



PAPER-BASED AND ON-LINE TEXT: IMPLICATIONS FOR PEDAGOGY AND READING SUCCESS

Throughout Canadian classrooms, students have access to books, magazines, charts, and posters, each providing an opportunity to use a wide range of strategic processes to interact with, explore, consider, and reflect on both the obvious and subtle messages of the texts' authors. These same students know that in their classrooms, this information is also available at the click of a mouse.

For large swaths of Canadian communities, such access to paper-based and on-line text continues at home. But access to text does not necessarily translate into student reading engagement. Is there a difference between these experiences of reading and how students engage with them?

Establishing a common understanding of reading and reading instruction

Reading is a strategic meaning-making, problem-solving process that increases in power and flexibility with practice and effective instruction. Effective reading instruction is complex and goes well beyond a specific approach, program, or piece of technology. Effective reading instruction is anchored in various interactions with engaging, accessible, and culturally relevant text. The instructional process is recursive—it begins with knowing each student as a learner and planning student-responsive lessons that scaffold on existing skills and knowledges. Students learn that effective interactions with text require a variety of approaches to think critically and strategically, intentionally using multiple cueing systems. Throughout this instruction, the teacher observes student participation and progress while providing timely feedback and prompts about the next steps to increased reading proficiency.

While we know a lot about reading instruction for paper-based texts, reading instruction for on-line text is still in its infancy. On-line reading is designed to be less linear and provides immediate access to various extensions of content through tabs, hyperlinks, embedded video, etc. To use these extensions effectively, and without getting lost in myriad vetted and unvetted links, on-line reading requires a sophisticated understanding of how and when to use navigation aids with intent, logic, and critical thought. If readers of on-line text have not developed these strategies, reading can devolve into skimming and scanning multiple (and often unrelated) items of information that may or may not enhance one's understanding. While encountering red herrings is of course also possible with paper-based text, the immediacy of access to massive quantities of information is a primary challenge of interacting with on-line text meaningfully.

This has implications for understanding the purpose, pedagogy, and potential of using computers and on-line text for reading instruction.

The most recent Progress in International Reading Literacy Study (PIRLS /ePIRLS 2016) provides information

about reading instruction for paper-based and on-line text in Canadian Grade 4 classrooms and its relationship with reading achievement.

Grade 4 reading achievement in Canada: Paper-based and on-line text

The 2016 results of PIRLS/ePIRLS confirm that Canadian students in Grade 4 are good readers. In the six Canadian provinces (British Columbia, Alberta, Ontario, Quebec, New Brunswick, and Newfoundland and Labrador) that participated in the 2016 PIRLS study, 83 per cent of Canadian students met the advanced, high, or intermediate level of achievement for reading paper-based text, similar to the international median of 82 per cent. The results for students in the three provinces (British Columbia, Ontario, and Newfoundland and Labrador) participating in ePIRLS (on-line text) were similar; a total of 82 per cent of students met the advanced, high, or intermediate benchmarks of reading achievement. This total is similar to the international median of 84 per cent (Brochu, O’Grady, Scerbina, & Tao, 2018).

Reading instruction in Canadian classrooms

The PIRLS 2016 context questionnaires provide a glimpse into what reading instruction looks like in Canadian Grade 4 classrooms. As Figures 1 and 2 illustrate, many of the components of effective reading instruction are visible in the majority of Canadian classrooms. Teachers provide reading materials that link new content to prior knowledge and reflect the students’ instructional level. This is a strong indication that teachers are using formative assessment practices to gather information about student learning and are making instructional decisions based on that learning. With this information, teachers know that students are approaching a task with sufficient experience to engage with the content and that they face enough of a challenge to apply developing strategies and skills effectively. However, while these practices reflect most of the recursive “using assessment to inform instruction” loop, the proportion of teachers who provide students with individualized feedback is very low, so the loop remains incomplete. Without individual feedback, the opportunity to engage students in meaningful conversations about their progress and next steps in learning may be lost.

PIRLS/ePIRLS data also provide insight into classroom instruction in reading comprehension. Teachers in participating provinces are providing students with opportunities to participate in class discussions about texts and to reflect on the texts’ messages by locating information in text and providing support for its interpretation. These are often referred to as surface-level comprehension activities. Areas of reading instruction that require more strategic thinking and problem solving are less prevalent. These include the explicit instruction in the elements of an author’s craft and comprehension strategies such as predicting, comparing, and generalizing. Opportunities to learn about and engage in critical thought, which includes opportunities to challenge opinions and view text through multiple perspectives, are relatively rare.

FIGURE 1 Reading instructional tasks assigned by Canadian Grade 4 teachers participating in PIRLS/ePIRLS 2016

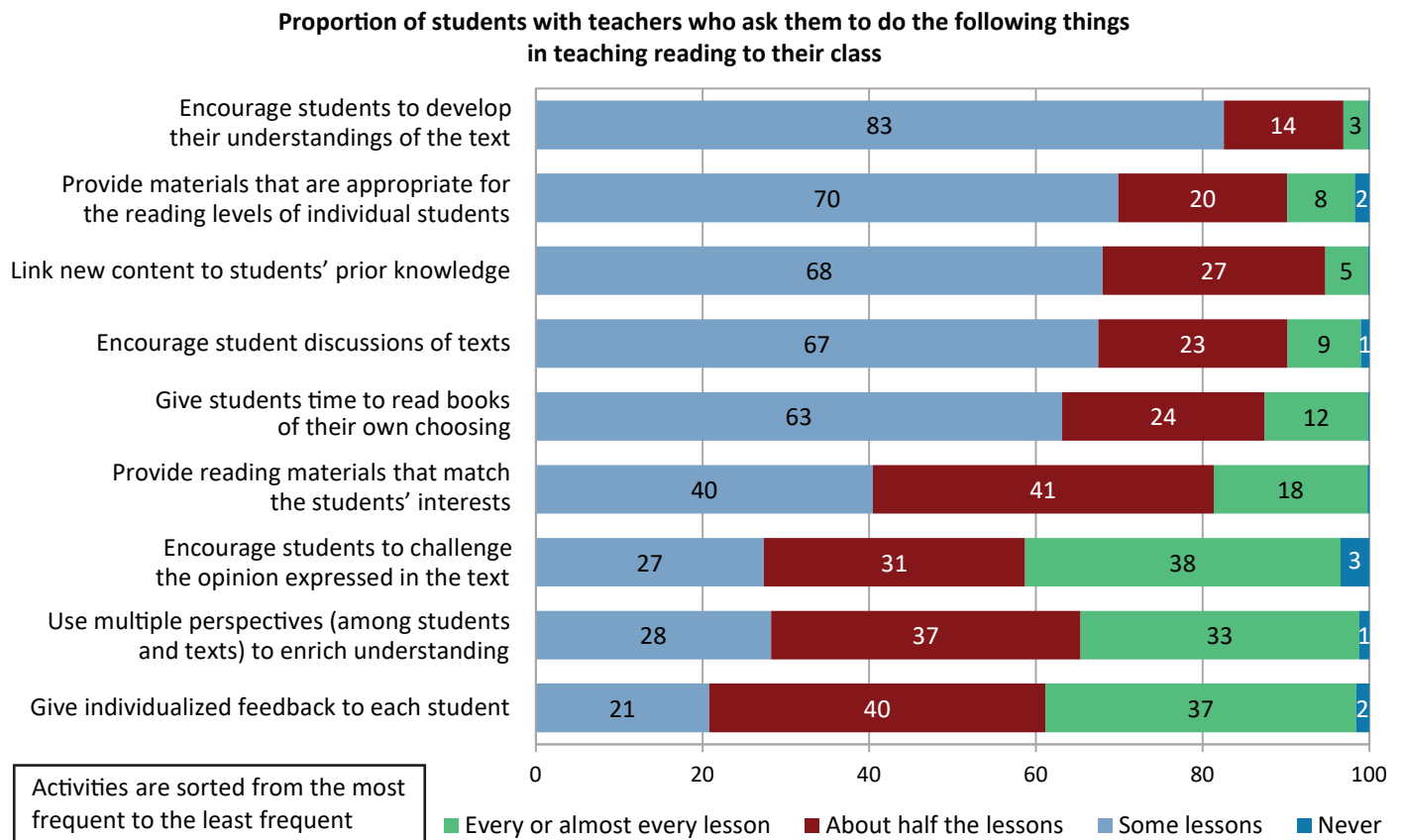
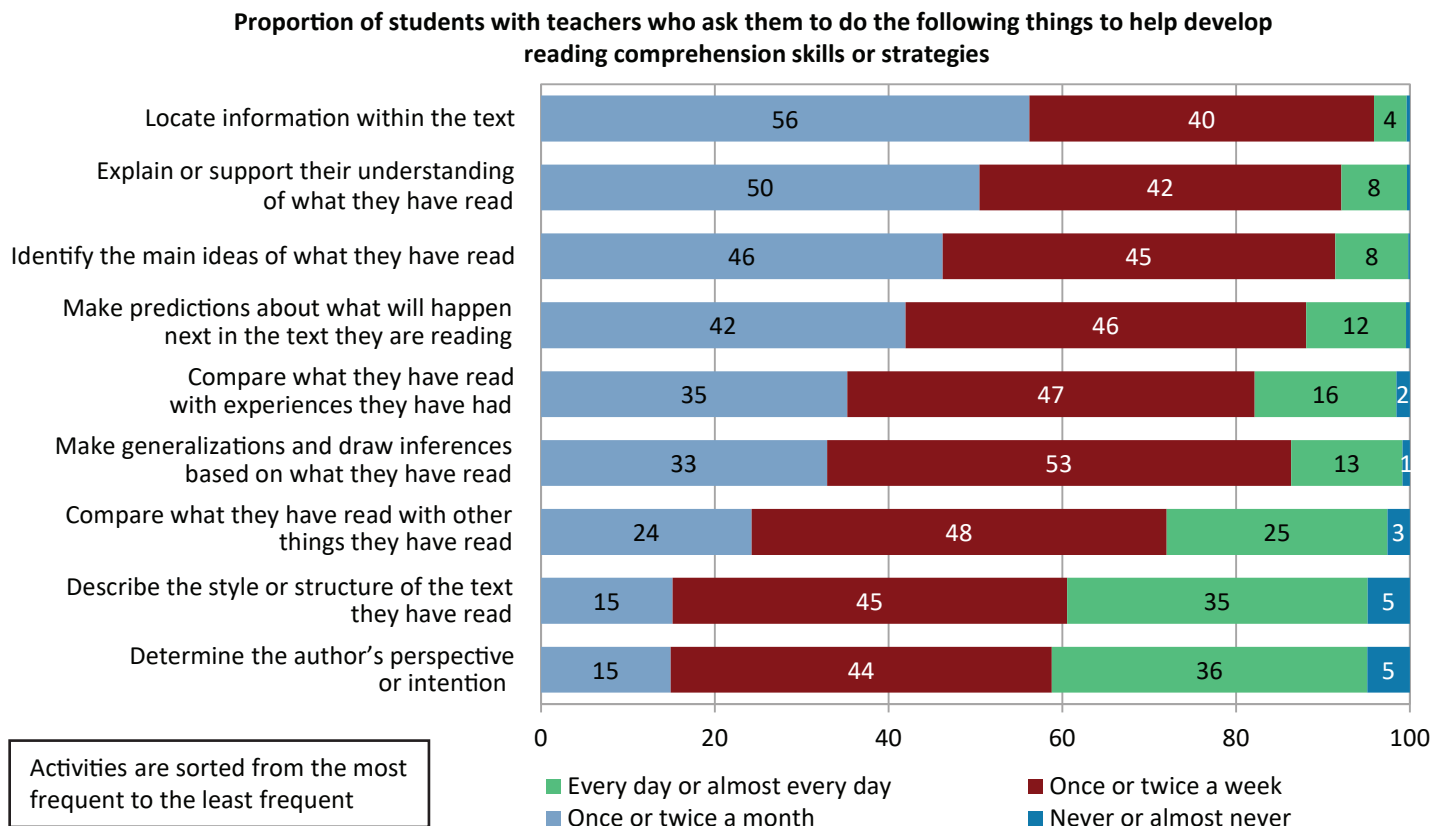


FIGURE 2 Strategies used to teach reading comprehension by Canadian Grade 4 teachers participating in PIRLS/ePIRLS 2016



Home and school supports for literacy

The PIRLS/ePIRLS context questionnaires provide information about home and school supports for literacy. “The data from these questionnaires enables PIRLS to relate reading achievement to curricula, instructional practices, and school environments ... The results obtained by PIRLS are used to improve teaching and learning methods in reading in many countries” (Brochu et al., 2018, p. 42). For example, some positive influences on paper-based and on-line reading achievement are liking reading, engagement with reading, self-efficacy in computer use, access to books, and home supports.

Liking and being engaged with reading

Students participating in PIRLS 2016 were asked several questions that provided insight into whether they liked and were engaged with reading. The results of student responses compared to their reading achievement establish a positive relationship between Canadian Grade 4 students who like and are engaged with reading and reading achievement in paper-based and on-line reading (Brochu et al., 2018). While at first glance the results might seem simple or even predictable, this is important information for decisions regarding policy and classroom practice such as curriculum, classroom book choice, topics studied, and pedagogy.

Student self-efficacy in computer use

The ePIRLS 2016 student questionnaire provided students with an opportunity to rate their levels of self-efficacy (i.e., perception of one’s own ability to meet a challenge and complete a task successfully) in computer use. Students with higher and medium levels of self-efficacy performed better in both PIRLS paper-based and ePIRLS on-line reading; students with low levels of self-efficacy in computer use performed less well. Based on these data, the difference in achievement between high and low levels of self-efficacy is slightly larger for ePIRLS than for PIRLS. This is consistent with the fact that the construct of on-line literacy as measured by e-PIRLS includes a component of computer use (Brochu et al., 2018).

Considering this information in light of how a teacher observes and responds to student learning confirms the importance of feedback. Feedback that begins with reference to what’s been accomplished, followed by a look forward to the next steps of learning and how to accomplish those steps, provides the student with a sense of their “known” and how that knowledge will inform their “new.” Karl, O’Leary-Kelly, and Martocchio (1993) found that while providing feedback is beneficial to all areas of study, the development of self-efficacy adds to that benefit. In other words, the relationship between feedback and the development of self-efficacy is positive. More recently, Yang and Wu’s (2015) work confirmed that feedback enhances student self-efficacy.

Access to home resources

The PIRLS 2016 Index of Home Resources includes the number of books in the home, the number of children’s books in the home, the highest level of parental education, the parents’ occupation, and the number of home study supports such as an Internet connection and a student’s own room in which to study (Mullis & Martin, 2015). Consistent with many other large-scale studies, PIRLS found the relationship between home resources and reading achievement to be positive but slightly less strong in Canada than internationally. Students living in homes with access to many resources performed significantly better on PIRLS than students with some or low access. The relationship of home resources to on-line reading achievement on ePIRLS was positive but slightly less than PIRLS paper-based reading (Brochu et al., 2018). The socioeconomic implications of these results are clear.

Exploring the relationship between computers and reading achievement

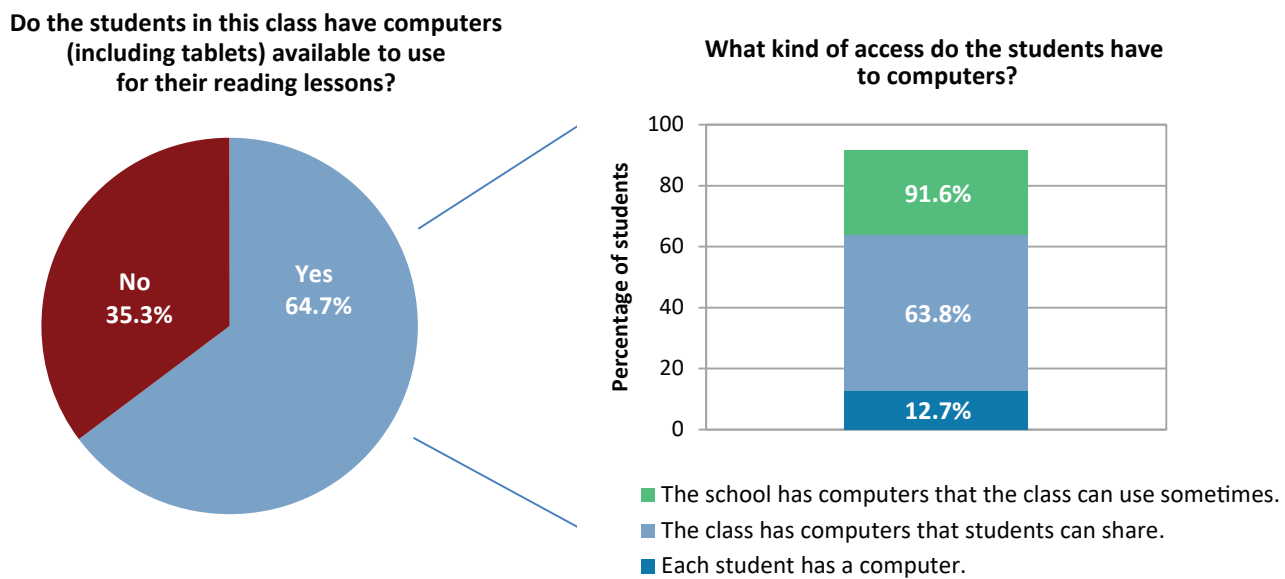
The 2016 PIRLS context questionnaires provided information about the relationship between reading achievement and access to computers and computer-based reading instruction. Some of these data confirm what appears to be obvious while other data challenge our assumptions.

Access to computers

The 2016 PIRLS context questionnaire included a Digital Devices in the Home Scale with three categories: high, medium, and low access. Students with high access to on-line devices at home performed better on ePIRLS than those with medium access. In Canada, virtually no students in participating provinces had low access to on-line devices at home (Mullis, Martin, Foy, & Hooper, 2017b).

As Figure 3 indicates, according to their teachers, two-thirds of participating Grade 4 students had access to computers or tablets to use for their reading lessons and 77 per cent of these students have shared or individual access to computers in their classrooms. This is more than the international average of 43 percent (Mullis, Martin, Foy, & Hooper, 2017a).

FIGURE 3 Student access to computers and tablets at school as reported by Canadian Grade 4 teachers in schools participating in PIRLS 2016



Despite this access, there is no relationship between on-line reading achievement and the availability of on-line devices in Canadian schools. This is different from the positive association observed between access to on-line devices in the home and on-line reading achievement (Brochu et al., 2018).

In Canada neither the presence of a school library nor its collection size of paper-based or on-line texts make a statistical difference to reading achievement. We surmise that it's the pedagogical practice used with any educational resource, such as computers in the classroom, a school library, or paper-based and on-line books, that provides the educational value. The discussion about pedagogical practice begins with frequency of use.

Frequency of computer use at home and at school

Since even the youngest child appears to engage with and navigate a computer with relative ease, it's a seemingly logical assumption that there would be a positive relationship between frequency of computer use and reading achievement. But the evidence challenges that assumption. Based on the ePIRLS 2016 results and student responses about computer

use, the relationship between on-line reading achievement and frequency of general computer use at home and at school is the same. In both cases, very frequent use is related to lower achievement.

Since access to and frequency of general computer use are not related to increased reading achievement, a deeper dive into the data is required to understand lower achievement’s association with frequent computer use. Student responses to questions about the purpose for which they use a computer or tablet at home or at school for schoolwork provide more information.

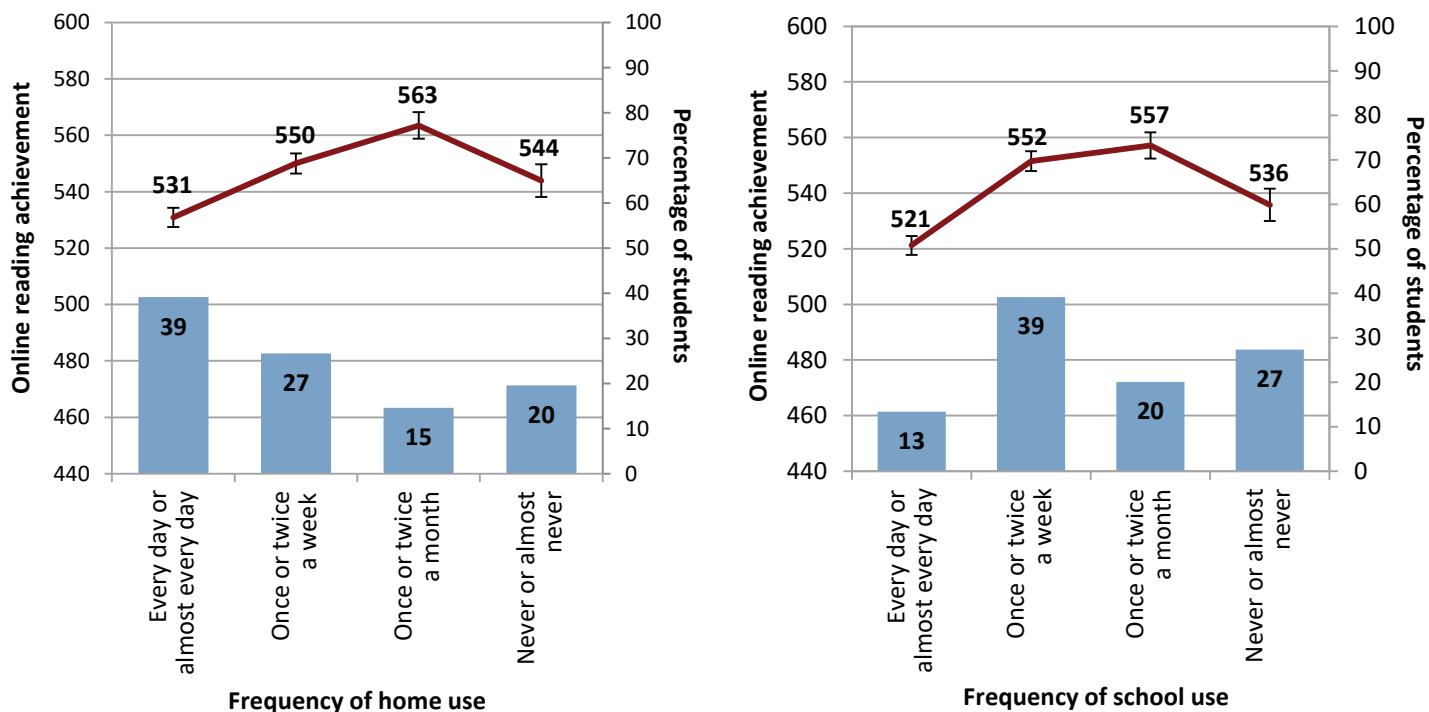
Computer use for schoolwork at home

About 80 per cent of Canadian Grade 4 students use a computer or tablet for schoolwork at home. The most positive relationship between frequency of use and on-line reading achievement is found when computers are used for schoolwork at home once or twice a month (Figure 4). This information confirms what we know about learning in the most general of terms: a simple measure such as time spent on any schoolwork, including reading paper-based or on-line text, is not related to success. Time becomes meaningful only when the learner is engaged with tasks that are purposeful, provide just the right amount of challenge, and offer opportunities to explore the topic through multimodal access which includes, but is not limited to, paper-based and on-line text (Taylor & Parsons, 2011).

Computer use for schoolwork at school

The relationship between computer use for schoolwork at school and reading achievement is the same as that for schoolwork at home: greater achievement is related to less frequent use (once or twice a month) of the computer for schoolwork (Figure 5). This information may challenge some existing classroom practices, such as the frequently scheduled “computer time.” If the intent of computer time is to build reading achievement, then computer time should include explicit instruction in the skills and strategies listed in Figures 1 and 2, opportunities for students to engage meaningfully with the text, and ongoing feedback from the teacher (or in some cases, feedback from the computer) about progress.

FIGURES 4 AND 5 Relationship between reading achievement and the frequency of general use of a computer and tablet at home and school as reported by Canadian Grade 4 students participating in PIRLS 2016



Each data set is compelling. While engagement, enjoyment, and self-efficacy are positively related to reading achievement, access, frequency, place of use, and general use are not.

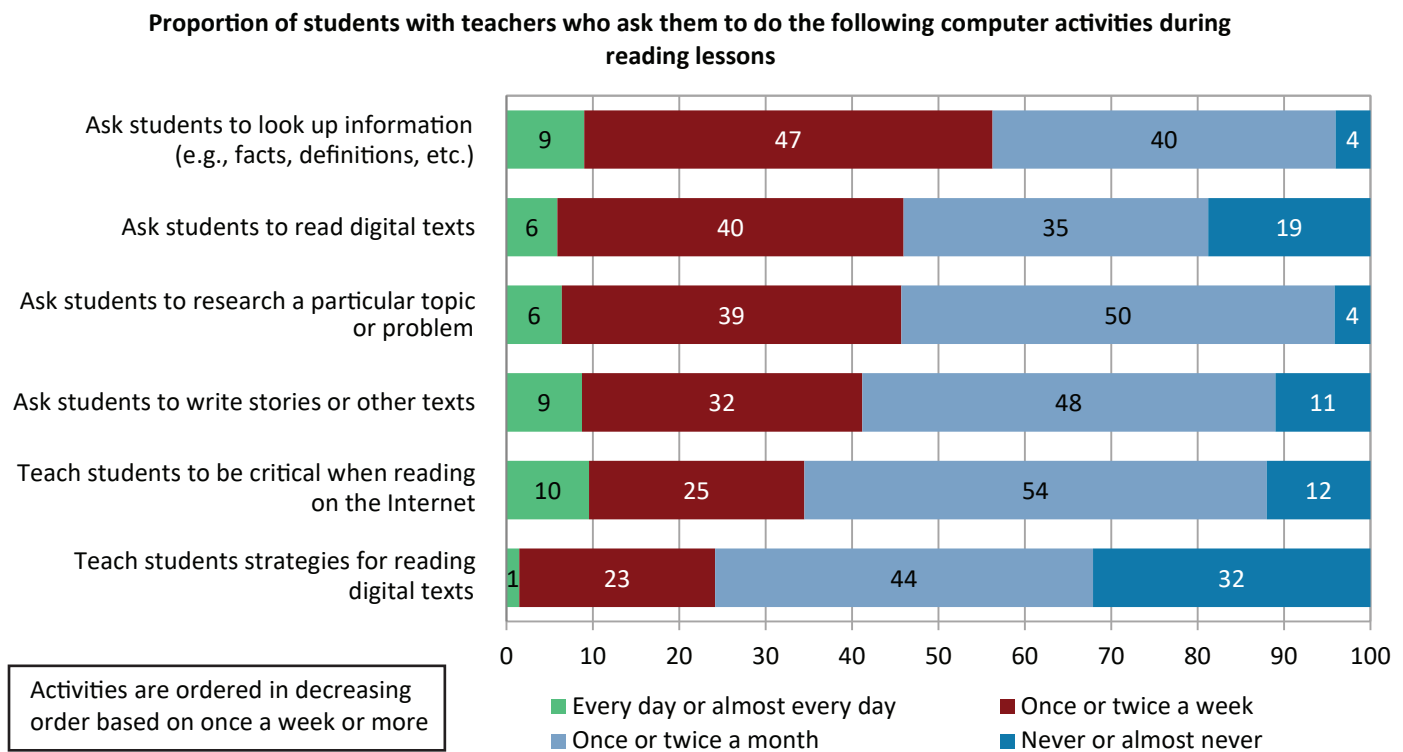
The positive relationship between student engagement and achievement noted here is not only a logical assumption but is also well supported by research. In a longitudinal review of the research, Dyer found “strong correlations between student engagement (typically defined as attention to the area of focus, active participation in learning, and time on task) and student achievement. These correlations remain strong for all levels of instruction, across all subject areas, and for varying instructional activities” (2015, p. 1). Perhaps even more important to any discussion about the relationship between classroom practice and student success is Dyer’s reference to the flip side of this research, which indicates that those students who were disengaged in the classroom had lower academic performance compared to engaged students. Since increased achievement for all students is a primary goal of educational change, it’s clear that student engagement must be considered. This continues to reinforce the importance of pedagogy that begins with acknowledging each student as a learner and the basis of knowledge (language, culture, interests, etc.) each student brings to their learning: the foundation for engagement begins with building on what one knows. Now that computers are available in most homes and schools, the opportunities to explore how to maximize their potential for enhancing paper-based reading are intriguing. First, we challenge some existing assumptions:

Just because our kids have grown up with devices doesn’t mean they know how to use them. On-line reading is different than print reading and our minilessons on paper text don’t always translate seamlessly to reading on a device. We must teach our students to navigate, interact and apply thinking strategies with text on screen. Then we need to observe, reflect and respond when understanding breaks down and reteach as necessary.

Too often when we send a child to read on a device it’s task oriented, “Go to National Geographic Kids and read the post about tsunamis. Then meet with your small group to discuss.” We need to make time for choice in on-line reading and guide our kids to ... websites that are appropriate and interesting. We provide students time to read, model and discuss what makes reading go well for us on either platform and guide students to understand the “why” behind what they choose to read.” (Ziemke, 2016, n.p.)

PIRLS/ePIRLS 2016 confirms this. When the PIRLS/ePIRLS 2016 reading achievement results were related to how computers were used for reading lessons, finding and reading information were contrasted with using a computer to prepare reports and presentations. There is no positive relationship between reading achievement and time spent on reading lessons focused on *finding and reading information* either in Canada or internationally (Mullis et al., 2017b). Figure 6 provides a potential reason for this. While 46 per cent of Canadian students have teachers who ask them to *read* on-line texts daily or weekly, only 24 per cent of students have teachers who *teach* them how to read on-line texts daily or weekly. Without effective instruction, student progress is limited. When instruction is present, and the more actively the student is involved, the better chances for engagement and success.

FIGURE 6 Proportion of students with teachers using computer activities in their Grade 4 reading classes

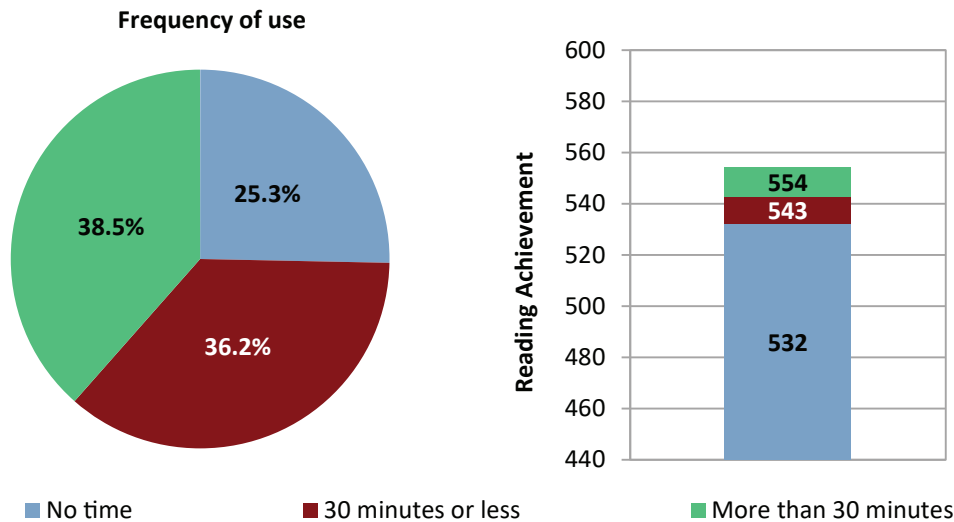


For example, while the relationship between the relatively passive activity of using the computer to find and read information and reading achievement is low, there is a positive relationship between computer use and reading achievement when students use a computer or tablet for preparing reports and presentations for more than 30 minutes a day (Figure 7). When we compare these two activities, it becomes clear why active learning is more productive than passive learning.

Looking up information requires the student to enter a query in a search engine and then watch as information appears, instantly accessible. If the results are not what was expected, the student enters a new query or topic. As students describe it, because this process is relatively passive and requires them to read and summarize, the cognitive energy required and potential for new learning are minimal. Contrasting this to the active and layered process involved in preparing reports and presentations, the increased level of cognitive energy and potential for new learning are obvious. Once the search for information is complete, the student must have learned how to read multiple sources of information, analyze and synthesize that information to match the report’s topic, think critically about how best to share the information, choose a presentation style that matches the intended audience, and decide how to prepare a presentation that will engage the audience. This requires much more than the ability to read and understand at a literal level, so this type of learning requires explicit instruction. And once the student has learned the “how to” of the process, preparing reports and presentations becomes a creative process: the student has the foundation to creatively explore new ways of thinking about and presenting information. Creativity is a source of engagement and engagement is positively related to reading achievement.

Figures 6 and 7 illustrate the importance of the teacher’s role in learning to read. Figure 6 indicates that while 56 per cent of Grade 4 students in participating schools have teachers who provide weekly instruction in how to look up information, only 46 per cent of students have teachers who provide weekly instruction in how to research a particular topic or problem. Almost 40 per cent of Canadian Grade 4 students spend more than 30 minutes per day using a computer or tablet to prepare reports and presentations. This is slightly more than the international average of 34 per cent (Mullis et al., 2017b). Pedagogy continues to be the determining factor in reading success. That leads to the next obvious question.

FIGURE 7 PIRLS 2016: Relationship between frequency of students' use of a computer or tablet to prepare reports and presentations and reading achievement



What is effective pedagogy?

Effective pedagogy leads to understanding. Albert Einstein is often credited with saying “You do not really understand something until you can explain it to your grandmother.” Kuropatwa elaborates:

Pedagogy ... is something along the lines of the art and science of teaching. I think every pedagogy is doing one of these three things: first starting with where the kids are and trying to figure out what misconceptions or ideas students bring to the table before we start trying to teach the new things ... A second [thing] would [be] ... teaching kids ... new ideas in the context of a network of ideas—how this idea fits with others and how together all those ideas make sense one way or another ... The third one is metacognition ... in what ways do we get kids to think about what they're learning as they are learning it? Perhaps the plus one or the fourth actually has to do with building community because of course education is always about relationships—the stronger the relationship is between the learner and the teacher the more that they can do and learn together. (Kuropatwa, 2014, video)

While the pedagogy involving computer use for reading instruction is still in its infancy, educators are learning more each year. As with all educational advances, the “successful integration of the computer into the learning program demands ingenuity and effort” (Hans & Hans, 2013, p. 19). The effort Hans and Hans refer to involves making informed use of school, local, national, and international research. School and local research ranges from the insight gained through personal and collegial professional reflection and professional development about factors influencing student learning. The sources of this information range from teachers' anecdotal notes about individual student learning to a range of classroom, local, and jurisdictional formative and summative assessment results. National and international research provides opportunities for teachers to critically consider educational change from wider perspectives. Through these professional learning opportunities, it becomes increasingly clear that without the presence of effective pedagogy, access to and general use of computers is not related to higher reading achievement.

Hans and Hans also invite us to consider the ingenuity of integrating a computer into the learning program—that ingenuity may come from the students themselves. What do their choices for computer use tell us about their learning?

We know that many (not all) students enjoy, are engaged by, spend time with, and are successful using computer activities such as on-line video searches, video viewing, gaming, multi-user communication, and creating graphics such as titles, charts, font changes, etc. Mistakenly, these activities are often referred to as “nonreading” activities.

In fact, the strategies and problem-solving processes involved in these well-liked and engaging student choices for computer use are the same strategies and problem-solving processes involved in not only learning to read but also in all learning experiences. Whether reading or using the computer for gaming or chatting, the student is accessing background knowledge to enter a text, monitoring to ensure meaning is developing, noticing errors, analyzing the components that created those errors, searching for options to correct the errors, navigating toward a solution, and then receiving feedback that their problem solving resolved the error. These strategies, which we know are foundational to reading instruction with paper-based text, can be applied to, and adapted for, reading instruction with on-line text. What does this type of pedagogy involve?

Shernoff, Shernoff, and Csikszentmihalyi connect engaging pedagogy to a learning state of mind or what they refer to as “flow.” To achieve flow, teachers design activities that are relevant, provide just the right amount of challenge, and allow the student to “feel in control of their learning environment and confident in their ability. These are activities in which students concentrate, experience enjoyment, and are provided with immediate, intrinsic satisfaction that builds a foundation of interest for the future. Teachers succeeding in providing such engagement most likely consider not only the knowledge and skills to be learned, but also the students as learners, adapting instruction to their developmental levels and individual interests” (2016, p. 173).

Marie Clay (2013) described effective pedagogy as providing learning experiences where the child scaffolds on the known as they learn about the new. Gee applies this pedagogy to the use of computer games:

Because of their rich and efficient way to teach and to gain students’ attention, Gee argues that games could—and should—be used in schools to help students learn new content as well as learn how to learn. Students should think critically while participating in games. Teachers can use games as a springboard for many activities such as teaching about facts and concepts and to improve students’ skills of writing, reading, and thinking. (referred to in Coscarelli 2016, p. 1)

Whether they use a computer for games, design, or communications, we know that many students spend a lot of time using this technology. Therefore, the computer provides teachers with an instructional tool that will complement and possibly enrich the learning environment for all students.

In summary, it’s important to remind ourselves that educational change takes time and critical reflection. PIRLS/ePIRLS 2016 provide us with insight into that change with evidence of progress thus far and a challenge to continue to explore the purpose and potential of effective paper-based and on-line reading pedagogy.

REFERENCES

- Brochu, P., O’Grady, K., Scerbina, T., & Tao, Y. (2018). *PIRLS 2016 Canada in context: Canadian results from the Progress in International Reading Literacy study*. Toronto: Council of Ministers of Education, Canada.
- Clay, M. (2013). *An observation survey of early literacy achievement*. (3rd ed.). Portsmouth, NH: Heinemann.
- Coscarelli, C. (2016). Shaping your instruction around the principles of playing video games. *International Literacy Association Daily Blog*. Retrieved from <https://www.literacyworldwide.org/blog/literacy-daily/2016/05/06/shaping-your-instruction-around-principles-of-playing-video-games>.
- Dyer, K. (2015). *Research proof points—Better student engagement improves student learning*. Retrieved from: <https://www.nwea.org/blog/2015/research-proof-points-better-student-engagement-improves-student-learning/>.
- Hans, A., & Hans, E. (2013). Role of computers in reading skills. *IOSR Journal of Humanities and Social Science*, 15(4), 15–19.
- Karl, K., O’Leary-Kelly, A., & Martocchio, J. (1993). The impact of feedback and self-efficacy on performance in training. *Journal of Organizational Behaviour*, 14(4), 379–394.

- Kuropatwa, D. (2014) New pedagogies? #129 While Walking, October. (Video file). Retrieved from: [https://www.youtube.com/watch?v= NMo9yRP0Pg](https://www.youtube.com/watch?v=NMo9yRP0Pg).
- Mullis, I.V.S., & Martin, M.O. (2015). *PIRLS 2016 assessment framework* (2nd ed.). Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.
- Mullis, I.V.S., Martin, M.O., Foy, P., & Hooper, M. (2017a). *PIRLS 2016 international results in reading*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.
- Mullis, I.V.S., Martin, M.O., Foy, P., & Hooper, M. (2017b). *ePIRLS 2016 international results in online informational reading*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.
- Ross, B., Pechenkina, E., Aeschliman, C., & Chase, A. (2017). Print versus on-line texts: Understanding the experimental research and challenging the dichotomies. *Research in Learning Technology*, 25. Retrieved from: <https://journal.alt.ac.uk/index.php/rlt/article/view/1976/2193>.
- Sherhoff, D.J., Sherhoff, E., Shneider, B., & Csikszentmihalyi, M. (2003). Student engagement in high schools from the perspective of flow theory. *School Psychology Quarterly* 18(2), 158–176.
- Starkey, L., & Zhong, J. (2018). *The effect of netbook ownership on children's academic achievement in mathematics, reading, and writing*. First published: 17 September 2018. Retrieved from <https://on-linelibrary.wiley.com/doi/full/10.1111/jcal.12308>.
- Taylor, L., & Parsons, J. (2011). Improving student engagement. *Current Issues in Education*, 14(1). Retrieved from <https://cie.asu.edu/ojs/index.php/cieatasu/article/view/745/162>.
- Woody, W.D. (2010). E-books or textbooks: Students prefer textbooks. *Computers and Education*, 55(3), 945–948.
- Yang, K-H., & Wu, Y-H. (2013). Effects of feedback types on the student's self-efficacy. *International Journal of e-Education, e-Business, e-Management and e-Learning*, 3(3), 202–205.
- Ziemke, K. (2016). Response to Larry Ferlazzo's reading digitally vs. reading on paper. *Education Week Teacher*, May. Retrieved from: http://blogs.edweek.org/teachers/classroom_qa_with_larry_ferlazzo/2016/05/response_reading_digitally_vs_reading_paper.html.