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Associations between Social Learning Environments and Students' Reading Comprehension Skills: An Analysis of PISA's Saudi Arabia Dataset

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Abstract

Despite the widespread use of social educational tools during the last decade in K12 education, the growth curve of utilizing these tools to enhance reading activities has remained lower than expected in learning environments. However, the rapid shift from face-to-face education to online education brought about by the pandemic has attracted educators who utilize these technologies to enhance reading scores among students. Drawing on data from Programme for International Student Assessment 2018, prediction models were conducted to investigate the effects of social reading activity tools on reading proficiency scores while controlling for other factors. The results indicate that reading emails, involvement in online chat (e.g., WhatsApp), reading online news, searching for information online to learn about particular topics and searching for practical information online (e.g., schedules) are significant predictors of higher reading proficiency scores. On the other hand, taking part in online group discussions or forums is a negatively significant predictor of reading proficiency scores. Moreover, reading proficiency scores differ depending on the types of schools students attended, their gender and their social, cultural and economic status when interaction was introduced in the model. These results should help educators as well as researchers to strategically utilize social reading activities according to the nature of the tasks they assign to students.

Keywords: Social reading activities, Social learning, Reading comprehension, International assessment.

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Contents

Contribution of this paper to literature

This study contributes to existing literature in that it explains how reading proficiency scores are affected by social reading activities, which could help researchers to redesign PISA framework, conceptually. Additionally, the prediction models used help to differentiate categories of demographic factors while the empirical contributions of the findings are discussed.

1. Introduction

The recent adoption of educational applications in social learning environments has fundamentally changed the nature of education. The use of technology has grown rapidly in the last two decades among K-12 students. In the past, students were able to identify one answer to every question with a high level of confidence. Nowadays, when students search for information online, they can find numerous answers to a single question. With the development of applications, schools can face serious challenges in the course of their transition from face-to-face education to distance education, especially during the COVID-19 pandemic, as well as thereafter. Thus, educators have been trying to utilize effective educational tools to enhance learning outcomes. On macro levels, countries and economies have also been trying to increase the quality of their educational outcomes through the reform of education systems using large-scale assessment indicators.

Considerable research has found that technology platforms significantly facilitate learning and support students' achievement and performance (e.g., (Babaali & Gonzalez, 2015; Cai, Liu, Wang, Liu, & Liang, 2021; Odiboh et al., 2020; Roschelle, Feng, Murphy, & Mason, 2016; Siegle, Amspaugh, & Mitchell, 2017; Verma, Stoffova, & Zoltán, 2018)). Recently researchers in the field of education have concentrated more on the effectiveness of designing educational applications that align with students' interests, which may help educators to integrate these applications, especially social media platforms into their curricula. Some technology applications were initially developed solely for entertainment and communication purposes but were later utilized for educational purposes, whereas other applications were developed with the specific intent of teaching through practice (Callaghan, Long, Van Es, Reich, & Rutherford, 2018; Hadjicharalambous & Demetriou, 2020).

1.1. Social Media as a Social Learning Platform

Several studies have found that the use of social media platforms increases the quality of social learning environments and levels of work efficiency through shared information, interests and emotions, whereas non-work-related communication may not improve the work environments directly, but it does positively affect the work commitment (Alanazi et al., 2020; Devi, Gouthami, & Lakshmi, 2019; Khechine, Raymond, & Augier, 2020; Kim, 2021; Luo, Guo, Lu, & Chen, 2018). Social media platforms are commonly used as they are effective in building social learning environments, student engagement and a sense of community (Bingham & Conner, 2010; West, Moore, & Barry, 2015).

The downside to this is well-known, especially with reading. Textbooks of the past were researched and verified before students were exposed to their content, but the Internet has allowed free publication of information, and it is up to the student to determine their veracity and reliability. It has also influenced reading and memory skills as the concentration required to digest a textbook passage is quite different from that of today's tweets and texts (Rogers-Estable, 2018). Reading for pleasure among teens has decreased in favor of reading to meet practical needs, with an increasing amount of all reading being done online over more traditional forms such as books, newspapers and magazines. Without the tools for critical thinking that quality education can provide, societies will continue to see people with a great deal of information at their fingertips, but with little understanding of how to analyze or synthesize it into something useful (Schleicher, 2019).

1.2. Relationship between Reading and Technology

The more knowledge that technology allows students to research and access, the more important a deep understanding becomes as well as the capacity to make sense of the content (Asadovna, 2021; Fain, 2017). Understanding involves knowledge and information, concepts and ideas, practical skills and intuition (Allen & McNamara, 2020). Fundamentally, it involves integrating and applying all of these in ways that are appropriate to the learner's needs Several studies have found that the use of technology enhances students' reading comprehension skills(e.g., (Alanazi, 2016; Alanazi, 2019; Chen, Wang, & Lin, 2019; Handayani, Mantra, & Suwandi, 2019; Korkmaz & Öz, 2021; Moon, Francom, & Wold, 2021)). Digital reading has several advantages over textbook reading, such as interactivity, the coverage of media and the feasibility of accessing information (Liu, 2012); in addition, reading aloud from e-books enhances performance (Davidson, Danby, Ekberg, & Thorpe, 2020). Although Singer and Alexander (2017) did not find a significant difference between the control group who read printed texts and the experimental group who read from digital texts, those who read from print recalled information better than their counterparts.

Reading is no longer mainly about extracting information but about constructing knowledge, thinking critically and making well-founded judgments (McGeown, Osborne, Warhurst, Norgate, & Duncan, 2016). In contrast to this, the findings from this latest cycle of PISA show that less than one in ten students in OECD countries were able to distinguish between fact and opinion, based on implicit cues in the content or source of information. When it comes to students' achievement in measurable terms (i.e., reading) and the availability of more accessible information using technology, it has been established that students can improve their deeper understanding and critical thinking skills especially because reading is more about knowledge construction than information collection (Schleicher, 2019). However, the types of devices and the quality of the devices used at home make a difference in students' reading performance, according to PISA scores of K12 students (Vázquez-Cano, Gómez-Galán, Infante-Moro, & López-Meneses, 2020). Thus, using technology in classrooms requires meaningful integration; making the technology accessible at schools is insufficient in itself as meaningful integration requires more important factors such as developing teaching and learning strategies, improving students reading skills and focusing on the quality of learning (Siefert, Kelly, Yearta, & Oliveira, 2019).

1.3. Saudi Arabian Students Reading Performance in PISA

The PISA 2018 cycle included all 37 OECD countries as well as 42 partner countries and economies. In the 2018 assessment cycle, around 600,000 students completed the assessment and they comprised approximately 32 million 15-year-old students in schools from 79 countries and economies. Thus, this significant number of samples puts pressure on policymakers to utilize the data and improve their education systems (Ozer, 2020).

The Kingdom of Saudi Arabia participated for the first time in the PISA in 2018. The Saudi Arabian sample in the PISA 2018 cycle was 6,136 students, from 235 schools who completed the assessment, representing a total population of 354,013 students. This number represents approximately 85% of the total population of 15-year-old students in the country. The results showed that the average reading performance of Saudi Arabian students was lower than the average of OECD. In reading proficiency, the score was 399, which is less than the minimum proficiency level in reading. At this level, students can only identify main ideas in a text of moderate length; find information based on explicit, though sometimes complex criteria and can reflect on the purpose and form of texts when explicitly directed to do so. Almost no students attained levels 5 or 6, where students can form a full and detailed understanding of a text whose content or form is unfamiliar and deal with concepts that are contrary to expectations, while in more than 20 education systems, more the 10% of the 15-year-old students were top performers. In addition,, the results showed that girls outperformed boys in reading by 54 points (OECD, 2019a).

1.4. Factors Affecting Students' Proficiency in Reading

Several factors affect student performance, such as socio-economic and cultural status (SECS), gender and the type of school students attend.

1.4.1. SECS

The lack of technology ownership has been associated with a low level of SECS; lower SECS students tend to perform poorly in technology-based tasks (Murphy, 2020). However, the results of the PISA 2018 cycle regarding the performance in reading of the lower SECS students are contradictory, meaning that being in the disadvantaged category does not mean a lower performance in reading. The report states that "[i]n spite of socio-economic disadvantages, some students attained high levels of academic proficiency. On an average across OECD countries, one in ten disadvantaged students was able to score in the top quarter of reading performance in their respective countries (known as academic resilience), indicating that disadvantage is not destiny" (OECD, 2019a). On the other hand, Han, Capraro, and Capraro (2015) found that economically disadvantaged learners, on average, performed lower than their counterparts. They also found a statistically significant negative correlation coefficient between being economically disadvantaged and reading proficiency, r = -.145. In addition, Reisdorf, Triwibowo, and Yankelevich (2020) found that not owning a laptop is negatively associated with academic performance even after controlling for influential factors, such as SECS. It should come as little surprise then that the top 10% of the wealthiest students outscored the lowest 10% in reading by an average of over 140 points in the PISA in 2018 in OECD countries.

1.4.2. Gender

A consistent lack in reading literature exists on the gap between the performance of boys and girls. In the PISA 2018 cycle, female students indicated a greater enjoyment of reading than their male counterparts (OECD, 2019a). The results of the latest cycle indicated that "[i]n all countries and economies that participated in PISA 2018, girls significantly outperformed boys in reading by 30 score points on average across OECD countries. The narrowest gender gaps (less than 20 score points) were observed in Argentina, Beijing, Shanghai, Jiangsu and Zhejiang (China), Chile, Colombia, Costa Rica, Mexico, Panama and Peru; the widest (more than 50 score points) were observed in Finland, Jordan, the Republic of North Macedonia, Qatar, Saudi Arabia and the United Arab Emirates" (OECD, 2019a).

According to the PISA 2018 results, there is a gender gap in students' reading performance in Saudi Arabia, where boys on an average scored 373 and girls scored 427, a difference of 54 points.

1.4.3. Type of Schools (Public vs. Private Schools)

According to the literature on public versus private schools, the type of school a student belongs to makes a difference in student learning outcomes (Jerrim, Parker, Katyn Chmielewski, & Anders, 2015; Joshi, 2020; Pianta & Ansari, 2018; Zuilkowski, Piper, & Ong'ele, 2020). The positive impact of technology depends on which schools students belong to, private or public; students in private schools reported higher levels of learning motivation when using technology than their counterparts in public schools (Ibáñez, Portillo, Cabada, & Barrón, 2020). Thus, the higher levels of motivation indicate higher levels of performance.

1.5. Related Studies

Although many studies have examined the relationship between reading and technology utilization to enhance reading skills, few studies have examined the types of technology (Vázquez-Cano et al., 2020). Moreover, most of the studies that examined the effectiveness of social reading platform tools and their relationships to proficiency were conducted in higher education settings (Alghazo & Nash, 2017; Delello, McWhorter, & Camp, 2015; Gupta & Irwin, 2016; Kwon, Halavais, & Havener, 2015; Mawdsley, 2015; Munoz, Pellegrini-Lafont, & Cramer, 2014; Sarsar, Başbay, & Başbay, 2015), or with teachers (Tezer, Taşpolat, Kaya, & Hamza, 2017), a few within high school settings (Aka, 2019; Ekström, 2016; Neto, Golz, & Polega, 2015), and a few studies (Solheim & Lundetræ, 2018) used international assessment surveys to compare scores across different large-scale assessment organizations.

2. The Importance of the Study

According to the PISA 2018 cycle report, students read more for practical needs in online formats such as chats, online news or websites containing practical information. Thus, this study investigates the relationship between social reading activities (SRAs) and reading proficiency. In addition, based on the aforementioned

literature, this study investigates the effects of these three demographic factors (i.e., SECS, gender, type of school) while analyzing reading proficiency scores and SRA sources. Thus, the following areas were investigated:

- The effects of SRA items on students' reading proficiency scores.
- The effects of SECS on students' reading proficiency scores.
- The gap in gender performance between boys and girls.
- The gap in school type performance between public and private schools.
- The effects of SECS on students' reading proficiency scores based on school type and gender.

2.1. Research Purpose

In this paper, the effects of the using different technology tools on tenth grade students' reading proficiency and how these tools affect students' learning were explored. Since there are several factors that can affect students' performance in schools, the author investigated the factors that can impact performance and identified their effects. The different variables such as SECS, gender and types of school were also investigated using data from the 2018 PISA to explore the relationships between these technology tools and reading proficiency scores. This is because most students use digital devices to interact with others and spend time using apps and other websites for their social activities.

3. Measures

The factors used to analyze the data in this study are as follows.

3.1. SRA Items

Items of PISA assessment used to measure students' SRAs were as follows:

- How often were students involved in reading emails [SRA1].
- How often were students involved in <Chat online> (e.g., WhatsApp, Messenger) [SRA2].
- How often were students involved in reading online news [SRA3].
- How often were students involved in searching for information online to learn about a particular topic [SRA4].
- How often were students involved in taking part in online group discussions or forums [SRA5].
- How often were students involved in searching for practical information online (e.g., schedule) [SRA6].

3.2. Reading Proficiency Scores

In the PISA dataset, reading performance scores are represented by ten plausible values that range from one to five. However, to represent these ten values through one variable, these ten reading proficiency scores were computed to represent one variable for the analysis.

3.3. School Type

There are two school types in the PISA 2018 vector: public and private.

3.4. Gender

There are two gender categories: female and male.

3.5. SECS

SECS are measured by weighting indexes from three components equally. The three components are parents' education, parents' occupation and the index of home possessions (OECD, 2019a).

4. Methodology

Two regression models were run to test the statistical significance of the relationships between the independent variables (i.e., SRAs) and reading performance scores as well as other demographic variables. Model assumptions were verified via observation diagnostics and tests of model fit. The full sets of PISA sampling weights as well as plausible values for reading assessment were utilized for the two models. To determine if the SRA items were related to reading assessment scores, the regression models were used to predict the magnitude and direction of the relationship between the variables to rank values since the real distance between categories was unknown (Tabachnick & Fidell, 1996). Participants were not administered every reading question in the PISA; they responded to a representative set of items of the entire assessment. Therefore, plausible values were computed as an approximation of consistent estimates of respondents' individual test scores. The author used the analytical techniques accounting for weights and plausible values as outlined by Pokropek and Jakubowski (2013). Supplied sampling weights were used and standard errors were estimated to account for the complex sampling design. For evaluations involving skill levels, analyses were repeated using each of the provided plausible values and parameter estimates averaged across analyses through STATA.

4.1. Data Analysis

The sample of the study consisted of 6,136 students from Saudi Arabian schools. Of the participants, approximately 51% (3,144) were males and 49% (2,992) were females. As for the participants' school types, approximately 85.49% (5,246) of the participants were from public/government schools and 14.51% (890) were from private schools. Prior to running the regression models, the study used a weighted variable analysis to represent reading proficiency plausible values. Then, the study conducted two regression models utilizing reading proficiency scores as the outcome variable and the six SRA items as the main independent variables along with demographic variables. The *initial model* contained only reading proficiency scores and SRA items to determine if

there were associations among SRAs and the explained variability of the dependent variable. The *full model* included a reading proficiency score, the six SRA items, as well as other variables including gender, SECS and types of school.

5. Results

5.1. Initial Model

The results of the initial model indicated that the overall model was significant, $R^2 = .1687$, which indicates that approximately 17% of the reading proficiency scores can be explained by the SRAs. The results also indicated that all the SRAs are significant predictors of reading proficiency. Specifically, reading emails (B = 3.01, p < 0.001), involvement in online chat (e.g., WhatsApp) (B = 18.37, p < 0.001), reading online news (B = 3.27, p < 0.001), searching for information online to learn about a particular topic (B = 8.06, p < 0.001) and searching for practical information online (e.g., schedules) (B = 4.41, p < 0.001) are positively significant predictors of reading proficiency. On the other hand, taking part in online group discussions or forums is a negatively significant predictor of reading (B = -11.66, p < 0.001); Table 1 shows the results of the initial model.

Table 1. Initial model.

Code	Items	Estimate	Std. Error	t value	Pr. (>|t|)
	(Intercept)	296.600	4.28	69.17	
SRA1	Reading emails	3.01	0.89	3.38	0.001
SRA2	<Chat on line> (e.g. <WhatsApp>, <Messenger>)	18.37	1.06	17.28	0.001
SRA3	Reading online news	3.27	0.99	3.28	0.001
SRA4	Searching for information online to learn about a particular topic	8.06	1.19	6.73	0.001
SRA5	Taking part in online group discussions or forums	-11.66	0.80	-14.46	0.001
SRA6	Searching for practical information online (e.g. schedules)	4.41	0.87	5.02	0.001

5.2. Full Model

The final model included a reading proficiency score, the six SRA items, school type, SES, and gender. The results of the final model indicated that the overall model was significant, $R^2 = 0.3230$, which indicates that approximately 32% of the reading proficiency scores are explained by the social reading activities, school type, SES, and gender. The results also indicated that all the SRAs are significant predictors of reading proficiency. Specifically, reading emails (B = 3.09, p < 0.001), involvement in online chat (e.g., WhatsApp) (B = 13.72, p < 0.001), reading online news (B = 3.41, p < 0.001), searching for information online to learn about a particular topic (B = 5.22, p < 0.001), and searching for practical information online (e.g., schedules) (B = 1.92, p = 0.016) are positively significant predictors of reading proficiency. However, taking part in online group discussions or forums is a negatively significant predictor of reading (B = -9.21, p < 0.001). In addition, the expected mean of private school boys is significantly higher than the expected mean of public-school boys (B = 19.13, p < 0.001), the expected mean of public-school girls is significantly higher than the expected mean of public-school boys (B = 46.46, p < 0.001), and the expected mean of private-school girls is lower than the expected mean of public-school boys but not statistically significant (B = -9.48, p = 0.095). Moreover, the expected public school boy SECS is a significant predictor of reading proficiency scores (B = 16.93, p < 0.001), the private-school-boy SECS is .49 lower than public-school-boy SECS (B = -0.49, p = 0.888), the public-school-girl SECS is higher than public-school-boy SECS (B = 1.73, p = 0.305), and the private-school-girl SECS is higher than public-school-boy SECS (B = 5.37, p = 0.335). Table 2 shows the results of the full model.

Table 2. Full model.

Variables	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	314.16	4.487	70.013	0.000
SRA1	3.09	0.818	3.782	0.000
SRA2	13.72	0.981	13.999	0.000
SRA3	3.41	0.916	3.731	0.000
SRA4	5.22	1.094	4.773	0.000
SRA5	-9.21	0.732	-12.601	0.000
SRA6	1.92	0.803	2.398	0.016
SchTypePrivate	19.13	3.675	5.207	0.000
GenderGirl	46.46	2.515	18.477	0.000
SchTypePrivate:GenderGirl	-9.48	5.686	-1.667	0.096
SES	16.94	1.298	13.054	0.000
SchTypePrivate:SES	-0.498	3.551	-0.140	0.888
GenderGirl:SES	1.736	1.694	1.025	0.306
SchTypePrivate:GenderGirl:SES	5.370	5.579	0.963	0.336

6. Discussion

The independent variables of the initial model showed about 17% of the variance in reading proficiency scores, and the model demonstrated that reading proficiency scores are significantly associated with reading emails, chatting online, reading online news, searching for information online to learn about a particular topic and searching for practical information online. For every one unit of standard deviation (SD) increase in these activities, this study predicted reading scores should increase by 3.01, 18.37, 3.27, 8.06, and 4.41, respectively. However, the study found that taking part in online group discussions or forums is negatively associated with reading scores in that for every one unit of SD increase in these types of online activities, it can be predicted that reading scores will decrease by 11.66 points. In the full model, the overall model R^2 is significant, which means that around 32% of the variability in reading proficiency scores is explained by the variables. Analyzing the three-way interaction model to

determine whether the relationship between online SRAs and reading scores varied by gender, social, economic and cultural status (SECS) and types of school provided more details. The results indicated that reading proficiency scores are significantly associated with reading emails, chatting online, reading online news, searching for information online to learn about a particular topic and searching for practical information online. For every single unit of SD increase in these activities, this study predicts reading scores to increase by 3.09, 13.72, 3.41, 5.22, and 1.92, respectively. However, this study also found that taking part in online group discussions or forums is negatively associated with reading scores, in that for every single unit of SD increase in these types of online social activities, this study predicts reading scores to decrease by 9.21 points. In addition, reading-proficiency scores of boys in private schools are significantly higher than reading proficiency scores of boys in public schools by 19.13 points; the reading-proficiency scores of girls in public schools are significantly higher than the reading-proficiency scores of boys in public schools by 46.46 points; and reading proficiency scores of girls in private schools are lower than the reading proficiency scores of boys in public schools by 9.48 points.Regarding students' SECS results, this study found that for every one unit of SD increase in SECS, reading proficiency scores increase by 16.94 points, and the difference of the slope in SECS between public and private schools is -0.498, which means that public schools have a stronger but not significant relationship with SECS than do private schools in reading proficiency scores The difference of the slope in SECS for girls in public schools is higher than for boys in public schools by 1.736; and the difference of the slope in SECS for girls in private schools is higher than boys in public schools by 5.370 (See Table 2 for more details).

7. Conclusion

According to the results of the data analysis of the models, student-reading performance is significantly influenced by social reading activities (SRAs). Reading emails, online chatting, reading online news, searching for information online to learn about a particular topic and searching for practical information online are positively related to students' reading proficiency, while taking part in online group discussions or forums is negatively related to reading proficiency. The more students read online, the more their reading proficiency scores increase, especially when they chat online with their peers through WhatsApp or other online application tools.

In addition, private school students generally outperformed public-school students. However, this outperformance differed when interaction was included in the model, as presented in Table 1. This means that the inclusion of gender in the model detects that private-school boys have a higher mean than public-school boys, the mean of public-school girls is higher than the mean of public-school boys, and the mean of private-school girls is lower than the mean of public-school boys. Although the type of school appears to differ, that difference depends on the category of gender and school type interaction. The same situation applies to the SECS variable. The social and cultural economic status differs depending on gender and the school type, yet being a member of a low-income family does not necessarily mean a lower performance in reading, and vice-versa (Fischer, Schult, & Hell, 2013).

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