



Reading achievements among students in the United Arab Emirates: A multilevel analysis of PIRLS 2021

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ABSTRACT

This study investigated student- and school-level factors explaining students' reading achievement in the United Arab Emirates (UAE). Using Progress in International Reading Literacy Study (PIRLS) 2021 data, a multilevel modeling analysis was conducted to examine the reading achievement of students in relation to student-level variables (gender, socioeconomic status, students like reading, students confident in reading, and students engaged in reading) and school-level variables (teacher read for enjoyment, teacher send students to library, and library in school, years as principal, and school characteristics). At the student level, all factors, except for students like reading, showed statistically significant effects on students' reading achievement. At the school level, only two variables, teachers sending students to the library and school characteristics, showed statistically significant effects on students' reading achievement. The paper suggests how reading literacy could be improved in this context.

1. Introduction

Research suggests that students who are fluent readers in Grade one will be fluent readers in Grade four and that struggling readers in Grade one will most probably be struggling in Grade four, coupled with decreased motivation and self-esteem (Chatterji, 2006; Fuchs et al., 1993; Mullis et al., 2007; OECD, 2015; Park et al., 2015; PIRLS, 2006; Taha-Thomure et al., 2022; Wagner, 2017). Good readers tend to be fluent and more able to comprehend what they are reading, while struggling readers usually lack fluency and have difficulty comprehending texts of various genres (Allington, 2002; Gorsuch & Taguchi, 2010; Hudson et al., 2005; Johns, 1993; Kim & Wagner, 2015; Perfetti, 2007; Stanovich, 1991). Readers who are not fluent tend to spend most of their attention decoding words, which leads to minimized comprehension and fatigue (LaBerge & Samuels, 1974; McCoach et al., 2006; OECD, 2015; Taha & Taha., 2020; Torgesen et al., 2001;2003).

Reading literacy is more than the ability to decode words; it is a pillar of education for students who want to study subjects of their choice. Therefore, fostering robust reading literacy programs in schools is not merely an educational aspiration but a social and economic imperative with far-reaching consequences (Taha-Thomure, 2023). At its core, reading literacy affords overall academic success and is linked to

economic prosperity and well-being. The UAE has invested time, effort, and resources into education. However, UAE's student performance on PIRLS remains below the international average of 500. In 2011, the UAE scored 439; in 2016, the score was 450, and there was a further improvement on the latest 2021 PIRLS, with a score of 483. Despite large strides and improvement over the past 10 years, scores remain below the world average (Mullis et al., 2017; 2023). Thus, the current study is interested in looking at the student and school-level factors affecting grade four students' performance in reading comprehension using PIRLS (Gregory et al., 2021).

2. Review of the literature

2.1. International assessments and educational systems

Governments, international bodies, and educators often regard international student assessments—such as the Trends in International Mathematics and Science Study (TIMSS) from the International Association for the Evaluation of Educational Achievement, the Progress in International Reading Literacy Study (PIRLS), and the Program for International Student Assessment (PISA) from the Organization for Economic Co-operation and Development (OECD)—as credible indicators of

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the quality of education systems (Ceylan & Sever, 2020; Ibrahim & Alhosani, 2020). Additionally, some economists and international organizations use these assessments as benchmarks to evaluate the quality of education systems within the global economy and as a variable in calculating the global learning poverty rates (Gregory et al., 2021; Ibrahim and Alhosani; OECD, 2012). The results of the international assessments are taken seriously by many of the participating countries. They can be the rationale for introducing system reforms, curricular changes, and policy amendments (Ibrahim & Alhosani, 2020), making these tests an overly trusted go-to venue for an overarching report on the state of education in any given country.

2.2. PIRLS' purpose, levels, and contextual factors

PIRLS is a reading comprehension test for grade four students administered every five years. It provides data on reading trends in various educational systems worldwide and allows for comparisons between systems, countries, and cities. PIRLS' purposes for reading cover reading for literary experiences and reading to acquire and use information. In doing so, PIRLS looks at four levels or processes of comprehension: (1) retrieving information directly from the text, (2) making direct inferences, (3) interpreting ideas and information, and (4) evaluating and critiquing content and textual features (Mullis et al., 2017).

Students at or above the PIRLS reading benchmark can locate information from the text, make inferences, interpret and integrate information, and analyze linguistic features of the texts (Mullis et al., 2017). Students below the intermediate benchmark need intervention work in reading as they can only make direct information from the text and interpret information on a shallow level (Mullis et al., 2017).

International tests conduct surveys for students, teachers, schools, and parents to understand better the factors affecting student performance. The Program for International Student Assessment (PISA) test, for example, found that the availability of technology at home improved reading literacy only if it is coupled with engagement activities, while solitary use of technology had a negative effect on student performance (Lee & Wu, 2012). Ertem (2021) analyzed the PISA 2018 factors and found that student-level variables, especially disciplinary climate in language lessons, enjoyment of reading, ICT usage, parental support, and cooperation, significantly predicted reading achievement. The study, moreover, found that school-level factors such as parental engagement in school, shortage of resources, student bullying, and teacher behavior significantly predicted reading achievement (Ertem, 2021).

PIRLS surveys data concerning home, school, student attributes, and teacher contexts. Those factors This paper will focus on school and student-level factors. Student-level factors include gender, socioeconomic status, students' attitudes toward reading, students' confidence in reading, and students' engagement in reading. School-level factors include teacher reading for enjoyment, teacher sending students to the library, having a well-equipped library in school, principals' years of experience, school discipline, respect for classmates, school emphasis on reading instruction, students' sense of school belonging, and parents' perception of school.

2.3. Student-level factors

Several research studies emphasized the importance of contextual factors affecting students' academic performance (Bu & Chen, 2023; Creemers & Kyriakides, 2013; Hu et al., 2022). Bronfenbrenner's model of ecological systems (Bronfenbrenner, 1979) and Walberg's educational productivity (Walberg, 1982) models emphasize contextual factors when looking at academic performance. Bronfenbrenner (1979) refers to a microsystem or immediate environment the child lives in and the ecosystem that includes the people and places that influence the child (Bronfenbrenner, 1979; Hu et al., 2022). Similarly, Walberg

(1982) maintains that learning is not affected by one factor alone but rather by a combination of contextual factors that influence one another and the child's learning and performance in a reciprocal rather than causal manner.

Surveys from PIRLS 2021 looked at student factors that could influence students' reading achievement. Those factors included gender, socioeconomic background, family wealth, parents' educational level, occupational status, and number of books at home (PIRLS, 2024). All those factors were significant indicators of a home literacy environment that can influence students' attitudes towards reading, confidence in reading, and engagement in reading. For example, PIRLS results revealed that the number of books at home was a significant factor related to reading achievement in all the countries and regions of the world (World Bank, 2023).

Early literacy exposure in early childhood can have a significant impact on reading scores as well. Hu et al., 2022, analyzed PIRLS 2016 data from 183,428 students from 61 countries and regions to find the critical contextual factors differentiating high and low-performing systems. The study reported that the number of books at home ranked 6th of 106 factors affecting reading performance. Moreover, the frequency of students' absence from school ranked 2nd out of 106 factors and can reflect parents' socioeconomic background, showing that factors influence each other well (Hu et al., 2022). Another finding was that PIRLS reading scores of highly interested and engaged students are higher than those of less engaged students (Hu et al., 2022). PIRLS 201 reports that fourth-grade participants from all regions generally had a favorable attitude toward reading (82 %), while 18 % of students reported not liking reading (PIRLS, 2024). Moreover, 43 % of fourth-grade participants said they were very confident in reading, 35 % were somewhat confident, and 22 % were not confident in reading. Highly confident readers achieved a high average on the PIRLS test, while unconfident ones scored below average (PIRLS, 2024).

2.4. School-level factors

The PIRLS 2021 surveys examined school factors that could influence students' reading achievement. Principals were asked to complete questionnaires about several factors, including parents' socioeconomic background, students' early literacy skills upon entering school, school emphasis on academic success, school resources, and school discipline (PIRLS, 2024). Data analysis revealed that students from more economically privileged backgrounds achieved higher scores than those from lower disadvantaged socioeconomic backgrounds, and students in average schools socioeconomically had average achievement in reading (PIRLS 2024).

Another factor school principals were asked about was information about literacy skills students had before starting primary school. Generally, schools had higher scores in reading when 75 % of their students had learned literacy skills before starting primary school, and schools scored below average when <25 % of their students entered primary school with no literacy skills (PIRLS, 2024). Early literacy engagement ranked 16th out of 106 factors Hu et al. investigated (2022), indicating the importance of engaging with the child in talk, literacy activities, reading books, and enrolling in kindergarten or early childhood education institutions.

Limited access to general school resources and reading resources were factors that affected reading achievement, whereby it was revealed that students in resource-rich schools had the highest reading achievement (519 points) than students with some reading resource shortages (498) or no resources at their schools (472), (PIRLS, 2024). Giving priority to academic success was another factor that seemed to influence reading achievement, where students in schools that prioritized academic success and emphasized it scored higher by 39 points on PIRLS 2021 than students in schools having less emphasis on academic success (PIRLS, 2024). Reading achievement was also gauged against discipline in schools where students who rarely reported discipline-related

problems scored 45 points higher than students who reported moderate to severe disciplinary problems (PIRLS, 2024).

2.5. UAE performance on PIRLS 2021

The UAE educational system is a relatively very young system that was established with the establishment of the UAE in 1971. The UAE has focused on developing its economy, improving citizens' welfare, and expanding its education system (Ibrahim & Alhosani, 2020). The country's key development goals include enhancing the knowledge and skills of all its citizens while transitioning to a sustainable, knowledge-based economy. According to the Knowledge and Human Development Authority (KHDA), which operates and regulates the 210 private schools operating in Dubai, students have placed 6th in the world in PIRLS (Knowledge and Human Development Authority (KHDA) 2024). In 2019, the UAE government allocated AED 60.3 billion to social development, with over 60 % directed toward community development, education, and healthcare (Ibrahim & Alhosani, 2020). The UAE's education system is overseen by several bodies, including the Ministry of Education (MoE), with the Abu Dhabi Department of Education and Knowledge (ADEK), (2024), KHDA, and Sharjah Private Education Authority (SPEA) overseeing private schools in Abu Dhabi, Dubai, and Sharjah respectively.

The UAE has been taking the PIRLS since 2011 in both Arabic and English. Students are assessed on their reading skills for informational and literary purposes (Mullis et al., 2007; 2017). While the PIRLS exam is not an assessment that exists to assign grades to students, it does provide relevant information for teaching progress and practice and for developing policies to improve education in a city or country.

Dubai schools, public and private, scored an average of 476 on their 2011 benchmarking assessments, whereas Abu Dhabi schools had an average of 424. A score of 500 is the scale's Centrepoint and the total achievement mean across all PIRLS participants. Abu Dhabi's 2011 score is a composite of their Arabic literacy test achievement, which averaged 409, and their English literacy test achievement, which averaged 472 (Yang et al., 2018). The PIRLS report on Dubai also noted that private school students outperformed public school students on the assessment (Knowledge and Human Development Authority (KHDA) 2018), and this still stands true in 2021. On the 2016 PIRLS exam, UK-system private primary schools were the top performers, while MoE private schools were the lowest, and the same results were true for PIRLS 2021 (Knowledge and Human Development Authority (KHDA) 2018).

The UAE has undergone significant educational development in the past two decades to be among the world's highest-performing educational systems. Four governmental entities oversee the development, implementation, and inspection of the country's primary and secondary educational systems. The first and overarching one is the Ministry of Education (MoE), which is responsible for setting policies and strategies, control systems on educational establishments, licensing, quality control, curriculum development, sponsorship, and accreditation, overseeing the national qualifications center and planning and educational services (MOE website, 2024). The second entity is the Knowledge and Human Development Authority (KHDA), responsible for the growth and quality of private education in Dubai, including annual inspections (KHDA website, 2024). The third is the Department of Education and Knowledge in Abu Dhabi (ADEK), responsible for regulating and developing Abu Dhabi's private and charter schools' education and for school policies and inspections (ADEK website, 2024). The newest additions are the Emirates Schools Establishment (ESE), in charge of public school operations in the country, and the Sharjah Private Education Schools Authority (SPEA), in charge of regulating private schools in the Emirate of Sharjah (SPEA website, 2024).

The UAE's primary and secondary education system comprises public schools, which use the UAE national curriculum, and private schools, which follow various curricula, such as the International Baccalaureate, U.K., U.S., Indian, or other international educational

systems. The private school system teaches 90 % of Dubai's primary and secondary students and 58 % of Emirati students (Knowledge and Human Development Authority (KHDA) 2018). UAE public schools are free to attend for Emirati students and are available at a fee to non-Emiratis.

The UAE significantly improved its scores on PIRLS 2021 (483) compared to 429 in 2016 and 439 in 2011 (PIRLS). Dubai private schools' students ranked sixth globally, an impressive achievement in PIRLS 2021 (Knowledge and Human Development Authority (KHDA) 2023). Overall, though, the percentage of students in the UAE scoring below the low international minimum proficiency is 25 percent (Taha-Thomure, 2022; WorldBank, 2023), which amounts to a quarter of the grade four student population.

PIRLS 2021 witnessed some delays in assessment due to COVID-19, leading to 12.2 percent of students in the UAE testing at the end of grade 4 and 87.8 percent testing in grade 5, a context that might make comparable studies with previous PIRLS not fully effective (World Bank, 2023).

In PIRLS 2021, teachers in the UAE reported having an average of 28.1 students in their classes (World Bank, 2023). Teachers reported 219.8 min of instructional reading time per week. Internationally, 90 min of daily reading instructional time is considered best practice, totaling 480 min weekly (World Bank, 2023). Thirty-one percent of parents surveyed in PIRLS 2021 reported having ten or fewer children's books in their homes (World Bank, 2023). Additionally, students enrolled in U.K. curriculum schools and I.B. schools scored highest, followed by students in Indian curriculum schools and U.S. curriculum schools. MoE schools fared the lowest in PIRLS 2016 and 2021 (Knowledge and Human Development Authority (KHDA) 2023). High-quality early childhood education has been linked to better achievement for all children, but mainly for those from a disadvantaged background (Knowledge and Human Development Authority (KHDA) 2018). In PIRLS 2021, 26.9 percent of students below minimum reading proficiency did not attend an early childhood program before primary school (World Bank, 2023).

In PIRLS 2016, student-level factors, including parental engagement and involvement in literacy-related activities, scored 34 points above students whose parents never or rarely engaged (Knowledge and Human Development Authority (KHDA) 2018). This aligns with international findings on PIRLS 2021 reported earlier in this section. Being a confident reader was another factor, whereby if students believe a task is difficult and cannot do it, they will view the exercise as pointless, affecting their motivation. By contrast, if students are confident, they are more likely to persevere to complete the task successfully (Bandura, 1997; Knowledge and Human Development Authority (KHDA) 2018). Another student-level factor is linked to their literacy experiences before they start formal schooling. It has consistently shown that students entering primary school with literacy skills do better on reading assessments than those with no literacy skills.

Over the past decade, the UAE introduced several measures to improve reading instruction and achievement. This included instating standardized assessments for reading and literacy and introducing the Arabic Reading Challenge initiative, which has managed to excite millions of students not only in the UAE but around the globe to participate in this star-studded reading event. Moreover, schools were asked to invest in memberships in online reading platforms that are made available to encourage children to read beyond the textbook (Knowledge and Human Development Authority (KHDA) 2023). Annually, a reading month is announced in the UAE, and all entities, including schools, are expected to introduce various reading initiatives aimed at instilling the love of reading in the country. Ninety-six percent of parents surveyed in PIRLS 2021 reported that their children read with understanding in English (Knowledge and Human Development Authority (KHDA) 2023). Parents, however, felt that efforts to read in Arabic were not promoted as well as in English (Knowledge and Human Development Authority (KHDA) 2023).

The significance of this study lies in its contribution to understanding the complex interplay of individual and school-level factors that influence students’ reading achievement in the UAE. By analyzing data from PIRLS 2021 and employing a multilevel modeling approach, the study provides valuable insights into how variables such as gender, socioeconomic status, student attitudes toward reading, teacher practices, and school resources impact reading outcomes. The findings underscore the importance of both student motivation and engagement and the role of school-level practices—particularly those related to library access and school environment—in shaping reading achievement. This research is additionally significant for enhancing educational strategies and higher-level policies within the UAE and improving literacy outcomes in a country where the educational system is evolving rapidly and striving for greater international competitiveness.

The study aims to investigate student- and school-level factors influencing the reading achievement of UAE students. The following questions guide the study:

- (1) Which student-level factors significantly explain the variation in students’ reading achievement?
- (2) Which school-level factors significantly explain the variation in students’ reading achievement?

3. Methods

3.1. Participants

The data for this study was obtained from the publicly available database for Progress in International Reading Literacy Study (PIRLS). PIRLS is a significant international assessment that measures reading comprehension and literacy of fourth-grade students around the world. Conducted every five years, PIRLS offers valuable insights into global educational trends and helps countries evaluate their educational policies and practices. In 2021, the PIRLS study continued to play a crucial role in understanding how well young students are learning to read and what factors contribute to their reading literacy. The PIRLS 2021 assessment was conducted under the challenging circumstances of the COVID-19 pandemic. Despite the disruptions caused by the pandemic, the study managed to gather data from a diverse group of countries, reflecting the resilience and adaptability of educational systems worldwide. The assessment included both digital and paper-based tests, allowing for flexibility in how it was administered, which was particularly important given the varying degrees of access to technology and online learning during the pandemic. The PIRLS 2021 data represents nearly 400,000 fourth-grade students from 57 countries and 8 benchmarking participants.

In the UAE dataset, 27,448 fifth-grade students nested within 663 schools, including public and private schools, participated in 2021 PIRLS. Among these students, 20,537 students (507 schools) took the test in English language, and 7008 students (157 schools) took the test in Arabic language. In this study, students who took the test in English language were only considered.

This study used a hierarchical linear modeling (HLM) approach, a statistical method used to analyze data that is nested in nature, such as students within schools. This approach allows researchers to understand how variables at different levels (student and school) interact to impact outcomes, like reading achievement. The research design is structured to examine the effects of both student-level and school-level variables on reading achievement. The nested structure of students within schools justifies the use of HLM, as it accounts for the non-independence of observations within clusters (schools). Three models are employed in this study. These are Unconditional Model as a base model, containing only the intercept. It provides a baseline measure of reading achievement, helping to understand the variability in the outcome without any predictors. Level-1 model introduces student-level variables. Examples include gender, socioeconomic status, students’ liking for reading,

confidence in reading, and engagement in reading. These variables help explain the variation in reading achievement at the student level. Finally full Level-2 model incorporates both student-level and school-level variables. School-level variables might include whether the teacher reads for enjoyment, whether the teacher sends students to the library, the presence of a library in the school, the number of years the principal has been at the school, and the school’s character. This model examines the combined effects of student and school factors on reading achievement. By incrementally adding variables and estimating their effects, researchers can discern the specific contributions of both student and school factors to reading achievement. This approach provides a nuanced understanding of how different variables interact and influence educational outcomes.

3.2. Variables

The dependent variable in this study was the reading achievement score derived from the PIRLS 2021 results. The study encompassed various independent variables, including characteristics related to students and their home environments and data about teachers and school-level factors. A total of five student-level variables and five school-level variables, along with the reading achievement score, were chosen for analysis. Table 1 shows the variables considered in this analysis and a description of each variable.

3.3. Student-level variables

The student variables, gender, socioeconomic status, students like reading, students confident in reading, and students engaged in reading, were chosen from the PIRLS 2021 student questionnaire. The item type and description of each variable can be seen in Table 1.

3.4. School-level variables

Of these school-level variables, two were teacher-related, two were

Table 1
Variables and descriptions.

Variables	Item type	Description
First level: Student-level variables		
Gender	Nominal scale	Girl/Boy
Socioeconomic status	1 item with a 3-point Likert scale	Home socioeconomic status/IDX (Higher, Middle, Lower)
Students like reading	1 item with a 3-point Likert scale	Students like reading/IDX (very much like reading, somewhat like reading, do not like reading)
Students confident in reading	1 item with a 3-point Likert scale	Students confident in reading/IDX (very confident, somewhat confident, not confident)
Students engaged in reading	8 items with a 4-point Likert scale	Student engagement focuses the student’s “in-the-moment” cognitive interaction with the content (e.g., like what I read in school)
Second level: School-level variables		
Teacher read for enjoyment	1 item with a 4-point Likert scale	Teacher read for enjoyment (every day or almost every day, once or twice a week, once or twice a month, never or almost never)
Teacher sends students to the library	1 item with a 4-point Likert scale	Teacher sends students to the library (every day or almost every day, once or twice a week, once or twice a month, never or almost never)
Library in school	Nominal scale	Have a library in school (Yes, No)
Years principal together	Ratio scale	Years of principal experience altogether
School character	12 items with a 5-point Likert scale	General characteristics of the school (e.g., teacher understanding, parental involvement, student desire to do well, respect for classmates) (very high, high, medium, low, very low)

school-related, and one was principal-related. Two teacher-related variables were teacher reading for enjoyment and teacher sending students to the library, and two school-related variables were library in school and general characteristics of the school. One principal-related variable was the total years of principal experience. It is important to note that, in this study, teacher variables were categorized as school-level variables and were treated and interpreted as student characteristics (Fishbein et al., 2024). This approach was adopted due to the absence of explicit sampling of teachers, making inferences about teachers themselves inappropriate (Fishbein et al., 2024; Rutkowski et al., 2010).

3.5. Analysis

In preparing the large-scale data for analysis, IDB Analyzer was used to merge the data files from different questionnaires, student backgrounds, teacher backgrounds, and school backgrounds, which were included in the data set. The Merge Module of IDB Analyzer generated an SPSS syntax file that takes into account information from the complex sampling design of the study (Sandoval-Hernández & Carrasco, 2020). Then, we used the lme4 package of R for this multilevel modeling approach to analyze nested data (Finch et al., 2019). The analysis is conducted using hierarchical linear modeling (HLM) with Statistical Package for Social Sciences (SPSS) Version 28, which using hierarchical linear modeling (HLM) with statistical package lme4 in R allows researchers to understand how variables at different levels interact to impact outcomes. In this case, the analysis examines how student- and school-level variables affect reading achievement. The analysis procedure begins with the Unconditional model, which serves as the baseline model. This model includes only the intercept, representing the average reading achievement score across all students and schools. This model does not include any explanatory variables, and its primary purpose is to provide a reference point for comparing the more complex models.

Next, the Level-1 model, which includes student-level variables, is introduced. These variables are gender, socioeconomic status, students' liking for reading, students' confidence in reading, and students' engagement in reading. These variables' coefficients and standard errors are estimated to assess their impact on reading achievement. The Full Level-2 model incorporates both student-level and school-level variables. This model provides a more comprehensive understanding of how different factors at both levels interact to impact reading achievement. School-level variables include whether the teacher reads for enjoyment, whether the teacher sends students to the library, the presence of a

library in the school, the number of years the principal has been at the school, and the school's character. These variables' coefficients and standard errors are estimated to assess their impact on reading achievement.

4. Results

To explore the extent to which variance in reading achievement is attributed to student-level and school-level factors, a null model, level-1 model, and full level-2 model were conducted using R. Table 2 displays the results of multilevel modeling analysis for each model.

Table 2 shows a comparison of three nested multilevel models. These models are fit with maximum likelihood estimation. The intercept value of the null/unconditional model, representing the average school performance in reading achievement, is 556.14. The model demonstrates significance ($t(3604) = 118.28, p < .001$) at a 95 % confidence interval from 546.92 to 565.36. The coefficient for the intercept in all three models is statistically significant at $p < .001$, meaning there is a significant amount of variation in the outcome variable. The unconditional model shows an intercept of 556.14. This value represents the predicted value of the outcome variable when all the explanatory variables in the model are zero. The difference between the intercept in the unconditional model (556.14) and the intercept in the level-1 model (368.68) represents the amount of variance accounted for by nesting the observations within groups. The standard errors (S.E.) in the table provide information about the precision of the coefficient estimates. Smaller standard errors indicate more precise estimates.

The Level-1 model, focusing on student variables and their effects on reading achievement, reveals an intercept value of 368.68, with significance ($t(3599) = 31.01, p < .001$) at a 95 % confidence interval from 345.37 to 392.00. In this model, gender, socioeconomic status, students' confidence in reading, and students' engagement in reading impact reading achievement (see Table 2). Girls outperform boys significantly in reading achievement ($\beta = -5.44, t(3599) = -2.27, p < .05$). Additionally, socioeconomic status ($\beta = 23.19, t(3599) = 10.41, p < .001$), students' confidence in reading ($\beta = 42.16, t(3599) = 26.43, p < .001$), and students' engagement in reading ($\beta = 13.17, t(3599) = 4.62, p < .001$) show a significant positive relationship with reading achievement.

These findings suggest that student variables, including gender, socioeconomic status, students' confidence in reading, and students' engagement in reading, significantly account for the variance in reading achievement.

The full level-2 model explores the impact of selected school-level

Table 2
The effects of student- and school-level variables on reading achievement.

	Unconditional model		Level-1 model		Full Level-2 model	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept	556.14***	4.7	368.68***	11.89	164.69***	25.95
Level 1						
Gender			-5.44*	2.40	-5.61*	2.39
Socioeconomic status			23.19***	2.23	22.51***	2.22
Students like reading			-2.85	2.03	-2.67	2.02
Students confident in reading			42.16***	1.59	42.37***	1.59
Students engaged in reading			13.17***	2.85	12.70***	2.84
Level 2						
Teacher read for enjoyment					-3.97	2.18
Teacher sends students to library					8.88***	1.89
Library in school					-2.49	4.34
Years principal together					-0.42	0.39
School character					47.88***	5.42
Intercept variance	4025		2609		1569	
Intraclass correlation	0.43		0.38		0.27	
Explained variance on level 1 (%)	NA		20.7		20.8	
Explained variance on level 2 (%)	NA		35.2		61	

* $p < .05$, ** $p < .01$, *** $p < .001$ Declaration of competing interest.

factors on reading achievement scores, the intercept model is significant (164.69) ($t(3594) = 6.35, p < .001$) within a 95 % confidence interval of 113.82 to 215.37. In this model, four variables at the student level, gender ($\beta = -5.61, t(3594) = -2.35, p < .05$), socioeconomic status ($\beta = 22.51, t(3594) = 10.14, p < .001$), students' confidence in reading ($\beta = 42.37, t(3594) = 26.65, p < .001$), and students' engagement in reading ($\beta = 12.70, t(3594) = 4.47, p < .001$), significantly influence reading achievement. Meanwhile, only two school-level variables, teachers sending students to the library ($\beta = 8.88, t(3594) = 4.70, p < .001$), and general characteristics of school ($\beta = 47.88, t(3594) = 8.83, p < .001$) significantly impact students' reading achievement.

Therefore, in this full level-2 model, student variables including gender, socioeconomic status, students' confidence in reading and students' engagement in reading, and school variables including teacher sending students to the library and school characteristics significantly explained the variation in students' reading achievement.

In the final model, introducing the selected student-level variables explained 21 % of the variance, four variables had significant effects on reading achievement. The remaining 79 %, however, was accounted for by other variables not included in the model. By introducing the selected school-level variables into the model, about 61 % of the variance was explained at the school level in the UAE. The remaining 39 % was accounted for by variables not included in the model. It should be noted that 19 % of the variance in students' reading achievement was between classrooms in the UAE.

Table 2 also shows some statistics related to how well the models fit the data. Intraclass correlation (ICC) is a statistic that measures the proportion of the variance that is due to between-school differences. The ICC for the unconditional model is 0.43, which means that 43 % of the variance in sending students to the library is due to between school differences. The ICC decreases to 0.27 in the full level-2 model, which means that after accounting for teacher enjoyment of reading and years the principal has been at the school, the proportion of variance due to between-school differences is reduced to 27 %.

5. Discussion and recommendations

Literacy is a collective endeavor and is not bound solely to the classroom. As such, PIRLS collects detailed information via questionnaires sent to parents, students, teachers, and schools. This gives the educational systems involved a bird's-eye view into the context in which learning occurs and highlights the impact of certain factors that can affect student performance at the student and school levels. This study investigated student-level and school-level factors influencing the reading achievement of UAE students. The following questions guided the study:

1. Which student-level factors significantly explain the variation in students' reading achievement?
2. Which school-level factors significantly explain the variation in students' reading achievement?

Data from the 20,537 UAE students' PIRLS 2021 results was extracted and analyzed to answer those questions. Five student-level factors and five school-level factors, along with the reading achievement scores, were analyzed.

5.1. Student-level factors

Five student-level factors were analyzed. Those included gender, socioeconomic background, attitudes towards reading, confidence in reading, and student engagement in reading. All five student-level factors were found to significantly predict reading achievement. This study reported that students from higher socioeconomic backgrounds scored 22.51 points higher on reading achievement than those from lower

socioeconomic backgrounds. Those are significant results that might mean that students who are in a higher socioeconomic bracket have more access to books at home, literacy activities prior to entering school, and access to quality early childhood education, all of which have been linked to better reading achievement (Krashen et al., 2012). Those results align with the overall PIRLS 2021, where students who attended schools with higher numbers of economically affluent students had higher reading achievement than those with lower numbers of economically affluent students. The reading achievement for students in the "more affluent" schools was highest (521), and achievement was lowest in the least affluent schools (479). The average reading achievement for students attending neither more affluent nor more disadvantaged schools was in the middle (502 points) (Mullis et al., 2023).

Within the UAE's sociocultural context, the home plays a crucial role in shaping children's literacy development. Positive attitudes toward reading, cultivated through parental engagement and literacy-based activities, are pivotal in fostering early literacy skills (Yang et al., 2018). In homes that promote pro-literacy environments, the presence of diverse reading materials alone may not suffice; a supportive and non-punitive atmosphere is essential for nurturing children's confidence and autonomy in reading. Positive attitudes toward reading, exemplified by making reading a joyful activity, choosing books, having access to quality children's literature, and having a parent who frequently engages with quality reading material, all promote a literacy-friendly environment where children feel motivated to read (Yang et al., 2018). The implication is that by not making parents aware of their crucial role in their children's literacy development and by not engaging in active literacy-based activities, parents might deprive the home environment of opportunities to foster literacy from an early age (Taha-Thomure, 2022). In the UAE, preschool and kindergarten are not mandatory, and many students will begin their education with grade 1 (Tsimpera-Maluch & Taha, 2021), especially students from lower socioeconomic backgrounds. Preschool attendance has a direct, positive impact on literary development (Reese et al., 2000). However, existing literature suggests a reliance in the UAE on nannies (Taha-Thomure, 2022) and schools rather than active parental involvement will have a limiting effect on providing opportunities for early literacy development (Moussa-Inaty & De La Vega, 2013), especially when many early education programs often overlook meaningful activities important to reading development, despite their proven benefits in the UAE on nannies (Taha-Thomure, 2022) and schools rather than active parental involvement (Tibi et al., 2013; Tsimpera-Maluch & Taha, 2021).

Results from this study also reported that students who said they were confident in reading scored 42.37 points higher on the student engagement in reading measure than students who reported being less confident in reading. This is aligned with research studies that suggest that students who are confident in reading are usually more motivated (Graham, 1997), with many researchers promoting the idea that reading is a cognitive process in as much as it is an effective process that is influenced by our experiences (Brown, 2014; Krashen, 2003; McEntire, 2003; Takahashi, 2013). This is also in alignment with Bronfenbrenner's model of ecological systems (Bronfenbrenner, 1979) and Walberg's educational productivity (Walberg, 1982) models emphasizing a system of influence or confluence of contextual factors when looking at academic performance.

Moreover, results reported on the PIRLS 2021 *Students Confident in Reading* scale show that fourth-grade students have an accurate self-assessment of their level of reading skills as measured by PIRLS. Fourth-grade students who reported being "very confident in reading" had high average reading proficiency (541), almost at the advanced level achievement of reading. In contrast, those who were "somewhat confident in reading" had mid-range achievement on average (498). Students who weren't confident in reading had an average achievement of 449, which is below the Intermediate International Benchmark in reading (475) (Mullis et al., 2023).

5.2. School-level factors

Recent educational reforms in the UAE have positioned the country as a global leader in educational standards and achievements. In 2016, the UAE's "Year of Reading" launched a 10-year National Strategy for Reading for both students and adults. This strategy encompasses various objectives such as enhancing cultural capital, improving reading infrastructure, encouraging workplace reading, and more (Ministry of Economy (MOEC) 2016). Reading holds particular significance for the UAE as it forms the pillar of a knowledge-based economy driven by innovation (AlHashmi et al., 2022; Ministry of Economy (MOEC) 2016).

Five school-level factors were analyzed in this study. Those included teacher reading for enjoyment, teachers sending students to the library, having a library in school, years of principal experience, school character such as teachers understanding students, parental involvement, student desire to do well, and respect for classmates. Two variables were mainly found to impact UAE fourth-grade students' reading achievement significantly: teachers sending students to the library and general characteristics of the school that include an emphasis on academic success and school discipline. Those results align with PIRLS 2021 international results and international research, whereby a higher level of school discipline and safety has been associated with higher achievement (Epstein et al., 2008; Kibriya et al., 2018). With the implication that teachers in the UAE might need better training in classroom and behavior management and investing in better library services across all schools, public and private PIRS 2021 reported that reading proficiency was higher for students in schools that reported hardly any problems (510) than for students in schools with minor problems (493). The average reading achievement for students who attended schools reported having moderate to severe problems with school discipline was 465 (Mullis et al., 2023).

Research has long reported links between school safety, discipline, and academic achievement (Epstein et al., 2008).

Another variable linked to school character has to do with academic success. This study found that students who attended schools that prioritized learning and emphasized academic success had higher average reading proficiency. This is aligned with PIRLS 2021 results whereby students in the very high emphasis category had the highest average proficiency (525), followed by the high emphasis category (509). Students in the medium emphasis category had the lowest average reading proficiency (486). Those results are relevant to reading achievement, and research has documented similar results for Mathematics and Science (Martin et al., 2016). Other research suggests that a school's emphasis on academic success is one of the components of school climate, which also strongly correlates with students' motivation (Scherer & Nilsen, 2016). This is a particularly relevant implication for UAE public schools that usually lag behind private schools in academic performance and literacy opportunities provided to students. Raising the academic performance in UAE's public schools is key to improving students' learning and literacy outcomes.

This study found significant linkages between teachers sending students to the library and their reading achievement. This is in alignment with the bulk of research in the field. Ramos et al. (1998), for example, did a study that focused on second and third-grade Hispanic students in an inner-city school, where increasing access to books through monthly visits to a public library significantly boosted children's interest in reading and their engagement with books at home, suggesting that providing access to interesting books can serve as a powerful motivator for reading among children.

The implication is that students who have access to well-equipped and staffed libraries and tend to spend more time reading typically show gains in vocabulary knowledge, recognition of authors and books, increased achievement on reading standardized tests, mastery of writing conventions, and stamina for reading (Krashen et al., 2012; Lance & Marks, 2008; Whitehead, 2004).

5.3. Recommendations

The UAE generally, and Dubai private schools specifically, have made some fantastic strides in literacy education over the past decade, landing the latter in sixth place globally on PIRLS 2021. However, the UAE still faces challenges on a system-wide level that need to be addressed. Twenty-five percent of UAE students ranked in the low achievement level of reading on PIRLS 2021 (World Bank, 2023), meaning that a quarter of all grade four students in the system cannot read and comprehend a text at their level and comprehend it. This will not only have academic implications for the students but also affect the economy and students' future academic and career success. The UAE will need better investment in instructional and recreational reading programs, especially in public schools, which are ranked lowest among other schools in PIRLS 2021. This will mean investing in a better school climate, focusing on academic success, instilling the love and habit of reading in students, ensuring students are utilizing the school or classroom libraries and enrichment reading activities, and engaging parents and students in home literacy activities.

Investing in robust reading literacy programs in schools is not simply an educational endeavor but a societal investment with far-reaching consequences. By nurturing strong reading skills, we empower future generations to become lifelong learners, critical thinkers, informed citizens, and active participants in shaping a better tomorrow.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work the author(s) used Grammarly in order to improve grammar, sentence structure, and reference format. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

CRediT authorship contribution statement

Hanada Taha Thomure: Writing – review & editing, Writing – original draft, Project administration, Conceptualization. **Cherry Zin Oo:** Resources, Methodology, Formal analysis, Data curation. **Myint Swe Khine:** Methodology, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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