Measuring the Role of Gender, Emotional Characteristics, and Family Support in Students' Reading Performance: Evidence from PISA 2022 Indonesia

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***Abstract*—Reading literacy is a foundational skill that plays a crucial role in students' academic success and lifelong learning. Drawing data from 13,439 Indonesian students who participated in PISA 2022, this study examines how gender, emotional characteristics, and family support interact to influence students' reading performance. This study employed a quantitative research design using Structural Equation Modelling (SEM) to examine the relationships between variables. This study found that all factors significantly predicted reading outcomes, with emotional characteristics, such as perseverance and self-control, being the strongest direct predictor (β = 0.258). Gender was also shown to have both direct (β = 0.125) and indirect (β = 0.036) effects on reading, as female students tended to receive more family support and demonstrate stronger emotional traits. Family support had a meaningful role in nurturing the emotional characteristics that enhance literacy, with a modest direct effect (β = 0.094) on reading performance. These findings underscore the importance of addressing not just cognitive skills but also emotional development and home environments in efforts to improve reading achievement. This study highlights the need for targeted, gender-sensitive educational interventions that integrate social-emotional learning and family engagement strategies within Indonesia's diverse educational landscape.**

***Keywords*—reading performance, gender difference, family support, emotional characteristics, PISA 2022 Indonesia**

I. Introduction

Reading literacy is fundamental to students' academic achievement and lifelong learning. Defined as the ability to understand, use, evaluate, reflect on, and engage with texts to achieve personal goals and participate in society, reading literacy is one of the core domains assessed by the Programme for International Student Assessment (PISA) [1]. In PISA 2022, reading performance is evaluated through tasks involving locating information, understanding texts, and evaluating and reflecting on content.

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PISA results have consistently shown disparities in reading outcomes influenced by factors such as gender, emotional characteristics, and family support. Gender differences are particularly notable, with girls outperforming boys by an average of 24 score points across OECD countries [2]. However, the mechanisms behind these patterns remain underexplored.

Recent societal shifts, such as increased focus on social-emotional learning, mental health, and family engagement in education, underscore the need to revisit these factors, especially in post-pandemic Indonesia. National initiatives like the Strengthening Character Education program reflect this policy emphasis [3–5].

Despite growing interest in these issues, few studies have examined the combined influence of gender, emotional traits, and family support on reading performance using large-scale datasets. The goal is to inform more inclusive, evidence-based educational strategies aimed at improving reading literacy for diverse student populations. This study is guided by the following research question:

How do gender, emotional characteristics, and family support influence the reading performance of Indonesian students based on PISA 2022 data?

II. Literature Review

A. Gender Differences in Reading Performance

Cognitive, emotional, and social factors all influence reading performance, with gender playing a significant role across various contexts. While numerous studies report that girls tend to outperform boys in reading, this trend is not universal, varying across cultural, linguistic, and educational settings. Such variation underscores the need to explore how gender interacts with other factors like emotional traits and family support, particularly in diverse, multilingual contexts such as Indonesia.

In many education systems, such as Finland and Sweden, boys consistently lag behind girls in reading, often due to gendered perceptions of reading, lower motivation, and reduced engagement among boys [6]. Globally, girls are more likely to enjoy reading, feel

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confident in their reading ability, and engage in literacy-related discussions with peers and family, all of which contribute to better outcomes [7].

However, findings from Indonesia present a more nuanced picture. Aditomo and Hasugian [8] found no significant gender gap in reading performance among secondary EFL learners, suggesting that outcomes may depend more on the types of support received than on gender alone. Boys benefited more from material resources, while girls responded better to emotional support and shared reading activities. Similarly, Sultan *et al.* [9] found higher reading comprehension scores among girls, possibly due to more effective reading strategies, while Syamsuri and Bancong [10] observed greater focus and motivation among girls, particularly in rural areas.

B. Emotional Characteristics on Reading Achievement

While cognitive ability has traditionally dominated discussions of academic achievement, emotional characteristics, such as self-control and perseverance, have proven equally crucial, particularly in reading performance. These traits serve as protective factors against academic and socio-emotional challenges. Gendered patterns in self-control, for example, may help explain girls' advantage in reading, as early-emerging self-regulation gives them a developmental edge [11]. However, contrasting findings from China, where boys exhibit higher self-control, highlight the influence of sociocultural factors such as parenting and societal norms [12].

Self-control further enhances focus and minimizes distractions—traits highly valued in cultural contexts like Indonesia, where discipline and respect for authority are emphasized [13–15]. Nonetheless, perseverance's effectiveness varies. Xu *et al.* [16] found it more predictive of achievement in East Asian systems that prioritize memorization. Moreover, grit is most impactful when coupled with passion; persistence without purpose may yield limited academic gains [17].

In Indonesia, studies affirm the role of self-regulated learning and emotional regulation in reading success but often overlook students lived experiences. While SRL correlates with reading comprehension and English achievement [18], few studies explore how students self-regulate. A mixed-methods study revealed that strategies such as interest enhancement and self-consequating foster reading motivation [19], and another study linked self-efficacy and self-regulation with achievement motivation among Muslim students, though gender and institutional differences were not considered [20]. A meta-analysis further revealed that although digital tools are widely available, student reading interest remains low, suggesting underutilization of technology for literacy development [21].

These findings highlight the importance of perseverance and self-regulation in reading, but also point to the need for culturally grounded research that centres student perspectives and examines the intersecting roles of gender and family support.

C. The Role of Family Support in Reading Performance

Family support plays a critical role in students' academic achievement and well-being. This includes financial assistance, access to learning resources, a conducive home environment, encouragement, and parental involvement in education [22, 23]. Studies have shown that such engagement enhances motivation, improves reading performance even in high-vulnerability settings [22], and positively influences academic outcomes [24]. Parental tutoring, especially in subjects like mathematics, fosters motivation and achievement [25], while combined support from parents and teachers can reduce stress and boost students' interest in learning [26].

In Indonesia, boys benefited more from access to academic resources, while girls thrived with maternal involvement in reading [8], underscoring the need for gender-responsive family support strategies. Despite this growing evidence, most research has treated gender, emotional characteristics, and family support as separate influences, limiting our understanding of how these factors interact to shape reading performance.

Therefore, this study addresses that gap by examining how gender, emotional traits (self-control and perseverance), and family support jointly influence reading achievement among Indonesian students, using data from PISA 2022. By doing so, it aims to generate evidence-based insights to support more equitable and effective literacy development in Indonesia and similar contexts.

Based on the literature, the hypothesized path model of this study has been formulated, as depicted in Fig. 1.

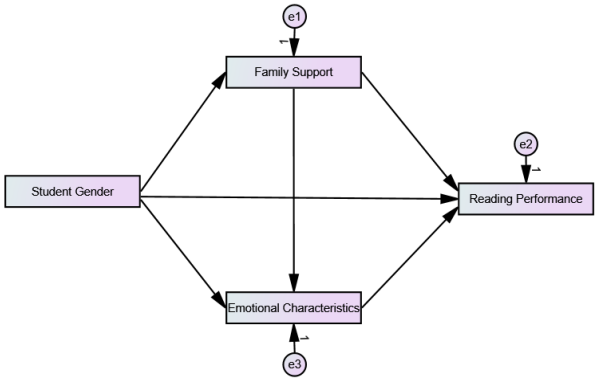

Fig. 1. Hypothesized path model of the study.

III. Materials and Methods

A. Variables

This study uses Indonesian data from PISA 2022, comprising 13,439 students across 410 schools. The dependent variable is reading performance, based on PISA's literacy assessment measuring information retrieval, comprehension, and critical reflection [1]. Three independent variables are included: gender, emotional characteristics, and family support. Gender is self-reported, with 6,864 females and 6,575 males [1]. Emotional characteristics are drawn from the Social and

Emotional Characteristics Module, focusing on task performance—behaviors reflecting conscientiousness, such as persistence, responsibility, and focus [1]. Family support is measured using ten items from the Parental Involvement and Support Module, capturing students' perceptions of family involvement, encouragement, and academic help [1].

B. Data Analysis

AMOS version 29 was used to conduct Confirmatory Factor Analysis (CFA) and Structural Equation Modelling (SEM). CFA was applied to validate the measurement model and test the relationship between observed variables and latent constructs [27]. SEM was then used to examine the structural relationships among gender, emotional characteristics, family support, and students' reading performance [28]. Model fit was evaluated using standard indices: CMIN/DF (< 3), TLI and CFI (≥ 0.90), and RMSEA (≤ 0.05) [29].

AMOS was selected for its robust SEM capabilities and user-friendly graphical interface, which facilitates model specification through visual path diagrams. It is particularly well-suited for single-level SEM involving large datasets such as PISA. AMOS also integrates seamlessly with SPSS and offers advanced features for handling missing data and estimating model parameters efficiently. These capabilities make it a practical and rigorous tool for testing complex educational models, especially when validating latent constructs and assessing indirect effects.

IV. Result and Discussion

A. Analysis of Measurement Model

The measurement model, as shown in Table I, evaluated the standardized factor loadings of observed variables onto their respective latent constructs: Family Support, Perseverance, Self-Control, and Reading Performance. Factor loadings indicate the strength of association between each observed item and its underlying construct, with values of 0.50 or higher generally considered acceptable.

TABLE I. Standardized Factor Loadings

Latent	Observed	Factor Loadings
Family Support	How often parents/family member: Discuss how well you are doing at school.	0.657
	How often parents/family member: Eat [the main meal] with you.	0.678
	How often parents/family member: Spend time just talking with you.	0.752
	How often parents/family member: Talk to you about the importance of [completing ISCED 3].	0.063
	How often: parents/family member: Talk to you about any problems you might have at school.	0.873
	How often parents/family member: Ask you about how well you are getting along with other students at school.	0.877
	How often parents/family member: Encourage you to get good [marks].	0.746
	How often parents/family member: Take an interest in what you are learning at school.	0.830
	How often parents/family member: Talk to you about your future education.	0.819
	How often parents/family member: Ask you what you did in school that day.	0.857
Perseverance	I keep working on a task until it is finished.	0.775
	I apply additional effort when work becomes challenging.	0.709
	I finish tasks that I started even when they become boring.	0.679
	I stop when work becomes too difficult.	0.011
	I am more persistent than most people I know.	0.511
	I give up after making mistakes.	0.035
	I quit doing homework if it is too long.	0.104
	I complete tasks even when they become more difficult than I thought.	0.627
	I finish what I start.	0.674
	I give up easily.	0.097
Self-Control	I am careful with what I say to others.	0.747
	I get easily distracted.	0.289
	I say the first thing that comes to my mind.	0.388
	I like to make sure there are no mistakes.	0.762
	I carefully check homework before turning it in.	0.711
	I stop to think before acting.	0.765
	I rush into activities without thinking.	0.022
	I wait for my turn to speak in class.	0.571
	I am more impulsive than most people I know.	0.372
	I think carefully before doing something.	0.754
Reading Performance	Plausible Value 1 in Reading	0.941
	Plausible Value 2 in Reading	0.811
	Plausible Value 3 in Reading	0.937
	Plausible Value 4 in Reading	0.940
	Plausible Value 5 in Reading	0.939
	Plausible Value 6 in Reading	0.942
	Plausible Value 7 in Reading	0.940
	Plausible Value 8 in Reading	0.941
	Plausible Value 9 in Reading	0.938
	Plausible Value 10 in Reading	0.941

For Family Support, most items demonstrated strong loadings, ranging from 0.657 to 0.877. Items such as "How often parents or family members talk to you about any problems you might have at school" (0.873) and "Ask you what you did in school that day" (0.857) were particularly strong indicators. However, one item exhibited a notably low loading (0.063), suggesting it may not meaningfully contribute to the construct and should be reconsidered in future analyses.

The Perseverance construct revealed a mixed pattern. High-loading items included "I keep working on a task until it is finished" (0.775) and "I apply additional effort when work becomes challenging" (0.709), reflecting persistence and goal-directed behavior. Conversely, several reverse-coded items—such as "I stop when work becomes too difficult" (0.011), "I give up after making mistakes" (0.035), and "I quit doing homework if it is too long" (0.104)—showed weak associations with the latent construct, indicating potential issues with item phrasing or construct alignment.

A similar trend was observed in Self-Control. While items such as "I stop to think before acting" (0.765), "I am careful with what I say to others" (0.747), and "I carefully check homework before turning it in" (0.711) strongly reflected the construct, several items fell below acceptable thresholds (0.022, 0.289, and 0.388), suggesting weaker connections to self-regulatory behavior.

In contrast, the construct of Reading Performance showed high consistency. Based on ten plausible values from the PISA 2022 assessment, all indicators loaded strongly onto the latent variable, with values ranging from 0.811 to 0.942. This consistency confirms the robustness of the construct and reflects the strong psychometric properties of the PISA reading literacy framework.

B. Analysis of Structural Model

The standardized results of the Structural Equation Modelling (SEM), presented in Fig. 2, reveal key relationships among gender, family support, emotional characteristics (perseverance and self-control), and reading performance.

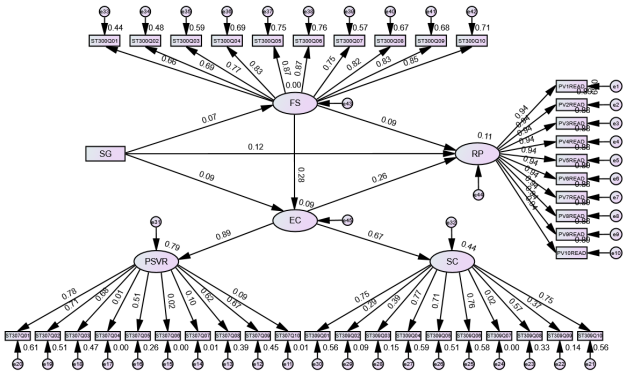

Fig. 2. Standardized estimates of structural equation modelling.

The model demonstrates good fit overall. Although the chi-square statistic (CMIN = 9049.739, DF = 772, CMIN/DF = 12.189) exceeds the recommended threshold—likely due to the large sample size—other indices indicate strong fit: TLI = 0.968 and CFI = 0.971, both above the 0.95 benchmark. The RMSEA is 0.029, well below the acceptable cutoff of 0.05, supporting the model's adequacy.

The results from the model show several significant relationships between the variables. Table II shows several statistically significant standardized relationships (all $p < 0.001$). Gender has a small effect on family support ($\beta = 0.069$) and emotional characteristics ($\beta = 0.095$). Family support significantly predicts emotional characteristics ($\beta = 0.279$) and reading performance ($\beta = 0.094$). Gender also directly affects reading performance ($\beta = 0.125$). Notably, emotional characteristics have the strongest direct effect on reading performance ($\beta = 0.258$), indicating their critical role in shaping academic outcomes.

TABLE II. STANDARDIZED SIGNIFICANT LEVELS AND REGRESSION WEIGHTS OF THE MODEL

Variables			Standardized Regression Weights	S.E.	*p*
Family Support	←	Student Gender	0.069	0.017	***
Emotional Characteristics	←	Family Support	0.279	0.007	***
Emotional Characteristics	←	Student Gender	0.095	0.009	***
Reading Performance	←	Student Gender	0.125	1.226	***
Reading Performance	←	Family Support	0.094	0.830	***
Reading Performance	←	Emotional Characteristics	0.258	2.178	***

Furthermore, as detailed in Table III, gender indirectly influences emotional characteristics through family support (indirect $\beta = 0.019$), yielding a total effect of 0.114. On reading performance, gender has both a direct ($\beta = 0.125$) and indirect effect ($\beta = 0.036$), resulting in a total effect of 0.161. Family support affects reading performance directly ($\beta = 0.094$) and indirectly via emotional characteristics ($\beta = 0.072$), with a total effect of 0.166. Emotional characteristics have the strongest direct effect ($\beta = 0.258$), confirming their mediating role in the model.

Overall, the model highlights emotional characteristics as the most influential predictor of reading performance, with family support and gender contributing both directly and indirectly through interrelated pathways.

TABLE III. DIRECT, INDIRECT, AND TOTAL EFFECTS OF THE MODEL

	Student Gender			Family Support			Emotional Characteristics		
	Direct	**Indirect**	**Total**	**Direct**	**Indirect**	**Total**	**Direct**	**Indirect**	**Total**
Family Support	0.069	–	0.069	–	–	–	–	–	–
Emotional Characteristics	0.095	0.019	0.114	0.279	–	0.279	–	–	–
Reading Performance	0.125	0.036	0.161	0.094	0.072	0.166	0.258	–	0.258

The findings validate and extend the literature in several important ways. First, the analysis confirms the central role of emotional characteristics as the strongest predictors of reading achievement. This supports the argument that while cognitive skills are vital, emotional traits serve as essential protective factors in students' academic journeys. The significant path coefficient ($\beta = 0.258$) aligns with studies that emphasized how self-regulation contributes to reading success and academic motivation [18, 20]. Moreover, this result complements earlier findings that perseverance is especially influential in education systems that emphasize discipline and memorization [16]. However, the weak factor loadings of reverse-coded items in both emotional constructs highlight potential issues in measurement alignment, suggesting a need for more culturally attuned instruments that accurately reflect Indonesian students' lived experiences [19, 20].

The results also reaffirm the importance of family support, which demonstrated both direct ($\beta = 0.094$) and indirect effects on reading through emotional characteristics ($\beta = 0.072$), with a total effect of 0.166. This aligns with literature emphasizing that family engagement positively impacts student outcomes [22, 24]. In particular, the strong factor loadings of items such as "talking about school problems" and "asking about daily school activities" underscore the importance of relational and emotional support, rather than solely material assistance. This finding reinforces the insight that Indonesian girls tend to benefit more from shared reading and emotional involvement, while boys respond more to access to resources [8], highlighting the need for gender-responsive family support strategies.

The effect of gender on reading performance, although statistically significant ($\beta = 0.125$), was smaller compared to emotional characteristics and family support. This nuanced finding aligns with the mixed results from prior Indonesian studies. While Sultan *et al.* [9] and Syamsuri and Bancong [10] reported higher reading performance among girls, Aditomo and Hasugian [8] found no significant gender gap, instead pointing to the type and quality of support as more influential. In this study, gender also showed indirect effects via family support and emotional traits, confirming its interaction with other variables rather than functioning as an isolated determinant.

V. CONCLUSION

Overall, the study highlights the central role of emotional characteristics in driving reading performance, while also showing how gender and family support shape these traits. Emotional traits such as motivation, focus, and perseverance are more influential than direct demographic or environmental factors.

These findings suggest practical implications. Schools should implement Social-Emotional Learning (SEL) programs that build self-discipline and perseverance. Additionally, parent education initiatives should promote differentiated strategies to support both boys and girls effectively. In culturally diverse settings like Southeast Asia, such approaches should be adapted to local norms to enhance relevance and impact.

Future research should examine how these relationships evolve over time and whether similar dynamics exist across other Southeast Asian education systems. Integrating emotional development and family engagement into education policy and practice can lead to more equitable and sustainable improvements in literacy outcomes.

CONFLICT OF INTEREST

The author declares that there is no conflict of interest regarding the publication of this paper.

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