Title: Characteristics and Validity of an Instrument for Assessing Motivations for Online

Reading to Learn

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Abstract

Motivation for reading is important to comprehension and has been studied extensively in offline reading contexts. However, we know little about the role of motivation in online reading, a new and increasingly important context for reading. This is largely because we lack valid and reliable instruments to estimate a student's motivation for online reading. This study reports on the development of a Motivations for Online Reading Questionnaire (MORQ) among 1,798 seventh grade students in two states. Results from confirmatory factor analysis revealed a three factor solution for the MORQ: curiosity/value, self-efficacy, and self-improvement beliefs. Additionally, measurement invariance across female and male students was established. Predictive validity of the MORQ was supported by the positive and significant contribution of MORQ to the Online Research and Comprehension Assessment, an established measure of online reading comprehension. Results help establish the MORQ as a well validated instrument for measuring online reading motivation. Results are discussed in relation to theory, research, and practice.

Keywords: motivation/engagement, online reading, comprehension, digital/media literacy, assessment

Characteristics and Validity of an Instrument for Assessing Motivations for Online Reading to

Learn

Many factors affect a reader's ability to comprehend and learn during reading, such as

prior knowledge (Bråten, Anmarkrud, Brandmo, & Strømsø, 2014; Kintsch, 1998), cognitive

skills and strategies (Duke & Pearson, 2002; Pressley & Afflerbach, 1995), texts, activities, and

contexts (RAND, 2002), and motivation (De Naeghel, Van Keer, Vansteenkiste, & Rosseel,

2012; Schiefele & Schaffner, 2016; Wigfield & Guthrie, 1997). While these factors are relatively

well understood in offline contexts, they are less well understood online, given the recency of

this new reading context (Afflerbach & Cho, 2010). Initial studies that have investigated reading

online have made important contributions to our understanding of reading but have focused

largely on the cognitive and metacognitive factors, prior knowledge, and texts and contexts that

affect readers' ability to comprehend, ignoring potential influences of motivation (e.g.

Afflerbach & Cho, 2010; Leu et al., 2015; Cho, 2014; Coiro, 2011; Coiro & Dobler, 2007). The

prominence of the Internet as a reading context in today's world, however, combined with the

profound interest and engagement of our youth with online media, suggests that reading

researchers need to better understand students' motivations and abilities when reading online

(Leu, Kinzer, Coiro, Castek, & Henry, 2019; Buckingham & Willet, 2013; Hutchison &

Reinking, 2011; Hutchison, Woodward, & Colwell, 2016). As we seek to understand the

relationship between motivation and comprehension when reading on the Internet, developing a

valid and reliable instrument to measure motivations for reading online would be useful.

Why should we develop an instrument to estimate online reading motivations when we already have instruments that estimate offline reading motivation? Research suggests that motivation may function somewhat differently online for several reasons. First, while offline and online reading share many similar characteristics, empirical results suggest they are not the same (Afflerbach & Cho, 2009; Coiro & Dobler, 2007; Coiro, 2011; Goodwin, Cho, Reynolds, Brady, & Salas, 2019). Online contexts may require greater attention to locating, evaluating, and self-monitoring (Cho, 2014; Coiro & Dobler, 2007) but may also position readers to be more critical and agentic, since readers in this context often create, rather than merely consume, knowledge and ideas, and they do so within an interactive, social context (Hutchison et al., 2016). Second, because online reading is often driven by the need to gather information to address a personal or professional issue (Stadtler, Scharrer, Brummernhenrich, & Bromme, 2013; Wineburg & Reisman, 2015), readers' motivations in this context may be more affected by a need to act on information rather than by curiosity alone. Third, students' varying Internet access, at home and at school, appears to play a role in their ability to read in this newer context (Leu et al., 2015; Mullis, Martin, Foy, & Hooper, 2017), likely influencing motivations. Such factors suggest that readers' motivations may be somewhat different online versus offline, necessitating the development of a tool to measure motivations for online reading, specifically.

Thus, to meet important needs for both research and practice, this study developed a multidimensional Motivations for Online Reading Questionnaire (MORQ) with a sample of seventh graders. In so doing, this study sought to analyze the factor structure of the MORQ and to test measurement invariance across gender. It also sought to evaluate predictive validity by investigating the relationship between the MORQ and an established measure of online reading

known as the Online Research and Comprehension Assessment, or ORCA (Leu et al., 2014, 2015).

Theoretical and Empirical Perspectives

Online Research and Comprehension

We situate our definition of online reading within a broader concept of digital reading involving readers engaged in "multifaceted meaning-making experiences" with multiple texts and for particular purposes within diverse digital contexts (Coiro, 2020, p. 4). The digital context in this study is the Internet. Reading on the Internet, or online reading, can take many forms, and we frame this study around the new literacies of online research and comprehension (Leu et al., 2015; Leu et al., 2019). This theory views online reading as a process involving both traditional and additional skills, strategies, and dispositions and suggests that online, readers often engage in inquiry to learn more about a particular issue or set of issues (Leu et al., 2019). This process includes several components that appear to function reciprocally: locating, evaluating, synthesizing, and communicating (see Forzani, 2016 and Leu et al., 2015 for elaboration). As students read to learn online, they encounter many forms of text, including informational graphics, newspapers, magazines, websites that present informational and narrative texts (e.g., biographical and travel reports, stories), and many more. This study includes all of these potential forms. We direct our focus to reading to learn since much of online information is used this way (Kiili et al., 2018b; Leu et al., 2019; OECD, 2011b).

Given the importance of reading to learn online, several related assessments have been recently developed to measure this ability: The PISA Digital Reading Assessment (OECD, 2011a); ePIRLS (Mullis & Martin, 2020); and the ORCA (Leu et al., 2014, 2015). The ORCA is a performance-based measure of readers' ability to locate information; evaluate author,

publisher, and content; synthesize within and across texts, and communicate findings via email or wiki. The ORCA was used in this study to measure online reading during an inquiry task in order to validate the MORQ with online reading performance using an established measure.

While offline and online reading overlap in many ways, research suggests they are not the same. This appears to be the case in less complex contexts, such as when reading on paper is compared to reading the same text on a screen without hyperlinks or other dynamic features (Goodwin et al., 2019). For example, Goodwin et al. (2019) found that highlighting was correlated negatively with comprehension in a paper context but positively in a screen context, and suggested that this may point to the increased importance of strategic behaviors in digital contexts. It also appears to be the case within the hyperlinked and dynamic context that defines the Internet (Leu et al., 2015; Coiro, 2011; Afflerbach & Cho, 2009). These demonstrations that offline and online reading differ suggest that motivations for reading in offline and online contexts also may differ. There may be several reasons for this.

First, the distinctive features of an online context appear to influence reading processes, and this may have consequences for motivational differences, too. Compared to offline reading, readers online encounter many more texts, and of a greater range of type and quality (Coiro, 2020; Leu et al., 2019). The constant and iterative selection and integration of information across these multiple texts with diverse perspectives requires readers to evaluate relevancy and credibility both more frequently and more vigilantly (Cho, 2014; Kiili, Leu, Marttunen, Hautala, & Leppanen, 2018a; Metzger & Flanagin, 2013). Additionally, the dynamic and stimulating nature of online elements such as video, hyperlinks, and advertisements make self-monitoring, to avoid distraction, more challenging (Cho, 2014; Coiro, 2020; Goldman, Braasch, Wiley, Graesser, & Brodowinska, 2012) and motivation more important. Online contexts also afford

readers greater opportunity to contribute to collective understandings and to voice opinions through shared tools such as blogs, wikis, and social media (Hutchison et al., 2016). Readers who enjoy this social context may be especially motivated to read online, even when the primary motivation is not social. These, and other factors, also suggest greater criticality and autonomy, which may be highly engaging and supportive for some readers but more challenging for others.

Second, readers' purposes for reading online, compared to offline, may be somewhat more specific. In offline contexts, readers read many types of texts for a variety of purposes, such as for enjoyment, to learn new information out of curiosity, or to gather information to serve a goal. In online contexts, readers may read most often to obtain specific information with which to act (Kiili et al., 2018a); Stadtler, et al., 2013). This may place more emphasis on being motivated by valuing information rather than by satisfying one's curiosity alone.

Third, several studies have found that greater access to digital devices in the home correlates with higher average online reading comprehension (Leu et al., 2015; Mullis et al., 2017). Lack of access and practice, among those without these advantages at home or at school, may lower readers' self-efficacy and beliefs about whether they can get better with practice, since such students may have less experience and thus fewer opportunities to develop such beliefs. In turn, this could directly influence their reading.

Finally, preliminary research on gender differences suggests readers may be motivated somewhat differently in online compared to offline contexts. Research in offline contexts suggests that girls are more motivated to read than boys (Logan & Johnston, 2010; McKenna, Conradi, Lawrence, Jang, & Meyer, 2012). Yet, research in digital contexts indicates that boys have more positive relationships with technology and online reading (Liu & Huang, 2008). This work suggests that online reading motivation may be somewhat different than offline motivation.

Approaches to and Dimensions of Reading Motivation in Offline and Online Contexts

Despite these differences, there is also much overlap between offline and online reading (Afflerbach & Cho, 2009, 2010; Coiro, 2011; Leu et al., 2015), implying overlap in motivations. For example, in both offline (Fuchs, Fuchs, Hosp, & Jenkins, 2001) and online (Kanniainen, Kiili, Tolvanen, Aro, & Leppänen, 2019) contexts, readers employ foundational skills in decoding, word identification, and fluency in order to comprehend. This frees up resources, allowing readers to focus on comprehending (Fuchs et al., 2001). In both contexts, skilled readers engage in many of the same comprehension processes, such as using prior knowledge to understand new information, reasoning inferentially, evaluating, and monitoring (Duke & Pearson, 2002; Pressley & Afflerbach, 1995; Afflerbach & Cho, 2009; Coiro, 2011). These cognitive systems are recruited, energized, and sustained by motivational processes during reading (Barber, Levush, & Klauda, 2019). Given these findings, theory and research in offline contexts may provide useful direction for mapping the complexities of motivations online.

In offline contexts, researchers often conceptualize reading motivation as a multidimensional construct representing a person's interests, values, beliefs, goals, and dispositions for reading (Malloy, Marinak, Gambrell, & Mazzoni, 2013; Schiefele, Schaffner, Möller, & Wigfield, 2012; Wigfield & Guthrie, 1997). Such motivations can be viewed as involving multiple factors and can vary by recreational versus academic context (De Naeghel et al., 2012; Schiefele & Schaffner, 2016). Indeed, instruments exist that measure offline reading motivations using such dimensions, broadly conceived, as interests, values, beliefs, goals, and dispositions (see, for example, McKenna, Kear, & Ellsworth, 1995; Gambrell, Palmer, Codling, & Mazzoni, 1996; Schiefele & Schaffner, 2016; Wigfield, 1997). We sought to benefit from this perspective and develop an instrument with multiple dimensions.

In order to develop a measure that could explain performance efficiently (i.e., using the fewest dimensions possible), we drew from multiple theoretical approaches in conceiving of motivation and in selecting dimensions that would positively predict comprehension. Consequently, we drew from three important theories of motivation: self-determination theory (Ryan & Deci, 2000), social-cognitive theory (Bandura, 1977; Dweck & Legett, 1988), and modern expectancy-value theory (Eccles & Wigfield, 2002). These theories undergird the Motivations for Reading Questionnaire, or MRQ (Wigfield & Guthrie, 1997), and related work for online contexts, such as the Survey of Online Reading Attitudes and Behaviors, or SORAB (Putman, 2014).

It is important to note that different approaches to motivation have been used to generate measures of motivation representing different dimensions. Some approaches suggest that factors like beliefs (e.g., self-efficacy) are antecedents or consequences of motivation, rather than motivations in themselves (see, for example, Schiefele & Schaffner, 2016; Schiefele, Schaffner, Möller, & Wigfield, 2012). Other approaches, represented by the MRQ (Wigfield & Guthrie, 1997) and the SORAB (Putman, 2014), view such factors as motivations which themselves provide the direct energy for a behavior.

Drawing on several theories, we framed this study using this latter perspective, defining motivation as providing the direct energy for a behavior, and viewing beliefs as motivations. Bandura defined motivation as involving the "activation and persistence of behavior" (Bandura, 1977, p. 193). According to expectancy-value theory, beliefs like expectancies (similar to self-efficacy) provide such activation and persistence by directly energizing and sustaining behavior: "expectancies…directly influence performance, persistence, and task choice" (Eccles & Wigfield, 2002, p. 118). Moreover, it seems plausible that beliefs can be motivations in

themselves, in the sense that they directly energize behavior. According to self-determination

theory, people have an innate desire to "exercise [their] capacities" (Ryan & Deci, 2000, p. 70)

and might engage in an activity for the feeling of competence it offers. Imagine a child learning

to read and feeling the competence that comes as they become skilled with a new and stimulating

activity. It is conceivable as well that readers choose to read online because they feel competent

in this particular context. This approach is also in line with Author's (Guthrie & Klauda, 2016)

heuristic model of motivation and engagement, in which factors such as efficacy, intrinsic

motivation, and value provide the direct energy required for engaging in reading, leading to

enhanced comprehension.

Thus, we decided to develop our initial questionnaire by starting with one of the more

expansive and comprehensive approaches, represented by the MRQ (Wigfield & Guthrie, 1997).

The MRQ suggests eleven dimensions of motivation that include: curiosity, involvement,

importance (i.e., value), self-efficacy, challenge, recognition, grades, social, competition,

compliance, and reading avoidance. While some studies (e.g., Guthrie, Klauda, & Ho, 2013)

suggest that five of these dimensions (recognition, grades, competition, compliance, and reading

avoidance) predict achievement in offline contexts, this correlation seems tenuous for an online

context and risked invalid interpretations. For example, students might not be motivated to read

for recognition in classrooms in which online reading is not yet highly valued, as is offline

reading. The same line of thinking can be applied to competition, compliance, and avoidance.

Thus, students' responses on items from these factors may indicate something other than

motivation for online reading. Therefore, these were not included. The sixth (social) is likely to

be relevant online, but we chose not to include it here because interpretations from items used in

the MRQ seemed suspect when applied to an online context. Some items, for example, focus on

offline social markers of reading (e.g., "visiting the library" and "trad[ing] things to read" with friends) that have no established analogs in an online context.

In contrast, the other dimensions of curiosity, involvement, value, self-efficacy, and challenge (i.e., self-improvement beliefs), seemed likely to be both relevant and fairly adaptable to an online context. Wigfield & Guthrie (1997) used the terms *curiosity* and *involvement* to refer to two aspects of intrinsic motivation, or choosing to engage in an activity for its own sake rather than for reasons extrinsic to the activity (cf. Ryan and Deci, 2000; Eccles and Wigfield, 2002). In the MRQ, the curiosity dimension focused on the concepts of interest and enjoyment as students read to learn about different topics. Curiosity seemed especially relevant to the current study, which focuses on reading to learn in online contexts. Involvement in the MRQ was used to capture reading "to get lost" in a story. Because items from the involvement dimension focus on particular genres (e.g., "mysteries," or "fantasy") or on enjoying a "long…book," this dimension was less relevant to an online context, where students encounter multiple genres and kinds of texts. Therefore, we used the curiosity dimension only.

Value is defined on the MRQ as the importance a student places on reading. In the MRQ, this concept is closely related to attainment value in some expectancy-value approaches (e.g., Eccles & Wigfield, 2002), or the personal importance of doing well on a particular task. A person may be more willing to engage in a personally relevant activity since it confirms positive aspects of identity and helps accomplish goals. On the SORAB, the value items additionally refer to outcomes (e.g., "I believe it is very important for me to learn how to use the Internet for getting information."), indicating utility value (Eccles & Wigfield, 2002), or the usefulness of a task for current and future goals. However, when the outcome is more autonomous, or aligned with an individual's internalized goals, it becomes "personally important" (Ryan and Deci, 2000,

p. 72) such that attainment and utility value could be conceived as similar in a reading to learn context, where readers may be likely to engage in reading tasks that are both personally important and useful for current and future goals. Some students might also identify more than others with digital technologies and view online reading as personally useful. Thus, we included both kinds of items: attainment and utility.

Similarly, we viewed the self-efficacy construct on the MRQ as important for online reading. On the MRQ, self-efficacy for reading referred to students' beliefs about their ability to engage in reading activities, which influences decisions about whether and how they will engage in such activities (Wigfield & Guthrie, 1997; Gambrell et al., 1996). In social-cognitive theory (Bandura, 1977), efficacy refers to existing beliefs, whereas in expectancy-value theory, it refers to expectancy for performing well in an upcoming task. Despite this theoretical difference, these constructs appear to be similar empirically (Eccles & Wigfield, 2002). Thus, we included items that refer both to current efficacy (e.g., "I am outstanding at doing research and reading on the Internet.") and to future expectations (e.g., I will do well the next time I do research and read on the Internet."). Self-efficacy appears to play an important role in reading achievement (Wigfield & Guthrie, 1997; Proctor, Daley, Louick, Leider, & Gardner, 2014) and might be especially relevant online, since some students have greater access to and experience with the Internet (Leu et al., 2015), likely increasing opportunities to develop competency beliefs.

Finally, the dimension of self-improvement beliefs, deemed "challenge" on the MRQ, referred to students' ideas about the extent to which they can improve through effort and practice. In Dweck & Leggett's (1988) social-cognitive approach, students' implicit beliefs about how people learn orient them towards goals for their own learning. Students with positive self-improvement beliefs, or a "growth mindset," believe that, rather than being a fixed trait,

intelligence and skills are developed over time through effort (Dweck, 2006). Thus, such

students' goals are aligned with learning and challenge. In contrast, students with a "fixed

mindset" believe that intelligence cannot be developed through effort (Dweck & Leggett, 1988).

Such students hold goals aligned with performance. Therefore, items in this dimension include

beliefs about learning and effort. Students' beliefs about their ability to learn using new

technologies such as the Internet might influence their beliefs about learning from text online.

Given that some research shows that offline reading ability explains a significant amount

of variance in students' online reading ability (Leu et al., 2015; Coiro, 2011), there appears to be

overlap in the elements important to both offline and online reading (Afflerbach & Cho, 2009).

Thus, it is likely that factors that motivate students to read in offline contexts also play an

important, if somewhat different, role in students' motivations in online contexts. This idea is

supported by preliminary research in online reading motivation.

In an initial study, Putman (2014) developed the SORAB and found motivational factors

that overlapped with reading motivation in offline contexts. These included self-efficacy for

reading online, value in using the Internet for learning, and expectations about outcome and

goals related to searching for information online. However, this was only a preliminary study; it

reported the results of initial instrument development from an exploratory factor analysis using a

convenience sample of participants who were relatively experienced with online reading.

Clearly, additional research is needed to better understand the motivations that affect students'

online reading (Putman, 2014).

Motivation and Comprehension in Digital Contexts

Some limited work in hypertext environments suggests that motivation for reading in

online environments may be important to online reading comprehension. One study of college

English majors in Taiwan (Shang, 2016) found that motivation contributed to students' ability to comprehend information while reading hypertext. While hypertext reading is similar to online reading in that both contexts include links, an Internet context contains many additional elements with which students must contend, including advertisements, search engines, nearly unlimited information, communication tools, and a far more diverse range of authors, texts, and content. Thus, it is not clear how these results, beyond the basic, positive association, generalize to the more complex context of online reading.

Another study using PISA's digital reading data investigated the extent to which online information engagement, or time spent conducting online reading activities (e.g., reading news sites, using online encyclopedias, and searching for information) and online social engagement, or time spent conducting social activities (e.g., using social networks, texting, and gaming), predicted the ability to navigate and access content online, as well as the extent to which content access predicted overall digital reading task performance (Naumann, 2015). This study found a positive correlation between information engagement and general digital reading task performance. Research in offline reading has suggested that motivation connects to engagement, which in turn connects to comprehension (Guthrie et al., 2013). Naumann's work (2015) therefore suggests that motivation may play an important role in online reading.

To our knowledge, however, no fully validated instruments exist specifically for measuring motivations for online reading, despite the importance of this area (OECD, 2011a). Developing such a tool is an important first step in understanding the relationship between motivation, engagement, and online reading. Therefore, based on previous research in both offline and online contexts, reviewed above, we developed the MORQ using four dimensions that included curiosity, (the desire to learn more about topics of one's interest for enjoyment),

value (the importance of reading online), self-efficacy (beliefs about one's ability to undertake the task), and self-improvement beliefs (beliefs about one's ability to improve with effort).

The Current Study

The goal of the present study was to develop and evaluate a multidimensional online reading motivation questionnaire based on previous research in both offline and online contexts that could be used with a range of secondary students. Specifically, we investigated the following questions:

1. What is the factor structure of the Motivations for Online Reading Questionnaire (MORQ)?

2. Does the MORQ perform similarly for boys and girls?

3. To what extent is the MORQ associated with ORCA performance?

Methods

Sample and Procedure

Participants included 1,798 seventh grade students, obtained from a stratified sampling process intended to generate a representative sample of students from each of two states in the Northeastern United States. These students participated in the Online Research and Comprehension Assessment (ORCA) project, which examined students' online reading ability during an online research and comprehension task (Leu, Kulikowich, Sedransk, & Coiro, 2009-2014). The present study included all students who completed an ORCA II-Virtual assessment and the Motivations for Online Reading Questionnaire (MORQ) in Year 4 of this ORCA Project. This included 883 male students (49.1%) and 915 female students (50.9%). The majority of students were non-ELL (98.7%), had no individualized education plan (90.6%), and spoke

English at home (96.7%). In one state, 30% of students in the sample qualified for free and

reduced price lunch, and in the other, 45% of students.

Schools and districts were identified based on a sampling plan that stratified districts by

SES, geographic area (urban, suburban, rural), and mean reading comprehension score on

standardized state tests. In each school that was selected from this plan, principals were asked to

identify two English/Language Arts (ELA) teachers whose heterogeneous classes most

represented the student population of the school. Principals then asked each identified ELA

teacher to select two of their classes that most represented the student population within that

school. All students in each class were invited to participate. However, only those who both

returned a parental permission form and signed a student assent form were allowed to participate.

This included approximately 20 students per class. Participants completed two ORCAs and one

MORQ during regular class instructional time across three non-consecutive days, with one

assessment per day. Students completed the computer-based ORCAs on a set of provided

laptops. Students completed the MORQs on school computers with their own teacher through the

online platform Survey Monkey.

Measures

Motivation for online reading questionnaire (MORQ). The MORQ was comprised of

five items in each of four dimensions, for a total of 20 items (see Table 1):

- *Curiosity*: The desire to learn more about topics of one's interest for the purpose of

  enjoyment (Wigfield & Guthrie, 1997; Alexander et al., 1994);

- *Value*: A belief that reading and researching online is important and useful (Wigfield &

  Guthrie, 1997; Guthrie et al., 2013; Eccles & Wigfield, 2002; Putman, 2014; Ryan &

  Deci, 2000);

- *Self-efficacy*: An individual's beliefs about their ability to read and research online (Wigfield & Guthrie, 1997; Bandura, 1977; Eccles & Wigfield, 2002); and,

- *Self-improvement beliefs*: An individual's beliefs about the extent to which effort can help them become better at reading and researching online (Cho, Toste, Lee, & Ju, 2019; Dweck & Leggett, 1988; Petscher, Al Otaiba, Wanzek, Rivas, & Jones, 2017).

[Insert Table 1 here]

For each of these factors, there were five positively-worded items. Respondents were required to answer each item on a 4-point rating scale that included 0 (*very different from me)*, 1 (*a little different from me*), 2 (*a little like me*), and 3 (*a lot like me*). Higher scores therefore indicated higher levels of agreement with the respective items. Based on the MRQ, we included one negatively worded item in each scale to help ensure that students were paying attention to the meaning of the items rather than merely choosing all 3s, for example, to make themselves look good. However, these items were later removed, after students completed the questionnaire, because of concern during analysis that they loaded on a single factor as an artifact of the negative language.

The selection of four dimensions for the MORQ was based on theoretical considerations as well as prior research in both print and digital contexts reviewed above. In particular, we focused specifically on those dimensions that have been shown to have a positive effect on students' reading outcomes because we wanted a measure that was relatively predictive of online reading performance using as few constructs as possible. Additionally, we included those dimensions that seemed especially relevant for an online reading context, as described above.

The dimension of intrinsic motivation appears on both the MRQ and the RMQ and has been positively linked to comprehension in multiple, offline studies (e.g. Guthrie et al., 2013; De

Naeghel et al., 2012; Schiefele & Schaffner, 2016) but has yet to be included in any instruments

of online reading motivation. Similarly, the dimensions of value and self-efficacy have also been

correlated with positive reading outcomes in offline (Wigfield & Guthrie, 1997; De Naeghel et

al., 2012) contexts and were included in the online SORAB (Putman, 2014). Additionally, we

included self-improvement beliefs, or a student's beliefs about the extent to which they can get

better at something with effort and practice. While similar to the "challenge" dimension of the

MRQ in referring to students' learning beliefs, specific items were based off of more recent

research in reading (see, for example, Blackwell, Trzensiewski, & Dweck's, 2007). Recent

research suggests that having positive self-improvement beliefs is related to better

comprehension (Cho et al., 2019; Petscher et al., 2017). Research has highlighted the unique and

robust importance of this factor as an aspect of students' motivations in academic areas (Dweck

& Leggett, 1988). Students who have positive self-improvement beliefs are more likely to have

better learning outcomes in a variety of contexts, including reading comprehension (Cho et al.,

2019; Lin-Siegler, Dweck, & Cohen, 2016).

Within each dimension, items were developed based on prior offline and online

motivation assessments, including the MRQ and SORAB, with two key adaptations. First, only

those items that showed strong positive associations with performance in offline reading

motivation studies and that made sense for an online context were chosen. Additionally, we

chose to include item stems that could relate to either recreational or academic contexts despite

the fact that a recreational context has been shown to have a greater positive effect on reading

outcomes compared to academic contexts (De Naeghel et al., 2012; Schiefele et al., 2012). Since

there is no work exploring differences in online reading between these contexts, our work to

understand motivation for online reading is only beginning, and we wanted the instrument to be as encompassing as possible.

Second, once these items were chosen, the specific wording was adapted from the MRQ and the SORAB by specifying an Internet reading context. In particular, each of our items included some version of the phrase "do research and read on the Internet" (see Table 1) to specify that we were referring to online reading for the purpose of learning through research and to create consistency around this construct across items. To underscore this concept to students prior to answering the questions, we prefaced the questionnaire with the following statement: "We are interested in your research and reading on the Internet. For all of the sentences [i.e., items] you should think about the kinds of things you do when you research and read on the Internet." Finally, we provided students with an example that included "I like to do research and read on the Internet about music" with the four different response options.

For the curiosity dimension, specifically, we adapted items from the same dimension on the MRQ to fit an online context. For example, a curiosity item on the MRQ reads, "I have favorite subjects that I like to read about." The item we created for the MORQ reads, "I have favorite subjects that I like to *do research on and* read about *on the Internet*." Similarly, the value and self-efficacy items on the MORQ were developed based on similar items in both the offline MRQ (Wigfield & Guthrie, 1997) and the online SORAB (Putman, 2014). For example, a value item on the MRQ reads, "It is very important to me to be a good reader." We adapted this item by adding language specifying an Internet reading context: "It is very important to me to be good at *doing research and reading on the Internet*" (see Table 1 for this and other items with similar wording).

Similarly, a self-efficacy item on the MRQ reads, "I know that I will do well in reading next year." We adapted this to read, "I will do well the next time I do research and read on the Internet." This item captures students' expectancy beliefs about how well they expect to do in an upcoming online reading activity. From the SORAB, we also adapted existing efficacy beliefs. The item "I feel confident that I can easily understand the information I research on the Internet" to "I am outstanding at doing research and reading on the Internet" in order to focus students' attentions on their existing self-efficacy beliefs rather than on their feelings about these existing beliefs.

Finally, for the self-improvement beliefs dimension, we developed items based on both the learning goals items from the MRQ (e.g., "I usually learn difficult things by reading.") as well as effort items from Blackwell et al.'s (2007) motivation questionnaire. These effort items focused on beliefs about general effort and performance rather than effort in reading, specifically, and used variations of the terms "effort," "hard work," and "practice." For the MORQ, we used these three concepts by specifying these words or phrases in our item stems but within an Internet reading context (see Table 1).

Online research and comprehension assessments (ORCAs). Online reading comprehension was assessed through the ORCA-II Virtuals, hereafter called ORCAs, or Online Research and Comprehension Assessments. The ORCAs are constructed-response, performance-based assessments of students' ability to read online (see Leu, Kulikowich, Sedransk, & Coiro 2009-2014 and also https://www.youtube.com/watch?v=HTmJCLoyYHE). In past research, the ORCAs have demonstrated high reliability, with Kuder-Richardson Formula 20 (KR-20) values ranging from 0.86 to 0.90 depending on topic (see Leu et al., 2014).

Students completed an online research and comprehension task that required them to locate, evaluate, and synthesize information across multiple webpages within a closed Internet environment before communicating their findings via an email or wiki tool. The environment included a social network with email, text messaging, a wiki, and a simulation of the Google search engine with 500 webpages. A programmed student avatar presented a problem that needed to be solved and asked students to read online information to learn about the problem and suggest a solution. The problems were related to heart and eye health, part of the larger area of study of human body systems included in the science curriculum for 7th graders in most U.S. states. The four topics included: 1) How do energy drinks affect heart health?, 2) How can snacks be heart healthy?, 3) Do cosmetic contact lenses harm your eyes?, and 4) Do video games harm your eyes?

Items were presented by the student avatars within the social network and varied depending on the nature of the item. Some items were requests of things students should do, such as find a particular website (Locate), write a summary of what they had learned across two websites (Synthesize), or compose an email message to the School Board President about what they had learned (Communicate). For example, for the first Locate item, an avatar said to the student, "Please, use the Internet to find a news article titled *Energy Drinks: OK for Athletes?* The article was published August 8, 2009 by the Mayo Clinic." Some items were also questions students had to answer directly, such as the four evaluate items, which were asked by an avatar through a chat window, along with a link to a webpage students were to evaluate. For Evaluate 4, for example, the avatar asked, "Is the information at this website reliable? How do you know?"

During regular class time, each student completed one ORCA with 16 items, each scored on a binary (0-1) basis. Higher scores indicated successful completion of more online

comprehension tasks. Depending on the topic, about half of the items in each version (i.e., topic)

of the assessment were automatically scored by a scoring system, since this demonstrated

slightly greater accuracy with scoring than hand scorers (Maykel, Forzani, Leu, Coiro, &

Kulikowich, 2014). Four trained undergraduate scorers manually scored the remaining items

with inter-rater reliability over 90%.

Data Analysis

What is the factor structure of the Motivations for Online Reading Questionnaire

(MORQ)? To identify and validate the factor structure of the MORQ, exploratory and

confirmatory factor analyses were conducted. Exploratory factor analysis is used to explore the

dimensionality of an instrument, particularly when there is a lack of prior theoretical and

empirical data to inform the factor structure, as was the case here. Thus, exploratory factor

analysis imposes no a priori structure on the items. Confirmatory factor analysis is used to then

confirm the factor structure hypothesized from the exploratory factor analysis (McCoach, Gable,

& Madura, 2013).

For the factor analyses, data were randomly split into a training set and a validation set

($N_1 = 929$, $N_2 = 869$). The training set was used to explore the factor structure of the instrument

through exploratory factor analysis, and the validation set was used to validate this factor

structure through confirmatory factor analysis (Gerbing & Hamilton, 1996). Once factors were

confirmed, reliability (Cronbach's alpha) of the subscales was estimated. Reliability analysis was

conducted to compute the internal consistency reliability of each subscale. The entire sample was

used for reliability analysis to take advantage of the full range of variability in the data.

Does the MORQ demonstrate measurement invariance with respect to gender?

Because we were interested in developing a tool that could be used to investigate the influence of

gender on students' motivations for online reading, we also sought to test measurement

invariance across gender. Measurement invariance concerns whether scores from

operationalizing a construct have the same meaning under different conditions, e.g. between

gender groups (Kline, 2011). Thus, invariance testing is necessary for establishing that

differences in groups can be attributed to actual differences among groups rather than to

differences in how the items function across different groups.

To what extent is the MORQ and its subscales correlated with ORCA performance?

Some research has used the relationship between an offline motivation instrument and offline

reading ability as a method of establishing the predictive validity of the motivation instrument,

since prior research has established the positive link between motivation and comprehension

(see, for example, Schiefele & Schaffner, 2016). For this reason, we were interested in

examining the relationship between the MORQ and the ORCA. As a result, we ran Structural

Equation Models to study the relationship between the motivation factors and online reading

performance. The measurement model for the MORQ was based on the previous psychometric

analysis of the MORQ.

<div align="center">

Results

</div>

Factor Structure of the MORQ

Exploratory Factor Analysis. To explore different possibilities with regard to the factor

structure of the instrument, two, three, and four factor solutions were extracted from the EFA

(see Table 1 for the factors and items). Direct oblimin was chosen as a rotation method, as we

expected factors to correlate with each other and an oblique rotation method would be likely to

render a more accurate factor solution (Costello & Osborne, 2005). The scree plot suggested that

all three solutions were plausible. However, after examining the factor structures, we chose the

three factor solution because the empirical results were the most consistent with the hypothesized

factor structure. Furthermore, the fit indices of the model, as well as the communalities of the items, were satisfactory (see Table 2).

[Insert Table 2 here]

The factor loadings are shown in Table 1. We determined which items to retain as measuring a particular factor based on the following decision rules: 1) the highest factor loading for the item was at least 0.3, and 2) the highest factor loading for the item was at least 0.1 above the second highest factor loading. The first factor (eight items) included a combination of items from our initial two factors of curiosity and value. We defined this curiosity/value factor as being interested in reading and researching online for its own sake, including a belief that reading online is useful. The other two factors were self-efficacy and self-improvement beliefs. Three items from the instrument, including one from each of valuing, self-efficacy, and self-improvement beliefs, did not belong to any of the three factors because they had low factor loadings or high cross loadings, and these were removed before confirmatory factor analysis was run with the remaining items on the validation set.

Each of these removed items appear to ask about a slightly different construct than any on the measure. For example, an item initially hypothesized to be part of the value construct that did not fit well with the curiosity/value construct read, "On the Internet, understanding the material I find is extremely important to me." Understanding material is somewhat different from being interested in it or valuing it and may suggest a different construct all together, such as ability to comprehend and do well. This is somewhat different even from self-efficacy, since it is more about the value of understanding the material (expressed through the words "is extremely important to me") rather than about the student's belief about their ability to understand the material, which would point more towards self-efficacy. This suggests that specific phrases and

ways of wording items here may have affected the way students interpreted them and thus, the item scores. See Table 1.

Finally, we evaluated the correlations between the three factors. The factor correlation was 0.63 between curiosity/value and self-efficacy, 0.53 between curiosity/value and self-improvement beliefs, and 0.54 between self-efficacy and self-improvement beliefs.

Confirmatory factor analysis. We used the model fit indices and R square of individual items to evaluate the results of the confirmatory factor analysis based on the three factor solution. Results indicated good global fit with the data (see Table 2). The factor loadings of all items were above 0.40 on the curiosity/value factor and above 0.60 on both the self-efficacy and self-improvement beliefs factors. See Figure 1 for a path diagram of the final confirmatory factor analysis model. See Table 1 for the final factor structure.

[Insert Figure 1 here]

Descriptive Statistics and Intercorrelations. Table 1 presents means and standard deviations for each item. Table 3 presents average means, standard deviations, and percentage of students scoring at each score point. An examination of these data revealed no ceiling or floor effects. Table 4 presents means, variances, reliabilities, and latent correlations for the final version of the MORQ. All three subscales demonstrated reasonably high internal consistency reliability since Cronbach's alpha for the three subscales ranged from .76-.82. The especially high factor correlations in relation to prior research (see, for example, Schiefele & Schaffner, 2016; Wang & Guthrie, 2004, 2004; Wigfield & Guthrie, 1997) prompted us to wonder whether the three factors should be merged into a single factor. Therefore, we ran the model again specifying a single factor predicting all items. However, we decided to keep the three factor solution, which had better fit (see Table 2). Additionally, students in the study were relatively

motivated to read online to learn. Of a possible mean of 3 for each factor, students scored, on

average, 1.63 on curiosity/value; 1.83 on self-efficacy, and 1.82 on self-improvement beliefs (see

Table 4).

[Insert Table 4 here]

Measurement Invariance Across Gender

Because past research has demonstrated differences in offline reading motivation by

gender (Logan & Johnston, 2009; Wigfield & Guthrie, 1997), we were interested in developing

an instrument with demonstrable measurement invariance with respect to gender so that the

instrument could be used to understand possible differences in motivation between boys and

girls. Creating a measurement invariant tool typically involves testing at least three levels of

invariance by introducing additional quality constraints at each level to achieve stricter

invariance (Millsap & Olivera-Aguilar, 2012). At each level, new constraints are tested in

addition to the constraints from the prior level, and model fit is compared to that of the previous

level. When the fit of the higher level does not substantially differ from that of the lower level,

measurement invariance is established at the higher level.

A baseline model is first established by testing configural invariance. Configural

invariance refers to whether the factor structure (the assignment of items to load on the latent

factors) is the same across groups. This involves fitting the confirmatory factor analysis models

for each group separately and comparing the fit of these models with another model that assumes

the same factor structure for everyone. At the next level, metric (weak) invariance also tests

whether the factor loadings of the items are equivalent across groups. At the third level, scalar

(strong) invariance requires that the item intercepts be equivalent across groups. However, when

strong invariance does not hold, it is still possible to establish partial measurement invariance by allowing some of the items to be freely estimated (Steenkamp & Baumgartner, 1998).

To test gender invariance of the MORQ, we first ran separate confirmatory factor analysis models for the MORQ for boys and girls to demonstrate model fit for each group separately. The models showed good fit for boys and for girls (see Table 5). We then proceeded to evaluate the four levels of measurement invariance of the MORQ across gender. Our analyses indicated good fit for configural and weak invariance. However, results suggested that the fit for the strong factorial invariance model was significantly worse than for the weak factorial invariance model. Therefore, we tested for partial strong factorial invariance by allowing 10 item thresholds to be freely estimated for boys and girls (see Dimitrov, 2010 and Millsap & Olivera-Aguilar, 2012). Results suggested that partial strong factorial invariance holds (see Table 5). This invariance testing suggests that it is appropriate to compare the means and intercorrelations between girls and boys on the MORQ.

[Insert Table 5 here]

Understanding the Relationship Between the MORQ Factors and ORCA

To investigate the validity of the MORQ, we examined the latent correlations between the dimensions of the MORQ and the ORCA. We expected positive correlations for all three of the dimensions, and the findings were in line with this hypothesis (see Table 4). Also as expected, each of the MORQ factors were positively and significantly correlated with ORCA: curiosity/value, self-efficacy, and self-improvement beliefs. See Models 1.1-1.3 for each dimension, respectively, in Table 6. Due to the high correlations between the MORQ factors, which creates multicollinearities between the independent variables, we choose not to present the results of a multiple regression analysis.

[Insert Table 6 here]

Discussion

It appears that online reading during an inquiry task is a unique context in which opportunities for the role of motivation may be somewhat different, and possibly more enhanced for some readers, compared to reading in an offline context. This means it is especially important that we develop instruments that allow us to observe and measure motivations in online reading contexts. However, while students' motivations for offline reading have been studied extensively in the past, little work has explored students' motivations for online reading, despite the fact that prior research indicates that motivation may be different in online, compared to offline, contexts. In particular, multiple studies have found that reading online differs somewhat from reading offline (Afflerbach & Cho, 2010; Leu et al., 2015; Coiro & Dobler, 2007; Coiro, 2011; Goodwin et al., 2019), suggesting that motivations may be different as well. Thus, there is an important need to understand students' motivations for reading in online contexts, which can have important implications for instruction and assessment.

Development and evaluation of the MORQ was somewhat extensive. To develop the MORQ, we first developed theoretical and research based constructs. Then, we created items based on several offline instruments but adapted them to fit an online context. To adapt items, we used only those items that would be salient to an online context, and we changed the wording of items to focus on "reading and researching online" rather than referring to reading in traditional contexts. To evaluate the MORQ, we first evaluated the factorial validity of the instrument through exploratory and confirmatory factor analyses, and revised items between these analyses. We then evaluated measurement invariance across gender to establish the instrument as one that could be used to evaluate potential gender differences since research suggests there are gender

differences in motivation in both print (Logan & Johnston, 2009, 2010) and digital (Liu & Huang, 2008) contexts. Finally, in order to provide empirical support for the predictive validity of the MORQ and its subscales, we analyzed the relationship between the MORQ and an established measure of online reading known as the ORCA (see Leu et al., 2015). We expected a measure of online reading motivation to correlate positively with students' online reading ability, since motivation has been shown to contribute to students' reading comprehension in both offline (Taboada, Tonks, Wigfield, & Guthrie, 2009; De Naeghel et al., 2012; Schiefele & Schaffner, 2016) and hypertext (Shang, 2016) environments.

To our knowledge, this is the first study to develop and fully test an instrument for measuring students' motivations for online research and comprehension that demonstrates both reliability and validity, making it immediately available for both researchers and practitioners. The need for an instrument like this is increasing, as youth are spending more time with online information (Hutchison & Reinking, 2011). While this instrument is only a first step in understanding students' motivations for reading in a wide variety of online and other digital contexts, having an instrument like the MORQ will now permit future research to more completely understand how different students' motivations for reading impact their online reading ability.

Factor Structure of the MORQ

The exploratory factor analysis suggested a three factor solution that included the dimensions of curiosity/value, self-efficacy, and self-improvement beliefs. The confirmatory factor analysis showed good fit indexes, and these three subscales showed good internal consistency. The correlations between the three factors were relatively high, but this is not

uncommon in reading motivation research (see, for example, Guthrie et al., 2013). While we tested a one factor model, we decided to retain the three factor model since the fit was better.

As hypothesized, self-efficacy and self-improvement beliefs each loaded as their own factor. That curiosity and value appeared as a single factor in this study may indicate that these two factors are more similar to one another in an online, compared to an offline, environment. One reasonable explanation for this may be that in online inquiry contexts in particular, the emphasis is typically on reading to learn information to use for a particular purpose (Leu et al., 2019; and also Kiili et al., 2018b). Therefore, readers' focus may rest on the value of information to fulfill a purpose even when readers are intrinsically motivated, or interested, in the information for its own sake. In one study of reading to learn in offline contexts, curiosity and value were highly correlated, suggesting that in certain contexts, curiosity and value may be somewhat similar (Guthrie et al., 2013).

Another, related possibility is that the MORQ is capturing academic motivation, specifically. Offline reading tasks are often differentiated as recreational, which consists of reading for enjoyment, or academic, which consists of reading to learn out of curiosity or interest. With these distinct purposes, curiosity and value are separately relevant and often comprise separate factors in factor analyses (Wigfield & Guthrie, 1997). However, unlike recreational reading, online research is rarely intrinsically motivating unless valued because "research" is often seen as a school task. In the academic arena, activities are more likely to correlate with value than with curiosity. Moreover, each item stem of the MORQ includes the phrase "do research and read on the Internet" (e.g., "I find it fun to do research and read on the Internet."). It is possible that students perceive "research" as academic and distinct from "surfing the web," which is also a kind of research but one that students may perceive more as a

recreational activity. The task of "researching and reading on the internet" is frequently

associated with digital school learning tasks, which may be inherently interesting and valued to a

similar degree. For this reason, future studies may find it valuable to include item stems without

this wording, or to provide students with a definition and examples of what is meant by

"research." Alternatively, future instruments could attempt to capture students' motivations in

both academic and recreational contexts, since research indicates that students may be less

motivated when reading for school-related reasons than when reading for non-school reasons (De

Naeghel et al., 2012; Schiefele et al., 2012).

Yet a third possibility is that curiosity and value on the MORQ are both capturing more

autonomous forms of motivation, and the distinction between autonomous and controlled

motivation is particularly apparent in this new, online context compared to a traditional reading

context. Autonomous motivation, or a reader's perceived control over, and choice in, the task,

can impact readers' comprehension. For example, De Naeghel et al. (2012) found that, like many

other studies (Wigfield & Guthrie, 1997; Schiefele & Schaffner, 2016), recreational, autonomous

motivation had a positive relationship with reading. Interestingly, however, and unlike other

studies, the authors also looked at recreational, controlled motivation and found a negative

relationship with comprehension. In more traditional, offline contexts, students may perceive

reading as uninteresting for its own sake but valuable, since society, and schools, so highly value

reading. The same may not yet be true for online contexts, however. Therefore, it is possible that

students perceive being interested in reading to learn on the Internet (the curiosity factor on the

MORQ) as similar to reading to learn because it is valuable to them (the hypothesized value

factor on the MORQ). In both instances, students presumably read more because it is valued by

choice (i.e., autonomous motivation) rather than because it is valued by society (i.e., controlled motivation; Ryan & Deci, 2000).

Invariance Analyses

Additionally, the MORQ demonstrated configural, weak factorial invariance and partial strong factorial invariance. Although strong factorial invariance was not found at first, we found that allowing 10 out of 60 thresholds to be freely estimated across the genders allowed the model to have partial strong factorial invariance. Many researchers consider a small number of non-invariant parameters acceptable when the majority of measurement parameters are equal across groups (Dimitrov, 2010; Millsap & Olivera-Aguilar, 2012). This suggests that the instrument measures the same constructs for boys as it does for girls and that composite and factor scores from subscales can be interpreted to have the same meaning for the two genders (Bowen & Masa, 2015), allowing for valid mean comparisons across gender.

Having a motivational instrument for online reading that measures a similar construct for the two genders permits the more systematic and thorough study of gender differences in online reading motivation in varying contexts. Initial work suggests that the pattern for gender differences for online reading might be somewhat different than the pattern for offline reading (Forzani, 2018; Hutchison et al., 2016; Liu & Huang, 2008). Given generally lower reading performance by boys in offline reading and correspondingly lower levels of motivation for offline reading (DeNaeghel et al., 2012; Logan & Johnston, 2009, 2010; Schiefele et al., 2016), it would be useful, from an instructional perspective, to have a more complete and precise picture of gender differences in motivation for online reading by various types of online reading tasks. This might permit intervention strategies that leverage potentially stronger motivational areas for

boys in online reading that could, eventually, impact offline reading as well, especially for learning.

Analyzing the Relationship Between Students' Motivations and Online Reading Ability

We were interested in understanding the relationship between motivation and performance in online research and comprehension as a method of testing the predictive validity of the MORQ. In this study, and in line with prior, offline studies, each of the motivation factors positively and significantly predicted comprehension as measured by the ORCA (Guthrie et al., 2013; De Naeghel et al., 2012; Schiefele & Schaffner, 2016). In univariate analyses, curiosity /value explained 1.6% of the variance in ORCA, self-efficacy 12%, and self-improvement beliefs 4.8%. See Table 6.

In other studies, contributions of curiosity are somewhat variable. Some studies have found positive, significant correlations between curiosity and comprehension. In one study, curiosity contributed about 3% of the variance in passage comprehension (Schiefele & Schaffner, 2016) and in another study, about 4% (Schaffner, Schiefele, & Ulferts, 2013). Other studies, however, have found small, nonsignificant (see, for example, Schiefele, Stutz, & Schaffner, 2016; Wang & Guthrie, 2004) or even negative (Guthrie et al., 2013) correlations between curiosity and comprehension. Negative correlations between value and informational text comprehension have also been reported (Guthrie et al., 2013).

The positive effects of curiosity/value found in this present study may be specific to students' age and the online context. Interestingly, Retelsdorf, Köller, & Möller (2012) found that curiosity was not associated with the initial level of reading comprehension for students at the beginning of grade 5 but was associated with their growth in comprehension from grade 5 to grade 8. The opposite was true for involvement. The authors hypothesized that both better and

poorer readers may use reading to satisfy their curiosity. However, age may play a role as well, with curiosity becoming a more important factor in the amount of reading students do as they grow older and read more to learn about a particular topic, leading to better comprehension (e.g., see Schiefele et al., 2012). Thus, curiosity may be an especially important motivation for older students and an important aspect for teachers to cultivate. The Internet may provide an opportunity for curiosity to play a significant role in students' online reading comprehension because, at least for those students who have Internet at home and at school, the Internet allows for immediate, broad, and deep access to texts that might satisfy one's curiosity, which might also align with the reader acting on what they learn. As a consequence, curiosity may be more correlated with online compared to offline comprehension.

In line with previous studies, both self-efficacy and self-improvement beliefs were positive predictors of comprehension. In this study, self-efficacy predicted more of the variance in comprehension than what we typically see in offline reading contexts. One study found that self-efficacy predicted about 7% of the variance in offline, informational text reading (Guthrie et al., 2013). In another study of English Language Learners, the authors found that of multiple motivation dimensions, including curiosity, involvement, and importance, only self-efficacy predicted reading comprehension (Proctor et al., 2014). It may be that self-efficacy is one of the strongest motivation predictors of online reading comprehension and is particularly important in this context. For example, in online contexts, readers have to self-monitor to a degree perhaps greater than that required in an offline context, choosing their own reading path by selecting links and then staying on task by ignoring multiple opportunities for distraction (e.g., clicking on extraneous links, looking at advertisements unrelated to their searches; Cho, 2014; Coiro & Dobler, 2007; Goldman et al., 2012). This might require greater self-efficacy in this more

uncertain context. Additionally, we report a somewhat smaller correlation between self-improvement beliefs and comprehension compared to prior, offline studies. Petscher et al. (2017) reported correlations of .35 to .44 for different comprehension measures, whereas we report a correlation of .22. Not all students have equal access to and use of the Internet, which likely impacts their opportunities to practice and thus their comprehension (Authors, 2015). This may, in turn, affect their self-improvement beliefs.

Implications for Instruction

The need for an instrument to measure motivation for online research and comprehension is especially important for practitioners. For some time we have known that teachers consider interest in reading to be an important issue for them. A national survey in the United States, conducted by the National Reading Research Center, has demonstrated this. Of the 84 topics that teachers reviewed, "creating interest in reading" was rated as the top priority. Three others related to motivation appeared in the top 10 (Gambrell et al., 1996). Having a valid and reliable instrument such as the MORQ allows teachers to better understand how motivated their classes and individual students may be in this area and to respond appropriately when planning instruction. Assessing individual and group levels of motivation for online research and comprehension at the beginning of the year, for example, can enable teachers to more effectively design online reading and learning activities for students during the year. Assessing individual and group levels of motivation at the end of the year will enable teachers and researchers to evaluate the effectiveness of different approaches to increasing motivation for online research and comprehension.

In addition to using the instrument to develop students' interest in reading online, educators can also use the instrument to support students' self-efficacy and self-improvement

beliefs. For example, recent work has shown that by teaching students about a flexible mindset, teachers can influence students' self-improvement beliefs and, in turn, their performance ability (Yaeger et al., 2019). The MORQ could give teachers valuable information, allowing them to directly support students' self-improvement beliefs and self-efficacy for online reading, likely leading to better online research and comprehension abilities.

Limitations and Future Directions

Development of a tool such as the MORQ is an essential starting point for subsequent research examining the role of students' motivations in online reading comprehension. However, this study is limited in at least two ways that are worth noting. First, while this tool is an important first step in understanding students' potentially unique motivations for reading in online contexts, additional research is needed to better understand the motivational factors that influence reading comprehension in digital environments. There are at least two important ways to approach such work. The first is to seek to capture online reading more broadly rather than focusing on online research and comprehension specifically. The second is to keep the instrument more narrowly focused but to create additional instruments that capture other forms of online reading.

With either approach, future instrument development could expand the factors to capture additional motivational aspects such as social motivation, as well as others that may correlate negatively with comprehension, such as extrinsic motivations (e.g., rewards). Both of these are important aspects on the Motivations for Reading Questionnaire (Wigfield & Guthrie, 1997) and the Reading Motivations Questionnaire (Schiefele & Schaffner, 2016) and can help us to more fully understand how motivations for reading in online contexts may differ from motivations for reading in offline contexts. For example, in the present study, we view the social nature of online

reading as an aspect of online environments that may influence the motivational aspects measured here. However, it is also possible that, rather than merely influencing motivational aspects, participating in a social community for the connection to others it provides is a motivation for reading online in its own right. Additionally, future research could also administer both a traditional motivations assessment alongside a measure such as the MORQ and compare students' responses on the two. Such a comparison would allow us to better understand how students are differently motivated in the two contexts. Nevertheless, the instrument developed here provides a valuable starting point for developing further research for understanding students' motivations for reading in online contexts.

Second, the current analyses were based on seventh graders only. The present factor structure and other analyses may be different for different ages of students. In particular, as students grow older and have more experience both in and out of school with technology and the Internet, their internal motivation/value, self-efficacy, and self-improvement beliefs may grow. Compared to traditional print reading contexts, many children may not have as much access to and experience with online reading from a young age. Thus, these motivation factors may change as they grow older. These factors may also change as the Internet grows more prominent in society and as the value of online reading for both academic and professional contexts increases.

Given the relatively new yet highly relevant context of online reading to living and working in society today, and given the similarities and differences between these two contexts, it is highly important that we better understand students' motivations for reading online. Many teachers are already using online texts and contexts in their instruction (Hutchison & Reinking, 2011), and many assessments of online reading have already been created and implemented to better understand students' performance in online contexts (Leu et al., 2015; OECD; 2011a;

Mullis et al., 2017). The use of online reading contexts in assessment and instruction is likely based on much recent work showing the centrality of this context for life and work today (Leu et al., 2019; Common Sense Media, 2017). Without understanding how motivation impacts students in these contexts, teachers may be creating further opportunity divides, based on income, or they may be missing out on opportunities to help students build motivation for reading in this potentially more engaging new context. All of these reasons make it imperative that we better understand students' motivations for reading online.

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Table 1

Items, Factor Structure, and Descriptive Statistics from Exploratory and Confirmatory Factor Analyses for the Motivations for Online Reading Questionnaire

Hypothesized Dimension	Item Number	Item	M	SD	F 1	F2	F3	95% CI for Alpha	Avg. Inter-item correlation
					Factor Loadings			Reliability Analysis	
C	1	+I find it fun to do research and read on the Internet.	1.40	1.06	**0.83***	-0.02	0.00	(0.803 - 0.830)	0.358 (IM/ Value)
	2	+I enjoy doing research and reading about new things on the Internet.	1.69	1.01	**0.79***	0.01	-0.04		
	3	+On the Internet, I do research and read about my favorite topics as often as I can.	1.81	1.00	**0.58***	0.05	-0.11*		
	4	+I have favorite subjects that I like to do research and read about on the Internet.	1.85	1.04	**0.56***	0.03	0.10*		
	5	+If a topic is interesting to me, I always try to do research and read about it on the internet.	1.95	0.95	**0.44***	0.13*	0.10*		
V	6	+For me, doing research and reading on the Internet is time well spent.	1.48	.96	**0.65***	0.00	0.15*		
	7	+What I learn on the Internet is valuable to me.	1.66	0.87	**0.49***	0.10*	0.12*		
	8	+I believe that doing research and reading on the Internet is more useful than any of my other school activities.	1.26	.99	**0.45***	0.02	0.00		

	9	On the Internet, understanding the material I find is extremely important to me.	1.81	1.00	0.30*	0.28*	0.18*		
	10	+It is very important to me to be good at doing research and reading on the Internet.	1.83	0.95	0.15*	**0.41***	0.27*		
SE	11	+I will do well the next time I do research and read on the Internet.	1.96	0.88	-0.05	**0.67***	0.19*	(0.763 - 0.796)	0.417
	12	+When I do research and read on the Internet I can explain everything I read.	1.69	0.91	0.06	**0.71***	-0.10*		
	13	+I can figure out unfamiliar words on the Internet.	2.00	0.97	0.04	**0.62***	-0.08*		
	14	+I am outstanding at doing research and reading on the Internet.	1.69	0.93	0.27*	**0.57***	-0.05		
	15	I learn a lot when I do research and read on the Internet.	1.92	0.85	0.28*	0.36*	0.08*		
SIB	16	+I believe that working hard helps me improve in doing research and reading on the Internet.	1.83	0.94	0.00	-0.04	**0.88***	(0.763 - 0.796)	0.470
	17	+I believe that working hard when I do research and read on the Internet will help me get better.	1.90	0.93	0.07	0.15*	**0.66***		
	18	+I believe that practice will help me with doing research and reading on the Internet.	1.60	0.93	0.23*	-0.04	**0.59***		
	19	+I can become better at doing research and reading on the Internet by putting effort into my work.	1.94	0.92	0.09	0.26*	**0.37***		
	20	I believe that I can learn how to do research and read on the Internet.	1.92	0.93	-0.09*	0.46*	0.40*		

Note. C = curiosity; V = value; SE = self-efficacy; SIB = self-improvement beliefs. Bolded factor loadings indicate that the item loaded on the referenced factor. *Indicates significance at the 0.05 level. +Indicates that the item was retained in the revised version of the MORQ. See Figure 1 for the coefficients for the CFA. The order of the items in the actual questionnaire are different from the order that appears here. All factor analyses were conducted using M*plus 8* (Muthén & Muthén, 1998-2017). All items were treated as ordered categorical variables instead of continuous variables because they had four response options. As a result, the weighted least squares mean and variance adjusted estimator (WLSMV) was used, which is the default estimator in M*plus*.

Table 2

Model Fit Statistics for the Exploratory and Confirmatory Factor Analyses

	EFA			CFA	
	Two-factor Solution	Three-factor Solution	Four-factor Solution	One-factor Solution	Three-factor Solution
CFI	.94	.97	.98	.90	.96
TLI	.92	.95	.97	.88	.95
RMSEA	.08	.06	.05	.11	.07
Range of Communalities for Items	.23-.65	.23-.75	.24-.77	---	---

Note. CFI is Confirmatory Fit Index; TLI is Tucker-Lewis Index; RMSEA is Root Mean Square Error of Approximation.

Table 3

Average Means, Standard Deviations, and Percentages of Students Scoring at Each Score Point by Hypothesized Scale

	Average *M*	Average *SD*	Average Percentage of Students Scoring At Each Score Point			
Score Point			0	1	2	3
Scale			Very different from me	A little different from me	A little like me	A lot like me
Curiosity	1.74	1.01	15	23	33	28
Value	1.61	.95	15.58	28.55	35.51	20.34
Self-efficacy	1.85	.91	9.4	22.77	41.34	26.50
Self-improvement beliefs	1.83	.93	10.03	23.31	39.48	27.18

Table 4

Latent Correlations and Descriptive Statistics for the Dimensions of Online Reading Motivation (Motivations for Online Reading Questionnaire, Final Version) and the ORCA

Variable	1	2	3	4
1. Curiosity/Value	--			
2. Self-efficacy	.80	--		
3. Self-improvement beliefs	.73	.78	--	
4. ORCA	.13	.35	.22	--
5. Mean	1.63	1.83	1.82	0.42
6. Standard deviation	.65	0.68	0.72	.20
7. Cronbach's α / KR-20	.82	.78	.78	0.76

Note. All correlations are significant at the .05 level. Means and standard deviations are averages for each subscale and are calculated based on students' observed values on the items in each subscale. Correlations among the subscales are latent factor correlations. Cronbach's alpha was computed for the three motivation factors. KR-20 was computed for ORCA.

Table 5

Model Fit Statistics of Models for Testing Gender Invariance for the Motivations for Online Reading Questionnaire

Model	RMSEA	RMSEA 90% CI	CFI	TLI	Difference Test
Male Only	0.07	(0.06, 0.08)	0.96	0.96	N/A
Female Only	0.07	(0.06, 0.08)	0.95	0.94	N/A
Configural Invariance	0.07	(0.06, 0.07)	0.96	0.95	N/A
Weak Factorial Invariance	0.06	(0.06, 0.07)	0.96	0.96	Weak vs. Configural: $X^2 = 22.50$, $df = 14$
Strong Factorial Invariance	0.06	(0.06, 0.07)	0.96	0.96	Strong vs. Weak: $X^2 = 75.55$, $df = 31*$
Partial Strong Factorial Invariance	0.06	(0.06, 0.07)	0.96	0.96	Partial vs. Weak: $X^2 = 29.05$, $df = 21$

Note. CFI = comparative fit index. RMSEA = root mean square error of approximation. TLI = Tucker–Lewis Index. * $p < .05$. The difference test was estimated by using the DIFFTEST option in M*plus*. The criteria for rejecting higher order measurement invariance were (1) ΔRMSEA > 0.01, (2) ΔCFI > 0.01 and (3) $p < 0.05$ for the robust Chi-square difference test with mean and variance adjusted test statistics (DIFFTEST in Mplus8). The fixed indicator method was used to set the scale. To test measurement invariance of ordered categorical indicator variables, we used the WLSMA estimator with a theta parameterization, where residual variance of the MORQ factors was fixed at one for both gender groups (see Muthén and Muthén, 1998-2017).

Table 6

Motivation Variables Predicting ORCA Performance

Predictor	Model 1.1 Curiosity/ Value	Model 1.2 SE	Model 1.3 SIB
	b	b	b
Curiosity/Value	0.13		
Self-Efficacy		0.35	
Self-Improvement Beliefs			0.22
R-Square on ORCA	0.02	0.12	0.05
CFI	0.96	0.96	0.96
TLI	0.96	0.95	0.95
RMSEA	0.02	0.02	0.03

Note. P<.001 for all analyses. CFI is Confirmatory Fit Index; TLI is
Tucker-Lewis Index; RMSEA is Root Mean Square Error of Approximation.

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