should do next. Wegerif (1996) found the software

Table 2.2
Affordances of Technology Identified in Studies

Affordance	Description	Study
Provisionality	Tentative contribution of an idea; Ability to change easily to represent the current thinking of the group	Cook et al., 2019; Gillen et al., 2007; Mercer et al., 2010
Resourcing	Linking to previous or relevant resources	Gillen et al., 2007; Mercer et al., 2010
Multimedia	Interactive media to expand possibilities within the task	Aflalo et al., 2018; Gillen et al., 2007
Annotation	Annotate content to account for developing discussion	Aflalo et al., 2018; Mercer et al., 2010
Object Manipulation	Direct contact or manipulation of words, pictures, or other artifacts to organize or manipulate ideas	Aflalo et al., 2018; Cook et al., 2019; Maher, 2012; Warwick et al., 2010
Artifacts	Visual representation of ideas used to externalize thinking, mediate discourse, and represent the contributions of students	Cook et al., 2019; Gillen et al., 2007; Mercer et al., 2003; Mercer et al., 2010; Valenides & Angeli, 2008
Assistive Memory	Represent relevant information to reduce the reliance on working memory	Cook et al., 2019; Warwick et al., 2010
Task Structure	Sequence, provide guidance, delimit, or manipulate student interaction within the task	Cook et al., 2019; Gillen et al., 2007; Mercer et al., 2010; Warwick et al., 2010
Shared Dialogic Space	Space where ideas can be shared, explored, and challenged	Kerawalla, 2013
Networked	Providing connections to the teacher, other students, or resources beyond the classroom; Allows for asynchronous collaboration	Looi et al., 2010; Pifarré & Staarman, 2011

Note. Affordances are likely contextualized and therefore are not meant to suggest transferability across tools or tasks.

design supported reasoning through talk while Mercer et al (2003) found students needed help to understand how to use talk as a tool to learn. Both authors concluded ground rules and affordances of the technology were necessary to promote effective talk. Two related studies considered the relationship between talk and technology use. Rojas-Drummond et al. (2008) observed students collaborating to write multimedia texts and discovered students used the technology to position the talk, writing, and multimedia as artifacts to co-construct meaning.

Knight and Mercer (2014) observed students using a search engine to learn more about a role model, finding the most successful students were also the ones who engaged in the most exploratory talk.

Utility of Technology for Dialogic Discussion

Ten studies involved the observation of a technology-supported discussion activity designed to fit within the established curriculum of the classroom (see Table 2.1). The remaining eight studies involved dialogic tasks that were novel in nature (i.e., stood separate from the typical curriculum occurring within the classroom). It is unclear how the novel studies might impact future teacher practice, specifically regarding ways the technology and task could be adapted to fit typically occurring instruction. Relatedly, ten overlapping but different studies involved the generic use of widely available technology such as Interactive Whiteboards, search engines, or wikis (see Table 2.1). The remaining eight studies involved the study of specific pieces of technology, such as GroupScribbles (Looi et al., 2010), ODRES (Valanides & Angeli, 2008), or Talk Factory (Karawalla et al., 2013). Again, it is unclear if the tools were available to educators upon completion of the study as well as the adaptability to typical classroom instruction, bringing into question the relevance for future instruction.

In many studies, researchers determined the pedagogy of the teacher affected the uses of the technology (see Table 2.1). For example, Alflalo et al. (2018) studied the dialogic practices in classrooms where IWBs are frequently used. Teachers exemplifying a pedagogy lacking in dialogic interaction frequently used IWB tools, but the instruction was mostly delivered by the teacher at the front and student interaction was limited. Similarly, Gillen et al. (2007) studied whether the use of IWBs was associated with changes in pedagogy. Although the IWB was engaging for students, they found it reinforced traditional practices in which the teacher asked a

closed question and called on individual students to answer. Cook et al. (2019) explored the dialogic interactions among students, the teacher, and Talkwall—a microblogging platform. They found technology facilitated reflective thinking that expanded the dialogic space and led to the development of academic concepts, although the teacher's dialogic intentions for the use of the tool likely determined its use. To that end, the utility of the technology depends upon the pedagogy of the teacher, which may require shifts in beliefs and practices.

Quality of Included Studies

Across the nine small group discussion studies, five met all Risko et al. (2018) quality indicators (see Table 2.3). Three studies failed to adequately describe participants (Mercer et al., 2003; Mercer et al., 2010; Warwick et al., 2010). Mercer et al. (2003) identified the age of participants only as 8 to 10 years old. Mercer (2010) only described participants as 9-10 from primary schools in Cambridgeshire. No other information regarding the participants or setting is provided. Two studies also failed to establish reliability, credibility, or trustworthiness (Mercer, 1994; Mercer et al., 2003). Mercer et al. (2003) described data collection as video recorded discussion, but did not report the number of recordings or if other sources of data were collected, preventing the reader from determining if multiple sources of information was used to corroborate findings. Mercer (1994) failed to describe the data collection process to allow readers to follow the trail of data analysis.

For the two whole group discussion studies, Maher (2012) met all Risko et al. (2018) quality indicators (see Table 2.3). However, the study by Nachowitz and Brumer (2014) failed to report enough information to allow for study replication, to demonstrate reliability and validity, or to describe study participants. Across the six studies using mixed whole and small group discussions, three studies met all quality indicators (see Table 2.3). Three studies did not

Table 2.3
Quality of Studies, as Evaluated by Risko et al. (2008)

	Argument			Methodology					Findings	
Study	A1	A2	A3	B1	B2	B3	B4	B5	C1	C2
Aflalo et al., 2018	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Cook et al., 2019	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Druin et al., 2003	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Fernández Cárdenas, 2004	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Gillen et al., 2007	Y	Y	Y	Y	Y	Y	Y	N	Y	Y
Kerawalla, 2013	Y	Y	Y	Y	Y	N	Y	N	Y	Y
Knight & Mercer, 2014	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Looi et al., 2010	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Maher, 2012	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Mercer et al., 2003	Y	Y	Y	Y	N	N	N	N	Y	Y
Mercer et al., 2010	Y	Y	Y	Y	Y	Y	Y	N	Y	Y
Mercer, 1994	Y	Y	Y	N	Y	Y	N	Y	Y	Y
Nachowitz & Brumer, 2014	Y	Y	Y	N	Y	Y	N	N	Y	Y
Pifarré & Staarman, 2011	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Rojas-Drummond et al., 2008	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Valanides & Angeli, 2008	Y	Y	N	Y	Y	Y	Y	Y	N	Y
Warwick et al., 2010	Y	Y	Y	Y	Y	Y	Y	N	Y	Y
Wegerif, 1996	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note: Risko et al., 2008; A1: Theory and previous research; A2: Question, purpose, or objective; A3: Links findings to research; B1 Allows for replication or following of analysis; B2: Numbers, durations, degree of involvement; B3: Corroborate findings; B4: Reliability, credibility, trustworthiness; B5: Describes participants; C1: Consistent with question or purpose; C2: Consistent with data collected

adequately describe elements of the study. Gillen et al. (2008) identified students as ages 7-11 in urban primary schools in England, but failed to adequately characterize the sample related to specific grades or subjects. Similarly, Kerawalla et al. (2013) described the study setting as a UK primary school and participants as ages 9-10, but no other information is provided. Discussions were video recorded, but no other sources of information were reported as being used to corroborate findings. Valanides & Angeli (2008) did not meet other indicators of quality. The findings were not explicitly linked to previous research or theory. Also, the results did not clearly match or answer the stated research questions.

Discussion

The purpose of this systematic review was to determine the current state and research quality of the literature associated with digital technology to support dialogic discussion in elementary reading comprehension. The resulting synthesis of studies provides some direction for the implementation of dialogic teaching in elementary classrooms and helps identify gaps in the field. Of the 18 included studies, 10 studied small group discussion, two studied whole group discussion, and six involved a mixture of whole group and small group discussion (see Appendix A).

This review resulted in several major findings regarding the current state of research. First, few studies exist evaluating digital technology-supported dialogic teaching with elementary students to support reading comprehension. Although many studies were discovered through the database search, the most common inclusion criteria not met was the targeting of upper elementary, ages 8 to 12. The vast majority of the search results of dialogic teaching involving technology focused on secondary and higher-education settings. Additionally, only one of the 18 studies directly measured changes in reading comprehension (Nachowitz & Brumer,

2014). Talk might be a goal in and of itself (Wegerif & Major, 2019) but more research is needed to know whether improvements in discussion also lead to improvements in individual reading comprehension ability.

Related, more high-quality research of digital technology-supported dialogic pedagogy is needed involving the reading comprehension of elementary students. Of the 18 included studies evaluated with the standards developed by Risko et al. (2008), only ten met all the quality criteria. If a technology-supported dialogic teaching is a potential candidate for enhancing the quality of classroom discussion in relation to reading comprehension for elementary students, additional research is needed that clearly identifies participants in an effort to determine generalizability, provides details about efforts to reduce the introduction of bias, and provides enough information for study replication.

Another main finding from this review involves the intervention design. Studies varied in the approach to research design, including both descriptive observation of typically occurring instruction and experimental evaluation of specific software tools. Similarly, there is a wide variance in the amount of time engaged in dialogic teaching across included studies. Interventions within studies ranged from one single session to 26 sessions, with a median of 6.5 sessions. Previous researchers (Pearson, 2010) found modeling and support of discussion is needed over time in order to increase exploratory talk. Moreover, Garas-York and Almasi (2017) determined the scaffolding of talk over time developed comprehension and interpretive processes. From this perspective, the existing literature fails to address the impact over time of technology-supported dialogic teaching on student talk. Considering the difficulty teachers have enacting dialogic teaching in the classroom (Alexander, 2017; Howe & Abedin, 2013), along

with the time it takes for students to learn about talk as a tool, future research should include a program of implementation of dialogic practices over the course of many sessions.

A third main finding is that the studies often included the use of ground rules, an open-ended or partially-structured task, or group reflection in the design of the intervention but rarely all three critical elements of dialogic teaching implementation. In other words, in the majority of existing research three critical elements of dialogic teaching are rarely enacted. Ground rules are a key feature of dialogic teaching shown to raise the quality of discussion (Mercer et al., 1999). Taking time to reflect on the talk and the application of the ground rules helps the group set goals for skills and dispositions necessary for ongoing improvement (Phillipson & Wegerif, 2020). Also, partially-structured or open-ended tasks offer more opportunities for interpretation and decision-making through exploratory talk (McGregor, 2008). Therefore, it is likely the research examining the efficacy of dialogic teaching would be strengthened by ensuring all three elements are present by design.

Finally, while digital technology successfully supported dialogic discussion, most studies emphasized the relationship between task design and the type of student talk. According to Major and Warwick (2020), the learning intentions and curriculum considerations are central to the enacting of technological affordances. That is, the pedagogy informs the use of the technology within a specific context. Henessey et al. (2018) found shifting the pedagogic intentions of teachers for the use of technology led to increases in collaborative meaning making and reasoning. In other words, the way in which technology is used is more important than the tool itself (Tondeur et al., 2017). To that end, the effective uses of technology observed in many of the included studies in this review can likely be attributed to each individual teacher's

pedagogical beliefs around the importance of an open task as well as the enacted affordances of the technology for supporting dialogic discussion.

Limitations and Future Directions

This systematic review of literature has several limitations. First, this study is limited by scope of the included studies, specifically in the database retrieval of studies. There is a chance studies exist with findings relevant to this review but were either excluded or uncaptured due to the inclusion criteria. For example, the authors did not include literature focusing on secondary and higher-education students, deciding to focus directly on research with upper elementary students. Studies with potentially relevant findings with these older populations of students were not considered. Similarly, the search did not include grey literature (i.e., studies not published in peer reviewed journals), potentially introducing a publication bias. The authors focused on studies involving an element of reading comprehension, and studies involving learning with relevance to literacy (e.g., reasoning) without some form of comprehension were not considered. The limited number of included studies provided information regarding the current state of the literature regarding technology-supported dialogic learning with upper elementary students within the domain of reading comprehension.

This review is also limited by the database search methods and search terms. Although a wide range of search terms were used, there is a possibility that relevant research may not have used any of the search terms and therefore was not discovered through the database search. The theoretical framing for dialogic teaching, including the role of ground rules for exploratory talk could have introduced bias into search term selection. Relatedly, dialogic teaching—represented here as an approach involving the use of talk as a tool for co-reasoning—does not have common terminology or labels (Haneda, 2017). Although the authors carefully selected search terms

likely to collect a wide range of studies involving practices typically associated with dialogic teaching regardless of terminology, the potential for undiscovered relevant studies remains. This challenge is not only a limitation within this study, but it also represents a limitation to the field of dialogic teaching in general. A final limitation involves the application of Risko et al., (2008) quality indicators of research. While the authors felt it was important to evaluate the quality of the existing research and not just the quantity and characteristics, limited consensus exists regarding the metrics by which to judge quality. The authors selected Risko's indicators due to the reliability with small scale qualitative research, although they also recognize that selecting other sets may have results in a different interpretation of the quality.

Implications for Practice

Despite the limitations presented above, this systematic review contributes to practice and future research in meaningful ways. First, this study suggests implementing a digital technology-supported dialogic teaching is a challenging undertaking that requires teacher pedagogical training and many classroom sessions distributed over time. A resource commonly used in successful implementations was the *Thinking Together* program (Dawes et al., 2000). However, teachers should ensure the implementation includes the use of ground rules, an open-ended task, and group reflection after discussion. Furthermore, the successful use of digital technology should be grounded in the pedagogy as well as the design of the task.

Additionally, this study contributes to practice by establishing a need for additional high-quality research of technology-supported dialogic teaching for supporting reading comprehension with elementary students. Specifically, teachers will benefit from studies involving many sessions to track changes over time. For example, studies tracking the impact

over time of teacher facilitation, technology affordances, and task design could potentially simplify the implementation of dialogic teaching.

APPENDIX

APPENDIX

Table 2.4

Studies Involving Technology and Literacy with Dialogic Teaching

Study	Technology	Goal	Participants & Setting	Design[a] & Data Collection	Duration	Findings
			Small Group Discussion			
Druin et al., 2003	Laptop computer (Software: "SearchKids")	Determine differences in collaborative behavior and dialogue	98 students (ages 7-9) in the US	(Q) Video recording of discussion; Log of mouse clicks	One lesson	Differences between conditions related to how students shared goals, collaborative tasks, and outcomes.
Fernández-Cárdenas, 2004	Desktop computer (Software: SiteCentral; eMindMaps)	How language is used while collaboratively constructing multimodal electronic documents	23 students (ages 9-10) in the UK	(Q) Transcription of recorded lessons; Detailed field notes; Computer screen recordings	11 one-hour lessons, then 8 weekly lessons, the 3 lessons in the final week	Students adjusted their way of talking according to the difficulty of the task. When a shared understanding was clear, students were more economical in their language use
Knight & Mercer, 2014	Desktop computer (Software: Unnamed Internet search engine)	Ways students search for information in collaborative groups	8 students (ages 11-12) in the UK	(M) Video recording of computer screen; Audio recording of student discuss at the computer	One 75 minute lesson	Exploratory talk was related to effective collaborative information seeking
Mercer et al., 2003	"Kate's Choice" software	Evaluate impact of the software on oral and literate abilities	18 students (ages 10-11) in the UK	(Q) Video recorded lesson	One lesson following a 10 week unit on talk	Software supported the development of talk and literacy when partnered with teaching of speaking and listening skills

Table 2.4 (cont'd)

Mercer et al., 2010	IWB (Software: Unspecified)	Potential for IWB to provide shared dialogic space for reasoned discussion	12 small groups (3-4 students, ages 9-10) from 12 different classrooms in the UK	(Q) Video recorded lessons; Small group interview	3 lessons, each one hour long	Supports discussion through access to relevant material, annotation of material, all members see what is being discussed, students offer advice regarding annotation
Mercer, 1994	Desktop computer (Software: various)	Explicit approach for studying talk; Role of teacher in supporting computer-based talk; Influence of software on talk	50 students (ages 5-13) sampled from 15 classrooms in the UK	(Q) Video recorded discussions; Video recorded interviews	"A series of related sessions of work"	Student talk is influenced by technology, the teacher, and the task
Pifarré & Staarman, 2011	MediaWiki website	Collaborative processes of students working together in a wiki environment	25 students (ages 9-10) in Spain	(M) Collected contributions in the wiki environment	7 lessons, each one hour long	Pair work before working in group of 6 enhanced participation; Wiki space allowed for asynchronous collaboration
Rojas-Drummond et al., 2008	Goldwave software; PowerPoint software	How oracy, literacy, and technology mediate collaboration	56 students (ages 9-10) in Mexico	(Q) Transcription of recorded discussions	12 lessons	Exploratory talk helps conceptualize the quality of peer collaboration, but it does not fully describe productive collaboration
Warwick et al., 2010	Interactive Whiteboard (IWB; Software: Unspecified)	Relationship of IWB and processes of learning and knowledge building	12 intact classrooms (ages 8-10) in the UK	(Q) Video recorded lessons; Field notes; Student interviews	3 lessons, each one hour long	Teacher vicariously mediates student activity through rules and procedures as well as task environment in IWB

Table 2.4 (cont'd)

Wegerif, 1996	Two software programs: Software simulation, Branching narrative	Effectiveness of integrating exploratory talk into curriculum areas	33 students (ages 9-10) in the UK	(Q) Video recorded lessons	7 off-computer lessons, 1 lesson with one software, 1 with the other	Software effectively integrated reasoning through talk, enhancing group cognition, with some transference to individuals
			Whole Group Discussion			
Maher, 2012	IWB; Laptop (Software: Microsoft Word)	Nature of participant interaction when mediated by an IWB	54 students (ages 8-11) from one school in Australia	(Q) Transcription of recorded lessons; Questionnaires at the beginning and end of the study	Six 40-60 minute lessons spread across the school year from two classrooms (12 lessons total)	IWB allowed for students to easily see and manipulate ideas, and mediated sharing of both written and verbal ideas
Nachowitz & Brumer, 2014	"Knowledge Forum" online software	Determine effect on reading skills	1 intact sixth grade classroom in the United States	(M) Transcripts of talk; Transcripts of online chat; Posttest	2 lessons per week for 4 months	Students read deeply, interpreted and analyzed a novel and justified with textual evidence
			Mixture of Whole Group and Small Group Discussion			
Aflalo et al., 2018	IWB; Laptop (Software: Unspecified)	Contribution of IWB to class interaction	62 sixth-grade students from two elementary schools in Israel	(QT) Structured observation of teacher-designed lessons involving reading and discussing science texts, videos, or diagrams	26 lessons, each 45 minutes long	Dialogic interaction was limited among students as IWB tools were mostly used to support teacher-focused interaction
Cook et al., 2019	TalkWall microblogging tool via iPad	Contribution of TalkWall to classroom-based group tasks	29 students (ages 11-12) in the UK	(Q) Transcription of recorded lesson	One lesson	Increased access to and questioning of ideas contributed by classmates

Table 2.4 (cont'd)

Gillen et al., 2007	IWB	IWBs as mediating tools for interaction	4 intact urban classrooms (ages 7-11) in the UK	(Q) Transcriptions of recorded lessons	Two sets of two lessons in each classroom	Links content across days; text is easily manipulated; engaged students; more IRE/closed questions; Slowed pace of lesson
Kerawalla, 2013	Talk Factory software	Role of Talk Factory in supporting exploratory talk	46 students (ages 9-10) in the UK	(Q) Transcriptions of recorded lessons	Two intro "talk" lessons, 8 pre-intervention class discussions, 8 intervention class discussions	Graphical representations of talk used in real time and retrospectively increased exploratory talk features
Looi et al., 2010	"GroupScribbles" software	Effectiveness of software to support collaborative activities	80 students (average age = 10) from 2 classrooms in Singapore	(M) Transcription of recorded lessons; Detailed field notes; Computer screen recordings; Posttest	10 one-hour lessons	Software facilitated collaborative learning and improved beliefs and attitudes toward learning
Valanides & Angeli, 2008	Laptop (Software: ODRES)	Scaffolded design of the ODRES software	18 sixth-grade students from one intact elementary classroom in Cyprus	(M) Transcriptions of recorded lessons, field notes, software log files, reasoning test	One 120 minute lesson; Pretest, posttest, retention-test	Collaboration through communication, sharing points of view, and organizing collaborative work resulted in significant and lasting conceptual change of science topic

Note. [a]M: Mixed Methods; Q: Qualitative; QT: Quantitative

REFERENCES

REFERENCES

References marked with an asterisk indicate studies included in the review.

*Aflalo, E., Zana, L., & Huri, T. (2018). The interactive whiteboard in primary school science and interaction. *Interactive Learning Environments*, *26*(4), 525–538. https://doi.org/10.1080/10494820.2017.1367695

Alexander, R. (2017). *Towards* dialogic *teaching: Rethinking classroom talk* (5th ed.). Dialogos.

Applebee, A. N., Langer, J. A., Nystrand, M., & Gamoran, A. (2003). Discussion-based approaches to developing understanding: Classroom instruction and student performance in middle and high school English. *American Educational Research Journal*, *40*(3), 685–730. https://doi.org/10.3102/00028312040003685

Asterhan, C. S. C., Howe, C., Lefstein, A., Matusov, E., & Reznitskaya, A. (2020). Controversies and consensus in research on dialogic teaching and learning. *Dialogic Pedagogy: An International Online Journal*, *8*, 1–16. https://doi.org/10.5195/dpj.2020.312

Aukerman, M. S. (2007). When reading it wrong is getting it right: Shared evaluation pedagogy among struggling fifth grade readers. *Research in the Teaching of English*, *42*(1), 56–103.

Barnes, D. (1992). *From communication to curriculum*. Heinemann.

*Cook, V., Warwick, P., Vrikki, M., Major, L., & Wegerif, R. (2019). Developing material-dialogic space in geography learning and teaching: Combining a dialogic pedagogy with the use of a microblogging tool. *Thinking Skills and Creativity*, *31*(November 2018), 217–231. https://doi.org/10.1016/j.tsc.2018.12.005

Daniel, M. F., Lafortune, L., Pallascio, R., Splitter, L., Slade, C., & De La Garza, T. (2005). Modeling the development process of dialogical critical thinking in pupils aged 10 to 12 years. *Communication Education*, *54*(4), 334–354. https://doi.org/10.1080/03634520500442194

Dawes, L., Mercer, N. and Wegerif, R. (2000). *Thinking Together: A programme of activities for developing speaking, listening and thinking skills for children aged 8-11*. Imaginative Minds Ltd.

*Druin, A., Revelle, G., Bederson, B. B., Hourcade, J. P., Farber, A., Lee, J., & Campbell, D. (2003). A collaborative digital library for children. *Journal of Computer Assisted Learning*, *19*(2), 239–248. https://doi.org/10.1046/j.0266-4909.2003.00024.x

*Fernández Cárdenas, J. M. (2004). The appropriation and mastery of cultural tools in computer supported collaborative literacy practices [Doctoral thesis, The Open University]. https://doi.org/10.21954/ou.ro.0000d561

Galton, M., Hargreaves, L., & Pell, T. (2009). Group work and whole-class teaching with 11- to 14-year-olds compared. *Cambridge Journal of Education*, *39*(1), 119–140

Garas-York, K., & Almasi, J. F. (2017). Constructing meaning through discussion. In S. E. Israel (Ed.), *Handbook of Research on Reading Comprehension* (2nd ed., pp. 500–518). The Guilford Press.

*Gillen, J., Staarman, J. K., Littleton, K., Mercer, N., & Twiner, A. (2007). A "learning revolution"? Investigating pedagogic practice around interactive whiteboards in British primary classrooms. *Learning, Media and Technology*, *32*(3), 243–256. https://doi.org/10.1080/17439880701511099

Haneda, M. (2017). Dialogic learning and teaching across diverse contexts: Promises and challenges. *Language and Education*, *31*(1), 1–5. https://doi.org/10.1080/09500782.2016.1230128

Hennessy, S. (2011). The role of digital artefacts on the interactive whiteboard in supporting classroom dialogue. *Journal of Computer Assisted Learning*, *27*(6), 463–489. https://doi.org/10.1111/j.1365-2729.2011.00416.x

Hennessy, S., Dragovic, T., & Warwick, P. (2018). A research-informed, school-based professional development workshop programme to promote dialogic teaching with interactive technologies. *Professional Development in Education*, *44*(2), 145–168. https://doi.org/10.1080/19415257.2016.1258653

Howe, C., & Abedin, M. (2013). Classroom dialogue: A systematic review across four decades of research. *Cambridge Journal of Education*, *43*(3), 325–356. https://doi.org/10.1080/0305764X.2013.786024

*Kerawalla, L., Petrou, M., & Scanlon, E. (2013). Talk Factory: Supporting 'exploratory talk' around an interactive whiteboard in primary school science plenaries. *Technology, Pedagogy and Education*, *22*(1), 89-102. https://doi.org/10.1080/1475939X.2012.745049

Kintsch, W. (1998). *Comprehension: A paradigm for cognition*. Cambridge University Press.

*Knight, S., & Mercer, N. (2014). The role of exploratory talk in classroom search engine tasks. *Technology, Pedagogy and Education*, *24*(3), 1–17. https://doi.org/10.1080/1475939X.2014.931884

Lin, H., & Kelsey, K. D. (2009). Building a networked environment in wikis: The evolving phases of collaborative learning in a wikibook project. *Journal of Educational Computing Research*, *40*, 145–169. https://doi.org/10.2190/EC.40.2.a

*Looi, C. K., Chen, W., & Ng, F. K. (2010). Collaborative activities enabled by GroupScribbles (GS): An exploratory study of learning effectiveness. *Computers and Education*, *54*(1), 14–26. https://doi.org/10.1016/j.compedu.2009.07.003

Lynch, J. S., & van den Broek, P. (2007). Understanding the glue of narrative structure: Children's on- and off-line inferences about characters' goals. *Cognitive Development*, *22*(3), 323–340. https://doi.org/10.1016/j.cogdev.2007.02.002

Major, L., & Warwick, P. (2020). Affordances for dialogue the role of digital technology in supporting productive classroom talk. In N. Mercer, R. Wegerif, & L. Major (Eds.), *Routledge International Handbook of Research on Dialogic Education* (pp. 394–410). Routledge.

*Maher, D. (2012). Teaching Literacy in Primary Schools Using an Interactive Whole-class Technology: Facilitating Student-to-Student Whole-Class Dialogic Interactions. *Technology, Pedagogy and Education*, *21*(1), 137–152. https://doi.org/10.1080/1475939X.2012.659888

Maine, F. (2015). Dialogic *readers: Children talking and thinking together about visual texts*. Routledge.

Mason, L. (2001). Introducing talk and writing for conceptual change: A classroom study. *Learning and Instruction*, *11*(4–5), 305–329. https://doi.org/10.1016/S0959-4752(00)00035-9

McGregor, D. (2008). The influence of task structure on students' learning processes: Observations from case studies in secondary school science. *Journal of Curriculum Studies*, *40*(4), 509–540. https://doi.org/10.1080/00220270701813282

*Mercer, N. (1994). The quality of talk in children's joint activity at the computer. *Journal of Computer Assisted Learning*, *10*, 24–32. https://doi.org/10.1111/j.1365-2729.1994.tb00279.x

*Mercer, N., Fernandez, M., Dawes, L., Wegerif, R., & Sams, C. (2003). *Talk about texts at the computer: Using ICT to develop children's oral and literate abilities*. *July*, 81–89. https://doi.org/http://dx.doi.org/10.1111/1467-9345.3702006

Mercer, N., Hennessy, S., & Warwick, P. (2019). Dialogue, thinking together and digital technology in the classroom: Some educational implications of a continuing line of inquiry. *International Journal of Educational Research*, *97*, 187–199. https://doi.org/10.1016/j.ijer.2017.08.007

*Mercer, N., Warwick, P., Kershner, R., & Staarman, J. K. (2010). Can the interactive whiteboard help to provide 'dialogic space' for children's collaborative activity? *Language and Education*, *24*, 367–384. https://doi.org/10.1080/09500781003642460

Mercer, N., Wegerif, R., & Dawes, L. (1999). Children's talk and the development of reasoning in the classroom. *British Educational Research Journal*, *25*(1), 95–111. https://doi.org/10.1080/0141192990250107

*Nachowitz, M., & Brumer, N. (2014). Teaching the talk, not the text. *Voices From the Middle*, *22*(1), 15–21.

O'Connor, C., Michaels, S., Chapin, S., & Harbaugh, A. G. (2017). The silent and the vocal: Participation and learning in whole-class discussion. *Learning and Instruction*, *48*, 5–13. https://doi.org/10.1016/j.learninstruc.2016.11.003

Pearson, C. (2010). Acting up or acting out?: Unlocking children's talk in literature circles. *Literacy, 44*(1), 3–11.

Phillipson, N., & Wegerif, R. (2020). The Thinking Together approach to dialogic teaching. In E. Manalo (Ed.), *Deeper learning, dialogic learning, and critical thinking: Research-based strategies for the classroom* (pp. 32–47). Routledge.

*Pifarré, M., & Kleine Staarman, J. (2011). Wiki-supported collaborative learning in primary education: How a dialogic space is created for thinking together. *International Journal of Computer-Supported Collaborative Learning*, *6*, 187–205. https://doi.org/10.1007/s11412-011-9116-x

Risko, V. J., Roller, C. M., Cummins, C., Bean, R. M., Block, C. C., Anders, P. L., & Flood, J. (2008). A Critical Analysis of Research on Reading Teacher Education. *Reading Research Quarterly*, *43*(3), 252–288. https://doi.org/10.1598/rrq.43.3.3

*Rojas-Drummond, S. M., Albarrán, C. D., & Littleton, K. S. (2008). Collaboration, creativity and the co-construction of oral and written texts. *Thinking Skills and Creativity*, *3*(3), 177–191. https://doi.org/10.1016/j.tsc.2008.09.008

Rojas-Drummond, S., Maine, F., Alarcón, M., Trigo, A. L., Barrera, M. J., Mazón, N., … Hofmann, R. (2017). Dialogic literacy: Talking, reading and writing among primary school children. *Learning, Culture and Social Interaction*, *12*, 45–62. https://doi.org/10.1016/j.lcsi.2016.09.005

Rojas-Drummond, S., Mazón, N., Littleton, K., & Vélez, M. (2014). Developing reading comprehension through collaborative learning. *Journal of Research in Reading*, *37*(2), 138–158. https://doi.org/10.1111/j.1467-9817.2011.01526.x

Sakr, M. (2018). Multimodal participation frameworks during young children's collaborative drawing on paper and on the iPad. *Thinking Skills and Creativity, 29*(March), 1–11.

Sedova, K., Salamounova, Z., & Svaricek, R. (2014). Troubles with dialogic teaching. *Learning, Culture and Social Interaction*, *3*(4), 274–285. https://doi.org/10.1016/j.lcsi.2014.04.001

Sedova, K., Sedlacek, M., & Svaricek, R. (2016). Teacher professional development as a means of transforming student classroom talk. *Teaching and Teacher Education*, *57*, 14–25. https://doi.org/10.1016/j.tate.2016.03.005

Shanahan, T., Callison, K., Carriere, C., Duke, N. K., Pearson, P. D., Schatschneider, C., & Torgesen, J. (2010). *Improving reading comprehension in kindergarten through 3rd grade: A practice guide* (NCEE 2010-4038). Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education. Retrieved from whatworks.ed.gov/publications/practiceguides

Talbott, E., Maggin, D. M., Van Acker, E. Y., & Kumm, S. (2018). Quality indicators for reviews of research in special education. *Exceptionality*, *26*(4), 245–265. https://doi.org/10.1080/09362835.2017.1283625

Tennent, W. (2015). *Understanding reading comprehension: Processes and practices*. Sage Publications.

Tondeur, J., Van Braak, J., Ertmer, P. A., & Ottenbreit-Leftwich, A. (2017). Understanding the relationship between teachers' pedagogical beliefs and technology use in education: a systematic review of qualitative evidence. *Educational Technology Research and Development*, *65*, 555-575.

Topping, K. J., & Trickey, S. (2014). The role of dialog in philosophy for children. *International Journal of Educational Research*, *63*, 69–78. https://doi.org/10.1016/j.ijer.2013.01.002

*Valanides, N., & Angeli, C. (2008). Distributed cognition in a sixth-grade classroom : An attempt to overcome alternative conceptions about light and color. *Journal of Research on Technology in Education*.

Warwick, P., Mercer, N., & Kershner, R. (2013). "Wait, let's just think about this": Using the interactive whiteboard and talk rules to scaffold learning for co-regulation in collaborative science activities. *Learning, Culture and Social Interaction*, *2*(1), 42–51. https://doi.org/10.1016/j.lcsi.2012.12.004

*Warwick, P., Mercer, N., Kershner, R., & Staarman, J. K. (2010). In the mind and in the technology: The vicarious presence of the teacher in pupil's learning of science in collaborative group activity at the interactive whiteboard. *Computers & Education*, *55*(1), 350–362. https://doi.org/10.1016/j.compedu.2010.02.001

Webb, P., Whitlow, J. W., & Venter, D. (2017). From exploratory talk to abstract reasoning: A case for far transfer? *Educational Psychology Review*, *29*(3), 565–581. https://doi.org/10.1007/s10648-016-9369-z

*Wegerif, R. (1996). Using computers to help coach exploratory talk across the curriculum. *Computers and Education*, *26*(1), 51–60. https://doi.org/10.1016/0360-1315(95)00090-9

Wegerif, R., & Major, L. (2019). Buber, educational technology, and the expansion of dialogic space. *AI & Society*, *34*(1), 109–119. https://doi.org/10.1007/s00146-018-0828-6

Wegerif, R., Mercer, N., & Dawes, L. (1999). From social interaction to individual reasoning: An empirical investigation of a possible socio-cultural model of cognitive development. *Learning and Instruction*, *9*(6), 493–516. https://doi.org/10.1016/S0959-4752(99)00013-4

Wilkinson, I. A. G., Reznitskaya, A., Bourdage, K., Oyler, J., Glina, M., Drewry, R., Kim, M. Y., Nelson, K. (2017). Toward a more dialogic pedagogy: changing teachers' beliefs and practices through professional development in language arts classrooms. *Language and Education*, *31*(1), 65–82. https://doi.org/10.1080/09500782.2016.1230129

CHAPTER 3 – COMPARATIVE CASE STUDY

Abstract

This study aimed to describe how differing discussion training approaches functioned within a web-based videoconferencing environment. While researchers have shown use of dialogic teaching to promote reasoning and support higher-level comprehension skills, little is known about applying these pedagogical practices to remote learning settings. This study described discussion processes within the video conferencing tool Zoom, changes in text-based discussion following a training session, and changes over time. Using a comparative case study approach, three training conditions were studied using a sociocultural discourse analysis. Researchers found the qualities of discussion changed following a training session, and changes in group behaviors followed repeated exposure. This exploratory study provides guidance for future research concerning dialogic teaching and text-based discussion within videoconferencing environments.

Text-Based Discussion from a Distance: A Comparative Case Study of Discussion Training within a Web-Based Video Conferencing Environment

Despite decades of research, reading achievement data suggest American students struggle with high-level comprehension. Results from the 2019 National Assessments of Educational Progress (NAEP) show 9% of fourth grade students performed at the advanced level in reading and 26% of students performed at the proficient level (National Center for Educational Statistics, 2019), leaving 65% that did not meet sufficient levels of proficiency in reading. This finding is concerning as reading achievement in the upper-elementary level is highly predictive of high school graduation (Snow & Matthews, 2016). One way to support elementary students' skills in constructing high-level comprehension is through text-based discussion (Wilkinson & Son, 2011). According to Garas-York & Almasi (2017), text-based discussion focused on cognitive and social development over time, as opposed to questioning for comprehension of the immediate text, lead to higher-level reading comprehension skills. That is, teaching students to think and collaborate around a text through discussion leads to improved comprehension in individuals.

Higher-level reading comprehension skills are complex. According to the Construction-Integration model, reading comprehension is achieved when an individual actively constructs mental representations of a text (Kintsch, 1998), using inferences to bridge gaps in the coherence of a text (Freed & Cain, 2017). Establishing global coherence—overarching concepts such as theme, superordinate character goals, or gist—is essential for understanding a narrative text and for integrating information to reflect the overall meaning of the text, referred to as the situation model (Kendeou et al., 2016). Global coherence is also essential for maintaining text coherence and relevant information that is no longer in the working memory (León & Escudero, 2017).

However, elementary students are not apt to spontaneously generate global coherence inferences without support in explicitly attending to time and place of goals, character states, themes, and actions in narrative text (Kendeou et al., 2014).

One explanation for the lack of spontaneously generated global coherence inferences is the individual reader's improper standards of coherence (Kendeou et al., 2014). Engaging with a text through thinking-aloud can encourage higher standards of coherence (Freed & Cain, 2017). This type of engagement can be promoted through text-based discussion. As students discuss the text, they can draw not only on their own background knowledge and activated networks from their long-term memory but also on knowledge, networks, and perspectives activated within the dialogic space (Maine, 2015). Therefore, the interactions that occur within a text-based discussion support the construction of a mental model. Discussions of reading provide a context for students to re-code ideas into verbal representations which strengthens reading comprehension (Duke et al., 2011), while observations of thinking and social processes of peers provides scaffolds for learners as they internalize higher cognitive function necessary for the interpretation of literature (Garas-York et al., 2013).

Despite the affordances of discussion in constructing reading comprehension, students are rarely taught the skills necessary to effectively engage in a high-quality discussion of a text (Garas-York & Almasi, 2017; Rojas-Drummond et al., 2014). In addition, little is known about text-based discussion within videoconferencing environments (e.g., Zoom), the importance of which dramatically increased in response to pandemic-era remote learning. With such a gap between what is known about the processes associated with high-level reading comprehension and how instructional practices can influence reading achievement, it is important to find

approaches that apply what is known from research to remote teaching practices in a way that positively impacts student achievement.

Dialogic Teaching

One approach that supports negotiation within text-based discussion is dialogic teaching. According to Mercer & Littleton (2007), dialogic teaching is designed to use classroom discussion as a tool to think collectively and deepen understanding while building higher cognitive functions. In a study investigating the effect of knowledge construction during dialogic learning, Noroozi et al. (2013) found students within structured small group discussions reasoned based upon the externalized reasoning of their partners and extended their individual reasoning based on feedback from their partners. This occurred as student elaborated on learning materials or ideas or leveraged the knowledge of their partners.

The Spoken Language and New Technology (SLANT) project conducted in the United Kingdom in the early 1990s identified a type of language use, called 'exploratory talk', that lead to collaborative reasoning (Mercer, 1994). However, the study found incidents of exploratory talk were rare and indicated teachers seldom explicitly or directly supported this type of talk. In a systematic review of nearly 40 years of research of dialogic learning, Howe and Abedin (2013) found exploratory talk to be difficult for teachers to promote, attributing the difficulty to balancing the evaluation of differing opinions associated with exploratory talk with the guidance towards a target understanding of content. In an effort to identify practices that promote exploratory talk, Mercer et al. (1999) studied the impact of 'ground rules' on the quality of student talk. They found promoting rules for talking together and ensuring adherence to the rules resulted in higher quality discussion as well as increased individual reasoning ability. To that

end, exploratory talk is an important element of dialogic learning, and ground rules are an important way to support exploratory talk.

The interactions that occur through exploratory talk help open a dialogic space—a shared meaning space in which students attend to the dialogue itself, thinking together freely to explore ideas (Wegerif, 2007). Rather than simply sharing ideas and agreeing upon one, learning occurs through the interaction among differing perspectives and ideas (Wegerif & Major, 2019). In other words, students consider new perspectives, deepening their own understanding in the process. This dialogic space, both physical and social in nature, serves as the mechanism for building reading comprehension through the externalizing of thought and consideration of differing perspectives. Since this space goes beyond the surface to epistemological stance for interaction, it is not immediately apparent whether it has been successfully opened (Sedova et al., 2016).

In an effort to provide a way to verify the presence of a dialogic approach, Alexander (2017) introduced 47 classroom indicators, ranging from question structure to respecting minority viewpoints. According to Alexander, indicators serve as a heuristic—not a checklist—and serve to describe the properties of talk as well as the context in which it occurs. At the same time, researchers frequently rely on analytic schemes when studying dialogic teaching. For example, in a study designed to evaluate discussion approaches in classrooms, Soter and colleagues (2008) used a set of features of quality discourse in small group settings. The authors identified productive discussion approaches through observations of the discourse features. Similarly, Sedova and colleagues (2016) identified observable indicators of a dialogic teaching, including three indicators within student talk: (1) the expression of thoughts with reasoning; (2)

the occurrence of student questions; and (3) open discussion operationalized as a free exchange of ideas.

Technology-Mediated Dialogic Discussion. Digital technologies offer several advantages for enhancing student talk within a dialogic pedagogy. Digital technology used in small group co-located settings—face-to-face small group discussions with a digital device in the center—can enhance collaborative discussion by: (a) supporting the development of a shared task, (b) structuring collaborative learning processes, (c) engaging the co-construction of knowledge, (d) monitoring and regulating collaborative learning, and (e) creating a dialogic space (Donnelly et al., 2014; Jeong & Hmelo-Silver, 2016; Wegerif, 2007). Further, digital technology can create artifacts and historical data that represent the emerging shared thinking occurring within the dialogic space (Lin & Kelsey, 2009). In a study comparing the effectiveness of computer multimedia and print materials for mediating face-to-face collaboration, Angeli and Tsaggari (2016) found technology provided a common goal for students and served as a tool to direct their attention and action in organizing information in the shared space. Fernández-Cárdenas and Silveyra-De La Garza (2010) had similar findings, adding the multimodal interaction afforded by the digital technology helped students better communicate as they interacted while talking, and found an increase in gestures and pointing within groups interacting around technology.

Internet-connected digital technologies offer several affordances for developing a dialogic space through which discussion is appropriately structured and students can share and challenge ideas (Mercer et al, 2010). For example, Wegerif and Major (2019) described the ways in which a dialogic space is expanded when students use an Internet search engine during their discussion. As students search for information while they discuss, the dialogic space expands

beyond space and time, engaging vicariously in discussion with a broader community and widening the range of perspectives.

Current Study

While dialogic teaching is an empirically-validated approach for supporting elementary students in developing high-level comprehension skills, little is known about the dialogic processes that occur within a web-based video conferencing environment. In this comparative case study of three training conditions, we explored different approaches in training students for text-based discussions within a video conferencing learning environment. Specifically, this study sought to answer two research questions: (a) How are changes enacted in children's text-based discussion after participating in technology and/or text-based discussion training sessions within a videoconferencing learning environment?, and (b) In what ways does repeated exposure to a dialogic approach support text-based discussion within a videoconferencing learning environment?

Method

Participants & Setting

A sample of third-grade students (ages 8 and 9) from a Midwestern K-12 public elementary school participated in this study. The participating school was a traditional public school, serving students with a wide variety of backgrounds and needs, representing a wide range of typical West Michigan schools with free and reduced lunch rates at 38%, 86% of students identifying as white, and 14% of students with an Individualized Education Program (IEP). In response to the COVID-19 pandemic, two of the three classrooms met face-to-face, and the third classroom met entirely online. The participating school used *Teachers College Reading, Writing, and Phonics Units of Study* as common reading materials and curriculum, and directly taught

inferential reading comprehension every day, along with other literacy areas (i.e., decoding, fluency, vocabulary, etc.). The school district provided mobile devices for every student, specifically Chromebooks for third grade.

Nine third-grade students were randomly selected from a pool of 22 with returned consent and assent documents (see Table 3.1). The 22 represented 50% of the 44 possible third grade students from the two face-to-face classrooms invited to participate during the 2020-2021 academic school year. Due to logistical concerns regarding scheduling and technological support, students enrolled in the single virtual class were not targeted for participation. The researchers selected nine students to create groups of three, which is consistent with the literature of dialogic teaching (Mercer et al., 2010; Rojas-Drummond, 2014; Wegerif, 2007). Of the 9 students, 5 came from one room and 4 from the other. Small groups remained the same for the duration of the study and were strategically formed with teacher input to create three balanced groups in regard to reading and discussion ability. Study conditions (i.e., dialogic discussion,

Table 3.1
Characteristics of Study Participants

Training Condition	Student	Gender	Age	Reading Benchmark[a]	Classroom
Dialogic	Abby	F	9	K	A
	Miles	M	9	Q	A
	Valda	F	8	O	A
Technology	Casey	M	8	O	B
	Oscar	M	9	O	B
	Melanie	F	8	O	B
Dialogic and Technology	Damon	M	9	P	A
	Andrea	F	9	K	A
	Sarita	F	10	O	B

Note. Student names are pseudonyms.

[a]Reading benchmark levels reported using the Fountas and Pinnell text gradient.

Zoom technology, or technology-mediated dialogic discussion) were randomly assigned to the groups. All interactions occurred fully on the Zoom platform during the school day. To minimize audio feedback, students in the same class each found a quiet spot separate from each other within the classroom or in the hallway immediately outside the classroom door and wore a headset microphone. Due to COVID safety protocols, cohorted students were not allowed in other learning spaces in the building.

Materials and Resources

Zoom

Zoom was selected as the video conferencing platform for this study. Zoom was needed as the researchers were unable to meet face-to-face with students due to university restrictions prohibiting face-to-face data collection with human subjects during the 2020-2021 academic year as well as the school's cohorted approach to education during the year of the study, both a result of the COVID-19 pandemic. Zoom was used by many teachers in the study setting school district in the spring of 2020 when instruction went online due to COVID-19. It was freely available and widely used during the COVID-19 pandemic in 2020 (Basilaia & Kvavadze, 2020). The platform supports compatibility across devices, with apps available for iPad and Android tablets as well as web-based apps that can be used in a browser on a mobile device. Like other platforms, Zoom uses video and audio as a primary means of communication, while also allowing for text-based messaging. Currently, Zoom allows for multiple users to share their screens, allows for users to give control of their mouse and keyboard to others, and provides a whiteboard space for multiple users to annotate ("Zoom meetings and chat," n.d.). Nonverbal communication can occur through video as well as through a 'reactions' feature that allows users to select a 'thumbs-up' or 'clapping' emoticon that displays over their video.

Read Aloud Texts

Four fiction picture books were selected to provide a shared literacy experience from which small groups engaged in text-based discussions. To select texts, the researcher obtained input from six elementary literacy coaches with significant classroom experience with the target age group as well as substantial knowledge of high-quality picture books. Texts were identified to meet several guidelines: (a) comparable themes and storylines that provoke meaningful discussions; (b) high-interest for third grade students; (c) students would likely have enough world knowledge to understand the theme; (d) similar length and format, taking less than eight minutes to read aloud; (e) similar text complexity in regards to listening comprehension; and

Table 3.2
Characteristics of Read Aloud Texts

Text	Words	Flesch-Kincaid	Dale-Chall	Synopsis
Millie Fierce by Jane Manning (Baseline Counterfactual Discussion)	590	93.1	5.9	The character feels ignored and is often shunned by classmates until she snaps and acts out. Eventually she realizes how her bad behavior affects others, and decides instead to use good deeds to get noticed. The story contains themes of empathy, kindness, and justice.
The Invisible Boy by Trudy Ludwig (Discussion 1)	744	85.3	6	The character feels invisible until a new student arrives at school and shows kindness, resulting in friendship. The story contains themes of hope, belonging, and kindness.
Paper Kingdom by Helana Ku Rhee (Discussion 2)	926	90.7	5.6	The character joins his parents at their jobs as nighttime office cleaners. His parents entertain him by turning the office into a magic kingdom. The story contains themes of family, hard work, and imagination.
A Bike Like Sergio's by Maribeth Boelts (Discussion 3)	960	94.8	5	The character wants a bike, and after finding a $100 bill, must decide what to do. The story contains themes of doing what is right and honesty.

Note. Text levels calculated using Flesch-Kinaid reading ease to determine the ease of understanding and the Dale-Chall formula to approximate U.S. grade level.

(f) depicting characters from diverse background and non-dominant groups. Although the texts were read aloud to students and therefore did not require the decoding of print, text characteristics are reported in Table 2 for comparison. To minimize variance in comprehension requirements, the six elementary literacy coaches reviewed the texts to confirm requirements for comprehension are comparable.

Procedures

In this comparative case study that sought to present exploratory research in contextualized conditions (Yin, 2014), three training conditions were studied relative to text-based discussions using videoconferencing. One group received a dialogic discussion (DLD) training session, which built upon the 'Thinking Together' approach (Dawes et al., 2000) to situate talk as a tool. A second group received a Zoom technology (TECH) training session, which taught students to use the feature of the Zoom environment (e.g., screen sharing, reactions). The third group received a Zoom technology-mediated dialogic (T+DLD) training session, which combined both training approaches.

Baseline Discussion

The baseline discussion served as a counterfactual for each group. Prior to the training session, each group met separately with the researcher via Zoom. During the baseline discussion session, the group watched a video of the researcher read aloud the picture book *Millie Fierce* (Manning, 2012). The read aloud was video recorded prior to the discussion to ensure an identical read aloud experience for each group, and showed the illustrations and text from a document camera as well as the researcher's face from a webcam. After the read aloud, the researcher presented a set of potential discussion questions before inviting the group to discuss the text, and a timer was set for 10 minutes. The discussion was video recorded.

Condition Trainings

Dialogic Discussion Training. The DLD training condition involved students in one group receiving a 30-minute training within the Zoom platform several days after the preliminary baseline discussion. This training lesson was adapted from the Thinking Together program developed by Dawes et al. (2000). The lesson was adapted for use in a remote learning environment (see Appendix A for details). For example, the lesson developed by Dawes et al. began with a plenary session—a short lesson presented by the teacher to the whole class. Next, the planned lesson sent students off into small groups to discuss talk as a tool, co-constructing three to five ground rules about talk. Students were to consider what actions, questions, dispositions, or decisions should guide small group discussions. Finally, the group was to reconvene to consolidate ground rules. Since this training session was provided via Zoom to only three students who were their own small group, the training started with a short mini-lesson before the researcher turned off his camera to allow for the students to do the small group work of agreeing on ground rules. At the end of the lesson, the researcher presented a set of potential discussion questions before inviting the group to engage in a practice discussion, using the ground rules they created. The session ended with a group reflection of their talk.

Technology Training. The TECH group participated in a 30-minute Zoom technology training, also within the Zoom platform (see Appendix B). During the training, the researcher demonstrated the basics of the Zoom platform (e.g., mute audio, mute video), as well as additional features (e.g., chat, share screen, stop screen share, reactions). Then, each participant in the group took a turn trying out all of the features demonstrated by the researcher. Next, the researcher explained a practice task and presented a set of potential discussion questions before

inviting the group to engage in a practice discussion using the features of Zoom. The session ended with a brief discussion through which the group reflected upon their talk.

Technology-Mediated Dialogic Discussion Training. The T+DLD group participated in a 40-minute technology-mediated dialogic discussion training (see Appendix C). This session incorporated components of the two trainings discussed above, requiring an additional 10 minutes. The session began in a similar fashion to the DLD training, engaging students in agreeing upon four ground rules. Next, the researcher presented Zoom basics, tips, and tricks, with time for each student to practice using each feature. In line with the other two training sessions, this session ended with the researcher presenting a set of potential discussion questions before inviting the group to engage in a practice discussion, practicing their ground rules as well as using the features of Zoom. The session also ended with group reflection through discussion.

Post-Training Discussions

After participating in a training session, each group engaged in three additional Zoom-based sessions spread across two weeks. Each discussion was recorded. Each reading discussion session in the study was facilitated in a similar fashion by the same researcher, and each session began with a previously recorded video read aloud of the picture book. The order of the three read alouds was the same for all three groups. Then the researcher turned off his webcam and microphone to visually disengage from the group, and set a timer to allow the group to engage in discussion for 10 min. The researcher selected 10 min since most discussions in pilot sessions lasted for less than 10 min.

After the discussion, the researcher provided timely feedback appropriate to the training condition (e.g., reminding students about a particular ground rule) and engaged in technology troubleshooting. This occurred either through the text chat feature, or the researcher unmuted his

camera and microphone, as necessary. While the emphasis within the small group was on student-directed activity, researcher-provided reminders emulated what a teacher might give to small groups within a traditional brick-and-mortar classroom. Quality of implementation was verified for each recorded session with a fidelity checklist (see Appendix D). At the end of each session, the group reflected upon the quality of discussion, answering three questions as a group: (1) What went well? (2) What was difficult? and (3) What might you do differently next time? Altogether, each session took approximately 30 minutes.

Data Collection

The researcher video recorded each small group, allowing for analysis of discussions from each of the study conditions. The recordings included the entire session in an effort to minimize distraction from starting and stopping video recording. However, only the 10 min small group discussions were transcribed. The teacher introductions and read alouds as well as the end of lesson reflections were not transcribed, although they were video recorded. To allow for systematic analysis, the recording of each group discussion was transcribed to represent speech as well as any other behavior with communicative function, such as gestures, non-word utterances, or use of technological features. Time stamps and pauses were also indicated. Video recordings were retained for confirmation and clarification of discourse. Additionally, the researcher collected low-inference field notes regarding interactions with the technology (e.g., sharing the screen, Zoom "reactions"), observations regarding student talk moves (e.g., references to ground rules), and content and rationale for any feedback given to the group by the researcher. Finally, the researcher collected transcripts of the text chat from the Zoom platform.

Data Analysis

The analysis derives from a sociocultural discourse analysis framework (Mercer, 2004) focused on multiple aspects of language combined with an attention on the use of technology and the presence of reading comprehension within the talk. Within this framework, multiple aspects of language are considered (i.e., linguistic, psychological, cultural) through the comparison of individual contributions to the larger meanings within the discussion (Pifarré et al., 2011). A sociocultural discourse analysis positions discussion as inherently situated within a social and temporal context (Kershner et al., 2010), therefore a frame of reference is used to make sense of the talk without reducing and abstracting the corpus to a set of tallies (Mercer, 2004). The initial frame of reference for analysis in this study used target features established by Wegerif and Dawes (1998) for dialogic talk (i.e., student-delivered task-focused questions, reasons provided for statements and challenges, consideration of more than one position, and drawing opinions from all members of the group). The analysis served to surface potential changes within each group across sessions as well as possible differences between groups. The initial frame of reference also included observed inferences found by Tompkins et al. (2013) to be significantly related to story comprehension (i.e., goals, actions referring to how goals are achieved, and character states). This frame of reference was not used as a coding scheme but rather a basis for making meaning while maintaining the contextualized nature of talk (Mercer, 2004).

To become more familiar with the overall discussions, the first author first watched the recordings of each session sequentially for each study condition. This allowed for an overall sense of each discussion (Willig, 2008). Next, transcripts were coded with the initial frame of reference in mind. During this stage, meaning units potentially related to aspects of the frame of reference were coded in relation to the nature and function of the language (Pifarré et al., 2011).

To analyze the data considering the research questions, the first author examined and compared coded transcripts with a focus on potential changes or differences across discussions. Potential changes were triangulated with field notes and video recordings.

Since qualitative research is influenced by assumptions and highly contextualized (Merriam & Tisdell, 2015), it is important to establish credibility and provide sufficient information to determine transferability. Triangulation is one method for establishing credibility in qualitative research, and involves two or more methods, data sources, investigators, or theories to confirm findings (Denzin, 1978). Triangulation of data sources (i.e., transcripts, video recordings, field notes) were used to promote credibility.

Results

Training and Text-Based Discussions

Changes from pre- to post-training discussions were observed for each of the three training conditions. For the sake of intelligibility, utterances that served as fillers such as "um" and "like" were removed from transcript excerpts. Student names are pseudonyms.

DLD Group

Prior to the dialogic training session, the group engaged in a text-based discussion of a read aloud. During this preliminary discussion, the talk did not feature reasoning, nor did it focus on the text. Take, for example, the following excerpt taken from the discussion of the text *Millie Fierce* (Manning, 2012) prior to the training session:

> Abby: I think that… just treat others like you want to be treated.
> Miles: And, even if you're mad at someone, you shouldn't treat someone else the way that… how you're mad. Instead you should just try to deal with the other person.
> Valda: Yeah, and tell adults how you feel and what people are doing to them so the adults can fix it. And be really nice.
> Miles: And try not to be mean to people. Try to be nice. And you might want to try to not be mean to someone else… not blame all your feelings on them…

Valda: And be nice no matter what.
Miles: No matter if…
Valda: Even when you want to be mean.
Miles: Even if someone else makes you mad, and then you want to blame it on someone else just to get your anger out, you still shouldn't because then you'll be asking the other person, "What did I do wrong?" and then they'll just say a bunch of mean stuff to you.

Although all the members of the group engaged in a polite discussion, Valda and Miles represented most of the talking. The topic of discussion centered on being nice and preventing bullying, which is thematically related to the text. However, the group did not center the discussion on the text or characters. Further, participants did not ask questions about ideas, nor did they give or question reasons for statements. For example, Abby started off by saying to "just treat others like you want to be treated." She did not explicitly link the idea to the text or give a reason, nor did any of the participants question it. This excerpt is representative of the type of talk that occurred throughout the full 10 min discussion in which group members took turns talking but did not work to understand differing perspectives.

After participating in the dialogic training session, the group engaged in another text-based discussion. In this discussion, the group attempted to promote reasoning within a discussion that was focused on the text. For example, the following excerpt from the group's discussion of the text *The Invisible Boy* (Ludwig, 2013) illustrates this initial shift:

Abby: What I think about the book is that… when it's starting, he felt lonely. But then he started feeling—kind of in the middle and the end—he started to feel not very invisible anymore 'cuz he had new friends now.
Valda: Yeah. And one of his friends were nice, and one of his friends… that was nice, his friend was meaner.
Miles: And also, I wonder why you think that?
Valda: So, why I think that is because his friend is nice and his other friend was mean. And then, the friend that was mean did not want to play with him, and became that he was invisible.
Miles: True.
Abby: Yeah, I agree with you, Valda.
Valda: Thank you for agreeing with me.

Here Abby suggested the character in the book changed at the end after gaining new friends. This statement is left unquestioned before Valda shared a new observation that one friend was nice, and another was meaner. However, this led Miles to ask for further explanation, resulting in Valda's repetition of the statement, adding the perspective that the mean friend is the reason the main character was invisible. This excerpt illustrates an early attempt by the group to ask for reasoning, an important component of the dialogic training session. It also signifies the group's uneven approximation of engaging in deep discussion of a text. Abby's idea is not explicitly acknowledged, clarified, or challenged by the group. When Valda was asked for the reasoning that led to the idea, she did not expand on the idea. Following this exchange, Miles and Abby agreed, and the group moved on. This excerpt shows tracks of the dialogic training, including the importance of sharing ideas, asking for reasons, and listening to the person who is speaking. This exchange also demonstrates the novice status of this group in using talk to expand thinking.

As illustrated by the excerpts, the post-training discussion differed from the pre-training discussion in a few ways. The post-training discussion was focused on the text, considering ways in which the main character changed across the book. Next, evidence of a request for reasoning is present; Miles asked Abby to explain her reasoning after she shared an idea. Also, the contributions by group members were cumulative in nature, each building on the previous turn. These observed changes were directly taught and practiced during the dialogic training session.

T+DLD Group

The technology-mediated dialogic discussion group also engaged in a discussion of the text *Millie Fierce* (Manning, 2012) in a pre-training session. This discussion featured ideas thematically related to the text, but not specifically grounded in the story. In addition, group

members simply agreed rather than questioning reasoning. For example, the following excerpt demonstrates this cumulative talk:

> Sarita: What's important is if you don't get noticed, you shouldn't do bad things because that will make it more worse.
> Damon: Yeah. I agree.
> Andrea: The same.
> Damon: And, yeah, the important… the idea is you don't want to be mean, you just want to be nice, and maybe that will give you more attention.
> Sarita: 'Cuz if you're doing the bad choices 'cuz you want to get noticed, it'll actually make it worse, and may get more people to stop noticing you.
> Damon: Yeah. (19 seconds of silence.) Andrea, do you have any ideas or anything you want to share?
> Andrea. No.

In this excerpt, the group engaged in polite discussion about being nice, which is thematically related to the text. Sarita presented the idea that you "shouldn't do bad things because it will make it worse." Damon and Andrea simply agreed rather than asking questions.

Following the training session for dialogic discussion and Zoom technology, the group again engaged in discussion of a text. Within this discussion, the group focused on elements of the story, and attempted to question ideas for evidence of reasoning. In the following excerpt, the group discussed the text *The Invisible Boy* (Ludwig, 2013) focusing on the actions of the characters:

> Damon: (Shares his screen and displays a typed-up copy of the book, scrolling up and down as he talks.) So, I also think what's not fair is that everyone was being mean to the invisible boy. So, he… and I kind of felt bad because they didn't pay attention to him.
> Sarita: I got a question.
> Damon: Yeah?
> Sarita: I want to know how do you think everyone was being mean to him, because it… the reason because how people can be mean is like if they are bullying that person or hurting that person's feeling. Can you tell me something how people are mean to that boy? The invisible boy? Because all that I know that the characters are doing are just not talking to him.
> Damon: Ah. (4 second pause) And also, I think that the invisible boy is kind of sad because everyone was being mean to the new kid, Justin.

Within this excerpt, Damon presented the idea that it isn't fair that everyone is mean to the main character. He shared a copy of the text on the screen, scrolling up and down, likely looking for textual evidence. Sarita pushed back on the idea, first explaining what she defines as being mean, then asking for specific examples from the text. This caused Damon to pause, presumably to think about a response, before rejecting the question and moving on by sharing a new idea. This questioning without follow-through was a typical occurrence with this group.

The differences in the post-training as compared to the pre-training discussion are very similar to those of the DLD group. Differences included a discussion more focused on the book, requests for reasoning, and cumulative contributions in which students listened to and built upon previous ideas. In addition, the use of tools via screen sharing were attempted in the discussion. These observed changes were directly taught and practiced during the dialogic training session.

TECH Group

Finally, the technology group also engaged in a pre-training discussion of *Millie Fierce* (Manning, 2012). This group discussion included some thoughts related to the text, but limited interactions. The following excerpt illustrates the limited interactions of the group:

> Melanie: Um, she was not being appreciated.
> Casey: Ugh.
> Oscar: When they're mean a lot… when you start to not be mean anymore, nobody's going to want to be your friend.
> Casey: Hmmm. Nope. (24 seconds of silence.)

The excerpt shared here is representative of the group pre-training discussion. Melanie shared an idea about the character without reasoning or support. No questions or requests for more information came from the group. Then, Oscar shared a new idea thematically related to the text, but not specifically about the text. Again, no reasoning was provided, nor was it requested.

After participating in a training session involving features of Zoom that can support discussion, the group engaged in another text-based discussion. In this discussion, the group took turns sharing ideas about the book, demonstrating a more text-centered approach. The following excerpt is taken from the group's discussion of the text *The Invisible Boy* (Ludwig, 2013):

> Melanie: When they were picking people, people were trying to steal Claire—I can't remember her name, or his name. But the person, whoever chose Justin, is trying to be mean to Brian, so Brian doesn't get somebody to work with him. But then, at the end, they started getting to get together.
> Casey: I think that in the beginning of the book, nobody was really noticing Brian because when they were playing ball-thingy or whatever, they didn't even pay attention to Brian.
> Oscar: Nobody asked Brian when they were going to play ball.
> Casey: At lunch, Justin was kind of like… At lunch when he was at lunch, people were like… I don't know. Nevermind.
> Melanie: In the middle, Brian was trying to make friends. But in the end, he ended up making Justin and I can't remember the other person's name.

Here the group took turns sharing ideas about the book. Oscar paraphrased Casey's statement referring to the character, Brian, being excluded from tetherball. Although reasoning was not a part of the technology training, both Casey and Melanie included reasons in their ideas. However, ideas were not chained together, and no questions were asked about the presented ideas.

The changes in the post-training discussion as compared to the pre-training discussion involved the volume of talk as well as the shift towards text-based discussion. Whereas the first discussion involved very few ideas about the book and almost no reasoning, the post-training discussion focused on the character change in the book and included many more contributions. The use of technology remained consistent between the two sessions, despite specific instruction during the training session regarding tools to support discussion.

Repeated Exposure and Text-Based Discussion With Technology

T+DLD Group Screen Sharing

As part of the technology training, students learned about the screen sharing feature in Zoom. Across the three post-training discussions, the group increasingly used the screen share feature, most often to open a transcript of the text from the read aloud. Although students were likely looking for textual support to help guide the discussion, not once in any of the sessions was a student able to find a specific passage in the text, often resulting in scrolling up and down as the group talked. The sharing of screen also resulted in long turns that reduced the number of interactions among students. Take, for example, Andrea's turn in session 3 from the T+DLD group:

> Andrea: So, let me share my screen. (Shares her screen.) So, if we…
> Damon: Click the club research links.
> Andrea: So… (Opens the transcript of the book.) If we look in the book… so if we look in the book, the boy wants the bike so he doesn't have to run. He can ride. Um… and, like he said… but I know if I ride home on a bike, then I'll have to tell my parents where I got the money. So, he doesn't want to tell his parents, but he… wants the bike. (Stops sharing her screen.)

This sequence took 1:51 of the 10-minute discussion, and was one of three long sequences involving a screen share. Although this sequence contained both reasoning and elaboration, due to the binary coding of the turn, it contributed only one of each to the quantitative data. In contrast, the DLD group did not use the screen share feature of Zoom at all. In comparison to the long turn from the T+DLD group, here is a one of the longest turns from the DLD group:

> Miles: I think that Ruben was a very bad kid, but he was a good kid at the end because he finally gave the money back. And also, probably the only reason he gave the money back was he saw her being sad. And he just wanted the money for his own self, so he was kind of being selfish, and he also just wanted it so he could actually have a ride to school.

This turn took 28 seconds and contained both reasoning and elaboration. As a result, the DLD group engaged in discussion with a greater frequency of changes in speaker.

Naturalistic Discussion

Across sessions, discussion in both the DLD group and the T+DLD group became increasingly naturalistic in nature. During the first session after the training session, discussion was highly turn-based, with each student either taking turns or simply agreeing with an idea. For example, in the first discussion after the training, the DLD group frequently had interactions similar to this:

> Abby: What I think about the book is that… when it's starting, he felt lonely…
> Valda: Yeah.
> Abby: But then he starting feeling… kind of in the middle and the end…
> Valda: Yeah.
> Abby: He started to feel not very invisible anymore 'cuz he had new friends now.
> Valda: Yeah. And one of his friends were nice, and one of his friends… one of his friends that were... the friend that was nice, his friend was meaner.

Later, in the second discussion, the group incorporated more natural discussion moves, such as finishing sentences or overlapping discussion. For example:

> Abby: I'm surprised that the parents, they… they…
> Miles: …they work for them?
> Abby: …they work for them because they're so messy.

This also occurred within the T+DLD group in the second discussion:

> Andrea: So, the kid felt bad for his parents because the did didn't want his parents to, like…
> Damon: Like, to clean… the kid didn't want…
> Andrea: Yeah. The kid didn't want the parents to clean because the kid want to help out.

In the third discussion for the DLD group, quick exchanges led to overlapping speech:

> Valda: And I think it's mean to steal somebody's money and never give it back. But her thought it was bad to steal people's money, so he gave it back, [but
> Abby: (Overlapping Valda) [You're… Especially a hundred dollar bill.] [That's a lot of money…
> Valda: (Overlapping Abby) […because of that much money. Yeah, it's not nice to take that much money.

Discussion

The purpose of this study was to understand how different approaches function in training elementary students for text-based discussion within a videoconferencing learning environment. From this study, small groups of students were assigned to one of three conditions—dialogic discussion only training (DLD), technology only training (TECH), and technology + dialogic discussion training (T+DLD). Changes in the quality of discussion were observed within the DLD condition and the T+DLD condition, and changes in the quantity and focus of discussion were observed in the TECH condition. Student discussion within the two conditions involving dialogic discussion (i.e., DLD, T+DLD) became increasingly natural over time, with exchanges overlapping frequently in a productive manner.

Changes in Text-Based Discussion

Several changes in the students' small group discussion resulted from the training sessions. One of the changes was a greater emphasis on reasoning within the groups receiving dialogic training (i.e., DLD, T+DLD). Previous research concerning the scaffolding of talk in elementary classrooms found when ground rules are collectively agreed upon and practiced, students in a small group are able to co-regulate their discussion to include reasoning (Warwick et al., 2013). When the students decided on ground rules and intentionally put the rules into action, the importance of asking questions about ideas was clearly defined. This potentially caused the change in reasoning for the dialogic groups (i.e., DLD, T+DLD) after the training.

Second, changes in small group discussions following the DLD and T+DLD training sessions included a cumulative nature in the exchanges. Alexander (2017) described the cumulative nature of talk within a dialogic discussion as questions, answers, and feedback that build into a coherent chain of reasoning. Within the DLD and T+DLD groups, students listened

to each other, added on to ideas, and engaged in more questioning. According to Sedova et al. (2016), this cumulative line of reasoning is a function of questions designed to elicit thoughtful answers, leading to new questions. Noroozi et al. (2013) attributed this line of reasoning to the affordance of a structured small group discussion in which reasoning is externalized. It is likely the emphasis on the questioning of reasoning led the DLD and T+DLD groups to engage in a coherent chain of reasoning.

Additionally, the use of technological features to support discussion increased in the T+DLD condition following the training session. Both the TECH and the T+DLD groups received training about the affordances of Zoom but only the T+DLD group attempted to use the technology in discussion. The difference in the use of Zoom features between the TECH and the T+DLD groups confirms previous research in which the use of technology depended more upon pedagogy than technologic affordances (Tondeur et al., 2017). Mercer et al. (2019) found digital technology can effectively provide support for implementing dialogic teaching but only if used with tasks designed to intentionally promote collective thinking. The difference between the TECH group and the T+DLD group (i.e., the dialogic training and purpose) likely explains the difference in the use of technology. The T+DLD group had a dialogic purpose to use the technology features to make meaning. The TECH group did not, and they did not put the tools to use. In other words, the pedagogy provided the need, and the technology provided the tool.

Finally, a change in discussion involved an increased focus on the text and story elements. This is noteworthy because not only did this shift occur in the two conditions receiving dialogic training but it also occurred with the group receiving only the technology training, even though the quality of reasoning did not change. This shift in the focus of the discussion fits with what researchers have long known about the effect of digital technology on discussion. For

example, in a study of talk among pairs of elementary students completing a computer-based task, Mercer (1994) discovered the computer environment and task design shaped the type of discussion that occurred. Even without the teacher directly facilitating the discussion, the design of the tool and the task indirectly influenced it. Warwick et al. (2010) described this as the vicarious presence of the teacher in the digital technology. The task design (i.e., listening to a read aloud and then discussing it) as well as the digital technology likely signaled to all groups that their discussion was supposed to be about the book. That is, students were highly aware of the content of the discussion due to the task design in the study.

Repeated Exposure to Dialogic Discussion

The repeated exposure to dialogic discussion resulted in three findings. The first finding relates to the nature of discussion. Over time, the discussions became more natural (e.g., overlapping speech, finishing the sentence of another person). With each discussion, students in the DLD group and the T+DLD group shifted from taking turns to share ideas to finishing sentences and talking over each other. Phillipson and Wegerif (2020) described a shift in which students move from wanting validation for an individual view to endorsing a more open-ended process of group dialogue, allowing for different viewpoints. From this perspective, it is likely that as students became more comfortable engaging in discussion, they started thinking more as a group and less as individuals, leading to overlapping and interconnected talk.

Second, the use of the technology tool without ongoing support decreased student interactions. Within the T+DLD group, the increased use of screen sharing took up an increasing amount of time. While the researcher reinforced ground rules for talk in both the DLD and the T+DLD groups, no additional support for using technology was given beyond the training session. Warwick et al. (2013) argued both direct scaffolding (e.g., physical presence of the

teacher to support students) and indirect scaffolding (e.g., ways the teacher supports students through task design and technology tool) are necessary, with the expectation that the teacher might need to respond to a request for help or to observed difficulties with a task. Within this study, much of the wasted time occurred when students were searching for a part of the text within a transcript of the picture book. However, without support from the teacher with suggestions such as annotating the text while listening to the book or prior to engaging in discussion, the use was ineffective.

Finally, the use of technology did not supplant the teacher. While all three post-training discussions in the DLD and the T+DLD condition maintained the presence of all four key dialogic indicators, no discernable pattern of change was found. This fits with the findings of Howe and Abedin (2013) in which the promotion of reasoning through exploratory talk was difficult for teachers to support in small group discussions. While exploratory talk was evident in the discussions, it did not increase over time. The two groups maintained the pattern where each student shared thinking and pressed for reasoning. This is likely due to a lack of ongoing teacher instruction during each session. Since learning occurs within a dialogic approach when participants consider multiple perspectives (Wegerif & Major, 2019), ongoing instruction through mini lessons could promote the exploration of differing ideas. However, previous research by Sedova et al. (2016) found changes in dialogic indicators were gradual and partial, occurring over time in a nonlinear fashion. Therefore, it is possible that additional sessions would reveal a pattern of change that was not observable in only three sessions.

Implications for Practice

The findings of this study provide evidence for the efficacy of implementing a dialogic discussion entirely within a videoconferencing environment and contributes to practice as well as

future research. First, this study suggests a training session based upon the Thinking Together program (Dawes et al., 2000) is an effective way to implement a dialogic discussion within a virtual setting for text-based discussion. Specifically, small groups should agree upon, practice, and reflect on ground rules for talk, with an emphasis on providing reasons for thinking. Additionally, teachers should consider ways to structure the task to highlight and explore differences in perspectives. Second, the technology does not replace the role of the teacher in supporting high-quality text-based discussion. While the task and the digital technology may provide the indirect scaffolding of the dialogue through the vicarious presence of the teacher, students still need scaffolding provided directly by the teacher. The teacher should reinforce ground rules, and provide feedback regarding the use of technology to represent collective thinking about the text.

Limitations & Future Directions

Several important limitations need to be considered. First, this study is limited by the sample size and design. While a case study provided meaningful qualitative data for analysis, the generalizability of the findings is unknown, as is the potential for sampling bias. Although the design may impact generalizability, the findings from this study are designed to make sense of the study context and provide guidance for future application elsewhere (Merriam & Tisdell, 2015). Future research might explore the efficacy of dialogic discussion with a greater number of small groups from various schools and classrooms. Another important limitation involves the longitudinal effects of the intervention. Each group participated in five sessions: a pre-training discussion, a training session, and three post-training discussions but all sessions occurred within three weeks. Future research could space the sessions, providing opportunities for additional discussions between observations, allowing for additional practice. This study was also limited

by the context in which the sessions occurred. Taking place within a public school experiencing both remote and in-person learning due to the COVID-19 pandemic, the context was unpredictable. At the specific time of the observed sessions, the format for learning was in-person. Participating students only met and engaged in discussion via Zoom, but this occurred within the structure and supervision of school staff, and each student was assigned a quiet spot away from other students. Prior experience with remote learning suggests this level of support is often not available at every home. Future research could evaluate less-structured environments, such as students in virtual learning settings. Finally, this study was limited by the task design associated with the dialogic discussion. The interactions between the researcher and the students were limited, resulting in two key differences between the study conditions and real-world conditions. First, the read aloud in the study was prerecorded, and was viewed in its entirety. In real-world dialogic tasks, there would likely be several opportunities throughout the read aloud for students to interact and think about the text. Second, students engaged in discussion without direct scaffolding from the researcher. Future studies should incorporate qualitative descriptive research in which authentic interactions among the students and the teacher take place, giving students additional ideas for discussion and opportunities for direct feedback during discussion.

APPENDICES

APPENDIX A

Dialogic Discussion Training Lesson

Training for Dialogic Discussion

(30 minute lesson) *Lesson adapted from:

Dawes, L., Mercer, N., & Wegerif, R. (2000). *Thinking together: A programme of activities for developing speaking, listening and thinking skills for children aged 8-11.* Birmingham, England: Imaginative Minds LTD.

Objective: To establish and practice using a set of 'ground rules' for talk.
I Can Statement: I can agree to a set of ground rules for talking in small groups.
Success Criteria: We can identify a short list of ground rules.

Introduction: (2 minutes)

- Review objective and success criteria.
- Introduce the concept of ground rules for social behavior:
    - Basic rules we all know even though they might not be talked about or written down
    - Ex: In a store (lining up, handling goods)
    - Ex: In a movie theater (talking during the movie, where to sit)
    - Ex: In a swimming pool (staying where it's safe for you, keeping electronics dry)
    - In class, people learn most when they discuss things. But we don't always all know the rules for talking. Ground rules help us get the most out of our discussions
- Are these useful rules? Read through the list and have kids give a thumbs up or thumbs down if the rule would help to encourage group discussion and learning.

Group Work: (10 minutes)

- Ask students to think alone for a minute: (Maybe jot notes)
    - What do you know about working in groups?
    - What sort of rules would help everyone to get the most out of the talk?
    - What are good ways to find out what other people know?
    - What difference does careful listening make?
- Share the "Are these rules useful?" on the screen.
    - Ask the group to appoint a writer.
    - Ask the group to talk together to create and decide on their six most important rules, remembering that the purpose for these rules will be to ensure effective group discussion.
    - Encourage children to consider their reasons for their choices.
- The group should quickly share their rules and reasons for them.
- While kids share, teacher types the rules on a blank document. Ensure the rules are concise, there are no more than six rules, and that none start with "don't"..

Practice Task: (15 minutes)

- Introduce the discussion questions:
    - What choices (big or small) did the character make?
    - What ***should*** the character have done?
- Introduce the task for the group:
    - Talk about the book, practicing using the ground rules. The most important part of the lesson is the discussion. The questions help start the conversation, but it doesn't need to be the only thing you talk about.
    - Today really concentrate on:
        - asking for and giving reasons for ideas
        - making sure everyone is heard
        - considering all ideas
- Read aloud the text, *Peter's Chair* by Ezra Jack Keats
- Students discuss the text, focusing on the Ground Rules. Ideas should be supported with reasons.
- Teacher provides feedback and support, referring to the Ground Rules and Discussion Questions.

Reflection: (3 minutes)

- Ask the students to reflect on the session content and on the quality of their talk together:
    - How well did your group work together?
    - What might your group want to do differently next time?

Are these useful rules?

1. The best reader should be in charge.
2. Ask everyone what they think.
3. Ask for reasons why.
4. Challenge what has been said if you have a different idea.
5. If people challenge your ideas, you can give reasons for them.
6. If a mistake is made, choose who is to blame.
7. If you hear a good reason, it's OK to change your mind.
8. If you know something important, keep it to yourself.
9. If you want to be heard, shout.
10. Make up your mind right away and don't ever change it.
11. Respect other people's ideas.
12. The most talkative person should speak most.
13. The oldest person should start the talk.
14. There should be a leader and the group does what they say.
15. People your own age can't teach you anything.
16. Make sure everyone is asked what they think.
17. Look at and listen to the person who is talking.
18. You should only agree with people you know.

APPENDIX B

Technology Training Lesson

Training for Zoom Technology

(30 minute lesson)
Objective: To identify and practice using the features of Zoom.
I Can Statement: I can use Zoom tools while talking in a small group.
Success Criteria: We can demonstrate the use of Zoom tools.

Introduction: (2 minutes)

- Review objective and success criteria.
- Introduce the basics of Zoom:
    - Zoom has tools the can help make it easier to talk to others online
    - Ex: Chat
    - Ex: Share screen
    - Ex: Reaction
    - In class, people learn most when they discuss things. But it can be tricky to have discussions online. Zoom has additional tools that can help make that discussion easier.
- Show the screen shots and tips and tricks for using the Zoom tools.

Group Work: (10 minutes)

- Share the Zoom skills on the screen.
    - Ask each student to try out all four skills (chat, share screen, stop share, reactions).
    - Check that basic skills are also in place (mute audio/video, connect to sound)
- Teacher helps students troubleshoot.

Practice Task: (15 minutes)

- Introduce the task for the group:
    - Introduce Task: Talk about the book, trying out the features of Zoom.
    - Teacher Reads aloud the text, *Peter's Chair* by Ezra Jack Keats
- Students discuss the text, using the features of Zoom.
- Teacher provides feedback and support, referring to the features of Zoom.

Reflection: (3 minutes)

- Ask the students to reflect on the session content and on the quality of their talk together:
    - How well did your group work together?
    - What might your group want to try differently next time?

APPENDIX C

Technology-Mediated Dialogic Discussion Training Lesson

Training for Dialogic Discussion AND Technology

(40 minute lesson) *Lesson adapted from:

Dawes, L., Mercer, N., & Wegerif, R. (2000). *Thinking together: A programme of activities for developing speaking, listening and thinking skills for children aged 8-11.* Birmingham, England: Imaginative Minds LTD.

Objective: To establish and practice using a set of 'ground rules' for talk; To identify and practice using the features of Zoom.
I Can Statement: I can agree to a set of ground rules for talking in small groups.
Success Criteria: We can identify a short list of ground rules.

Introduction: (2 minutes)

- Review objective and success criteria.
- Introduce the concept of ground rules for social behavior:
    - Basic rules we all know even though they might not be talked about or written down
    - Ex: In a store (lining up, handling goods)
    - Ex: In a movie theater (talking during the movie, where to sit)
    - Ex: In a swimming pool (staying where it's safe for you, keeping electronics dry)
    - In class, people learn most when they discuss things. But we don't always all know the rules for talking. Ground rules help us get the most out of our discussions
- Are these useful rules? Read through the list and have kids give a thumbs up or thumbs down if the rule would help to encourage group discussion and learning.

Group Work: (10 minutes)

- Share the "Are these rules useful?" on the screen.
    - Ask the group to appoint a writer.
    - Ask the group to talk together to agree on the four most important rules, remembering that the purpose for these rules will be to ensure effective group discussion.
    - Encourage children to consider their reasons for their choices.
- Students talk together.
- When the group has agreed on four rules, the teacher types the rules on the Google Slide.

Zoom Features: (10 minutes)

- Introduce the basics of Zoom:
    - Zoom has tools the can help make it easier to talk to others online

        - Ex: Chat
        - Ex: Share screen
        - Ex: Reaction
    - In class, people learn most when they discuss things. But it can be tricky to have discussions online. Zoom has additional tools that can help make that discussion easier.
- Show the screen shots and tips and tricks for using the Zoom tools.
- Share the Zoom skills on the screen.
    - Ask each student to try out all four skills (chat, share screen, stop share, reactions).
    - Check that basic skills are also in place (mute audio/video, connect to sound)
- Teacher helps students troubleshoot.

Practice Task: (15 minutes)

- Introduce the discussion questions:
    - What choices (big or small) did the character make?
    - What ***should*** the character have done?
- Introduce the task for the group:
    - Talk about the book, trying out the features of Zoom.
- Read aloud the text, *Peter's Chair* by Ezra Jack Keats
- Students discuss the text, focusing on Ground Rules and using the features of Zoom.
- Teacher provides feedback and support, referring to the Ground Rules and features of Zoom.

Reflection: (3 minutes)

- Ask the students to reflect on the session content and on the quality of their talk together:
    - How well did your group work together?
    - What might your group want to try differently next time?

APPENDIX D

Fidelity Checklists

Fidelity Checklist: Dialogic

Session #: _____

Table 3.3
Sample Fidelity Checklist: Dialogic

Teacher Behavior	YES or NO	Description (If Needed)
Session began with a review of the Ground Rules		
Prerecorded read aloud was played in its entirety.		
Read aloud adhered to the predetermined order (1. The Invisible Boy; 2. The Paper Kingdom; 3. A Bike Like Sergio's).		
Researcher muted camera during student discussion.		
Group had exactly 10 minutes to discuss the text.		
Researcher provided feedback on the use of ground rules.		
Group reflected on their talk by answering three questions: What went well? What was difficult? What might you do differently next time?		

Fidelity Checklist: Technology

Session #: _____

Table 3.4

Sample Fidelity Checklist: Technology

Teacher Behavior	YES or NO	Description (If Needed)
Session began with a review of the Zoom tools		
Prerecorded read aloud was played in its entirety.		
Read aloud adhered to the predetermined order (1. The Invisible Boy; 2. The Paper Kingdom; 3. A Bike Like Sergio's).		
Researcher muted camera during student discussion.		
Group had exactly 10 minutes to discuss the text.		
Researcher helped troubleshoot technology problems (if needed)		

Fidelity Checklist: Technology + Dialogic

Session #: _____

Table 3.5

Sample Fidelity Checklist: Technology + Dialogic

Teacher Behavior	YES or NO	Description (If Needed)
Session began with a review of the Ground Rules and the Zoom tools.		
Prerecorded read aloud was played in its entirety.		
Read aloud adhered to the predetermined order (1. The Invisible Boy; 2. The Paper Kingdom; 3. A Bike Like Sergio's).		
Researcher muted camera during student discussion.		
Group had exactly 10 minutes to discuss the text.		
Researcher provided feedback on the use of ground rules.		
Group reflected on their talk by answering three questions: What went well? What was difficult? What might you do differently next time?		

REFERENCES

REFERENCES

Alexander, R. (2017). *Towards* dialogic *teaching: Rethinking classroom talk* (5th ed.). Dialogos.

Angeli, C., & Tsaggari, A. (2016). Examining the effects of learning in dyads with computer-based multimedia on third-grade students' performance in history. *Computers & Education*, *92–93*, 171–180. https://doi.org/10.1016/j.compedu.2015.10.015

Basilaia, G., & Kvavadze, D. (2020). Transition to online education in schools during a SARS-CoV-2 Coronavirus (COVID-19) pandemic in Georgia. *Pedagogical Research*, *5*(4), em0060. https://doi.org/10.29333/pr/7937

Boelts, M. (2022). *A bike like Sergio's*. Candlewick Press.

Boyd, M. P., & Markarian, W. C. (2011). Dialogic teaching: Talk in service of a dialogic stance. *Language and Education, 25*(6), 515-534.

Dawes, L., Mercer, N. & Wegerif, R. (2000). *Thinking together: A programme of activities for developing speaking, listening and thinking skills for children aged 8-11*. Imaginative Minds Ltd.

Denzin, N. K. (1978). *The research act: A theoretical introduction to sociological methods*. McGraw-Hill.

Donnelly, D. F., Linn, M. C., & Ludvigsen, S. (2014). Impacts and characteristics of computer-based science inquiry learning environments for precollege students. *Review of Educational Research*, *84*(4), 572–608. https://doi.org/10.3102/0034654314546954

Duke, N., Pearson, D., Strachan, S., & Billman, A. (2011). Essential elements of fostering and teaching reading comprehension. In S. J. Samuels & A. E. Farstrup (Eds.), *What research has to say about reading instruction* (4th ed., pp. 51–93). International Reading Association. https://doi.org/10.1598/0829.03

Fernández-Cárdenas, J. M., & Silveyra-De La Garza, M. L. (2010). Disciplinary knowledge and gesturing in communicative events: a comparative study between lessons using interactive whiteboards and traditional whiteboards in Mexican schools. *Technology, Pedagogy and Education*, *19*(2), 173–193. https://doi.org/10.1080/1475939X.2010.491219

Freed, J., & Cain, K. (2017). Assessing school-aged children's inference-making: The effect of story test format in listening comprehension. *International Journal of Language & Communication Disorders*, *52*(1), 95-105.

Garas-York, K., & Almasi, J. F. (2017). Constructing meaning through discussion. In S. E. Israel (Ed.), *Handbook of research on reading comprehension* (2nd ed., pp. 500–518). The Guilford Press.

Garas-York, K., Shanahan, L. E., & Almasi, J. F. (2013). Comprehension: High-level talk and writing about texts. In B. M. Taylor & N. K. Duke (Eds.), *Handbook of effective literacy instruction: Research-based practice K–8* (pp. 246–278). The Guilford Press.

Howe, C., & Abedin, M. (2013). Classroom dialogue: A systematic review across four decades of research. *Cambridge Journal of Education*, *43*(3), 325–356. https://doi.org/10.1080/0305764X.2013.786024

Jeong, H., & Hmelo-Silver, C. E. (2016). Seven affordances of computer-supported collaborative learning: How to support collaborative learning? How can technologies help? *Educational Psychologist*, *51*(2), 247–265. https://doi.org/10.1080/00461520.2016.1158654

Kendeou, P., McMaster, K. L., & Christ, T. J. (2016). Reading comprehension: Core components and processes. *Policy Insights from the Behavioral and Brain Sciences*, *3*(1), 62–69. https://doi.org/10.1177/2372732215624707

Kendeou, P., van den Broek, P., Helder, A., & Karlsson, J. (2014). The division for learning disabilities of the council for exceptional children a cognitive view of reading comprehension: Implications for reading difficulties. *Learning Disabilities Research & Practice*, *29*(1), 10–16.

Kershner, R., Mercer, N., Warwick, P., & Kleine Staarman, J. (2010). Can the interactive whiteboard support young children's collaborative communication and thinking in classroom science activities? *International Journal of Computer-Supported Collaborative Learning*, *5*(4), 359–383. https://doi.org/10.1007/s11412-010-9096-2

Kintsch, W. (1998). *Comprehension: A paradigm for cognition*. Cambridge University Press.

León, J. A., & Escudero, I. (2017). Causal inferences in reading comprehension. In J. A. León & I. Escudero (Eds.), *Comprehension in educational settings* (pp. 63–86). John Benjamins Publishing Company.

Lin, H., & Kelsey, K. D. (2009). Building a networked environment in wikis: The evolving phases of collaborative learning in a wikibook project. *Journal of Educational Computing Research*, *40*, 145–169. https://doi.org/10.2190/EC.40.2.a

Ludwig, T. (2013). *The invisible boy*. Knopf Books for Young Readers.

Maine, F. (2015). *Dialogic readers: Children talking and thinking together about visual texts*. Routledge.

Manning, J. (2012). *Millie Fierce*. Philomel Books.

Mercer, N. (1994). The quality of talk in children's joint activity at the computer. *Journal of Computer Assisted Learning*, *10*(1), 24–32. https://doi.org/10.1111/j.1365-2729.1994.tb00279.x

Mercer, N. (2004). Sociocultural discourse analysis: Analysing classroom talk as a social mode of thinking. *Journal of Applied Linguistics*, *1*(2), 137–168. https://doi.org/10.1558/japl.2004.1.2.137

Mercer, N., & Littleton, K. (2007). *Dialogue and the development of children's thinking: A sociocultural approach*. Routledge.

Mercer, N., Hennessy, S., & Warwick, P. (2019). Dialogue, thinking together and digital technology in the classroom: Some educational implications of a continuing line of inquiry. *International Journal of Educational Research*, *97*, 187–199. https://doi.org/10.1016/j.ijer.2017.08.007

Mercer, N., Warwick, P., Kershner, R., & Staarman, J. K. (2010). Can the interactive whiteboard help to provide 'dialogic space' for children's collaborative activity? *Language and Education*, *24*(5), 367–384. https://doi.org/10.1080/09500781003642460

Mercer, N., Wegerif, R., & Dawes, L. (1999). Children's talk and the development of reasoning in the classroom. *British Educational Research Journal*, *25*(1), 95–111. https://doi.org/10.1080/0141192990250107

Merriam, S. B., & Tisdell, E. J. (2015). *Qualitative research: A guide to design and implementation.* John Wiley & Sons

National Center for Education Statistics. (2019). *Digest of education statistics*. Author

Noroozi, O., Weinberger, A., Biemans, H. J. A., Mulder, M., & Chizari, M. (2013). Facilitating argumentative knowledge construction through a transactive discussion script in CSCL. *Computers and Education*, *61*(1), 59–76. https://doi.org/10.1016/j.compedu.2012.08.013

Nystrand, M. (2006). Research on the role of classroom discourse as it affects reading. *Research in the Teaching of English, 40*(4), 392–412.

Nystrand, M. (2006). Research on the role of classroom discourse as it affects reading comprehension. *Research in the Teaching of English*, *40*(4), 392–412.

Ottenbreit-Leftwich, A., Liao, J. Y. C., Sadik, O., & Ertmer, P. (2018). Evolution of teachers' technology integration knowledge, beliefs, and practices: How can we support beginning teachers use of technology? *Journal of Research on Technology in Education*, *50*(4), 282–304. https://doi.org/10.1080/15391523.2018.1487350

Phillipson, N., & Wegerif, R. (2020). The Thinking Together approach to dialogic teaching. In E. Manalo (Ed.), *Deeper learning, dialogic learning, and critical thinking: Research-based strategies for the classroom* (pp. 32–47). Routledge.

Pifarré, M., & Kleine Staarman, J. (2011). Wiki-supported collaborative learning in primary education: How a dialogic space is created for thinking together. *International Journal of Computer-Supported Collaborative Learning*, *6*, 187–205.

Rhee, H. K. (2020). *The Paper Kingdom.* Random House.

Rojas-Drummond, S., Mazón, N., Littleton, K., & Vélez, M. (2014). Developing reading comprehension through collaborative learning. *Journal of Research in Reading*, *37*(2), 138–158. https://doi.org/10.1111/j.1467-9817.2011.01526.x

Sedova, K., Sedlacek, M., & Svaricek, R. (2016). Teacher professional development as a means of transforming student classroom talk. *Teaching and Teacher Education*, *57*, 14–25. https://doi.org/10.1016/j.tate.2016.03.005

Snow, C. E., & Matthews, T. J. (2016). Reading and Language in the Early Grades. *The Future of Children*, *26*(2), 57–74. https://doi.org/10.1353/foc.2016.0012

Soter, A. O., Wilkinson, I. A. G., Murphy, P. K., Rudge, L., & Reninger, K. (2016). *Analyzing the discourse of discussion: Coding manual*. Unpublished manuscript, Department of Teaching and Learning, College of Education & Ecology, The Ohio State University. https://doi.org/10.13140/RG.2.1.4171.4163

Soter, A. O., Wilkinson, I. A., Murphy, P. K., Rudge, L., Reninger, K., & Edwards, M. (2008). What the discourse tells us: Talk and indicators of high-level comprehension. *International Journal of Educational Research*, *47*(6), 372–391. https://doi.org/10.1016/j.ijer.2009.01.001

Tompkins, V., Guo, Y., & Justice, L. M. (2013). Inference generation, story comprehension, and language skills in the preschool years. *Reading and Writing*, *26*(3), 403–429. https://doi.org/10.1007/s11145-012-9374-7

Tondeur, J., Van Braak, J., Ertmer, P. A., & Ottenbreit-Leftwich, A. (2017). Understanding the relationship between teachers' pedagogical beliefs and technology use in education: a systematic review of qualitative evidence. *Educational Technology Research and Development*, *65*(3), 555-575.

Warwick, P., Mercer, N., & Kershner, R. (2013). "Wait, let's just think about this": Using the interactive whiteboard and talk rules to scaffold learning for co-regulation in collaborative science activities. *Learning, Culture and Social Interaction*, *2*(1), 42–51. https://doi.org/10.1016/j.lcsi.2012.12.004

Warwick, P., Mercer, N., Kershner, R., & Staarman, J. K. (2010). In the mind and in the technology: The vicarious presence of the teacher in pupil's learning of science in collaborative group activity at the interactive whiteboard. *Computers & Education*, *55*(1), 350–362. https://doi.org/10.1016/j.compedu.2010.02.001

Wegerif, R. (2007). *Dialogic education and technology*. Springer. https://doi.org/10.1007/978-0-387-71142-3

Wegerif, R., & Dawes, L. (1998). Encouraging exploratory talk around computers. In M. Monteith (Ed.), *IT for Learning Enhancement* (pp. 10–29). Intellect Press.

Wegerif, R., & Major, L. (2019). Buber, educational technology, and the expansion of dialogic space. *AI & Society*, *34*(1), 109–119. https://doi.org/10.1007/s00146-018-0828-6

Wegerif, R., Mercer, N., & Dawes, L. (1999). From social interaction to individual reasoning: an empirical investigation of a possible socio-cultural model of cognitive development. *Learning and Instruction*, *9*(6), 493–516. https://doi.org/10.1016/S0959-4752(99)00013-4

Wilkinson, I. A. G., & Son, E. H. (2011). A dialogic turn in research on learning and teaching to comprehend. In M. L. Kamil, P. D. Pearson, E. B. Moje, & P. P. Afflerbach (Eds.), *Handbook of reading research* (Vol. 4, pp. 359–387). Routledge. https://doi.org/10.4324/9780203840412.ch16

Wilkinson, I. A. G., Reznitskaya, A., Bourdage, K., Oyler, J., Glina, M., Drewry, R., … Nelson, K. (2017). Toward a more dialogic pedagogy: Changing teachers' beliefs and practices through professional development in language arts classrooms. *Language and Education*, *31*(1), 65–82. https://doi.org/10.1080/09500782.2016.1230129

Willig, C. (2008). Discourse analysis. In J. A. Smith (Ed.), *Qualitative psychology: A practical guide to research methods* (2nd ed., pp. 160–185). SAGE Publications.

Yin, R. (2014). Case study research: Design and methods (5th ed.). Sage.

CHAPTER 4 – PRACTITIONER PIECE

Abstract

Despite empirical support for discussion as a method for reading comprehension as well as Common Core standards calling for student-led discussions of texts, it can be difficult for teachers to enact this type of instruction, especially remotely. This article presents a dialogic teaching, supported by digital technology, as an approach for promoting higher-level reading comprehension with elementary students in remote learning contexts. In addition to a theoretical underpinning, this article describes practical elements for the use of digital technology and lays out steps for introducing technology-supported dialogic discussion in the virtual classroom.

Enhancing Reading Comprehension with Small Group Discussion in Remote Settings

Implementing dialogic teaching is not easy during a pandemic. In the spring of 2020 when schools across much of the United States shifted to remote learning, teachers suddenly found themselves scrambling to provide instruction. Traditional instructional approaches of in-person teaching was pushed aside as many teachers learned the ins and outs of teaching via technology, many using such tools for the first time. Although students in a face-to-face classroom discussions could simply look to charts hanging on a wall or flip to a page in a book, students participating in discussion through a digital device have barriers to accessing the comparable artifacts. Due to the limited screen size, students must remember the various resources and toggle between screens, putting a significant burden on working memory and increasing cognitive load (Liu et al., 2012).Attending to the complexities of in-person approaches—such as a dialogic teaching—was not a priority. Instruction was further complicated when schools and individual classrooms shifted back and forth between in-person and remote learning during the COVID-19 pandemic. In light of these unexpected changes, there is also an opportunity for the reimagining of learning experiences in a post-pandemic world (Glaser et al., 2021).

Text-Based Discussion

Reading comprehension is a complex process with the ultimate goal of constructing meaning, and is highly influenced by attributes of the reader, the text, and the context of the reading (Duke & Cartwright, 2019). One way to facilitate the interactions among the reader, context, and text is through text-based discussion. Researchers established text-based classroom discussion positively impacts meaning making (e.g., Murphy et al., 2016), helping students to bridge gaps in understanding (Van den Branden, 2000) and supporting the development of

higher-order reading and thinking skills (Sun et al., 2015). In addition, reading achievement scores increase when text-based discussion is incorporated into classroom practice (Goodwin et al., 2021; Li et al., 2016). Specifically, researchers demonstrated the positive impact on reading comprehension from the promotion of reasoning together within group discussions about texts (e.g., Maine, 2013; Murphy et al., 2018). When students discuss a text and build on ideas shared by others, higher-level reading skills are developed (Wolf et al., 2006). This type of high-quality discussion fits within an instructional approach described by Mercer and colleagues (2019) as a dialogic teaching. Within this approach, teachers elevate the use of talk as a tool for collaboratively constructing and deepening the understanding of a text, empowering students to take over the facilitation of the discussion from the teacher (Mercer et al., 2019).

Considering the complexity in reading comprehension along with the affordances of using high-quality classroom discussion for constructing meaning, it is important to devise a method for supporting talk in remote or virtual settings. Teachers need accessible protocols and supports for integrating digital technology as well as instructional moves to strengthen discussion of text. This article provides some background as well as a process for implementing such an approach using a web-based videoconferencing platform.

Foundations of Dialogic Discussion

According to Vygotsky (1978), higher-order thinking first occurs through social interaction before individuals internalize the thinking. From a sociocultural perspective, students use talk, physical artifacts, and other tools to co-construct meaning (Wells, 2007). These interactions are influenced by the cultural values held by the students as well as the underlying institutional values of the learning environment. This sociocultural perspective suggests the interaction between the social processing of the group and the processing of each individual is

foundational (John-Steiner & Mahn, 1996). Therefore, the values, traditions, and experiences of individuals influence the ways in which they interact with others, which in turn impacts the individual construction of knowledge.

Within the domain of literacy, Freebody and Luke (1990) described reading comprehension as dependent upon social interaction around a text. That is, reading is a social act, drawing on social practices and cultural values. What this means for teachers is students need opportunities to interact with others around a text, illuminating the unique perspective of each individual reader. Through the negotiation of differing perspectives, students engage in collective reasoning and develop high-level comprehension (Murphy et al., 2009). Furthermore, the higher-level thinking skills developed through discussion also support deep comprehension on future texts (McKeown & Beck, 2015).

Embracing Differing Perspectives

Dialogic discussion leverages the power of student talk through which differing interpretations are discussed and understanding is created (Beers & Probst, 2012). This type of interaction redistributes interpretive authority to each student, rather than centering the teacher's interpretation (Soter et al., 2008). Through the discussion, students come to realize there is not a 'right' answer; rather, the differing ideas are all valued and considered. For example, a teacher might launch a discussion by asking the question, "Why do you think our main character reacted the way she did?" As students discuss their own interpretations, they justify, question, and evaluate ideas.

However, well-designed questions and meaningful student discussions do not necessarily represent a dialogic discussion. While it is important to provide an opportunity for students to share their thinking, it is equally important to develop a culture in which students want to

understand ideas different from their own, and have tools and skills at their disposal to draw out nuances in the thinking of others. By attending to the differing perspectives and ideas, students revise and deepen their own thinking (Asterhan et al., 2020), and a deeper comprehension is constructed jointly (Maine, 2015). One way to facilitate a dialogic discussion is to focus on the type of talk occurring within student discussions. Mercer et al., (1999) found exploratory talk—a kind of critical and constructive talk that brings out reasoning from ideas—is associated with an increase in reasoning, and promoting it can bring out differing perspectives to co-construct meaning. However, engaging in exploratory talk is predicated on the behavioral norms of the participants (Mercer et al., 2019). To establish and support these norms, teachers and students can create a set of ground rules for talk. When students know how to engage in deep conversation, the teacher can step back and assume the role of a coach standing on the sideline.

Technology-Supported Dialogic Discussion

Research regarding dialogic teaching is increasingly focused on the potential role of digital technology (Major & Warwick, 2020), specifically in the way students interact with each other while using technology (Knight & Littleton, 2015). Researchers found digital technology can support the development of a 'dialogic space'—the social context in which a small group interacts, supporting students as they think together through the sharing and understanding of differing perspectives (Wegerif & Major, 2019). In virtual setting, this could look and sound like a small group of students sharing, understanding, and challenging ideas. While engaging in this space, students manipulate digital artifacts, objects, and annotations that become ongoing representations of shared thinking, resulting in the co-construction of meaning (Kershner et al., 2010). Angeli and Tsaggari (2016) found digital technology works as a tool to direct student attention and action in the dialogic space, and Fernández-Cárdenas and Silveyra-De La Garza

(2010) discovered multimodal interaction afforded by digital technology increases gestures and pointing, leading to improved student communication.

At the same time, simply using digital technology is insufficient. The effectiveness of the technology in mediating interaction requires established dialogic practices and tasks (Engin & Donanci, 2015; Mercer et al., 2019), and the dialogic space is established and strengthened through the combination of digital technology, teacher support, and the task in which students are engaged (Warwick et al, 2010). In a review of the literature on the relationships between digital technology and classroom dialogue, Major and colleagues (2018) found digital technology enhanced productive classroom dialogue by supporting dialogic activity (e.g., knowledge co-construction), through the affordances of the technology (e.g., mediating interaction), and through the learning environment (e.g., motivation and engagement). These findings validate the importance of considering interactions among the task, the technology, and pedagogy of the teacher within a sociocultural context.

Essential Elements of Digital Platforms

As much as the use of technology relies upon effective dialogic practices and tasks, there are also a few important technical capabilities for a digital platform or app to support a dialogic discussion (see Table 4.1). Since reinforcing ground rules—important actions that promote high quality talk—is an effective practice for engaging students (Murphy et al., 2018), the technology should provide easy access to a list of the ground rules for students to reference during their discussion. In addition, the technology should allow for digital artifacts that can be manipulated while students share ideas with others (Mercer et al., 2019). Artifacts could be images or other media, moveable text, annotations, or other objects that could represent ideas or thinking. Students should be able to move, point at, or gesture towards these artifacts as they discuss a text

(Hennessy, 2011), creating a focal point that graphically represents the current thinking of the group (Angeli & Tsaggari, 2016). One example of technology with features that can support discussion is Talkwall (see Table 4.1). Talkwall provides a class feed for students to contribute ideas, pictures, and weblinks. Small groups can physically drag ideas from the class feed into their discussion space and manipulate the ideas on screen. The small group can also identify central ideas among artifacts.

Table 4.1

Sample Free Platforms that Support Dialogic Discussion

Platform	Description	Web Address	Supporting Features
Jamboard (Google)	Collaborative whiteboard	jamboard.google.com	• Multiple pages to house resources • Add and manipulate images, text, shapes • Annotate, highlight • Track changes and undo feature
Google Docs (Google)	Collaborative text editor	docs.google.com	• Hyperlink to other resources • Add and manipulate images, text, shapes • Add comments • Track changes and undo feature
Padlet	Virtual bulletin board	padlet.com	• Hyperlink or upload other resources • Add and manipulate images, text
Talkwall	Web-based space for class dialogue	talkwall.uio.no	• Displays the small group discussion task • Add and manipulate ideas, images, links • Provides a class feed of contributions

Since features such as drawing and annotation on a digital display are effective in promoting exploratory talk (Kerawalla et al., 2013), the technology should include tools such as digital pens, highlighters, and laser pointers. These tools provide an effective way to share ideas and help students focus on the thinking of the group. Additionally, the ability to track changes in

thinking over time is another element to consider (Lin & Kelsey, 2009). As students interact with artifacts and tools within the platform, historical data are collected to document the changes that occur. For example, Google Jamboard (see Table 4.1) provides a "version history" that tracks changes, providing times, dates, and allows the users to rename the versions. A teacher could click through the versions to view the changes over time, or a group could use the list of changes when reflecting on their discussion. Figure 4.1 provides a checklist to help with selecting a digital technology. While many platforms encompass many or all of these features, use of the technology itself does not ensure dialogic discussion. The teacher must intentionally coordinate the implementation of a dialogic approach, the discussion task, and the supporting features of the digital technology.

Figure 4.1

Checklist for Selecting a Digital Platform or App

Element	Examples	✓
Easy access to resources	• ground rules • reading lesson charts • copy of the text	
Add and manipulate digital artifacts	• digital sticky notes • text boxes • photos/media	
Workspace that serves as a focal point	• whiteboard • blank slide	
Annotation tools	• digital pen • highlighter • laser pointer	
History of changes	• 'track changes' feature • 'undo' feature • version history	

Considerations for Remote Learning

While, in theory, a pedagogical approach traditionally used in face-to-face classrooms should inform the virtual instructional practices, instruction within a remote setting might require

additional problem-solving. For example, a class meeting virtually on Zoom might not have charts on a wall or a physical book to which students can refer. It is still important to create a dialogic space in which ground rules help students draw out differing perspectives and engage in collective reasoning. Therefore, ground rules should be easily accessible to students, as well as any other talk stems, charts, or tools that could support discussion. A page could be added in Google Jamboard to hold space for the ground rules or any other charts that might be useful. Similarly, teachers might share resources with students through a Google Doc, a learning management system (e.g., Google Classroom, Seesaw), or even directly through the videoconferencing platform itself.

Privacy became an issue for many people when instruction shifted to a remote setting during the COVID-19 pandemic (Finders & Muñoz, 2021). With classes connecting virtually, and webcams sharing glimpses into the homes of students, new issues arose around surveillance (e.g., Who might be watching, what might they see or hear, and are they recording?), equity (e.g., What can be seen in the background?), and disruption (e.g., Are there loud background noises or activity that could be distracting?). Therefore, it is ideal for students to have access to headphones with built-in microphones, and the digital platform should provide options for obscuring the

Also worth considering are the constraints of the devices used by students. If students are collaborating within a digital space such as Google Jamboard, many will need practice to develop their proficiency in switching between the Google Jamboard and the teleconferencing platform. If the digital platform doesn't provide breakout rooms, students may also need support in following a schedule and links to small group meetings. Finally, students might need tips for managing times when Internet bandwidth becomes unstable such as stopping the video camera if

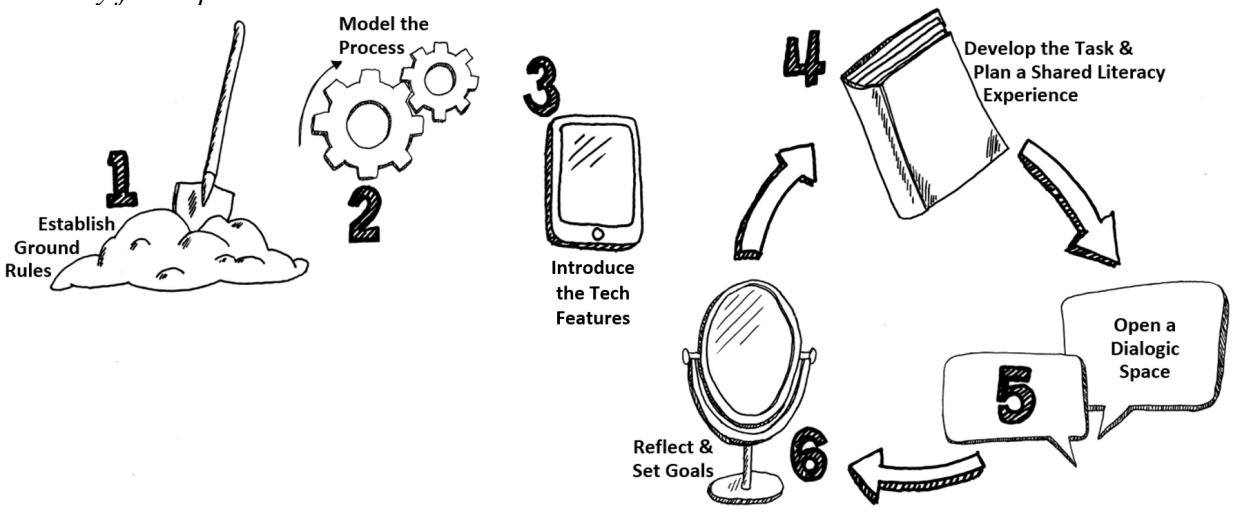
possible or moving closer to the router. Due to the specific context of each individual platform, teachers need to plan for challenges, and be prepared to problem-solve as additional challenges arise.

Launching Dialogic Discussion in a Remote Setting

The following section lays out steps for launching and supporting dialogic discussion that coordinates the teaching and the technology. Without suggesting a reductionist approach to an incredibly complex pedagogy, there are a few concrete components to help teachers begin this work. As illustrated in Figure 4.2, these components are organized into a sequence of six steps, representing one possible pathway for implementation. Each step could take a session or longer to accomplish, and steps four through six represent a continuous cycle in which each iteration is progressively improved and refined. Together, these steps work to coordinate the pedagogy, the technology, and the text-based discussion task, but could also be adapted for other subject areas, such as science or social studies. While Google Jamboard is used here to illustrate each step, there are other platforms that could easily support dialogic discussion (refer to Table 4.1).

Figure 4.2

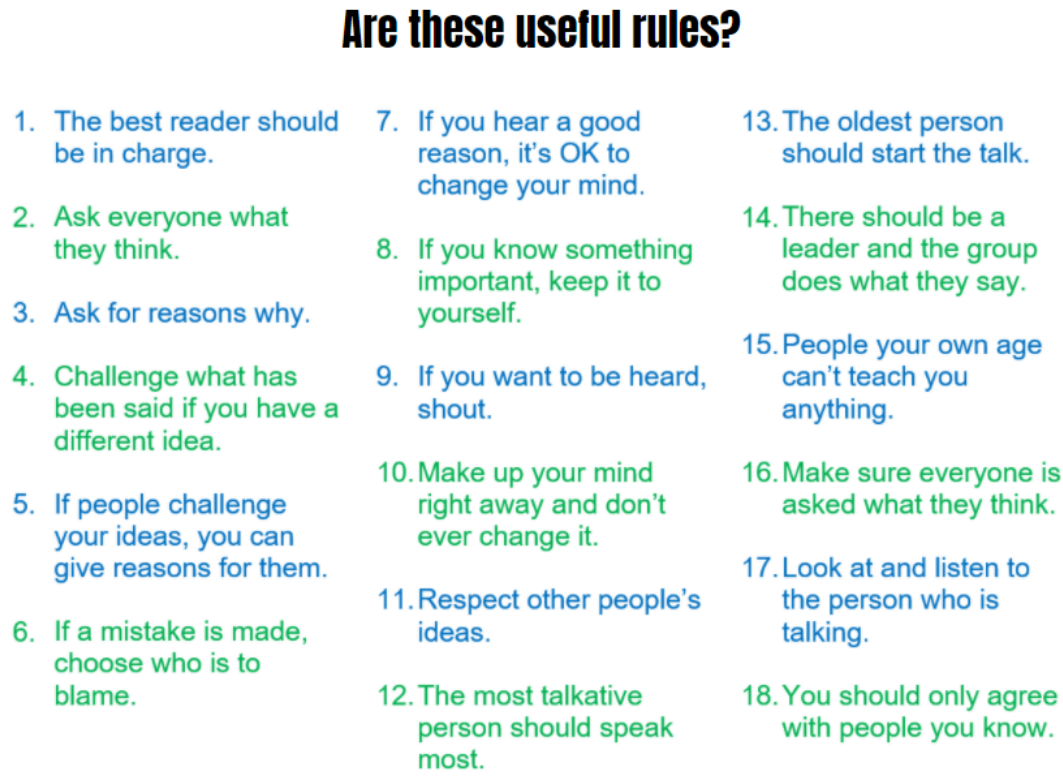
Pathway for Implementation



Step 1: Establish Ground Rules

To begin, teachers should introduce the concept of ground rules (Mercer et al., 1999), explaining to students that our world is full of rules that are helpful to know. For example, when playing sports or games, there is often a set of ground rules everyone agrees to before playing, such as play fair, take turns, and be a good sport. These rules might not be written down but they are generally understood and agreed to by all. Similarly, students should understand and agree to a set of ground rules to be used whenever talk is used as a tool for learning, especially in a remote setting. Mercer and colleagues (2019) found constructing ground rules as a class, then reinforcing the rules during discussion led to an increase in exploratory talk—the type of talk a dialogic approach seeks to promote. One way to create ground rules as a class is by providing ground rule examples and non-examples to create a selection activity (see Figure 4.3). The teacher numbers the examples and non-examples on a document, slide, or Jamboard, then shares it with students. Figure 4.3 shows an example of list of potential rules for students to review. Working together in small groups, students determine whether they believe each rule would be helpful, not helpful, or whether they aren't sure, and write the numbers on a piece of scrap paper they have at home or use a screen annotation tool in Zoom to indicate the selections. Students then further narrow down the choices and think about any additional rules that should be added. The final selection of rules could be shared with the teacher via chat box, notation on a Jamboard, or even handwritten on a piece of paper by one student to share verbally.

Figure 4.3
Examples and Non-examples of Ground Rules

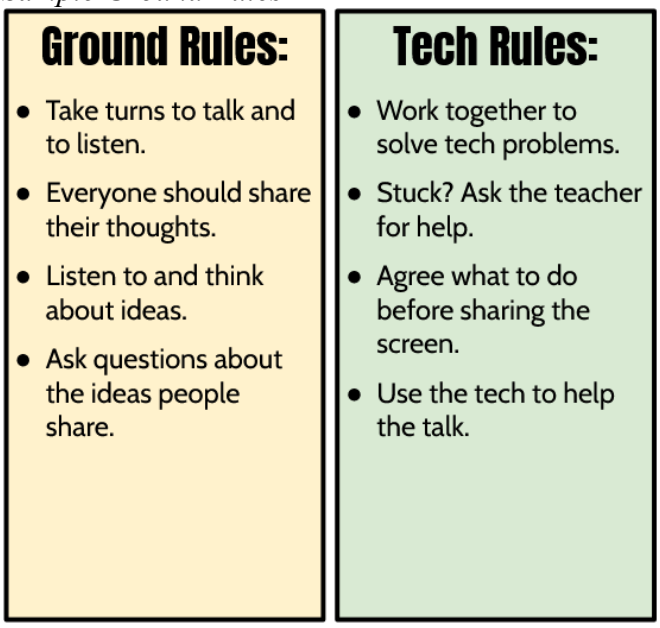


Adapted from https://thinkingtogether.educ.cam.ac.uk/resources

After small groups of students have selected the potential rules, teachers can bring the class together so each group can share the ground rules they selected. After students finish sharing their selections, teachers compile and combine to create a core set of ground rules that represents the thinking of the whole class (see Figure 4.4). This could be done quickly in front of the class via screen sharing or document camera, or revealed at a different time. Before expecting students to endorse the rules as something they helped create, it is important for teachers to allow students time to fully understand each rule, encouraging students to ask questions or advocate for changes. Once the rules are established, they should be shared in an accessible space for students, such as a Jamboard page, a shared document, or in a classroom

learning management system. These rules should be referenced frequently throughout synchronous sessions. The message should be clear: Whenever we are using talk as a tool for learning, we follow our agreed-upon ground rules. This can help establish a culture supportive in opening a dialogic space.

Figure 4.4
Sample Ground Rules



Students might need additional support for the use of the digital platform. Additional ground rules may be required specifically for the virtual environment to aide in reducing cognitive load. Although the process of developing ground rules for technology may be similar, their function might differ from ground rules for talk. Whereas ground rules for talk are designed to promote processes associated with exploratory talk, ground rules for technology might reinforce norms associated with effective uses of technology features, such as when to share a screen or how to use a virtual background appropriately. They are designed to support discussion as well as procedures for technology troubleshooting, such as the rules in Figure 4.4. To help students focus their attention on the discussion rather than getting distracted by the fancy

features, these technology ground rules should reflect the particular needs of the students and technology tools.

Step 2: Model the Process

After establishing the ground rules, teachers might demonstrate a discussion with a few student volunteers, using a fishbowl strategy (Reninger & Wilkinson, 2009). Much like a fish in a fishbowl, the small group discussion serves as the center of attention for outside observers. By observing and interpreting together, students approximate the work of co-constructing meaning while decentralizing interpretive authority. For example, the teacher might ask everyone except for the student volunteers to turn off their cameras, leaving only the fishbowl group visible. With the student volunteers, the teacher models a brief discussion about a previously read text while the rest of the class observes. Observers take note of what they see, hear, or feel happening in the discussion. During the demonstration, the teacher should try to make the use of the ground rules overt. For example, they might dramatically look at the ground rules and think aloud by saying, "Wow, our ground rules say everyone should be asked what they think and why they think it. I almost forgot about that. We haven't asked Lia yet. Lia, what do you think?"

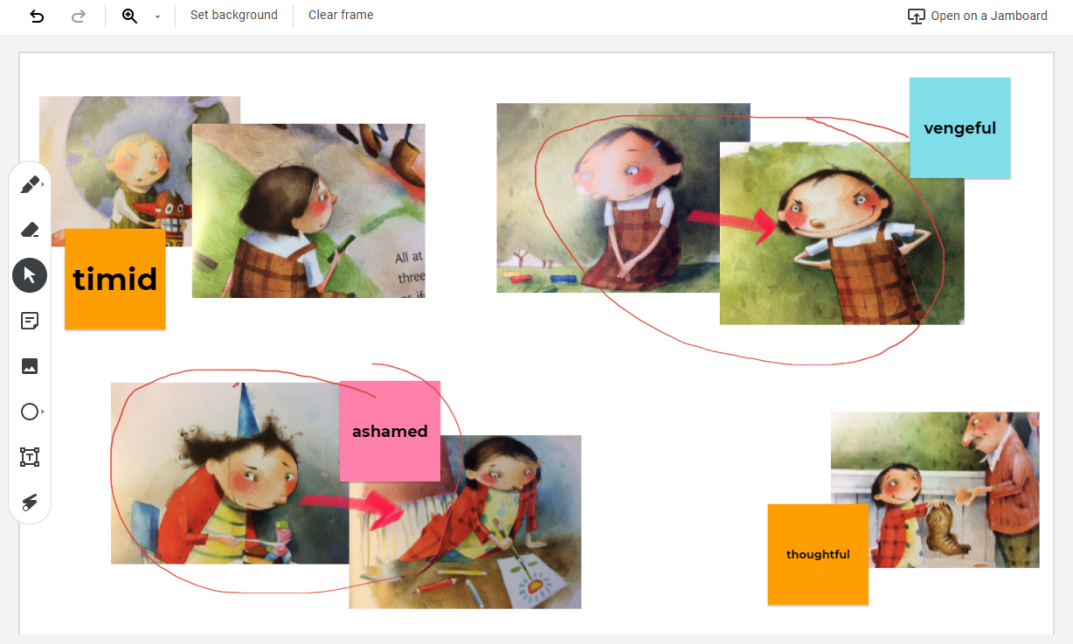
After modeling a brief discussion, the teacher might visually share the ground rules and take a few minutes to debrief with the whole class, asking what they saw, heard, or felt. Whenever possible, the response should connect back to one of the ground rules. While the students debrief what they noticed, the teacher considers possible revisions or additions to the ground rules. Building on the observations brought out by the class, they review and reinforce the importance of the ground rules. For example, "It sounds like we really noticed a lot that has to do with our ground rule about asking questions. We noticed that there were a lot of questions about ideas, and that really helped make the discussion even better." Then, teachers might send

the rest of the class up into breakout rooms of three and give students a chance to practice the ground rules, discussing the same book used by the demonstration group. Again, students begin to approximate the dialogic discussion. While the groups practice, the teacher will want to move quickly from room to room, coaching students to use the ground rules.

Step 3: Introduce the Digital Technology Features

After ground rules have been created and practiced—likely on a new day, teachers might introduce the features of the digital technology that will support their talk. This could begin with a demonstration of the features, such as adding an image or text, turning pages, or annotating on Google Jamboard. While demonstrating the technical features, a teacher might make connections between the feature and the role it could play during a discussion. The purpose here is to support the use of digital artifacts to mediate thinking in a dialogic space. For example, when introducing the function of adding an image to a Google Jamboard using the rear camera on an iPad, a teacher might suggest enhancing a discussion about a character changing across a book by adding a photograph of the character's face from a few key moments if the students have a physical copy, or taking a screenshot if the book is virtual. When introducing how to add text using the sticky note feature, teachers might suggest adding character feelings and traits to the Google Jamboard to help grow a theory about a character, as shown in Figure 4.5. To determine which features to highlight, teachers could make a list of the available features on the selected digital technology, then decide which features must be taught up front, and which features could be introduced later once students become more familiar with the technology. Often students will quickly discover new features the teacher might not even know about. As students continue to use the digital technology within their small group discussions, the technology will become second nature.

Figure 4.5
Google Jamboard Interface



Just like the way in which ground rules were introduced using a fishbowl and a follow-up practice, teachers will want to provide a model and an opportunity for students to see the technology in action. For example, if the group is using artifacts in Google Jamboard, the teacher might start a screen share, allowing the rest of the class to see what was happening within the online space. Very likely, the first time small groups practice using the technology will be bumpy. Someone might use the digital pen tool somewhere that bothers someone else. Students may get "lost" switching between windows. However, if the small groups work together over time, they will need to solve these issues. After reflecting afterwards on what went well and what was tricky, students are usually able to name problems that need to be addressed. By providing space for students to reflect and refine their own practices, they often come up with an additional ground rule or two related specifically to the technology.

Step 4: Develop the Task and Plan a Shared Literacy Experience

Planning for a discussion task is an important step. While the ultimate goal is to have students plan for a discussion about a book with minimal support, students will likely need a scaffolded approach to start. One way teachers can provide this support is through the creation of an open-ended task that promotes differing perspectives worth discussing. Depending on the text type you have selected, the discussion task might vary. Discussion for a narrative text might focus on character goals or change, or story theme, whereas discussion for informational texts might focus on answers to a central question or evidence for the author's point of view, to name a few. For example, in an interactive read aloud of the book *The Paper Kingdom* by Helena Ku Rhee (2020), the teacher might highlight a task comprising four lenses for thinking about the book: Important events, character change, lesson learned, and what's not fair (see Figure 4.6). Additional resources to help frame the discussion task might include the Common Core State Standards (http://www.corestandards.org/ELA-Literacy), inferential or interpretative comprehension resources from a core curriculum, or the Social Justice Standards (https://www.learningforjustice.org/frameworks/social-justice-standards). By planning a task that could draw out differencing perspectives, the teacher is ready to develop the shared literacy experience that will support the task.

Figure 4.6
Sample Task Chart

The shared literacy experience is designed to ignite discussion and support comprehension around the discussion task, often occurring live as a whole group before students are sent to breakout rooms or reconvene in small groups at a later time. This shared experience is designed to provide content for students to discuss related to the text, shared viewings of a short video, or explorations of images or infographics are common shared experiences. Before reading the text or sharing the media, the teacher needs to prepare for scaffolding that can occur through planned stopping points. For example, if planning an interactive read aloud, a teacher might find places in the text where they think aloud about the planned task, such as noticing when, how, and why a character changes. Teachers should plan for ways to support students during the experience so they are prepared to discuss it afterwards, such as jotting, gestures, or use of the chat box. For example, during an interactive read aloud of *The Paper Kingdom* (Rhee, 2020), a teacher might support students in noticing when Daniel—the main character—changes across the text by asking students to hold up a 'stop' hand when they see evidence. When several students signal to stop, the teacher might ask students to type a word in the chat box that describes the change, asking students to wait to hit submit the chat until a count of three, at which point all responses populate the chat simultaneously.

Step 5: Open a Dialogic Space

After reading the text, or after retelling the text if it is a different part of the day, teachers should start out by reviewing the ground rules. As students prepare to discuss the text, ground rules need to be at the forefront of their minds, enabling the complex work of engaging talk as a tool to deepen thinking and co-construct meaning. Teachers might review the task, then give students a few minutes to individually prepare for discussion. This preparation could include rereading notes, collecting artifacts for discussion such as screen shots of a character's face, or

jotting discussion ideas on a sticky note. Once everyone is mostly ready, it is time to launch small groups into their discussions.

While small groups are engaged in discussion, teachers will move between breakout rooms, listening to the talk. During this time, the focus of the teacher is coaching the talk, not the content of the talk. That is, the teacher might coach around the ground rules, identifying rules a group is working to include, giving reminders of ground rules a group is forgetting, or stopping a group to discuss and practice a particular ground rule that seems tricky (see Table 4.2 for sample methods of coaching small group discussions). The purpose is strengthening the dialogic space to improve productive talk. When time is up, or enthusiasm is beginning to wane, it is time to bring the discussions to a close.

Table 4.2
Methods for Coaching Small Group Discussions

Method	Description	Example
Whisper-in	Select one student in the group and whisper a suggestion.	"Ask her why she thinks that."
Join the group	Take on the role of a proficient participant.	"I'm really curious, Ali. Why do you think that?"
Pause the group	Briefly stop the group to offer a tip.	"Group, may I pause you a moment? When I look at our ground rules, I'm noticing you are really working on… A tip I have is…"
Record the group	Record a short video clip of the group, then show the clip to the group and ask what they notice.	"Group, let's take a moment and look at this clip of your work. While watching, think about what you notice."

Step 6: Reflect and Set Goals

While it might be easy to lose track of time in a busy virtual classroom, it is important to leave time at the end to reflect. According to Johnson and Johnson (2008), an important way to promote interdependence within a group is by ending discussions with a reflection, identifying

helpful and unhelpful interactions in the talk. To facilitate this reflection, teachers should do a quick whole-class check-in with the ground rules immediately following the small group discussions. A teacher might go through each ground rule one at a time, asking students to silently reflect on how their group did with that ground rule, giving a physical or virtual thumbs up or thumbs down. After the whole group reflection, teachers could ask each group to have a brief reflection conversation in breakout rooms, asking: What went well with our talk today? What was tricky about our talk today? What will we do differently tomorrow? This reflection is a way for students to set goals for improving the quality of talk. The next time there is a new text to discuss, students should identify what their goal is, then work towards achieving it. This reflecting into goal setting is key to long-term changes in the quality of talk.

Conclusion

Reflecting upon the potential for discussion in remote settings, it is clear that dialogic discussion represents high-quality thinking that is both individually created and collectively owned. This approach promotes speaking and listening skills called for in the Common Core State Standards such as preparing for discussion, asking and answering questions, and justifying thinking. Students also think deeply about text, developing comprehension at both the inferential and interpretive levels. Potentially more important are the ways in which students engage in prosocial behaviors to navigate collaborative work where ideas are shared and explored, using technology to mediate thinking. These skills and dispositions can work in remote settings, building the capacity to engage in high-quality discussions of texts in remote learning formats.

Yet, this type of discussion isn't easy to accomplish, and some days will be better than others. Teachers interested in enacting this type of learning should know it doesn't happen overnight, and the process is messy. At times, student discussion may seem awkward or

unproductive. There will be days when students won't have much to say about a read aloud. The technology platform or digital device will cause issues. Students will show up late, or not at all. However, continuing to practice and reflect will result in improvements, and the discussions will feel more authentic and less awkward over time. In the end, the dialogic virtual classroom is an exciting place where thinking and ideas are valued, students read with an eye towards discussion, and differing perspectives are celebrated. In settings like this, reading is a social act used to bring people together.

REFERENCES

REFERENCES

Angeli, C., & Tsaggari, A. (2016). Examining the effects of learning in dyads with computer-based multimedia on third-grade students' performance in history. *Computers & Education*, *92–93*, 171–180. https://doi.org/10.1016/j.compedu.2015.10.015

Asterhan, C. S. C., Howe, C., Lefstein, A., Matusov, E., & Reznitskaya, A. (2020). Controversies and consensus in research on dialogic teaching and learning. *Dialogic Pedagogy: An International Online Journal*, *8*, 1–16. https://doi.org/10.5195/dpj.2020.312

Beers, K., & Probst, R. E. (2012). *Notice and note: Strategies for close reading*. Heinemann.

Duke, N.K., & Cartwright, K.B. (2019). The DRIVE model of reading: Deploying reading in varied environments. In D.E. Alvermann, N.J. Unrau, M. Sailors, & R.B. Ruddell (Eds.), Theoretical models and processes of literacy (7th ed., pp. 118– 135). Routledge. https://doi.org/10.4324/9781315110592-8

Engin, M., & Donanci, S. (2015). Dialogic teaching and iPads in the EAP classroom. *Computers and Education*, *88*, 268–279. https://doi.org/10.1016/j.compedu.2015.06.005

Fernández-Cárdenas, J. M., & Silveyra-De La Garza, M. L. (2010). Disciplinary knowledge and gesturing in communicative events: a comparative study between lessons using interactive whiteboards and traditional whiteboards in Mexican schools. *Technology, Pedagogy and Education*, *19*(2), 173–193. https://doi.org/10.1080/1475939X.2010.491219

Finders, M., & Muñoz, J. (2021, March 3). Cameras on: Surveillance in the time of COVID-19. In *Inside Higher Ed*. Retrieved from https://www.insidehighered.com/advice/2021/03/03/why-its-wrong-require-students-keep-their-cameras-online-classes-opinion

Freebody, P., & Luke, A. (1990). Literacies programs: Debates and demands in cultural context. *Prospect: An Australian Journal of TESOL*, *5*(3), 7–16.

Glaser, H., Helmsing, M., Parker, A. K., & Zenkov, K. (2021). Adding the "T" to the "PACK" in clinical experiences: How technology shaped our pandemic teacher education pedagogies and partnerships. *New Educator*, *17*(4), 353–374. https://doi.org/10.1080/1547688X.2021.1983097

Goodwin, A. P., Cho, S. J., Reynolds, D., Silverman, R., & Nunn, S. (2021). Explorations of classroom talk and links to reading achievement in upper elementary classrooms. *Journal of Educational Psychology*, *113*(1), 27-48. https://doi.org/10.1037/edu0000462

Hennessy, S. (2011). The role of digital artefacts on the interactive whiteboard in supporting classroom dialogue. *Journal of Computer Assisted Learning*, *27*(6), 463–489. https://doi.org/10.1111/j.1365-2729.2011.00416.x

John-Steiner, V., & Mahn, H. (1996). Sociocultural approaches to learning and development: A Vygotskian framework. *Educational Psychologist, 31*(3/4), 191-206. https://doi.org/10.1080/00461520.1996.9653266

Johnson, D. W., & Johnson, R. T. (2008). Social interdependence theory and cooperative learning: The teacher's role. In R. Gillies, A. Ashman, & J. Terwel (Eds.), *The teacher's role in implementing cooperative learning in the classroom* (Vol. 7, pp. 9-37). Springer.

Kerawalla, L., Petrou, M., & Scanlon, E. (2013). Talk Factory: Supporting 'exploratory talk' around an interactive whiteboard in primary school science plenaries. *Technology, Pedagogy and Education*, *22*(1), 89-102. https://doi.org/10.1080/1475939X.2012.745049

Kershner, R., Mercer, N., Warwick, P., & Kleine Staarman, J. (2010). Can the interactive whiteboard support young children's collaborative communication and thinking in classroom science activities? *International Journal of Computer-Supported Collaborative Learning*, *5*(4), 359–383. https://doi.org/10.1007/s11412-010-9096-2

Knight, S., & Littleton, K. (2015). Thinking, interthinking, and technological tools. In R. Wegerif, L. Li, & J. C. Kaufman (Eds.), *The Routledge International Handbook of Research on Teaching Thinking* (pp. 467–478). Routledge. https://doi.org/10.5860/choice.51-2973

Li, M., Murphy, P. K., Wang, J., Mason, L. H., Firetto, C. M., Wei, L., & Chung, K. S. (2016). Promoting reading comprehension and critical-analytic thinking: A comparison of three approaches with fourth and fifth graders. *Contemporary Educational Psychology*, *46*, 101–115. https://doi.org/10.1016/j.cedpsych.2016.05.002

Lin, H., & Kelsey, K. D. (2009). Building a networked environment in wikis: The evolving phases of collaborative learning in a wikibook project. *Journal of Educational Computing Research*, *40*, 145–169. https://doi.org/10.2190/EC.40.2.a

Liu, T. C., Lin, Y. C., Tsai, M. J., & Paas, F. (2012). Split-attention and redundancy effects on mobile learning in physical environments. *Computers and Education*, *58*(1), 172–180. https://doi.org/10.1016/j.compedu.2011.08.007

Maine, F. (2013). How children talk together to make meaning from texts: A dialogic perspective on reading comprehension strategies. *Literacy*, *47*(3), 150–156. https://doi.org/10.1111/lit.12010

Maine, F. (2015). *Dialogic readers: Children talking and thinking together about visual texts*. Routledge. https://doi.org/10.4324/9781315718217

Major, L., & Warwick, P. (2020). Affordances for dialogue the role of digital technology in supporting productive classroom talk. In N. Mercer, R. Wegerif, & L. Major (Eds.),

Routledge International Handbook of Research on Dialogic Education (pp. 394–410). Routledge.

Major, L., Warwick, P., Rasmussen, I., Ludvigsen, S., & Cook, V. (2018). Classroom dialogue and digital technologies: A scoping review. *Education and Information Technologies*, *23*(5), 1995–2028. https://doi.org/10.1007/s10639-018-9701-y

Mckeown, M. & Beck, I. (2015). Effective classroom talk is reading comprehension instruction. In L. B. Resnick, C. S. Asterhan, & S. N. Clarke (Eds.), *Socializing intelligence through academic talk and dialogue* (pp. 51-62). American Educational Research Association. https://doi.org/10.3102/978-0-935302-43-1_4

Mercer, N., Hennessy, S., & Warwick, P. (2019). Dialogue, thinking together and digital technology in the classroom: Some educational implications of a continuing line of inquiry. *International Journal of Educational Research*, *97*, 187–199. https://doi.org/10.1016/j.ijer.2017.08.007

Mercer, N., Wegerif, R., & Dawes, L. (1999). Children's talk and the development of reasoning in the classroom. *British Educational Research Journal*, *25*(1), 95-111.

https://doi.org/10.1080/0141192990250107

Murphy, P. K., Firetto, C. M., Wei, L., Li, M., & Croninger, R. M. V. (2016). What REALLY works: Optimizing classroom discussions to promote comprehension and critical-analytic thinking. *Policy insights from the behavioral and brain sciences*, *3*(1), 27–35. https://doi.org/10.1177/2372732215624215

Murphy, P. K., Greene, J. A., Firetto, C. M., Hendrick, B. D., Li, M., Montalbano, C., & Wei, L. (2018). Quality talk: Developing students' discourse to promote high-level comprehension. *American Educational Research Journal*, *55*(5), 1113–1160. https://doi.org/10.3102/0002831218771303

Murphy, P. K., Wilkinson, I. A. G., Soter, A. O., Hennessey, M. N., & Alexander, J. F. (2009). Examining the Effects of Classroom Discussion on Students' Comprehension of Text: A Meta-Analysis. *Journal of Educational Psychology*, *101*(3), 740–764. https://doi.org/10.1037/a0015576

Reninger, K., & Wilkinson, I. A. G. (2009). Using discussions to promote striving readers' higher level comprehension of literary texts. In J. L. Collins & T. G. Gunning (Eds.), *Building Struggling Students' Higher Level Literacy: Practical Ideas, Powerful Solutions* (pp. 57–83). International Reading Association. https://doi.org/10.1598/0687.03

Soter, A. O., Wilkinson, I. A., Murphy, P. K., Rudge, L., Reninger, K., & Edwards, M. (2008). What the discourse tells us: Talk and indicators of high-level comprehension. *International Journal of Educational Research*, *47*(6), 372–391. https://doi.org/10.1016/j.ijer.2009.01.001

Sun, J., Anderson, R. C., Lin, T-J., & Morris, J. (2015). Social and cognitive development during collaborative reasoning. In L. B. Resnick, C. S. C. Asterhan, & S. N. Clarke (Eds.), *Socializing intelligence through academic talk and dialogue* (pp. 63-76). American Educational Research Association. http://www.jstor.org/stable/j.ctt1s474m1.8

Van den Branden, K. (2000). Does negotiation of meaning promote reading comprehension? A study of multilingual primary school classes. *Reading Research Quarterly*, *35*(3), 426–443. https://doi.org/10.1598/rrq.35.3.6

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes.* Harvard University Press.

Warwick, P., Mercer, N., Kershner, R., & Staarman, J. K. (2010). In the mind and in the technology: The vicarious presence of the teacher in pupil's learning of science in collaborative group activity at the interactive whiteboard. *Computers & Education*, *55*(1), 350–362. https://doi.org/10.1016/j.compedu.2010.02.001

Wegerif, R., & Major, L. (2019). Buber, educational technology, and the expansion of dialogic space. *AI & Society*, *34*(1), 109–119. https://doi.org/10.1007/s00146-018-0828-6

Wells, G. (2007). Semiotic mediation, dialogue and the construction of knowledge. *Human Development*, *50*(5), 244–274. https://doi.org/10.1159/000106414

Wolf, M. K., Crosson, A. C., & Resnick, L. B. (2006). *Accountable Talk in reading comprehension instruction* (Publication No. 670). National Center for Research on Evaluation, Standards, and Student Testing (CRESST).

CHAPTER 5 - DISCUSSION

This dissertation explored the role of digital technology within a dialogic approach, specifically as it relates to higher-level reading comprehension with upper elementary students. A systematic review of the literature presented in Chapter 2 established the current state of the research regarding digital technology and dialogic discussion for upper elementary students, identified gaps in the research, and provided directions for future research. Results demonstrate the limited number of studies evaluating technology-supported dialogic discussion with reading comprehension of upper elementary students, inconsistent use of essential components of dialogic teaching within intervention design, and the relationship between task design and the quality of student talk. The case study in Chapter 3 explored three different student training approaches for text-based discussions within a video conferencing learning environment. Several changes occurred in all three conditions related to the quality of discussion. Finally, the practitioner article in Chapter 4 provided teachers with a theoretical foundation for dialogic teaching and a practical means for implementation in a remote setting. A possible pathway for implementation was presented, based upon findings from this dissertation.

Overall, there are several findings synthesized from the various components of this dissertation, discussed below. Findings include the importance of the interaction of key elements (i.e., ground rules for talk, open task, and student reflection) for a dialogic approach. Second, the successful use of digital technology to support student discussion depended upon the task design (i.e., authentic and open) and support of dialogic processes. Next, technology can support dialogic discussion in both co-located and virtual settings. Finally, a gap exists in the literature for the role of technology-mediated dialogic discussion in literacy instruction despite indicators that the discussion can support higher-level reading comprehension.

The first major finding from this dissertation suggests dialogic discussion is built upon ground rules for talk, an open task, and student reflection, regardless of the medium or mode, which supports prior research (Engin & Donanci, 2015). The literature included in the systematic review in Chapter two identified the importance of all three, and the study in Chapter three was successful in initiating dialogic discussion using training and intervention sessions built on all three. According to Mercer et al. (1999), ground rules promote the reasoning and exploratory talk essential in a dialogic teaching. Knight and Mercer (2014) also determined task design directly impacts student discussion, and Phillipson and Wegerif (2020) identified student reflection as a method for developing the skills and goals necessary for ongoing improvement.

The second major finding from this dissertation suggests the successful use of digital technology to support discussion among upper elementary students depended upon the task design and support for dialogic processes. Within the systematic review, successful uses of technology were dependent upon the pedagogy, with most cases studying enacted affordances of the technology within the context of the instruction. This was observed in the study in chapter three in which both the technology-only group and the technology + dialogic discussion groups received training in the features of Zoom, but only the technology + dialogic discussion group put the tools to use during discussions. According to Tondeur et al. (2017), the use of technology is impacted more by pedagogy than technological affordances. Therefore, within a technology-mediated environment, the pedagogy provides the need for the tool as students think together.

The next major finding from this dissertation relates to the context of the digital technology. The technology was successful in supporting dialogic discussion both in co-located and virtual settings. Previous researchers successfully used classroom technology (e.g., interactive whiteboards, social media) to mediate face-to-face discussion (Cook et al., 2019;

Warwick et al., 2010). The researchers in this study were also able to use Zoom to support the initiation and facilitation of dialogic discussion within a virtual environment. Previous researchers studying the co-located use of technology found the task implemented within the technology as well as the introduction of the technology itself resulted in the vicarious presence of the teacher in the dialogic space (Warwick et al., 2010). Angeli and Tsaggari (2016) found digital technology served as a tool for shared attention and the development of a common goal. Therefore, the technology used within the systematic review as well as the study in Chapter three provided an indirect scaffold for the students that coincided with the teacher's dialogic perspective.

The final finding from this dissertation relates to reading comprehension. There are indicators that substantiate the use of a technology-mediated dialogic discussion for supporting higher-level comprehension but there is a gap in the field. In the dissertation, the Zoom-based training sessions led to increased reasoning in students as well as a greater focus on story elements (e.g., character feelings, motivations, problems). According to Kintsch and Rawson (2013), the understanding of story elements build on inferences drawn from textual information and background knowledge to establish global coherence—an essential component of higher-level comprehension. Likewise, previous researchers established higher-level comprehension as an outcome of high-quality text-based discussion (Duke et al., 2011; Matsumura et al., 2013). Although comprehension was not directly measured in this dissertation, the researchers hypothesize the shift in discussion could be attributed to a focus on higher-level comprehension. The lack of measuring comprehension directly is a systemic issue in the literature examining technology to support dialogic discussion, suggesting an area for further research.

Implications for Practice

Taken together, the components of this dissertation provide several practical implications for practitioners. The findings suggest teachers implementing dialogic teaching in service of strengthening text-based discussion with upper elementary students should focus on ground rules for exploratory talk, open-ended or partially-structured small group tasks that encourage multiple perspectives and collective decisions, and student reflections on their group talk. Although few studies in the systematic review contained all three components (i.e., ground rules, open-ended task, student reflection), each had significant empirical support individually. The study of Zoom-based discussion in Chapter three of this dissertation validated the use of all three components to improve the quality of discussion. Teachers enacting dialogic discussion within a virtual environment can provide support to students in text-based discussion by including the use of ground rules, reflection, and tasks designed with dialogue in mind. Teachers may want to consider how ground rules might be adapted to include collaborative processes specific to virtual environments, such as muting audio or video, or responding via text or other digital features.

A second implication is that educators should incorporate digital technology to support the implementation of dialogic discussion with elementary students to provide flexibility across virtual and co-located settings. In this dissertation, dialogic discussion was successfully implemented virtually within a teleconferencing environment (i.e., Zoom), and there is potential for flexibility across virtual and co-located settings. The systematic review of literature on dialogic discussion and digital technology substantiated the use of technology as a tool for mediating discussion, even if the research is in its infancy (Mercer et al., 2019). Teachers and researchers alike should consider the importance of exploring a dialogic approach to spoken discussion within virtual environments. The rapid changes of instructional format in response to

the COVID-19 pandemic has likely elevated the importance of technology for mediating remote learning for years to come (Twiner et al., 2021).

A final implication for teachers is the importance of shifting and growing pedagogical practices to endorse a dialogic approach. While technology can support discussion in either co-located or virtual settings, the more important implication is that a dialogic approach can transfer to a virtual environment. Ground rules can increase reasoning in conversation regardless of setting, and digital technology can provide artifacts that aid in opening a dialogic space. Since previous researchers suggest the task design within the dialogic space directly influences the type of talk that occurs as well as the use of technology (Mercer et al., 2003), teachers should design authentic tasks that are open in nature. Teachers should also adopt a student-centered approach to instruction, allowing students to engage in student-facilitated discussion. Rather than facilitating the discussion, teachers should support dialogic processes through the reinforcing of ground rules for talk as well as the use of digital tools, regardless of the setting in which the talk will occur. In other words, as students engage in discussion, teachers directly scaffold the talk, while the task and the technology indirectly scaffold discussion due to the vicarious presence of the teacher (Warwick et al., 2010). Finally, teachers should consider the process of shifting pedagogical practices to be an ongoing and long-term process. Ongoing modeling and reinforcing of ground rules should be included, as well as providing opportunities for students to reflect upon their talk and set goals for the future.

Limitations & Future Directions

This dissertation exhibits several limitations that are worth noting. The first limitation is the lack of reading achievement data. Although empirical support exists for the impact of high-quality discussions of text on reading comprehension, a dialogic approach supporting high-

quality discussion, and the affordances of digital technology in supporting a dialogic discussion, there is a need for research evaluating the impact of technology-mediated dialogic discussion on reading comprehension. Future researchers should include direct measures of individual reading achievement paired with an analysis of group discussion for higher-level comprehension in order to determine the efficacy of implementing dialogic discussion for supporting the development of comprehension ability.

Additionally, in consideration of the empirical recommendation for leveraging high-quality student discussions of text to promote higher-level reading comprehension (Matsumura et al., 2013), teachers will likely need support for extending discussions into the virtual realm. The exploratory research within this dissertation provided proof of concept for enacting dialogic discussion of texts within a virtual environment. However, students might also benefit from training on the technology tool as well, since prior experience with technology does not mean students are skillful users of the technology (Knight & Mercer, 2014). Additional research is needed to consider methods for training teachers to endorse digital technology-mediated dialogic discussion, methods for training students to engage in verbal discussion within virtual environments, the role of teacher as a mediator during virtual small group discussions, and the impact of differing technological platforms.

Another limitation is the generalizability of findings, especially regarding the small scale of the study in Chapter 3 and the small sample of included studies within the systematic review in Chapter 2. While clearly defined inclusion criteria in the systematic review and random sampling were implemented with the target population in mind (e.g., upper elementary students) in order to maximize external validity for that population, the small sample of included studies and students could have limited the generalizability. It is possible relevant research exists in

other contexts (e.g., math, secondary education) and could have influenced the outcomes. For this reason, additional research is needed with an expanded sample to determine generalizability. Future research should occur within the domain of literacy, with elementary students, and should include large scale studies potentially involving quantitative measurements of content learning. Expanding this empirical base would provide additional guidance for future practice and would explore the generalizability of the use of digital technology within a dialogic approach.

Finally, this dissertation is limited by the operationalized definition of dialogic teaching. This dissertation draws on a line of research influenced by the Spoken Language and New Technology project (SLANT; Mercer, et al., 1991) in England. This approach constitutes one method for structuring a dialogic discussion. However, a lack of coherence in the field regarding terminology and approaches resulted in other lines of research related to dialogic teaching (Kim & Wilkinson, 2019). Therefore, 'dialogic teaching' could be interpreted or implemented in different ways. Future research should consider the impact of digital technology with other dialogic approaches such as Accountable Talk (Michaels et al., 2008), collaborative reasoning (Chinn et al., 2001), dialogic inquiry (Wells, 1999), dialogic teaching (Alexander, 2017), and Philosophy for Children (Lipman, 2003).

REFERENCES

REFERENCES

Alexander, R. (2017). *Towards* dialogic *teaching: Rethinking classroom talk* (5th ed.). Dialogos.

Angeli, C., & Tsaggari, A. (2016). Examining the effects of learning in dyads with computer-based multimedia on third-grade students' performance in history. *Computers & Education*, *92–93*, 171–180. https://doi.org/10.1016/j.compedu.2015.10.015

Chinn, C. A., Anderson, R. C., & Waggoner, M. A. (2001). Patterns of discourse in two kinds of literature discussion. *Reading Research Quarterly*, *36*(4), 378–411.

Duke, N., Pearson, D., Strachan, S., & Billman, A. (2011). Essential elements of fostering and teaching reading comprehension. In S. J. Samuels & A. E. Farstrup (Eds.), *What research has to say about reading instruction* (4th ed., pp. 51–93). International Reading Association.

Engin, M., & Donanci, S. (2015). Dialogic teaching and iPads in the EAP classroom. *Computers and Education*, *88*, 268–279. https://doi.org/10.1016/j.compedu.2015.06.005

Kim, M. Y., & Wilkinson, I. A. G. (2019). What is dialogic teaching? Constructing, deconstructing, and reconstructing a pedagogy of classroom talk. *Learning, Culture and Social Interaction*, *21*(July 2018), 70–86. https://doi.org/10.1016/j.lcsi.2019.02.003

Kintsch, W., & Rawson, K. A. (2013). Comprehension. In M. J. Snowling & C. Hulme (Eds.), *The science of reading: A handbook* (pp. 211–226). John Wiley & Sons.

Knight, S., & Mercer, N. (2014). The role of exploratory talk in classroom search engine tasks. *Technology, Pedagogy and Education*, *24*(3), 1–17. https://doi.org/10.1080/1475939X.2014.931884

Lipman, M. (2003). *Thinking in education* (2nd ed.). Cambridge University Press.

Matsumura, L. C., Garnier, H. E., & Spybrook, J. (2013). Literacy coaching to improve student reading achievement: A multi-level mediation model. *Learning and Instruction*, *25*, 35–48. https://doi.org/10.1016/j.learninstruc.2012.11.001

Mercer, N., Hennessy, S., & Warwick, P. (2019). Dialogue, thinking together and digital technology in the classroom: Some educational implications of a continuing line of inquiry. *International Journal of Educational Research*, *97*, 187–199. https://doi.org/10.1016/j.ijer.2017.08.007

Mercer, N., Phillips, T., & Somekh, B. (1991). Spoken Language and New Technology (SLANT). *Journal of Computer Assisted Learning*, *7*(3), 195–202. https://doi.org/10.1111/j.1365-2729.1991.tb00248.x

Mercer, N., Wegerif, R., & Dawes, L. (1999). Children's talk and the development of reasoning

in the classroom. *British Educational Research Journal*, *25*(1), 95–111. https://doi.org/10.1080/0141192990250107

Michaels, S., O'Connor, C., & Resnick, L. B. (2008). Deliberative discourse idealized and realized: Accountable talk in the classroom and in civic life. *Studies in Philosophy and Education*, *27*(4), 283–297. https://doi.org/10.1007/s11217-007-9071-1

Phillipson, N., & Wegerif, R. (2020). The Thinking Together approach to dialogic teaching. In E. Manalo (Ed.), *Deeper learning, dialogic learning, and critical thinking: Research-based strategies for the classroom* (pp. 32–47). Routledge.

Tondeur, J., Van Braak, J., Ertmer, P. A., & Ottenbreit-Leftwich, A. (2017). Understanding the relationship between teachers' pedagogical beliefs and technology use in education: a systematic review of qualitative evidence. *Educational Technology Research and Development*, *65*, 555-575.

Twiner, A., Littleton, K., Whitelock, D., & Coffin, C. (2021). Combining sociocultural discourse analysis and multimodal analysis to explore teachers' and pupils' meaning making. *Learning, Culture and Social Interaction*, *30*(PA), 100520. https://doi.org/10.1016/j.lcsi.2021.100520

Warwick, P., Mercer, N., Kershner, R., & Staarman, J. K. (2010). In the mind and in the technology: The vicarious presence of the teacher in pupil's learning of science in collaborative group activity at the interactive whiteboard. *Computers & Education*, *55*(1), 350–362. https://doi.org/10.1016/j.compedu.2010.02.001

Wells, G. (1999). *Dialogic Inquiry*. Cambridge University Press. https://doi.org/10.1017/CBO9780511605895