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Gender differences in online reading engagement, metacognitive strategies, navigation skills and reading literacy

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Abstract

This study examined how knowledge of metacognitive strategies and navigation skills mediate the relationship between online reading activities and printed reading assessment (PRA) and electronic reading assessment (ERA) across 19 countries using the PISA (Programme for International Student Assessment) 2009 database. Participants were 34 104 fifteen-year-old students (female: 50.1%). The results showed that information-seeking activity, knowledge of metacognitive strategies and navigations skills positively predicted ERA and PRA. Social reading activities negatively predicted knowledge of metacognitive strategies and PRA but had no effect on ERA and the navigation skills in most countries. Increased information-seeking reading resulted in higher ERA and PRA as demonstrated by navigation skills and knowledge of metacognitive strategies. Gender differences in online reading engagement were not statistically significant in most countries. However, girls performed better in knowledge of metacognitive strategies, navigation skills and PRA but were not significantly better on ERA. Multiple group comparisons of gender indicated that the hypothesized model held for both boys and girls. Besides the infrastructure of information and communications technology as a tool to access the cyber informational space, students should be empowered to use appropriate strategies and navigation skills to achieve their goals. Implications for teaching and learning practices are discussed.

Keywords

gender difference, metacognitive strategy, navigation skill, reading engagement, PISA, reading literacy.

Since 2000, the Organization for Economic Co-operation and Development (OECD) has conducted 3-year cycles of assessment of students' reading, mathematics and science literacy through the Programme for International Student Assessment (PISA). The predicative power of PISA scores on academic and career outcomes has been documented (Knighton & Bussiere, 2006; OECD, 2007) and used to inform educational reform.

In 2009, the main focus of PISA was assessment of reading literacy, which is an essential skill for people to acquire new knowledge and survive in an increasingly global, information-based world. Based on the results

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of previous PISA cycles, girls have been found to demonstrate a consistent advantage in reading ability over boys (Chiu & McBride-Chang, 2006; Lietz, 2006); moreover, the overrepresentation of boys in the reading underperformance group has become an issue requiring closer attention (OECD, 2011a). In the e-learning era, the concept of reading literacy has evolved and expanded to include the ability to read both paper- and web-based materials. Acknowledging the importance of both forms of reading, PISA administered printed reading assessments (PRAs) along with electronic reading assessments (ERAs) in 2009.

What mechanism will help explain reading literacy in the digital era? Will the gender gap still exist in ERA? And will gender moderate the relationship between related factors (such as various online reading activities, navigation skills and metacognitive strategies) and reading literacy? These are the questions that drove the current study. Gender differences in PRA are a worthwhile pursuit in order to find a possible solution to closing the gender gap, so is an investigation in ERA.

Printed vs. electronic reading

Printed reading and electronic reading share several reading strategies, such as planning/goal setting, rereading, monitoring, evaluating and correcting (Akyel & Erçetin, 2009; Coiro & Dobler, 2007; Winne, 1995). Research shows that instruction in metacognitive strategies and metacognitive awareness can help students learn to read better (Boulware-Gooden, Carreker, Thornhill, & Joshi, 2007). Thus, a positive correlation has been found between knowledge of metacognitive strategies and reading literacy (Artelt, Schiefele, & Schneider, 2001).

However, besides metacognitive awareness and prior knowledge of the reading content, in a web-based environment, readers also need knowledge of the website structure as well as the search engine in order to be able to read and glean meaning (Coiro & Dobler, 2007). These navigation skills are pivotal to Internet reading because hyperlinks and search functions are the unique features of reading in a digital environment; however, at the same time, they are the cause of non-linearity, which often leads to learner distraction, disorientation and shallow reading (Akyel & Erçetin, 2009; Birkerts, 2006; Liu, 2005; Mangen, 2008).

Analysing the reading pattern of skilled sixth graders, Coiro and Dobler (2007) proposed a recursive cycle of reading pattern in a web-based open environment. The cycle consisted of four elements: plan, prediction, monitor and evaluation. Readers should have a goal and build a mental model at first, predict where the link will lead, monitor after an action is taken and evaluate the pertinence of the decision (Coiro & Dobler, 2007). Although this four-part reading cycle is similar to that used when reading paper-based materials, the predicting, monitoring and evaluating parts focus on the uncertainty of what readers will end up with when they make a decision rather than where the author of the book (or paper-based material) will lead them. As such, electronic reading capitalizes on individual differences in navigational skills, which involve 'constantly making a decision on how to proceed while reading, and monitoring of this process' (Akyel & Erçetin, 2009, p. 145), and are a reflection of metacognitive strategies specific to web-based reading.

Online reading activities and reading literacy

Historically, active engagement in reading has been positively associated with reading literacy (Froiland & Oros, 2013). In the digital age, different types of reading activities have emerged and can be broadly categorized into social and information seeking (OECD, 2011b). That is, people use different reading strategies based on the types of reading activities they engage in, which, in turn, have distinct influences on their reading in either the printed and digital environment.

Social reading activities, such as online chatting, have been found to have an adverse effect on learning due to its nature to make people distracted (Bowman, Levine, Waite, & Gendron, 2010; Fox, Rosen, & Crawford, 2009; Junco & Cotten, 2011). In contrast, information-seeking activities that involve constant decision making and monitoring resemble serious reading tasks and are beneficial to reading comprehension (Coiro & Dobler, 2007; Lee & Wu, 2012, 2013).

Gender differences in reading literacy and the essential factors that affect reading ability (e.g., engagement in online reading, knowledge of metacognitive strategies and navigation skills) as well as the mutual relationship among these factors form the foundation of the current research.

Purpose of the study

In a preliminary analysis of the PISA database, we found a zero-order correlation of 0.85 on ERA and PRA for the 19 participating countries. The correlation between the two variables, when converted to the concept of variance explained, showed a shared variance between ERA and PRA of 72%. Our motivation behind the present study was to explore possible factors that can explain the common variances in ERA and PRA and discover possible mediators that account for the relationship between the various online reading activities and ERA/PRA. As mentioned previously, navigation skills are specific to online reading environment (Akyel & Erçetin, 2009), whereas metacognitive strategies are universal to both printed and electronic reading (Coiro & Dobler, 2007). Therefore, we used metacognitive strategies, specifically self-regulated learning (Pintrich & De Groot, 1990), as the theoretical framework for examining how knowledge of metacognitive strategies and online navigation skills mediate the relationship between online reading activities and PRA and ERA across 19 countries using the PISA 2009 database.

The current study was designed to answer the following research questions using structural equation modeling in an overall model as well as in individual country models:

1. What are the direct effects of social reading activities on knowledge of metacognitive strategies, navigation skills, and ERA and PRA, controlling for socio-economic status and gender?
2. What are the direct effects of information-seeking reading activities on knowledge of metacognitive strategies, navigation skills, and ERA and PRA, controlling for socio-economic status and gender?
3. What are the direct effects of knowledge of metacognitive strategies on ERA and PRA, controlling for socio-economic status and gender?
4. What are the direct effects of navigation skills on ERA and PRA, controlling for socio-economic status and gender?
5. What are the indirect effects of social reading activities on ERA and PRA, as demonstrated by knowledge of metacognitive strategies and navigation skills, controlling for socio-economic status and gender?

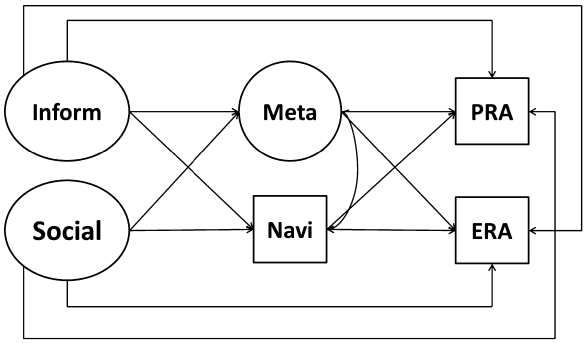

Figure 1 Hypothesized Mediation Model
Note. Inform = Information-Seeking Online Reading Activities; Social = Social Online Reading Activities; Meta = Perceived Usefulness of Metacognitive Strategies; Navi = Navigation Skills; PRA = Printed Reading Literacy; ERA = Electronic Reading Literacy. The Effects of Gender (Male = 1, Female = 0) and ESCS on Mediators and Outcome Variables were Controlled

6. What are the indirect effects of information-seeking reading activities on ERA and PRA, as demonstrated by knowledge of metacognitive strategies and navigation skills, controlling for socio-economic status and gender?

Besides testing the hypothesized relationships, we also examined the moderating effect of gender on online reading engagement, knowledge of metacognitive strategies, navigation skills, and PRA and ERA by asking:

7. What is the gender moderation effect on online reading engagement, knowledge of metacognitive strategies, navigation skills, and ERA and PRA, holding other variables constant?

The hypothesized model is exhibited in Figure 1.

Literature review

Instead of merely describing the relationship between different online activities and PRA/ERA, we explored possible mediators that explained the mechanism behind the relationship and examined moderating effects on the essential variables that influence reading. Specifically, we investigated the interplay of navigation strategies and knowledge of metacognitive strategies on the relationship between various online reading activities and reading literacy across 19 countries.

The following is a review of the literature related to metacognitive strategies and reading literacy, navigation skills and reading literacy, and the gender moderation on these factors.

Metacognitive strategies and reading literacy

Metacognitive strategies are internal psychological processes that influence readers' reading comprehension and are central to self-regulated learning processes. Metacognition involves the state of being aware of one's thinking along with the control and regulation of one's cognitive behaviours (Flavell, 1979; Zimmerman, 2002).

Results of empirical studies have indicated that proficient readers exert appropriate metacognitive strategies (Lau, 2006; Lau & Chan, 2003). Specifically, good readers monitor and evaluate the reading process and regulate reading methods to achieve their reading purposes. The importance of metacognitive strategies is also evident in the digital reading environment (Akyel & Erçetin, 2009; Stadtler & Bromme, 2007). For example, Jairam and Kiewra (2010) found that students who used the full SOAR (select, organize, associate and regulate) strategies had better online reading scores than those in the control or partial-strategy groups. In addition, skilled readers performed better in monitoring their comprehension of questions and information searching during online task-oriented reading assignments (Vidal-Abarca, Mañá, & Gil, 2010).

Navigation strategies and reading literacy

In order to read efficiently in a digital environment, readers need to travel across the nodes in the online texts effectively, which requires proficient navigation strategies to access, organize and integrate multiple sources of information. These strategies were referred to as 'advanced navigation strategies' to distinguish them from the basic navigation strategies pertaining to website structure (OECD, 2011b).

At the centre of advanced navigation processes are frequent self-monitoring and self-regulating of one's reading comprehension, which includes the ability to decide the next move that will lead to relevant information as well as to access, integrate and evaluate information from various web pages (Naumann, Richter, Christmann, & Groeben, 2008; Salmerón & García, 2011).

Researchers have studied navigation skills in relation to online reading in terms of navigation types (Barab, Bowdish, & Lawless, 1997; Bousbia, Rebaï, Labat, & Balla, 2010), link selection criteria (Salmerón, Kintsch, & Caãs, 2006a, 2006b), and reading models that contain navigation and other factors (Naumann *et al.*, 2008; Salmerón & García, 2011).

For the first category, Lawless, Brown, Mills, and Mayall (2003) commented that three online reader profiles can generally be identified: knowledge seekers, feature explorers and apathetic users. Knowledge seekers read the online documents in pursuit of the content. The feature explorers spent more time interacting with multimedia to know how things work than with the content. The apathetic users were unmotivated readers who only did a limited amount of web page exploration.

For the second category, Salmerón *et al.* (2006a) found that the coherence of text representation was related with reading comprehension based on the construction-integration model (Kintsch, 1988). Further, low-knowledge readers following the coherence strategy had better reading comprehension than those following the interest strategy, but no such effect was found among intermediate-knowledge readers (Salmerón *et al.*, 2006b).

Regarding the third category, Naumann *et al.* (2008) revealed that navigation skills mediated the relationship between learning strategy training and learning outcome. Students with high reading ability or working memory benefited from strategy training as demonstrated by better navigation behaviour and learning outcomes, but this effect was not found in students with low reading ability or working memory. Based on the assumption of coherence strategy, Salmerón and García (2011) showed that reading skills predicted one's navigation strategy measured in terms of the cohesion of navigation path, which in turn predicted reading performance.

The current study followed up on the third category to explore the mediation effects of knowledge of metacognitive strategies and navigation skills between various online reading activities and ERA and PRA. Besides investigating the general pattern, the 19 individual models from participating Asian, European,

South American and Oceanian countries were examined to check their congruency with the general pattern.

Gender effect on literacy, metacognitive strategies, online engagement and navigation skills

Gender differences in reading have been found consistently over the past decades and across geographical regions (for a review, see Lietz, 2006). For example, using the 2003 PISA data, Chiu and McBride-Chang (2006) found that girls had better reading performance than boys across 41 countries. Evidence from four longitudinal epidemiology studies also revealed that the per cent of reading disability was higher in boys with or without taking IQ into account (Carroll, 2004). Further, in OECD countries, the gender gap in reading literacy was especially noticeable in the underperformance group, where one in eight girls performed below the baseline proficiency level while one in four boys performed below that level (OECD, 2011a).

Metacognition makes a unique contribution in processing difficult texts beyond intelligence (Veenman & Beishuizen, 2004). Gender differences in choice of metacognitive strategies may help explain girls' advantages in reading comprehension. Girls reported more metacognitive strategy use than boys during reading (Sheorey & Mokhtari, 2001) and scored higher on comprehension monitoring (Kolić-Vehovec & Bajšanski, 2006). However, some research has suggested that even though girls had higher scores in metacognition than boys, the difference was not statistically significant (Roeschl-Heils, Schneider, & van Kraayenoord, 2003). This study revisited the gender difference in knowledge of metacognitive strategies using the large-scale, high-quality PISA data.

With regard to online engagement, results on gender differences were mixed. For example, no gender difference was found in e-mail use, chatting online, web surfing or information search in a sample of 340 Greek high school students aged 12–16 (Papastergiou & Solomonidou, 2005). Nevertheless, Chen and Fu (2009) found that eighth-grade girls reported using the Internet more often for both online searching and chatting than boys, even though the frequency of Internet use for girls was significantly lower than for boys in a sample of 1409 Taiwanese adolescents. Likewise, Tsai and Tsai (2010) found that boys had greater intensity of Internet use than girls; however, boys tended to use the Internet for explorative purposes whereas girls tended to use it for communicative purpose. The current study examined gender differences in online engagement of social reading and information-seeking activities.

As for navigation skills, gender differences may be examined in search patterns, actual skills or self-reported measures. Analysing eighth graders' search behaviours, Roy and Chi (2003) found that more boys than girls preferred horizontal moves by fast scanning information at an early reading stage, whereas more girls than boys preferred vertical moves by reading in a linear sequence between documents. However, students with high knowledge gains preferred horizontal moves regardless of gender. Early scanning on the web may reflect students' evaluation strategies to determine whether information is relevant to the reading topic and is essential to reading. As for self-reported measures, in a sample of 324 high school students, Tsai (2009) evaluated boys and girls' search strategies in the behavioural, procedural and metacognitive domains. No gender difference was found in the metacognitive strategy domain but a significant male advantage was found in Internet control and procedural strategies. Thus, even though men usually have higher self-assessed web skills, their actual search results may not be statistically different from women's (Hargittai & Shafer, 2006).

As illustrated, the literature on gender difference in navigation revealed mixed results. Therefore, the current study examined this issue by using the centred number of relevant page visited (OECD, 2011b) as an objective measure of navigation skills.

Method

Sample

The study used the PISA 2009 dataset for analysis. PISA 2009 utilized two-stage stratified sampling scheme to collect data. In the first stage, schools with probabilities proportionate to the number of 15-year-old students within the schools were selected from a sampling frame in a comprehensive national school list. A minimum of 150 schools were chosen in each of the participating countries. In the second stage, a random sample of 35 students was selected within participating schools. A total of 107 394 students from 19 countries and regions (Korea, Japan, Hong Kong-China, Macao-China, New Zealand, Australia, Ireland, Iceland, Sweden, Norway, Belgium, Denmark, France,

Spain, Poland, Hungary, Austria, Chile and Colombia) participated in both the PRA and ERA.

Among the 107 394 students, navigation data were recorded in the log file for only 34 104 students on the ERA. Therefore, only observations with available navigation data were included in the current analysis, resulting in a sample of 34 104 students (female: 50.1%).

Materials and instruments

PRA

The PRAs were designed to assess multiple aspects of reading skills, which may be divided into two groups: reading process and text composition. The reading process included three aspects: accessing and retrieving, integrating and interpreting, reflecting and evaluating. The text composition consisted of two aspects: continuous texts and non-continuous texts. Continuous texts are organized from sentences, paragraphs, to sections. Examples of non-continuous texts are lists, tables, graphs, diagrams, advertisements and schedules.

We used a combined scale reading score with all five aspects to evaluate student reading literacy. The PISA-combined scale had an average score of 500 and a standard deviation of 100.

ERA

Like the PRA, the ERA also focused on the three reading processes: accessing and retrieving, integrating and interpreting, reflecting and evaluating. The ERA simulates the online reading situation, which requires students to use their Internet control skills, such as clicking on a particular link or replying a comment on the discussion forum, to search for particular information or to explore the links that are relevant to the reading topic. For example, in accessing and retrieving, students may need to retrieve an answer to the question from a specific web page without navigating to other pages. In integrating and interpreting, students may need to integrate information on different web pages to develop an explanation. In reflecting and evaluating, students may consult an additional web document that is authoritative and trustworthy to support their preferences on one suggestion over another.

An item pool of 29 digital reading tasks formed three reading clusters. Each student was administered a 40-min ERA, randomly drawn from two of the three clusters. The scores on the ERAs and PRAs were equated with the means within the countries or regions so that the results could be compared. The mean ERA score was 499, with a standard deviation of 90 for the current sample.

Social and information online reading activities

Students' online activities may be divided into social reading activities and information-seeking reading activities. According to OECD (2009a), the former include reading e-mail and chatting online; the latter include reading online news, using online dictionaries or encyclopaedia (e.g., Wikipedia®), searching online information to learn about a particular topic or searching for practical information online. The online reading activities were evaluated in terms of frequency of use, ranging from 1 (*I don't know what it is*) to 5 (*several times a day*).

Knowledge of metacognitive strategies

Knowledge of metacognitive strategies consisted of two metacognitive strategy index variables. The index of summarizing (Metasum) and the index of understanding and remembering (Undrem) emphasize readers' abilities to monitor, evaluate and integrate reading materials. The following is a sample item for Metasum: 'I read through the text, underlining the most important sentences, and then I write them in my own words as a summary.' Sample item for Undrem is: 'I concentrate on the parts of the text that are easy to understand.'

Students were asked to rate the usefulness of strategies within each index variable. Experts also rated the usefulness of the strategies. Higher scores on the indices meant that students' ratings agreed more with the experts' ratings; namely, better knowledge of the metacognitive strategies.

Navigation skills

The measure of navigation skills was number of visits to relevant pages recorded in the computer log file when students were taking the ERA. Twenty-nine digital reading tasks were organized into three clusters, and students received two of the three clusters randomly. Therefore, students would not respond to the same set of digital reading items. To account for the effect of reading assessment orders and test compositions, we followed the reporting practice of the PISA

and used the centred number of relevant pages visited, which is calculated with equal weights to the OECD countries per test and then subtracted from individual students' values, as the indicator of navigation skills in this study.

The ESCS (economic, social and cultural status) covariate and the gender moderator

We controlled students' socio-economic status (ESCS) and tested the gender-moderating effect for knowledge of metacognitive strategies, navigation skills, and ERA and PRA in the hypothesized mediation model. The state of socio-economic status has been a dominating factor in student outcomes (White, 1982). This study controlled for socio-economic status with a focus on other variables of interest.

Data analysis

The hypothesized model was tested with mediation analysis (MacKinnon, 2008) using Mplus 6.11 (Muthén & Muthén, 2010). To calculate indirect effects of social reading and information-seeking reading activities on PRA and ERA scores, we utilized the Sobel (1982) test along with the delta method to test statistical significance (Krull & MacKinnon, 1999, 2001). All data analysis procedures were conducted following the suggestions of OECD (2009b). We used sampling weight and replicate weight to correct for biased parameter estimates and their standardized error estimates due to the two-stage stratified sampling schemes (Wu & Kwok, 2012). The plausible values were also used to approximate each participant's true score and ability.

Model fit was determined using root mean square error of approximation (RMSEA; Steiger, 1998) and standardized root mean square residual (SRMR; Hu & Bentler, 1999). The model fit chi-square test and related model fit indices are not provided because they were not available for an analysis employing replicate weights. A reversed model with all paths pointing in opposite directions from the original model was tested to examine if the reverse of hypothesized relationship existed. Besides testing the moderator effect of gender on the mediators, online engagement, PRA and ERA, which resembles *t*-test or mean gender differences, we also conducted a multigroup comparison to determine if the hypothesized model was statistically similar for boys and girls.

Results

This section presents the result for the overall and individual country mediation models. The correlations among the observed variables are presented in Table 1. As illustrated, the proposed mediation model exhibited adequate model fit with overall data (RMSEA = .063

Table 1. Zero-Order Correlation Among Items, Indices and Observed Variables

		1	2	3	4	5	6	7	8	9	10	11	12
1	ESCS	–											
2	PRA	.368**	–										
3	ERA	.405**	.850**	–									
4	Social01	.200**	.114**	.140**	–								
5	Social02	.121**	–.013*	.038**	.393**	–							
6	Inform01	.107**	.096**	.110**	.311**	.342**	–						
7	Inform02	.172**	.221**	.201**	.282**	.253**	.423**	–					
8	Inform03	.190**	.153**	.152**	.279**	.196**	.374**	.548**	–				
9	Inform04	.163**	.155**	.169**	.259**	.249**	.368**	.408**	.472**	–			
10	Metasum	.205**	.431**	.388**	.065**	–.014*	.031**	.118**	.091**	.072**	–		
11	Undrem	.171**	.373**	.337**	.069**	–.023**	.034**	.101**	.085**	.070**	.451**	–	
12	Navi	.262**	.623**	.683**	.146**	.088**	.109**	.230**	.156**	.161**	.321**	.269**	–

Note. ESCS = students' economic, social and cultural status; PRA = printed reading literacy; ERA = electronic reading literacy; Social01 = reading e-mails; Social02 = <chat online> (e.g., MSN®, Microsoft, Redmond, WA, USA); Inform01 = reading online news; Inform02 = using an online dictionary or encyclopaedia (e.g., Wikipedia); Inform03 = searching online information to learn about a particular topic; Inform04 = searching for practical information online (e.g., schedules, events, tips, recipes); Metasum = perceived usefulness of summarizing strategies; Undrem = perceived usefulness of understanding and remembering strategies; Navi = the centred numbers of the relevant pages visited by students during the digital reading assignment.
*$p < .05$, **$p < .01$.

and SRMR = .063). We provided both standardized and unstandardized path coefficients in the corresponding tables for the mediation models, but interpretation of the result was primarily made using unstandardized solution so that variables can be interpreted on meaningful metrics. While there were some significant paths for the reversed hypothesized model, the parameter estimates were very small in terms of effect size, ranging from 0 to 0.095. The significant results were regarded as trivial and may be due to the large sample size. Therefore, we focused our attention on the hypothesized model.

Direct effects

Table 2 presents the direct path estimates for the overall 19 countries. As illustrated, all the hypothesized direct paths in the overall mediation model were statistically significant except the one from social reading activities to navigation skills in the overall model ($b = 0.05$, SE = .46, $p > .05$). This finding was not surprising because social reading activities require fewer navigation skills; therefore, increasing the frequency of social reading activities will not lead to better navigation skills.

Across the 19 countries, only the patterns for Korea and Chile differed from the overall model. Social reading activities had a negative effect on navigation skills in Korea ($b = –4.02$, SE = 1.32, $p < .05$) whereas it had a positive effect on navigation skills ($b = 2.05$, SE = .06, $p < .05$) in Chile. Social reading activities also negatively predicted metacognitive strategy awareness ($b = –.37$, SE = .08, $p < .05$), PRA ($b = –66.65$, SE = 14.79, $p < .05$) and ERA ($b = –47.41$, SE = 11.64, $p < .05$) in the overall model.

In examining these effects across 19 countries, we found that the individual patterns agreed with the overall model for social reading on metacognitive strategy and PRA, but the effect on ERA tended to be null in most countries. That is, 14 out of 19 countries had an insignificant path from social reading to ERA. On the other hand, positive direct effects were observed from information-seeking activities on metacognitive strategies ($b = .27$, SE = .04, $p < .05$), navigation skills ($b = 2.95$, SE = .29, $p < .05$), PRA ($b = 38.44$, SE = 5.76, $p < .05$) and ERA ($b = 27.92$, SE = 4.74, $p < .05$). The significance pattern was consistent across the participating countries with few exceptions.

The effects of metacognitive strategies and navigation skills on the PRA and ERA were all positive and conformed to the literature on both the overall and the individual models. Specifically, for every one point increase in knowledge of metacognitive strategies, students' PRAs increased by 46.20 points (SE = 2.10, $p < .05$) and ERAs increased by 36.93 points (SE = 2.91, $p < .05$). Better navigation skills also led to higher PRA ($b = 3.59$, SE = .15, $p < .05$) and ERA scores ($b = 4.67$, SE = .27, $p < .05$).

Indirect effects

Table 3 exhibits the result for the indirect effects in the 19 countries. We calculated the indirect effects from social or information-seeking reading activities on the PRA and ERA via metacognitive strategies or navigations skills, yielding eight indirect effects. The indirect effects on the PRA and ERA from social reading activities were negative via metacognitive strategies ($b_{social→meta→PRA} = −16.85$, SE = 3.52, $p < .05$; $b_{social→meta→ERA} = −13.47$, SE = 2.75, $p < .05$). The indirect effects on the PRA and ERA from social reading activities were neutral via navigation skills ($b_{social→navi→PRA} = .19$, SE = 1.64, $p > .05$; $b_{social→navi→ERA} = .25$, SE = 2.15, $p > .05$). For both direct and indirect effects, results showed that social reading activities had either a negative or no effect on the PRA and ERA in overall and individual country analyses. The indirect effects on the PRA and ERA from information-seeking reading activities were positive via metacognitive strategies ($b_{info→meta→PRA} = 12.55$, SE = 1.47, $p < .05$; $b_{info→meta→ERA} = 10.03$, SE = 1.26, $p < .05$). The indirect effects on the PRA and ERA from information-reading activities were also positive via navigation skills ($b_{info→navi→PRA} = 10.57$, SE = .97, $p < .05$; $b_{info→navi→ERA} = 13.78$, SE = 1.65, $p < .05$). Overall, the results indicated that information-seeking activities had a positive effect on the ERA or PRA, as demonstrated by knowledge of metacognitive strategies or navigation skills.

Effects of gender differences and ESCS on online reading engagement, mediators, and PRA and ERA

We examined the moderating effects of gender on social or information-reading engagement, knowledge of metacognitive strategies, navigation skills, and the

Table 2. The Direct Path Estimates for the 19 Countries

Country or area (ranking)			19 countries		Hong Kong (5)		Korea (1)		Japan (4)		Macau (12)		New Zealand (2)		Australia (2)	
Model fit indices			RMSEA = .063 SRMR = .063		RMSEA = .073 SRMR = .054		RMSEA = .061 SRMR = .060		RMSEA = .046 SRMR = .037		RMSEA = .070 SRMR = .062		RMSEA = .068 SRMR = .071		RMSEA = .066 SRMR = .061	
Direct effect			Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
Social	→	Meta	***–0.37***	***0.08***	***–0.30***	***0.10***	***–0.78***	***0.20***	–0.29	0.23	***–0.26***	***0.08***	***–0.11***	***0.04***	***–0.10***	***0.04***
			(–.24)		***(–.24)***		***(–.48)***		(–.12)		***(–.25)***		***(–.13)***		***(–.12)***	
	→	Navi	0.05	0.46	–0.23	0.98	***–4.02***	***1.32***	–1.57	2.28	0.20	0.65	0.60	0.34	–0.33	0.28
			(.003)		(–.02)		***(–.30)***		(–.06)		(.02)		(.06)		(–.03)	
	→	PRA	***–66.65***	***14.79***	***–32.53***	***9.25***	***–73.86***	***14.36***	***–70.08***	***25.72***	***–19.68***	***5.31***	***–7.45***	***3.40***	–4.60	2.69
			(–.34)		***(–.23)***		***(–.47)***		***(–.26)***		***(–.16)***		***(–.07)***		(–.04)	
	→	ERA	***–47.41***	***11.64***	–9.88	5.08	***–19.95***	***9.64***	–16.85	14.72	2.29	4.06	4.44	2.64	0.42	2.00
			(–.23)		(–.08)		***(–.14)***		(.27)		(.02)		(.04)		(.004)	
Inform	→	Meta	***0.27***	***0.04***	***0.41***	***0.08***	***0.64***	***0.14***	0.16	0.08	***0.38***	***0.07***	***0.35***	***0.06***	***0.36***	***0.04***
			(.27)		***(.33)***		***(.51)***		(.18)		***(.35)***		***(.27)***		***(0.31)***	
	→	Navi	***2.95***	***0.29***	***3.02***	***0.79***	***4.19***	***0.86***	***2.84***	***0.83***	***1.75***	***0.64***	***2.48***	***0.57***	***3.48***	***0.45***
			(.23)		***(–.20)***		***(.41)***		***(.30)***		***(.13)***		***(.18)***		***(.25)***	
	→	PRA	***38.44***	***5.76***	***32.06***	***7.34***	***50.26***	***11.89***	***27.30***	***7.31***	***22.36***	***4.93***	4.92	4.34	***20.40***	***3.71***
			(.29)		***(.23)***		***(.41)***		***(–.07)***		***(.17)***		(.03)		***(.13)***	
	→	ERA	***27.92***	***4.74***	***20.95***	***4.53***	***26.47***	***7.18***	***19.25***	***4.32***	**8.18**	**3.92**	2.57	3.71	***14.66***	***3.26***
			(.20)		***(.16)***		***(.25)***		***(.24)***		**(.07)**		(.02)		***(.10)***	
Meta	→	PRA	46.20	2.10	33.78	4.38	30.57	4.56	54.67	7.67	35.83	3.45	48.68	4.22	45.90	3.72
			(.35)		(.29)		(.31)		(.49)		(.30)		(.38)		(.35)	
	→	ERA	36.93	2.91	21.84	2.77	25.66	3.99	35.79	5.29	23.31	2.58	41.90	3.68	35.93	2.71
			(.27)		(.21)		(.30)		(.39)		(.23)		(.35)		(.29)	
Navi	→	PRA	***3.59***	***0.15***	***3.92***	***0.27***	***3.13***	***0.50***	***2.78***	***0.35***	***4.01***	***0.16***	***4.81***	***0.31***	***4.92***	***0.25***
			(.35)		***(.42)***		***(.26)***		***(.26)***		***(.57)***		***(.41)***		***(.44)***	
	→	ERA	***4.67***	***0.27***	***5.31***	***.23***	***4.34***	***0.38***	***3.74***	***0.22***	***4.59***	***0.15***	***5.90***	***0.25***	***6.11***	***0.20***
			(.43)		***(.61)***		***(.42)***		***(.43)***		***(.17)***		***(.53)***		***(.58)***	

Table 2. Continued

Country or area (ranking)			Chile (18)		Colombia (19)		Iceland (6)		Sweden (7)		Ireland (8)		Belgium (9)		Norway (10)	
Model fit indices			RMSEA = .088 SRMR = .115		RMSEA = .084 SRMR = .109		RMSEA = .069 SRMR = .055		RMSEA = .066 SRMR = .061		RMSEA = .063 SRMR = .053		RMSEA = .063 SRMR = .056		RMSEA = .067 SRMR = .056	
Direct effect			Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
Social	→	Meta	**0.08** **(.12)**	**0.04**	**–0.11** **(–.18)**	**0.05**	0.01 (.004)	0.11	**–0.15** **(–.14)**	**0.07**	–0.03 (–.04)	0.03	***–0.26*** ***(–.17)***	***0.04***	**–0.25** **(–.18)**	**0.10**
	→	Navi	***2.05*** ***(.18)***	***0.60***	0.98 (.10)	0.54	–0.27 (–.02)	0.91	–0.06 (–.01)	0.50	0.58 (.07)	0.34	0.04 (.002)	0.58	0.53 (–.03)	1.21
	→	PRA	–2.69 (–.03)	4.00	0.76 (.01)	4.22	–14.01 (–.10)	8.36	–2.22 (–.02)	3.42	***–7.49*** ***(–.08)***	***2.73***	***–9.81*** ***(–.05)***	***3.43***	***–35.46*** ***(–.19)***	***7.43***
	→	ERA	0.57 (.01)	33.55	**0.26** **(.003)**	**3.22**	1.09 (.01)	5.39	0.63 (.01)	2.91	–0.13 (.002)	1.65	5.15 (.03)	2.99	***–16.71*** ***(–.10)***	***6.09***
Inform	→	Meta	–0.07 (–.08)	0.07	***0.25*** ***(.26)***	***0.06***	0.09 (.06)	0.11	***0.25*** ***(.19)***	***0.06***	***0.23*** ***(.18)***	***0.08***	***0.25*** ***(.19)***	***0.05***	***0.37*** ***(.30)***	***0.10***
	→	Navi	***2.07*** ***(.13)***	***0.73***	***2.69*** ***(.18)***	***0.86***	**2.15** **(.12)**	**0.93**	***2.78*** ***(.17)***	***0.57***	***3.20*** ***(.19)***	***0.81***	***1.46*** ***(.09)***	***0.51***	**2.19** **(.13)**	**1.11**
	→	PRA	4.54 (.04)	5.26	3.99 (.03)	5.61	***21.19*** ***(.11)***	***7.97***	**10.51** **(.06)**	**4.25**	***16.82*** ***(.10)***	***5.07***	3.98 (.02)	3.53	***23.85*** ***(.15)***	***7.12***
	→	ERA	**10.81** **(.08)**	**5.18**	7.27 (.06)	4.69	8.82 (.05)	6.85	***12.14*** ***(.08)***	***3.83***	***14.12*** ***(.09)***	***4.26***	2.34 (.02)	2.67	***14.26*** ***(.10)***	***5.24***
Meta	→	PRA	51.75 (.38)	5.35	49.15 (.39)	6.11	37.38 (.31)	5.15	47.32 (.37)	4.08	42.64 (.33)	4.30	52.56 (.42)	3.22	46.01 (.35)	4.95
	→	ERA	49.06 (.34)	5.13	39.76 (.33)	5.03	25.72 (.23)	4.93	31.46 (.27)	3.16	25.24 (.21)	3.71	39.12 (.33)	2.74	28.04 (.24)	2.94
Navi	→	PRA	***3.44*** ***(.44)***	***0.22***	***3.44*** ***(.42)***	***0.29***	***5.05*** ***(.48)***	***0.31***	***4.57*** ***(.43)***	***0.23***	***4.81*** ***(.48)***	***0.24***	***4.79*** ***(.45)***	***0.21***	***4.48*** ***(.45)***	***0.24***
	→	ERA	***4.53*** ***(.55)***	***0.19***	***4.19*** ***(.54)***	***0.24***	***6.14*** ***(.61)***	***0.28***	***5.43*** ***(.57)***	***0.23***	***5.86*** ***(.64)***	***0.22***	***5.50*** ***(.56)***	***0.16***	***5.74*** ***(.64)***	***0.19***

Table 2. Continued

Country or area (ranking)			France (11)		Denmark (13)		Spain (14)		Hungary (15)		Poland (16)		Austria (17)	
Model fit indices			RMSEA = .079 SRMR = .067		RMSEA = .066 SRMR = .064		RMSEA = .064 SRMR = .050		RMSEA = .076 SRMR = .099		RMSEA = .085 SRMR = .093		RMSEA = .092 SRMR = .069	
Direct effect			Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
Social	→	Meta	–0.07 (–.08)	0.05	**–0.24 (–.17)**	**0.12**	–0.03 (–.03)	0.05	–0.13 (–.11)	0.12	–0.27 (–.25)	0.15	–0.11 (–.11)	0.06
	→	Navi	0.41 (.03)	0.58	–1.60 (–.09)	1.47	–0.52 (–.04)	0.60	–0.45 (–.03)	1.32	0.34 (.02)	1.54	–0.40 (–.03)	0.69
	→	PRA	–11.18 (–.09)	8.00	***–25.58 (–.16)***	***8.55***	**–9.45 (–.09)**	**4.04**	–6.65 (–.05)	6.35	–4.06 (–.03)	9.35	***–19.35 (–.15)***	***5.48***
	→	ERA	0.45 (.004)	3.34	**–14.78 (–.09)**	**6.81**	–2.89 (–.02)	3.23	–5.35 (–.04)	7.37	13.37 (.11)	9.85	**–8.33 (–.07)**	**3.92**
Inform	→	Meta	***0.17 (.16)***	***0.06***	***0.38 (.30)***	***0.10***	**0.14 (.12)**	**0.06**	***0.33 (.31)***	***0.09***	**0.31 (.32)**	**0.14**	***0.34 (.26)***	***0.09***
	→	Navi	***2.74 (.18)***	***0.60***	**2.87 (.18)**	**1.30**	***3.89 (.24)***	***0.73***	***4.34 (.28)***	***1.08***	**3.01 (.23)**	**1.40**	***3.92 (.20)***	***1.20***
	→	PRA	10.69 (.07)	6.35	***21.96 (.15)***	***7.30***	***15.44 (.12)***	***4.40***	***14.23 (.11)***	***4.84***	6.01 (.05)	8.98	***22.81 (.13)***	***6.38***
	→	ERA	2.88 (.02)	3.12	***18.90 (.13)***	***5.951***	***14.69 (.10)***	***3.22***	**14.97 (.11)**	**7.03**	0.63 (.01)	8.94	**13.45 (.08)**	**5.52**
Meta	→	PRA	47.67 (.35)	6.70	36.09 (.31)	6.56	37.21 (.31)	4.13	38.28 (.32)	4.34	31.92 (.28)	4.09	42.86 (.31)	5.55
	→	ERA	21.61 (.17)	7.19	35.58 (.28)	5.45	27.34 (.21)	3.67	23.70 (.18)	4.61	28.58 (.25)	4.01	37.56 (.28)	5.05
Navi	→	PRA	***4.05 (.41)***	***0.90***	***3.93 (.42)***	***0.35***	***3.97 (.47)***	***0.20***	***3.68 (.45)***	***0.24***	***4.34 (.52)***	***0.20***	***4.35 (.48)***	***0.26***
	→	ERA	***6.53 (.71)***	***0.95***	***5.43 (.59)***	***0.28***	***5.96 (.65)***	***0.26***	***5.67 (.62)***	***0.23***	***5.24 (.62)***	***0.20***	***5.60 (.62)***	***0.25***

Note. p values smaller than .05 are shown in boldface; p values smaller than .01 are shown in bold and italic type. The number in the parenthesis indicates the standardized direct path estimate.

Table 3. The Indirect Path Estimates for the 19 countries

Country or area (ranking)			19 countries		Hong Kong (5)		Korea (1)		Japan (4)		Macao (12)		New Zealand (2)		Australia (2)	
Model fit indices			RMSEA = .063 SRMR = .063		RMSEA = .073 SRMR = .054		RMSEA = .061 SRMR = .060		RMSEA = .046 SRMR = .037		RMSEA = .070 SRMR = .062		RMSEA = .068 SRMR = .071		RMSEA = .066 SRMR = .061	
Indirect effect			Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
PRA on:																
Social	→	Meta	***–16.85***	***3.52***	***–10.05***	***3.13***	***–23.70***	***5.22***	–15.84	12.01	***–9.19***	***2.844***	**–5.52**	**2.18**	***–4.69***	***1.77***
			(–.09)	***(.01)***	***(–.07)***	***(.02)***	***(–.15)***	***(.03)***	(–.06)	(.04)	***(–.08)***	***(.02)***	**(–.05)**	**(.02)**	***(–.04)***	***(.02)***
	→	Navi	.19	1.64	–0.91	3.80	***–12.56***	***3.38***	–4.36	6.10	0.78	2.62	2.87	1.63	–1.61	1.39
			(.001)	(.01)	(–.01)	(.03)	***(–.08)***	***(.02)***	(–.02)	(.02)	(.01)	(.02)	(.03)	(.01)	(–.01)	(.01)
Inform	→	Meta	***12.55***	***1.47***	***13.74***	***2.89***	***19.65***	***3.96***	**8.68**	**3.89**	***13.51***	***2.58***	***16.95***	***3.10***	***16.73***	***2.71***
			(.10)	***(.01)***	***(.10)***	***(.02)***	***(.16)***	***(.03)***	**(.09)**	**(.04)**	***(.11)***	***(.02)***	***(.10)***	***(.02)***	***(.11)***	***(.02)***
	→	Navi	***10.57***	***.97***	***11.83***	***2.96***	***13.12***	***2.65***	***7.88***	***1.95***	***7.01***	***2.54***	***11.95***	***2.71***	***17.13***	***2.37***
			(.08)	***(.01)***	***(.08)***	***(.02)***	***(.11)***	***(.02)***	***(.08)***	***(.02)***	***(.05)***	***(.02)***	***(.07)***	***(.02)***	***(.11)***	***(.01)***
ERA on:																
Social	→	Meta	***–13.47***	***2.75***	***–6.49***	***2.26***	***–19.89***	***6.80***	–10.37	7.98	***–5.98***	***2.09***	**–4.75**	**1.90**	***–3.67***	***1.42***
			(–.07)	***(.01)***	***(–.05)***	***(.02)***	***(–.14)***	***(.05)***	(–.05)	(.03)	***(–.06)***	***(.02)***	**(–.04)**	**(.02)**	***(–.03)***	***(.01)***
	→	Navi	.25	2.15	–1.23	5.18	***–17.44***	***5.41***	–5.87	8.45	0.90	2.99	3.52	1.97	–2.00	1.73
			(.001)	(.01)	(–.01)	(.04)	***(–.13)***	***(.04)***	(–.03)	(.04)	(.01)	(.03)	(.03)	(.02)	(–.02)	(.02)
Inform	→	Meta	***10.03***	***1.26***	***8.88***	***2.08***	***16.50***	***5.04***	**5.68**	**2.58**	***8.79***	***1.88***	***14.59***	***2.78***	***13.10***	***1.97***
			(.07)	***(.01)***	***(.07)***	***(.02)***	***(.15)***	***(.05)***	**(.07)**	**(.03)**	***(.08)***	***(.02)***	***(.09)***	***(.02)***	***(.09)***	***(.01)***
	→	Navi	***13.78***	***1.65***	***16.01***	***4.15***	***18.22***	***3.85***	***10.62***	***2.96***	***8.04***	***2.97***	***14.66***	***3.33***	***21.28***	***2.85***
			(.10)	***(.01)***	***(.12)***	***(.03)***	***(.17)***	***(.03)***	***(.13)***	***(.04)***	***(.07)***	***(.03)***	***(.10)***	***(.02)***	***(.14)***	***(.02)***

Table 3. Continued

Country or area (ranking)			Chile (18)		Colombia (19)		Iceland (6)		Sweden (7)		Ireland (8)		Belgium (9)		Norway (10)	
Model fit indices			RMSEA = .088 SRMR = .115		RMSEA = .084 SRMR = .109		RMSEA = .069 SRMR = .055		RMSEA = .066 SRMR = .061		RMSEA = .063 SRMR = .053		RMSEA = .063 SRMR = .056		RMSEA = .067 SRMR = .056	
Indirect effect			Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
PRA on:																
Social	→	Meta	**4.31**	**2.18**	**–5.42**	**2.64**	0.17	4.06	**–7.11**	**3.14**	–1.15	1.44	***–13.84***	***2.33***	**–11.34**	**4.72**
			(.05)	**(.02)**	**(–.07)**	**(.03)**	(.001)	(.03)	**(–.05)**	**(.02)**	(–.01)	(.02)	***(–.07)***	***(.02)***	**(–.06)**	**(.03)**
	→	Navi	***7.07***	***2.15***	3.38	1.89	–1.34	4.60	–0.26	2.29	2.77	1.68	0.18	2.79	–2.35	5.33
			(.08)	***(.02)***	(.04)	(.02)	(–.010)	(.03)	(–.002)	(.02)	(.03)	(.02)	(.001)	(.01)	(.01)	(.03)
Inform	→	Meta	–3.61	3.86	***12.35***	***3.46***	3.35	4.21	***11.87***	***3.04***	***9.86***	***3.35***	***13.26***	***2.58***	***17.05***	***4.42***
			(–.03)	(.03)	***(.10)***	***(.03)***	(.02)	(.02)	***(.07)***	***(.02)***	***(.06)***	***(.02)***	***(.08)***	***(.02)***	***(.10)***	***(.03)***
	→	Navi	***7.14***	***2.54***	***9.26***	***3.17***	**10.83**	**4.79**	***12.72***	***2.63***	***15.37***	***3.69***	***7.01***	***2.45***	**9.83**	**4.76**
			(.06)	***(.02)***	***(.08)***	***(.03)***	**(.06)**	**(.02)**	***(.07)***	***(.02)***	***(.09)***	***(.02)***	***(.04)***	***(.01)***	**(.06)**	**(.03)**
ERA on:																
Social	→	Meta	4.08	2.10	**–4.39**	**2.12**	0.12	2.83	**–4.73**	**2.13**	–0.68	0.84	***–10.30***	***1.83***	**–6.91**	**2.97**
			(.04)	(.02)	**(–.06)**	**(.03)**	(.001)	(.02)	**(–.04)**	**(.02)**	(–.01)	(.01)	***(–.06)***	***(.01)***	**(–.04)**	**(.02)**
	→	Navi	***9.30***	***2.63***	4.11	2.29	–1.64	5.63	–0.31	2.74	3.38	1.98	0.21	3.20	–3.01	6.91
			(.10)	***(.03)***	(.06)	(.03)	(–.01)	(.04)	(–.003)	(.02)	(.04)	(.02)	(.001)	(.02)	(–.02)	(.04)
Inform	→	Meta	–3.42	3.68	***9.99***	***2.83***	2.30	3.02	***7.89***	***2.08***	***5.84***	***1.95***	***9.86***	***1.98***	***10.39***	***2.73***
			(–.03)	(.03)	***(.09)***	***(.03)***	(.01)	(.02)	***(.05)***	***(.01)***	***(.04)***	***(.01)***	***(.06)***	***(.01)***	***(.07)***	***(.02)***
	→	Navi	***9.39***	***3.39***	***11.27***	***3.65***	**13.18**	**5.82**	***15.12***	***3.24***	***18.72***	***4.68***	***8.05***	***2.77***	**12.58**	**6.32**
			(.07)	***(.03)***	***(.10)***	***(.03)***	**(.07)**	(.03)	***(.10)***	***(.02)***	***(.12)***	***(.03)***	***(.05)***	***(.02)***	**(.09)**	**(.04)**

Table 3. Continued

Country or area (ranking)			France (11)		Denmark (13)		Spain (14)		Hungary (15)		Poland (16)		Austria (17)	
Model fit indices			RMSEA = .079 SRMR = .067		RMSEA = .066 SRMR = .064		RMSEA = .064 SRMR = .050		RMSEA = .076 SRMR = .099		RMSEA = .085 SRMR = .093		RMSEA = .092 SRMR = .069	
Indirect effect			Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
PRA on:														
Social	→	Meta	–3.31	2.56	–8.52	4.54	–1.06	1.96	–5.08	4.60	–8.45	4.83	–4.59	2.46
			(–.03)	(.02)	(–.05)	(.03)	(–.01)	(.02)	(–.037)	(.03)	(–.07)	(.04)	(–.04)	(.02)
	→	Navi	1.65	2.37	–6.29	5.34	–2.06	2.34	–1.67	4.78	1.46	6.73	–1.73	2.97
			(.01)	(.02)	(–.04)	(.03)	(–.02)	(.02)	(–.01)	(.03)	(.01)	(.06)	(–.01)	(.02)
Inform	→	Meta	***8.23***	***3.00***	***13.62***	***4.12***	**5.16**	**2.39**	***12.51***	***3.54***	**9.83**	**4.43**	***14.53***	***4.21***
			(.05)	***(.02)***	***(.09)***	***(.03)***	**(.04)**	**(.02)**	***(.10)***	***(.03)***	**(.09)**	**(.04)**	***(.08)***	***(.02)***
	→	Navi	***11.12***	***3.26***	**11.30**	**4.54**	***15.42***	***2.71***	***15.94***	***3.66***	**13.04**	**6.08**	***17.06***	***5.44***
			(.07)	***(.02)***	**(.08)**	**(.03)**	***(.12)***	***(.02)***	***(.13)***	***(.03)***	**(.12)**	**(.06)**	***(.09)***	***(.03)***
ERA on:														
Social	→	Meta	–1.50	1.25	–7.69	3.96	–0.78	1.48	–3.15	2.85	–7.57	4.40	–4.02	2.14
			(–.01)	(.01)	(–.05)	(.02)	(–.01)	(.01)	(–.02)	(.02)	(–.06)	(.04)	(–.03)	(.02)
	→	Navi	2.66	3.85	–8.69	7.74	–3.10	3.54	–2.57	7.44	1.76	8.07	–2.23	3.83
			(.02)	(.04)	(–.05)	(.05)	(–.03)	(.03)	(–.02)	(.05)	(.02)	(.07)	(–.02)	(.03)
Inform	→	Meta	**3.73**	**1.88**	***12.30***	***3.63***	**3.79**	**1.91**	***7.74***	***2.58***	**8.80**	**4.04**	***12.73***	***3.78***
			(.03)	**(.02)**	***(.08)***	***(.03)***	**(.03)**	**(.01)**	***(.06)***	***(.02)***	**(.08)**	**(.04)**	***(.07)***	***(.02)***
	→	Navi	***17.92***	***4.89***	**15.62**	**6.75**	***23.168***	***4.20***	***24.60***	***5.82***	**15.75**	**7.53**	***21.95***	***6.82***
			(.13)	***(.03)***	**(.11)**	***(.05)***	***(.16)***	(.03)	***(.18)***	***(.04)***	**(.14)**	**(.07)**	***(.12)***	***(.04)***

Note. *p* values smaller than .05 are shown in boldface. *p* values smaller than .01 are shown in bold and italic type. The number in the parenthesis indicates the standardized indirect path estimate.

PRA and ERA, holding other variables constant. We did not find significant gender differences in the scores of social or information-reading engagement for the overall 19 countries (for social engagement, $b = -0.02$, SE = .01, $p = .22$; for information engagement, $b = 0.01$, SE = .02, $p = .60$). In individual country analyses, girls were engaged in more online social reading activities than boys in 4 out of the 19 countries at $p = .05$ level ($b_{Chile} = -0.13$, SE = .05; $b_{Denmark} = -0.11$, SE = .05; $b_{Ireland} = -0.30$, SE = .06; $b_{NewZealand} = -0.22$, $SE = .06$). As for information reading, for 7 out of the 19 countries, we found significant gender differences, but the results were mixed. Boys in four European countries tended to be more engaged in information-reading activities ($b_{Denmark} = 0.14$, SE = .05, $p < .05$; $b_{Iceland} = 0.17$, SE = .04, $p < .05$; $b_{Norway} = 0.08$, SE = .03, $p < .05$; $b_{Sweden} = 0.08$, $SE = .03$, $p < .01$) whereas girls in three Asian and Oceanian countries were more involved in information-reading activities ($b_{Korea} = -0.11$, SE = .05, $p < .05$; $b_{Macau} = -.09$, SE = .02, $p < .05$; $b_{NewZealand} = -0.10$, $SE = .03$, $p < .05$).

Girls had consistently better knowledge of metacognitive strategies ($b = -.28$, SE = .02, $p < .05$), navigation skills ($b = -1.27$, SE = .18, $p < .05$) and PRA ($b = -15.42$, SE = 1.72, $p < .05$) than boys. They also had better ERA scores than boys ($b = -4.78$, SE = 1.59, $p < .05$) in the overall model. Although the negative path direction was generally consistent in the ERA, insignificant results were found for 12 out of the 19 countries, indicating that the gender gap in the ERA may be minimal in most countries, holding other variables constant.

We also controlled for students' ESCS in the analysis. Results showed that the higher the ESCS, the higher the students' knowledge of metacognitive strategies, navigation skills, and PRA and ERA, holding everything constant.

Testing model equivalence across genders

To investigate if the hypothesized model was equivalent across gender, we performed additional multiple group comparisons. Specifically, we compared the constrained model, in which girls and boys' models are the same in parameter estimates, with the unconstrained model, in which the parameters in girls and boys' models are freely estimated.

The model fit statistics for the constrained model were BIC = 1 723 547.949, RMSEA = 0.061, SRMR = 0.069; for unconstrained model, they were BIC = 1 723 544.278, RMSEA = 0.066, SRMR = 0.068. Nevertheless, the differences between the fit statistics ($\Delta BIC = 3.671$, ΔRMSEA = .005 and ΔSRMR = .001) were trivial (Chen, 2007; Raftery, 1995), indicating that the hypothesized model was feasible for both girls and boys.

Discussion and implications for classroom instruction

The current study tested the effects of various online activities on two forms of reading assessments and explored the mechanism that explained the shared variance in PRA and ERA. The hypothesized pattern was evaluated and supported with the overall sample as well as individual country samples. Furthermore, the gender group comparison suggested that the hypothesized model held for both boys and girls.

By determining the possible mechanism, we will be able to provide effective interventions and treatments in the classroom to enhance student reading. The following discussion of the study results will focus on direct effects, indirect effects, and moderating and controlled effects.

Direct effects

The effect of metacognitive strategies and navigation skills on reading literacy

Based on the results of the overall and individual mediation models, we confirmed the effectiveness of knowledge of metacognitive strategies and navigation skills on reading literacy. Consequently, we encourage teachers to provide metacognitive strategy instruction not only to facilitate students' reading but also to promote higher level thinking.

To effectively implement metacognitive instruction requires a solid pedagogical understanding of metacognition, which refers to teachers' understanding of what is needed to teach students to be metacognitive (Wilson & Bai, 2010). The instructional content should include the strategies, how to implement the strategies and when to apply the strategies (Paris, Lipson, & Wixson, 1994).

Effective pedagogical practices recommended by researchers include thinking out loud (Wilhelm, 2001),

scaffolding (Choi, Land, & Turgeon, 2005; Clark & Graves, 2005) and debriefing (Leat & Lin, 2003). For example, Clark and Graves (2005) proposed a model of scaffolding students' comprehension before, during and after reading with moment-to-moment scaffolding and reciprocal teaching. Leat and Lin (2003) suggested using debriefing (defined as small-group or whole-class discussion after learning) to help students consciously extend or explore their learning.

It is essential to recognize that students need time to apply these strategies during reading and reflect the adequacy of their use (Wilson & Bai, 2010). Therefore, teachers should create an environment where students can put the metacognitive activities into action and reflect on their thinking (Leat & Lin, 2003). Computer-based programs can also be used for strategy training. For example, Sung, Chang, and Huang (2008) developed the computer-assisted strategy teaching and learning environment to aid students' strategy acquisition and practice in reading electronic texts.

In addition, teachers may consider including the training of navigation skills as part of their reading curriculum in recognition of the fact that today's adolescents are reading on the Internet and that navigation skills are a key to successful online reading. The strategy of debriefing (Leat & Lin, 2003) may also be used in navigation training. Activities such as small-group discussion during or after the online reading session can be used to encourage the sharing of decision-making processes and why students choose to click on a particular link, why they think the particular link will lead to where they expect to go, and how they can integrate and reflect on information across different pages.

The effect of different online reading activities on metacognitive strategies, navigation skills, and the PRA and ERA

The social and information-seeking reading activities had differential effects on metacognitive strategies, navigation skills, and the PRA and ERA. For example, information-seeking reading activities had positive effects on knowledge of metacognitive strategies, navigation skills, and ERA and PRA. When students are engaged in information-seeking activities, they need to carefully select the keywords to search, decide on the relevance of each returned query, predict the content of unseen pages and integrate information from multiple web pages. These intense mental activities were constantly recurring whenever students searched to read and learn online. With the increase in information-seeking activities, students' knowledge of metacognitive strategies, navigation skills, and ERA and PRA increase.

In contrast, social reading activities negatively impacted students' metacognitive strategies and PRA, and had no significant effect on navigation skills. When students are engaged in social reading activities, such as chatting online and reading e-mails, they are mainly sending and returning messages. These automatic routines have little to do with the improvement of navigation skills. Moreover, students' knowledge of metacognitive strategies and literacy scores tended to deteriorate with increased social reading activities.

Although the effect of social reading activities on ERA was negative in the overall model, the majority of countries had a null effect. As a result, the effect of social reading on ERA warrants more research.

Indirect effects of social and information-seeking activities on the ERA and PRA

The indirect effects of information-seeking reading activities on reading literacy shed light on the importance of the reading curriculum moving towards a student-centred reading paradigm. The direct effect told us that reading literacy can improve with better knowledge of metacognitive strategy and navigation skills, which can be best taught through embedded learning activities (Veenman & Beishuizen, 2004). Moreover, if students are engaged in more information-seeking activities, their knowledge of metacognitive strategies and navigation skills will be directly improved, and reading literacy, whether in print or digital form, will be promoted indirectly. The engagement in information-seeking activities involves higher order mental activities, which require students to control, monitor, integrate and evaluate their online reading processes.

The implications for classroom practice are to transform the teacher-centred paradigm towards a student-centred paradigm where students work on project-based reading activities or topic-specific readings to construct their unique intertext among multiple web pages and make sense of the reading materials (Lee, Waxman, Wu, Michko, & Lin, 2013). Teachers can

introduce students to online pedagogical tools in their web-based search project. For instance, the IdeaKeeper employs explicit representation of each online inquiry strategy to promote and facilitate students' planning, information search, analysing and synthesizing on the reading topic (Zhang & Quintana, 2012).

Gender differences in online reading engagement, metacognitive strategies, navigation skills, and ERA and PRA

We found gender differences in knowledge of metacognitive strategies, navigation skills, and ERA and PRA. These results were in line with those of other research (Kolić-Vehovec & Bajšanski, 2006; Sheorey & Mokhtari, 2001), showing that girls had better knowledge of metacognitive strategies. In addition, the findings in PRA were consistent with prior research, again exhibiting a female reading prominence (Carroll, 2004; Chiu & McBride-Chang, 2006; Lietz, 2006), but the gender gap in ERA tended to be smaller and nearly negligible in most countries in the hypothesized model.

Researchers and practitioners have attempted to close the gender gap in reading. Therefore, what is associated with the smaller gender difference found in this study will be of great importance. Though engagement in reading can predict students' achievements in reading (Froiland & Oros, 2013), we did not find gender differences in social or information-reading engagement in the overall model. However, based on Bandura's (1993) self-efficacy theory, it is possible that boys' greater confidence (Durndell & Haag, 2002; Ring, 1991; Vekiri & Chronaki, 2008) and girls' higher anxiety (Cooper, 2006) in the electronic reading environment contributed to the smaller gap in ERA. We recommend that future studies examine whether such an effect exists.

Research in the online search strategies usually have found that boys have better self-reported search (or navigation) skills (Hargittai & Shafer, 2006; Tsai, 2009). But in our study, we observed that girls' navigation skills, measured in terms of relevant pages visited, were better than boys'. In a sample of 29 novice, intermediate level, and expert participants, Tabatabai and Shore (2005) summarized that the key elements in successful web search included '(a) using clear criteria to evaluate sites, (b) not excessively navigating, (c) reflecting on strategies and monitoring progress, (d) having background knowledge about information seeking, and (e) approaching the search with a good attitude and enjoying the process' (p. 239).

Among these criteria, metacognitive strategy is a key component. In our proposed model, the correlation between navigation skills and knowledge of metacognitive strategies was .38 ($p < .01$), showing that the metacognitive strategies and the navigation skills were modestly and positively correlated so that girls having better knowledge of metacognitive strategies also tended to have better navigation skills. Female advantages on these variables lead to better reading literacy.

Conclusion

Reading in the e-learning era encompasses both print and digital media. Besides the infrastructure of information and communications technology as a tool to access the cyber informational space, students need to be empowered to use appropriate metacognitive strategies and navigation skills to achieve their reading goals. The current study emphasized the importance of knowledge of metacognitive strategies and navigation skills for student reading; moreover, our results demonstrated that it is essential to provide ample opportunities for students to perform information-seeking reading activities, which is an incubator for nurturing metacognitive strategy awareness and navigation skills. In contrast, social reading activities either had no effect or negative effect on learning, unless specially designed for learning purposes (Kabilan, Ahmad, & Abidin, 2010). Future research should focus on students' reading profiles or a combination of multiple reading activities on the Internet.

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References

Akyel, A., & Erçetin, G. (2009). Hypermedia reading strategies employed by advanced learners of English. *System*, *37*(1), 136–152.

Artelt, C., Schiefele, U., & Schneider, W. (2001). Predictors of reading literacy. *European Journal of Psychology of Education*, *16*(3), 363–383.

Bandura, A. (1993). Perceived self-efficacy in cognitive development and functioning. *Educational Psychologist*, *28*(2), 117–148.

Barab, S. A., Bowdish, B. E., & Lawless, K. A. (1997). Hypermedia navigation: Profiles of hypermedia users. *Educational Technology Research and Development*, *45*(3), 23–41.

Birkerts, S. (2006). *The Gutenberg elegies: The fate of reading in an electronic age*. Boston, MA: Faber & Faber.

Boulware-Gooden, R., Carreker, S., Thornhill, A., & Joshi, R. (2007). Instruction of metacognitive strategies enhances reading comprehension and vocabulary achievement of third-grade students. *The Reading Teacher*, *61*(1), 70–77.

Bousbia, N., Rebaï, I., Labat, J. M., & Balla, A. (2010). Learners' navigation behavior identification based on trace analysis. *User Modeling and User-Adapted Interaction: The Journal of Personalization Research*, *20*(5), 455–494.

Bowman, L. L., Levine, L. E., Waite, B. M., & Gendron, M. (2010). Can students really multitask? An experimental study of instant messaging while reading. *Computers & Education*, *54*(4), 927–931.

Carroll, J. (2004). Sex differences in developmental reading disability: Findings from four epidemiology studies. *Journal of the American Medical Association*, *291*(16), 2007–2012.

Chen, F. F. (2007). Sensitivity of goodness of fit indexes to lack of measurement invariance. *Structural Equation Modeling*, *14*, 464–504.

Chen, S.-Y., & Fu, Y.-C. (2009). Internet use and academic achievement: Gender differences in early adolescence. *Adolescence*, *44*(176), 797–821.

Chiu, M. M., & McBride-Chang, C. (2006). Gender, context, and reading: A comparison of students in 43 countries. *Scientific Studies of Reading*, *10*(4), 331–362.

Choi, I., Land, S. M., & Turgeon, A. J. (2005). Scaffolding peer-questioning strategies to facilitate metacognition during online small group discussion. *Instructional Science*, *33*(5–6), 483–511.

Clark, K. F., & Graves, M. F. (2005). Scaffolding students' comprehension of text. *The Reading Teacher*, *58*(6), 570–580.

Coiro, J., & Dobler, E. (2007). Exploring the online reading comprehension strategies used by sixth-grade skilled readers to search for and locate information on the Internet. *Reading Research Quarterly*, *42*(2), 214–257.

Cooper, J. (2006). The digital divide: The special case of gender. *Journal of Computer Assisted Learning*, *22*(5), 320–334.

Durndell, A., & Haag, Z. (2002). Computer self efficacy, computer anxiety, attitudes towards the Internet and reported experience with the Internet, by gender, in an East European sample. *Computers in Human Behavior*, *18*(5), 521–535.

Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive–developmental inquiry. *American Psychologist*, *34*(10), 906–911.

Fox, A. B., Rosen, J., & Crawford, M. (2009). Distractions, distractions: Does instant messaging affect college students' performance on a concurrent Reading comprehension Task? *CyberPsychology & Behavior*, *12*(1), 51–53.

Froiland, J. M., & Oros, E. (2013). Intrinsic motivation, perceived competence and classroom engagement as longitudinal predictors of adolescent reading achievement. *Educational Psychology*, doi:10.1080/01443410.2013.822964

Hargittai, E., & Shafer, S. (2006). Differences in actual and perceived online skills: The role of gender. *Social Science Quarterly*, *87*(2), 432–448.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6*(1), 1–55.

Jairam, D., & Kiewra, K. A. (2010). Helping students soar to success on computers: An investigation of the SOAR study method for computer-based learning. *Journal of Educational Psychology*, *102*(3), 601–614.

Junco, R., & Cotten, S. R. (2011). Perceived academic effects of instant messaging use. *Computers & Education*, *56*(2), 370–378.

Kabilan, M. K., Ahmad, N., & Abidin, M. J. Z. (2010). Facebook: An online environment for learning of English in institutions of higher education? *The Internet and Higher Education*, *13*(4), 179–187.

Kintsch, W. (1988). The role of knowledge in discourse comprehension: A construction-integration model. *Psychological Review*, *95*(2), 163–182.

Knighton, T., & Bussiere, P. (2006). *Educational outcomes at age 19 associated with reading ability at age 15*. Culture, Tourism and the Centre for Education Statistics Research Papers Ottawa: Statistics Canada (June).

Kolić-Vehovec, S., & Bajšanski, I. (2006). Metacognitive strategies and reading comprehension in elementary-school students. *European Journal of Psychology of Education*, *21*(4), 439–451.

Krull, J. L., & MacKinnon, D. P. (1999). Multilevel mediation modeling in group-based intervention studies. *Evaluation Review*, *23*(4), 418–444.

Krull, J. L., & MacKinnon, D. P. (2001). Multilevel modeling of individual and group level mediated effects. *Multivariate Behavioral Research*, *36*(2), 249–277.

Lau, K. L. (2006). Reading strategy use between Chinese good and poor readers: A think-aloud study. *Journal of Research in Reading*, *29*(4), 383–399.

Lau, K. L., & Chan, D. W. (2003). Reading strategy use and motivation among Chinese good and poor readers in Hong Kong. *Journal of Research in Reading*, *26*(2), 177–190.

Lawless, K. A., Brown, S. W., Mills, R., & Mayall, H. J. (2003). Knowledge, interest, recall and navigation: A look at hypertext processing. *Journal of Literacy Research*, *35*(3), 911–934.

Leat, D., & Lin, M. (2003). Developing a pedagogy of metacognition and transfer: Some signposts for the generation and use of knowledge and the creation of research partnerships. *British Educational Research Journal*, *29*(3), 383–414.

Lee, Y., Waxman, H. C., Wu, J., Michko, G. M., & Lin, G. (2013). Revisit the effect of teaching and learning with technology. *Educational Technology & Society*, *16*(1), 133–146.

Lee, Y., & Wu, J. (2012). The effect of individual differences in the inner and outer states of ICT on engagement in online reading activities and PISA 2009 reading literacy: Exploring the relationship between the old and new reading literacy. *Learning and Individual Differences*, *22*(3), 336–342.

Lee, Y., & Wu, J. (2013). The indirect effects of online social entertainment and information seeking activities on reading literacy. *Computers & Education*, *67*, 168–177.

Lietz, P. (2006). A meta-analysis of gender differences in reading achievement at the secondary school level. *Studies in Educational Evaluation*, *32*(4), 317–344.

Liu, Z. (2005). Reading behavior in the digital environment: Changes in reading behavior over the past ten years. *Journal of Documentation*, *61*(6), 700–712.

MacKinnon, D. P. (2008). *Introduction to statistical mediation analysis*. New York, NY: Erlbaum Psych Press.

Mangen, A. (2008). Hypertext fiction reading: Haptics and immersion. *Journal of Research in Reading*, *31*(4), 404–419.

Muthén, L. K., & Muthén, B. O. (2010). *Mplus user's guide* (6th ed.). Los Angeles, CA: Muthén & Muthén.

Naumann, J., Richter, T., Christmann, U., & Groeben, N. (2008). Working memory capacity and reading skill moderate the effectiveness of strategy training in learning from hypertext. *Learning and Individual Differences*, *18*(2), 197–213.

OECD (2007). *PISA 2006: Science competencies for tomorrow's world*. Paris, France: OECD Publications. Retrieved from http://www.oecd.org/unitedkingdom/39722183.pdf

OECD (2009a). *PISA 2009 assessment framework: Key competencies in reading, mathematics and science*. Paris, France: OECD Publications.

OECD (2009b). *PISA data analysis manual SAS®* (2nd ed.). Paris, France: OECD Publications.

OECD (2011a). How do girls compare to boys in reading skills? In OECD (Ed.), *PISA 2009 at a glance* (pp. 16–17). Paris, France: OECD Publications. Retrieved from http://dx.doi.org/10.1787/9789264095250-5-en

OECD (2011b). *PISA 2009 results: Students on line. Digital technologies and performance* (Vol. VI). Paris, France: OECD Publications.

Papastergiou, M., & Solomonidou, C. (2005). Gender issues in Internet access and favourite Internet activities among Greek high school pupils inside and outside school. *Computers & Education*, *44*(4), 377–393.

Paris, S. G., Lipson, M. Y., & Wixson, K. K. (1994). Becoming a strategic reader. In R. B. Ruddell, M. R. Ruddell, & H. Singer (Eds.), *Theoretical models and processes of reading* (Vol. 4, pp. 788–810). Newark, DE: International Reading Association.

Pintrich, P. R., & De Groot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology*, *82*(1), 33–40.

Raftery, A. E. (1995). Bayesian model selection in social research. *Sociological Methodology*, *25*, 111–163.

Ring, G. (1991). Student reactions to courseware: Gender differences. *British Journal of Educational Technology*, *22*(3), 210–215.

Roeschl-Heils, A., Schneider, W., & van Kraayenoord, C. E. (2003). Reading, metacognition and motivation: A follow-up study of German students in grades 7 and 8. *European Journal of Psychology of Education*, *18*(1), 75–86.

Roy, M., & Chi, M. T. (2003). Gender differences in patterns of searching the web. *Journal of Educational Computing Research*, *29*(3), 335–348.

Salmerón, L., & García, V. (2011). Reading skills and children's navigation strategies in hypertext. *Computers in Human Behavior*, *27*(3), 1143–1151.

Salmerón, L., Kintsch, W., & Caãs, J. (2006a). Coherence or interest as basis for improving hypertext comprehension. *Information Design Journal*, *14*(1), 45–55.

Salmerón, L., Kintsch, W., & Caãs, J. (2006b). Reading strategies and prior knowledge in learning from hypertext. *Memory & Cognition*, *34*(5), 1157–1171.

Sheorey, R., & Mokhtari, K. (2001). Differences in the metacognitive awareness of reading strategies among native and non-native readers. *System*, *29*(4), 431–449.

Sobel, M. E. (1982). Asymptotic confidence intervals for indirect effects in structural equation models. *Sociological Methodology*, *13*, 290–312.

Stadtler, M., & Bromme, R. (2007). Dealing with multiple documents on the WWW: The role of metacognition in the formation of documents models. *International Journal of Computer-Supported Collaborative Learning*, *2*(2), 191–210.

Steiger, J. H. (1998). A note on multiple sample extensions of the RMSEA fit index. *Structural Equation Modeling*, *5*, 411–419.

Sung, Y.-T., Chang, K.-E., & Huang, J.-S. (2008). Improving children's reading comprehension and use of strategies through computer-based strategy training. *Computers in Human Behavior*, *24*(4), 1552–1571.

Tabatabai, D., & Shore, B. M. (2005). How experts and novices search the web. *Library & Information Science Research*, *27*(2), 222–248.

Tsai, M. J. (2009). Online Information Searching Strategy Inventory (OISSI): A quick version and a complete version. *Computers & Education*, *53*(2), 473–483.

Tsai, M. J., & Tsai, C. C. (2010). Junior high school students' Internet usage and self-efficacy: A re-examination of the gender gap. *Computers & Education*, *54*(4), 1182–1192.

Veenman, M. V. J., & Beishuizen, J. J. (2004). Intellectual and metacognitive skills of novices while studying texts under conditions of text difficulty and time constraint. *Learning and Instruction*, *14*(6), 621–640.

Vekiri, I., & Chronaki, A. (2008). Gender issues in technology use: Perceived social support, computer self-efficacy and value beliefs, and computer use beyond school. *Computers & Education*, *51*(3), 1392–1404.

Vidal-Abarca, E., Mañá, A., & Gil, L. (2010). Individual differences for self-regulating task-oriented reading activities. *Journal of Educational Psychology*, *102*(4), 817–826.

White, K. R. (1982). The relation between socioeconomic status and academic achievement. *Psychological Bulletin*, *91*(3), 461–481.

Wilhelm, J. D. (2001). *Improving comprehension with think-aloud strategies*. New York, NY: Scholastic Professional Books.

Wilson, N. S., & Bai, H. (2010). The relationships and impact of teachers' metacognitive knowledge and pedagogical understandings of metacognition. *Metacognition and Learning*, *5*(3), 269–288.

Winne, P. H. (1995). Self-regulation is ubiquitous but its forms vary with knowledge. *Educational Psychologist*, *30*(4), 223–228.

Wu, J., & Kwok, O. (2012). Using structural equation modeling to analyze complex survey data: A comparison between design-based single-level and model-based multilevel approaches. *Structural Equation Modeling – A Multidisciplinary Journal*, *19*(1), 16–35.

Zhang, M., & Quintana, C. (2012). Scaffolding strategies for supporting middle school students' online inquiry processes. *Computers & Education*, *58*(1), 181–196.

Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory into Practice*, *41*(2), 64–70.