Chapter 17

Individual Differences in The New Literacies of Online Research and Comprehension

Donald J. Leu, University of Connecticut

Carita Kiili, University of Jyväskylä

Elena Forzani, University of Connecticut

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Individual Differences in The New Literacies of Online Research and Comprehension

Knowledge-based societies require citizens to be skilled in the effective use of online information for inquiry and communication (OECD, 2010; Rouet et al., 2009). The ability to conduct online research, comprehend, and learn has become an important aspect of online information use (Goldman, Braasch, Wiley, Graesser, & Brodwinska, 2012). Research into the individual differences of online research and comprehension is important so that educational systems better support the diversity that defines us, especially as the Internet is now central to both literacy and life.

We face an important challenge, however. As reading shifts from page to screen, new literacies emerge from the new online texts, technologies, affordances, and social practices that become possible (Lankshear & Knobel, 2006; Kist, 2005). As a result, we are unable to simply apply what we know about individual differences from offline reading to online reading; the two are not necessarily isomorphic (Leu, Zawilinski, et al., 2007).

There is also another challenge; new literacies are not just new today, they are new every day as even newer technologies are regularly distributed online (Leu, Kinzer, Coiro, Castek, & Henry, 2013). Each contains new affordances, requiring additional new literacies. This also complicates our understanding. Do the individual differences in online research and comprehension that we know about today apply tomorrow, when even newer technologies for literacy appear?

This chapter explores an emerging understanding of individual differences in online research and comprehension. We begin by defining online research and comprehension and exploring several measurement issues that present challenges to the analysis of individual differences in this area. Then we discuss what we know about individual differences in online

research and comprehension in a number of areas. We conclude by connecting these issues to the development of a broader theory of New Literacies.

Defining Online Research and Comprehension

Initially, online reading comprehension was the term used to describe what happens when we read online to identify a question, and then locate, critically evaluate, synthesize, and communicate online information. This construct informed several earlier studies into online reading (Castek, 2008; Coiro, 2011; Coiro & Dobler, 2007; Leu, Castek, Hartman, 2006) often framed within an emerging new literacies theory (Leu, Kinzer, Coiro, & Cammack, 2004). Unfortunately, the term online reading comprehension, connected to a theory of new literacies, has led to some confusion about whether or not anything is really "new" when we read online, perhaps because people first encountering the construct assumed a limited online reading activity such as the reading of a single web page.

There are many situations in which we might read online, such as when we read an email message, an online newspaper, or a single web page. Isolated reading acts, such as these, do not differ from offline reading comprehension except for the online context; there is little that is "new." Usually, however, online reading does not take place within isolated contexts. Instead, it occurs within a rich and complex process of inquiry as we seek answers to questions, large and small, and use the Internet to learn.

Recently, a more precisely descriptive term, the new literacies of online research and comprehension, has been used to capture the rich and complex nature of this inquiry process with greater precision and accuracy (Leu, Kinzer, Coiro, Castek, & Henry, 2013). Also, one can more easily understand how this term might not be identical to offline reading comprehension since online research requires technologies that are not used during offline reading (e.g., text

messaging and note taking tools) and online comprehension requires additional strategies (e.g., using a search engine to locate information about the creator of a web site to help determine the reliability of the information).

Online research and comprehension is a process of problem-based inquiry using information on the Internet. It includes the skills, strategies, dispositions, and social practices that take place as we read online information to learn (Leu et al., 2013). During online research and comprehension, readers construct texts, meaning, and knowledge while engaged in several online reading practices: reading to identify important problems, reading to locate information, reading to critically evaluate information, reading to synthesize information, and reading to communicate information.

Online research and comprehension is not limited to lengthy and formal research projects. It also includes shorter tasks when one needs to know the answer to a question such as When was Abraham Lincoln born? or What is the easiest way to get to downtown London from Heathrow? Information queries, both large and small, initiate online research and require the use of new technologies to read, comprehend, and learn.

Differences Between Offline Comprehension and Online Research and Comprehension

Does the nature of reading and writing change during online research and comprehension? What individual differences are important to this process? We are just discovering answers to these questions (Afflerbach & Cho, 2010). Preliminary evidence suggests that online research and comprehension may include additional, somewhat distinctive, skills and strategies compared to offline reading comprehension (Coiro, 2011; Coiro & Dobler, 2007; Leu, Zawilinski, et al., 2007).

Both offline and online elements of comprehension are layered in complex ways during

online research and comprehension and the nature of this commingling is yet to be fully understood (Leu et al., 2013). Similar to offline comprehension, online research and comprehension includes meaning construction. It appears to differ, though, from offline reading comprehension in several respects.

First, online research and comprehension takes place within a problem-solving task (Castek, Coiro, Guzniczak, & Bradshaw, 2012); a question or other informational need activates and informs the reading of online information. This results in a complex sampling process, as readers only select portions of text, often from multiple sources, to inform the solution of the problem. While this can happen with offline reading comprehension, it always happens during online research and comprehension.

Second, while readers construct meaning during both offline comprehension and online research and comprehension they also physically construct the texts that they read online. They construct these texts through the sampling choices that they make and the links that they follow (Coiro & Dobler, 2007). Again, this can happen offline but always happens during online research and comprehension.

Third, online research and comprehension takes place in a complex and unrestricted information space that may be poorly structured, and ill defined - the Internet. Typically, offline reading takes place within a more restricted, well structured, and more clearly defined information space.

A fourth difference is that new technologies such as browsers, search engines, wikis, blogs, email, and others are required, each containing affordances that differ from those found offline. Thus, additional skills and strategies appear to be needed in order to read, write, and interact with each of these technologies effectively.

Fifth, online research and comprehension also becomes tightly intertwined with writing as we communicate with others to learn more about the problems we seek to solve, and this often includes writing and communication as important parts of the meaning construction processes. For example, readers might take notes or seek others' opinions on Twitter, with text messaging, or on many other communication tools available on the Internet. During offline reading this may occur with writing, but not always, and typically not in such easily accessible, collaborative, and socially constructed ways.

Finally, while both offline comprehension and online research and comprehension require higher-level, critical thinking, this might be needed even more often online (Forzani & Maykel, 2013). In a context in which anyone may publish anything, higher level thinking skills, such as the critical evaluation of source material, are required with particular frequency. Again, this happens offline, of course (cf. Braaten, Strømsø, & Britt, 2009), but it becomes especially urgent and important online.

This brief discussion of the distinctive nature of online research and comprehension suggests a number of areas where individual differences are likely to appear. The precise nature of these individual differences as well as the extent to which they may differ from offline reading comprehension are not completely understood, however. This is at least partly true because we have yet to fully solve several measurement issues.

Measurement Issues

The Unique Nature of Readers' Text Constructions

During online research and comprehension, readers construct their own texts as they select different links, follow different paths, and connect different texts to solve a problem. Seldom will two readers read the same texts; each constructs a unique text from choices that are

made during the location, evaluation, and synthesis of information (Leu, Zawilinski, et al., 2007). Even when two students have an identical problem to solve, they may use different keywords to locate information, evaluate and select different links from a set of search results, explore links on a web page in distinctive ways, and connect the results in a unique fashion (Coiro & Dobler, 2007; Leu et al., 2013).

The unique nature of readers' text construction processes presents a central challenge for measuring individual differences. This is not to indicate that larger patterns cannot be identified, but that any conclusions about comprehension, drawn from multiple individuals who read the same text, are not possible.

On the other hand, the unique nature of readers' text construction processes presents a special opportunity to explore an additional layer of individual differences by studying differences in text construction processing. To date, there have been no systematic studies of this area. Differences inherent in the texts that are selected during online research and comprehension make the investigation of individual differences much more challenging than in the study of offline reading.

The Limited Number of Stable Assessments That Capture The Complex and Integrated Aspect of Online Research and Comprehension

The first assessments used in this area (Leu, Castek & Hartman, 2006) took place within the dynamic environment of the Internet, presenting a problem with stability. Simply put, the reading context changed from day to day, making comparability difficult, if not impossible, for any single reader, or groups of readers, over time. This also presented important challenges when trying to compare the performance of different individuals at different times, or when growth curve analyses (Duncan, Duncan & Strycker, 2013) are conducted.

Recently, several assessments have been developed that measure elements of online research and comprehension in more stable environments: PISA's Digital Reading Assessment (OECD, 2011), PIAAC's Problem Solving in Technology-rich Environments (Rouet et al., 2009), Global Integrated Scenario-based Assessments, or GISA (Sabatini, O'Reilly, Halderman & Bruce, 2014), and Online Research and Comprehension Assessments, or ORCAs (Leu, Kulikowich, Sedransk, & Coiro, 2009).

The PISA Digital Reading and PIAAC assessments sampled performance with isolated tasks within separate and restricted information spaces for items. As a result they may not capture the full complexity and complex interdependencies that appear between elements of online research and comprehension tasks. Many items, for example, appear within a multiple-choice format and/or take place at a single website. Somewhat surprisingly, there are a far greater percentage of multiple-choice items, restricting the information space for responses, that appear in the PISA Digital Reading Assessment (72%) than appear in the PISA assessment of print reading (47%).

The lack of a connected and more integrated sequence of tasks in the first two assessments fails to capture the more complex and integrated nature of online research and comprehension. Thus, any analysis of individual differences based on these measures may be limited.

The GISA approach uses scenario-based assessments to attempt to measure more integrated skills associated with higher-level comprehension during online research and comprehension in a stable environment. This is an important improvement on previous attempts.

Another recent attempt to capture the complexity of online research and comprehension in a stable environment is the Online Research and Comprehension Assessment (ORCA) Project

(Leu, Kulikowich, Sedransk, & Coiro, 2009). This project has developed performance-based assessments that include online research and problem-solving tasks in science within a stable, but complex information space, a representation of the actual Internet. This includes a social network, a search engine, web sites imported from the Internet, text messaging, a notepad, a wiki, and email. Students conduct an online research project on topics in human body systems and their performance on sixteen different aspects of the task are evaluated. A video overview appears at: http://youtu.be/aXxrR2wBR5Y and a video of one assessment appears at: http://neag.uconn.edu/orcavideo-ira/. Approaches such as GISA and ORCA may be more likely to give us a better understanding of individual differences in online research and comprehension by using an assessment context that is both rich and complex as well as stable.

Individual Differences: The Components of Online Research and Comprehension And The Monitoring And Regulation Of These Practices

Component Areas

A number of studies (e.g., Coiro, 2011; Coiro & Dobler, 2007; Goldman, et. al, 2012) have explored various contexts of online research and comprehension. Most have tended to focus on the cognitive practices and the relative difficulty of these skills for students, in general, rather than systematically examining individual differences in component skills. There are, however, several small-scale studies that have tried to capture individual differences in component skills.

Kiili, Laurinen & Marttunen (2008; 2009) found considerable inter-individual differences among 25 upper secondary school students in their ability to locate relevant information on the Web. The students who located relevant information effectively were able to spend much of their time reading useful online sources. On the other end of the continuum, students less skilled at

locating information online spent more time trying to locate useful information and, as a result, had less time available for reading relevant information.

In addition to individual differences with locating information, several studies have found that students generally lack skills in critically evaluating online information (e.g. Grimes and Boening, 2001; Walraven, Brand-Gruwel, & Boshuizen, 2008). However, only a few studies have reported findings related to individual differences in this area. Kiili, Laurinen, and Marttunen (2008) found five evaluation profiles among 25 upper-secondary schools students, using several dimensions of evaluation: *versatile evaluators* considered both the relevance and credibility of information by applying various evaluation strategies; *relevance-oriented evaluators* paid attention to the relevance of information but, compared to versatile evaluators, paid less attention to the credibility of information and their strategic repertoire was also not very diverse; *limited evaluators* seldom evaluated the credibility of information and their evaluation of relevance was less active compared to the previously mentioned groups of students; *disoriented readers* had difficulty in locating relevant information on the Internet; and *uncritical readers* differed significantly from the other groups in the quality of the webpages they selected to read.

Synthesizing information during online reading may be the least understood online reading practice. There are some studies that have explored synthesizing information with pre-selected online texts (e.g. van Strien, Brand-Gruwel & Boshuizen, 2014; Wiley et al., 2009) but few studies (Barzilai & Zohar, 2012; Kiili, Hirvonen, & Leu, 2013) have explored the synthesis of multiple online sources within a dynamic, Internet environment. Barzilai and Zohar (2012) investigated sixth graders' epistemologies and their relation to online reading practices. They found considerable variability in students' epistemic thinking which, in turn, was found to play

an important role in the way in which the students integrated online sources. Students who viewed knowledge as complex and developing made comparisons between websites and used multiple websites to construct an argument more often than the students who viewed knowledge as absolute.

Metacognition

The Internet is a complex information environment that requires readers to orchestrate several, often intertwined, cognitive processes. As such, it is likely to demand substantial amounts of metacognitive processing (Kiili, 2012; Quintana, Zhang & Krajick, 2005). Quintana, Zhang and Krajick (2005) suggest that problems in metacognitive processing may appear as inadequate planning of search tasks, poor time allocation between searching and other online reading practices, and an inability to change one's ineffective behavior. Kiili, Marttunen & Laurinen (2009; see also Kiili, 2012) found differences among upper secondary school students in how they planned, monitored, and regulated their activities on the Web. While some students seemed to work on the Web in a forward-looking, proactive fashion, adjusting their strategies to the task demands, others largely monitored and regulated their immediate actions in a reactive fashion. The way of working seemed to be associated with success in locating relevant information, the evaluation of information relevance, and with elaborative processing of content.

Some research describes attempts to support students' metacognitive processes during online reading with verbal scaffolds (Li & Lim, 2008). Online reading also has been supported with software tools that prompt readers to monitor their activities, making students more aware of online reading processes (Stadtler & Bromme, 2008; Zhang & Quintana, 2012). Research still needs to clarify how students with differing skills, epistemological beliefs, and learning problems benefit from metacognitive support, and how metacognition develops for online readers.

Individual Differences: Gender, Domain Knowledge, and Economics

Gender

There is little research on gender differences specifically related to online research and comprehension. The primary international source, the PISA study of digital reading (2010) shows a gender gap among 15-year-olds in 19 nations favoring girls who scored, on average, 24 points higher than boys. This gender gap was larger with offline reading (39 score points) compared to online reading (24 score points), suggesting that girls perform better than boys, overall, but that the gap is larger for offline reading than for online reading. The smallest gap in online reading (3 score points) appeared in Colombia; the largest gap (40 points) appeared in New Zealand. Thus gender differences may be somewhat related to culture.

Studies of gender differences in attitudes towards the Internet provide somewhat mixed findings and may suggest that gender differences in attitudes are changing. Earlier studies showed that men and boys had more positive attitudes about the Internet (e.g., Jackson, Ervin, Gardner, & Schm, 2001; Schumacher & Morahan-Martin, 2001). Other, more recent, studies have shown no difference in attitudes between boys and girls (e.g., Kim, Lehto, & Morrison, 2007; Koohang & Durante, 2003). Few direct studies exist, however, of gender differences in attitudes specific to online research and comprehension.

Domain Knowledge

Domain knowledge of a topic is a major contributor to reading comprehension with offline texts (Kintsch, 2013; Spilich, Vesonder, Chiesi, & Voss, 1979). Domain knowledge also appears to be important during online research and comprehension, but perhaps in different ways. One of the few studies to evaluate the role of domain knowledge during online research and comprehension was conducted by Coiro (2011). Surprisingly, Coiro found that prior knowledge

of the domain did not significantly contribute to predicting online research and comprehension performance among 13 year olds when offline reading comprehension ability was controlled. Coiro speculated that students with lower levels of domain knowledge could acquire it through the texts they selected during the online research and comprehension task, thus developing necessary prior knowledge along the way. No data were provided to support this hypothesis, however, and studies have yet to replicate this finding. Thus, we will need to establish the precise role of domain knowledge and how it differs among individual students during online research and comprehension.

Economics

According to the National Assessment of Educational Progress, the offline reading achievement gap based on wealth is not only substantial but is increasing in the U.S., while the gaps based on ethnicity are decreasing (Bailey & Dynarski, 2011; Reardon, 2011). Leu, et al. (2012) controlled for offline reading comprehension differences and found a separate and independent achievement gap in online research and comprehension between 7th grade students attending economically advantaged and challenged districts. This suggests that achievement gaps may actually be greater than those found in offline reading.

Given the expense of computers and online access, advantages are likely to accrue to students from wealthier households as they are more likely to have opportunities to conduct online research and comprehend online information at home. Data from the U. S. Census indicates that 35.6% of households with less than $25,000 have no computer at home and no Internet access anywhere while only 2.8% of households with income of $150,000 or greater report the same (U.S. Census Bureau, 2013).

Internationally, the PISA assessment of digital reading found, on average, a significant

difference in scores between students who used a computer at home and those who did not use a computer at home (OECD, 2011). Another recent study found there was both an offline reading achievement gap and a separate and independent online research and comprehension achievement gap between seventh grade students attending a richer school district and a poorer district in the U.S. (Leu et al., 2012). These results suggest there may be important equity issues, in many nations, with online research and comprehension.

Individual Differences: Younger Children, Older Adults, And Struggling Readers

Younger Children

Investigations into online research and comprehension have focused primarily on adolescents and college-age students (e.g., Coiro & Dobler, 2007; Goldman et al., 2012) while young children largely have been ignored. This is especially true in studies of broader digital literacy issues in young children's classrooms where there is little research (Burnett, 2009). Instead, most research with young children focuses on out-of-school digital literacy practices (e.g., Lieberman, Bates, & So, 2009). Many important questions that focus on school contexts have yet to be fully explored, such as "What type of instruction is needed for different types of young learners, and how should this instruction be implemented? Will different instructional models work better than others for particular types of readers?" Research that examines these issues would allow teachers to create more targeted instruction to better suit the needs of particular types of younger learners.

Several studies of young children's in-depth, online experiences have found that these experiences can greatly contribute to overall learning among young children (Black, 2010; Kafai, 2010; Marsh, 2011). Yet, these studies have not looked specifically at online research and comprehension. Instead, they have focused more on online games and virtual worlds rather than

on reading, specifically. One exception is a study by Zawilinski (2012) who compared fifth graders and first graders during a collaborative classroom research project requiring the use of a blog. Students in both classrooms taught one another important blog strategies but first graders required instruction in how to effectively teach one another. Generally, however, we are still developing an understanding of individual differences in online research and comprehension during young children's development.

Older Adult Learners

Similarly, there are only limited data on individual differences among older, adult learners. We know that older adults (ages 60-83) perform less well than younger adults on well-defined search tasks (e.g., searching for a specific medical condition using a given medical term and its definition) but perform better than younger adults on less well-defined search tasks such as searching for information on pain symptoms (Chin, Fu & Kannampallil, 2009). It also appears that older adults use qualitatively different search strategies while locating information, taking more of a conceptually-based, "top down" approach compared to younger adults (Fairweather, 2008). Thus, at both ends of the lifespan continuum there is a need for ongoing research that helps us better understand the nature of individual differences.

Struggling Readers

We also know little about how struggling offline readers perform with online research and comprehension. The prevailing wisdom, often expressed in schools, is that students who are weak offline readers should wait until they are more skilled at offline reading before going online. However, there are several aspects of online research and comprehension that may actually facilitate reading for weaker offline readers.

First, the Internet is a multimedia context with video, audio, and animations that are

likely to support weak offline readers (Henry, Castek, O'Byrne, & Zawilinski, 2012). These supports may be easier to make meaning from than text for these readers.

Second, online research and comprehension typically requires the reading of shorter text units as short search result entries are read and as readers follow links to drill down to important information where they then skim a page to locate the relevant information. Having to read shorter units of text, may be supportive since struggling readers typically struggle with fluency and longer text. Thus, those struggling readers who are skilled in locating information do not always have to labor with the fluency demands required to read extended text.

Third, readers direct their own reading paths during online research and comprehension through the links they select. Thus, it may be more likely that weaker readers can find information suitable to their interest, prior knowledge, and ability through the choices they make. All of these aspects may motivate weaker readers to continue to read online, since online text contains important supports. This may further develop their reading skills as students gain more and more practice. This, however, is speculation. We require systematic studies of struggling readers to fully evaluate individual differences among this population. We have little work in this area.

Goldman et al. (2012) found that better learners engaged in greater amounts of sense making, self-explanation, and comprehension monitoring on reliable sites than did poorer learners. These were college students, though, few of whom are likely to truly struggle with reading. This study reminds us that the Internet can pose unique challenges to struggling readers, as readers must contend with clickable and often moving advertisements, hyperlinks, and multimedia features, which can be distractions. It is clear that much more work is needed to ascertain the extent to which struggling readers offline are also struggling readers online, or if

several unique affordances of online reading permit special opportunities for learning among struggling readers.

Individual Differences: Collaborative Online Research and Comprehension

From more of a social practice perspective (Lankshear & Knobel, 2006), online research and comprehension seems to be enhanced when students engage in productive collaboration (Castek, Coiro, Guzniczak & Bradshaw, 2012; Kiili et al., 2012). Kiili, Laurinen, Marttunen and Leu (2012) conducted a study of Finnish upper secondary students who read online, in pairs, to gather information and write a short report about a controversial issue. Cluster analysis revealed five collaborative reading profiles ranging, in order from the greatest to the least amount of collaboration: co-constructors, collaborators, blenders, individually oriented readers, and silent readers. Essay performance matched this sequence of profiles with those who co-constructed meaning the most having the highest scores.

However, it seems that students differ considerably in their ability to engage in productive collaborative interaction during online inquiry (Castek et al., 2012; Kiili et al., 2012; Sormunen, Tanni, Alamettälä, & Heinström, 2013). While some students can take full advantage of the collaborative situation by engaging in productive co-construction of meaning, others may have a stronger preference for working alone (Kiili et al., 2012). What we do not know yet is how various individual (e.g. personality traits, and epistemic beliefs), social (e.g. relationships between students) and cultural factors (e.g. culturally specific conversational conventions) are related to these differences.

Some direction may be provided by Davis and Neitzel (2010), who looked at students' reading orientations: strategy-oriented, experience-oriented, precision-oriented, or tactic-oriented. They found these reading orientations were related to interaction patterns while working together

to construct meaning from four printed short texts. In addition, personality traits and individual approaches to studying may affect successful interaction patterns during online research and comprehension.

Gender differences may also influence collaborative interaction patterns when students read online together. Salminen, Marttunen & Laurinen (2012) found gender differences in communication styles when students engaged in chat discussions after reading three offline texts on a controversial issue. Results from this study suggest that males' more adversarial communication style may support the critical exploration of issues during online inquiry, whereas females' more collaborative communication style may facilitate the sharing and elaboration of ideas.

Finally, there appear to be some cultural differences in the ways in which people talk about and learn from texts. For example, Weinberger, Marttunen, Laurinen & Stegmann (2013) found cultural differences in communication styles when Finnish and German students tried to solve a problem in an online learning environment with the help of text material they read. Compared to Finnish students, the argumentative practices of German students were more conflict-oriented. German students expressed disagreements whereas Finnish students avoided them and often integrated arguments of learning partners into their own line of reasoning. Although the study found cultural differences that may frame the way people talk around text, there are also situational and personal differences within cultures as well.

Individual Differences in Online Research and Comprehension: Theoretical Implications

This review of individual differences in online research and comprehension suggests that we have much work ahead. Part of the challenge is that we now read in continuously changing contexts online.

How can we develop adequate theory about individual differences in online research and comprehension when the very context for our study of these differences continuously changes? Our field has never before faced a challenge like this, since literacy has generally been static, permitting us, over time, to carefully study and understand it. One way out of this conundrum may be to think about theory on two different levels using a dual-level theory of New Literacies (Leu, Kinzer, Coiro, Castek, & Henry, 2013).

A dual-level theory of New Literacies conceptualizes literacy at lowercase (new literacies) and uppercase (New Literacies) levels. Lowercase conceptions of new literacy, such as the new literacies of online research and comprehension, are better able to keep up with the rapidly changing nature of literacy; they are closer to the specific types of changes that take place. There are many other lowercase conceptions of new literacies, driven by separate lines of research, such as studies of text messaging (Lewis & Fabos, 2005), the semiotics of multimodality in online media (Kress, 2003); or new literacy studies (Street, 2003). Multiple lowercase theories permit our field to maximize the perspectives we use and the technologies and contexts we study. This chapter has only focused on one of these lowercase theories, the new literacies of online research and comprehension, and we have described the limited knowledge we have of individual differences in this area. Similar limitations exist in the many other lowercase levels of new literacies.

New Literacies, the uppercase theory, includes the common principles that appear across most lowercase areas. These common principles define New Literacies and, as such, are likely to be more stable in a context in which the technologies of literacy rapidly change. While eight common principles have been identified (Leu, et al., 2013), none speak to the important issues of individual differences in online contexts. This review of work in one lowercase area of new

literacies suggests that much work remains to be done, suggesting that the principles of New Literacies may need to be reframed around individual differences to bring greater attention to this important issue. This is an important omission since nearly all of these lines of research explore performance with complex literacy tasks online, a context that should be rich with possibilities for individual variation and could inform an upper-case theory of New Literacies in important ways.

In today's knowledge-based society, where accessing and using online information is essential for full participation in both work and life, creating effective learning environments to teach online information skills is important. Understanding individual differences is essential for designing and creating these environments for learners of different genders, ages, ability levels, cultures, socioeconomic backgrounds, and developmental levels. Clearly, however, we have much work ahead of us before we can confidently create effective learning environments tailored to the needs of individual students, preparing them for a world that is increasingly defined by reading, writing, communicating, and learning online.

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