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Gender Differences in the Influence of Family Background on Internet Addiction and Environmental Behaviour: Does Islamic Elementary School Matter?

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ABSTRACT
Pro-environmental behaviour is a critical global issue across all sectors, including education. This study examines how family socioeconomic background influences internet addiction and pro-environmental behaviour among elementary school students, investigates the effects of school type and grade level, and explores gender as a moderating variable in these relationships. Using a quantitative approach with Partial Least Squares Structural Equation Modeling (PLS-SEM), data were collected from 210 parents (150 females, 60 males) through convenience sampling. The findings reveal that family economic status and family structure significantly and positively influence children's internet addiction, with students from affluent and two-parent families being more prone to smartphone or internet overuse. Internet addiction, in turn, has a significant negative impact on students' pro-environmental behaviour. The effect of maternal education on pro-environmental behaviour is more pronounced among male students, whereas family economic status has a stronger influence on female students.. Islamic education was found to have no significant effect on either internet addiction or pro-environmental behaviour. This study contributes to the theoretical discourse in Islamic education and offers practical implications for curriculum and instructional development within Islamic educational settings.

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Pro-enviromental behaviour, Internet addiction, family background

ABSTRAK
Perilaku pro-lingkungan merupakan isu global yang penting di berbagai sektor, termasuk pendidikan. Penelitian ini bertujuan untuk mengkaji pengaruh latar belakang sosial ekonomi keluarga terhadap kecanduan internet dan perilaku pro-lingkungan pada siswa sekolah dasar, meneliti pengaruh jenis sekolah dan tingkat kelas, serta mengeksplorasi peran moderasi gender dalam hubungan-hubungan tersebut. Penelitian ini menggunakan pendekatan kuantitatif dengan metode Partial Least Squares Structural Equation Modeling (PLS-SEM). Data diperoleh dari 210 orang tua siswa (150 perempuan, 60 laki-laki) melalui teknik convenience sampling. Hasil penelitian menunjukkan bahwa status ekonomi dan struktur keluarga secara signifikan dan positif memengaruhi kecanduan internet pada anak. Siswa dari keluarga mampu dan keluarga dengan dua orang tua cenderung lebih rentan terhadap kecanduan smartphone atau internet. Kecanduan internet secara signifikan berdampak negatif terhadap perilaku pro-lingkungan siswa. Perilaku pro-lingkungan siswa perempuan lebih dipengaruhi oleh status ekonomi keluarga dan sedangkan pengaruh pendidikan ibu lebih besar pada siswa laki-laki. Pendidikan Islam tidak ditemukan berpengaruh signifikan terhadap kecanduan internet maupun perilaku pro-lingkungan. Temuan ini memberikan kontribusi teoretis bagi literatur pendidikan Islam dan menawarkan implikasi praktis bagi pengembangan kurikulum dan pembelajaran di lingkungan pendidikan Islam.

Kata kunci
Prilaku pro-lingkungan, Kecanduan internet, latar belakang keluarga

Introduction

Environmental issues have become a significant topic within the education sector. In Malaysia, environmental education has been integrated into the teaching of relevant subjects (Mahmud & Osman, 2010). In Macedonia, the majority of student literature is related to ecological themes (Denkova, 2011). In Slovenia, environmental studies have been included in the basic education curriculum for nine years since the late 20th century (Hus, 2010). Meanwhile, in Indonesia, environmental education has been incorporated into all subjects under the Merdeka Curriculum (Rachman et al., 2024). Environmental education plays a crucial role in addressing the global climate crisis. Therefore, digital literacy is also a key component of the Merdeka Curriculum, as the digital era demands that students be able to adapt, think critically, and engage creatively with technology. Digital literacy is designed to meet teaching and learning needs which increasingly require unlimited space through the presence of information technology (Fitriyah et al., 2024). The rapid development of technology requires the education sector to adapt digital literacy to make the learning process more relevant to 21st-century needs (Siregar et al., 2024).

However, on the other hand the advancement of digital technology also affects children's emotions and behavior, including their pro-environmental tendencies. The negative impact of social media use can lead to a sense of exhaustion in individuals, a condition commonly referred to as social media fatigue (Zulfi et al., n.d.). Research has shown that internet addiction is associated with emotional intelligence and self-regulation (Fernández-Martínez et al., 2023; Özer et al., 2023). Mental health is a fundamental part of students' overall health and has a significant impact on many aspects of their lives (Khodijah et al., 2024). Moreover, internet addiction may increase the likelihood of cyberchondria, which can negatively impact real-life functioning and lead to extreme anxiety related to health concerns (Yorulmaz et al., 2025). Meanwhile, other studies have also explored the relationship between digital game addiction in early childhood, digital parenting practices, intrafamily relationships, and children's social competence. The findings reveal that digital parenting awareness negatively affects children's digital game addiction (Kay & Sağlam, 2025).

Consequently, numerous studies have explored pro-environmental behavior among students. Gatersleben et al., (2014) concluded that values and identities are significant predictors of pro-environmental behavior. Environmental regulations have also been shown to influence such behavior (Coelho et al., 2023). Studies from various countries have demonstrated that religion can enhance pro-environmental behavior (Zemo & Nigus, 2021). Education is another factor that significantly affects pro-environmental behavior (Akhir et al., 2022).

PEBs can be enhanced by prompting individuals to reflect on their attitudes toward environmental issues (Flörchinger et al., 2025). A more comprehensive understanding of these factors is expected to serve as a foundation for designing more effective interventions aimed at fostering pro-environmental behavior from an early (J. Liu & Green, 2024). Parental values and habits can shape children's environmental attitudes and behaviors in the future (J. Li et al., 2024). Creating a supportive family environment is associated with a reduction in children's behavioral problems (Chu et al., 2024). Among the signs of good character are understanding goodness, having an affinity for virtuous actions and consistently exhibiting positive behavior (Kholis et al., 2024). Generation-specific approaches may be necessary to effectively foster innovative behavior and

enhance environmental awareness within each generation (Baran & Sypniewska, 2024).

Although the impact of internet addiction on children's mental health and well-being has been widely studied, a substantial gap remains in understanding the role of school-related factors in influencing both internet addiction and pro-environmental behavior. Specifically, in the context of Indonesia, which features two major primary education systems—Islamic schools and general public schools—the influence of school type on internet addiction and pro-environmental behavior remains underexplored empirically.

Furthermore, Indonesia's Kurikulum Merdeka (Independent Curriculum) emphasizes environmental awareness and pro-environmental behavior as essential learning objectives across all levels of education. Nevertheless, to date, no comprehensive and explicit theoretical framework has been developed to explain how school-related factors, family socioeconomic background, and individual characteristics such as gender influence both internet addiction and pro-environmental behavior within this unique educational system. Therefore, this study aims to fill this theoretical gap by proposing a novel approach to understanding the interrelationship among these factors.

Therefore, this study aims to:

RO_1: Examine the effect of family socioeconomic background on internet addiction and pro-environmental behaviour among elementary school students.

RO_2: Investigate the effects of school type and grade level on internet addiction and pro-environmental behaviour among elementary school students.

RO_3: Explore the moderating role of gender in the relationship between family socioeconomic background, school type, and internet addiction on pro-environmental behaviour among elementary school students.

This study will contribute to the theoretical enrichment in understanding internet addiction and pro-environmental behaviour among elementary school students. Theoretically, it will offer insights from the context of both Islamic and general education systems in Indonesia, which possess distinctive characteristics. Practically, the findings of this study will provide valuable guidance for schools and parents in preventing internet addiction and promoting pro-environmental behaviour in children.

Literature review

Pro-environment behavior in Islamic elementary school

Indonesia, as an archipelagic nation with vast and diverse geographical characteristics (Pratiwi et al., 2024). Human interactions with nature have profound implications for maintaining ecological balance and sustainability (Kurniawan et al., 2024). faces increasingly complex environmental challenges amid growing global attention to ecological issues. This condition necessitates the strengthening of character education as a foundational approach to cultivating a socially and ecologically responsible generation. In this context, national character development has become a strategic priority for the Indonesian government, as evidenced by the introduction of various policies specifically designed to address fundamental issues in shaping national character (Firmansyah et al., 2023). Character education makes a positive contribution to students' academic achievement within the learning process (Aditama, 2024) . One of the crucial components of character education is environmental awareness, which is now positioned as a key element within the national education curriculum. Environmental education not only provides conceptual understanding of the causes and consequences of ecological problems, but also plays a critical role in fostering a sense of care and responsibility

toward nature (Salazar et al., 2024). In Indonesia, primary education is categorized into two main types: Sekolah Dasar (SD), which is administered by the Ministry of Education, Culture, Research, and Technology, and Madrasah Ibtidaiyah (MI), which operates under the supervision of the Ministry of Religious Affairs. The values of honesty, discipline, religiosity, responsibility, tolerance, creativity, and environmental and social awareness must be instilled in students (Atin & Maemonah, 2022). Character education related to environmental awareness has been taught in SD and MI (Noptario et al., 2024). This education aims to cultivate students' awareness and sense of responsibility toward the environment, as well as to encourage positive behavior in preserving its sustainability Effective implementation of environmental education promotes increased student awareness and understanding of environmental issues, enriches their knowledge, and nurtures positive attitudes, which ultimately encourage active engagement in preserving the environment and behaving responsibly (I. Erhabora & U. Don, 2018).

In Islamic teachings, caring for the environment is one of God's commands, as emphasized in several Qur'anic verses (QS. Al-A'raf: 56; QS. Ar-Rahman: 7–9; QS. Al-Isra: 27; QS. Al-A'raf: 31). Consequently, environmental stewardship and sustainability are integral components of Islamic education. Furthermore, fostering a love for nature is one of the key objectives of Indonesia's Merdeka Curriculum, as reflected in the Pancasila Student Profile (Nurdyansyah et al., 2022; Rachman et al., 2024). Thus, in Islamic education, environmental issues are not only part of the academic curriculum but also embedded within religious teachings instilled in children.

This highlights the importance of conducting research on pro-environmental behaviour within the context of Islamic schools. In other words, understanding students' pro-environmental behaviours and the factors influencing them—both in Islamic and general education settings—is essential. However, current literature suggests that research on environmental education at the primary school level remains limited, particularly in Islamic educational institutions.

Internet addiction

Children in the modern era exhibit a strong inclination toward the digital world. As a learning tool, digital games offer a fun and engaging approach for elementary school students (Sari et al., 2025). Excessive internet use among children can potentially lead to digital dependence or addiction (Islam et al., 2023). Additionally, 76.8% of Indonesian children are allowed by their parents to use digital devices, including smartphones (Batubara et al., 2024). Internet or smartphone addiction has been associated with various behavioral issues. It may result in serious behavioral problems such as aggression, anxiety, and depression (Derevensky et al., 2019; Yilmaz Kurt et al., 2025). Moreover, internet addiction has been linked to an increased risk of suicidal ideation (Miao et al., 2024). The negative effects of internet addiction should not be overlooked (Nur Rahmawati, 2018). The frequent use of internet-connected tablets among children is associated with an increased likelihood of parent-child (Puspitasari & Hakim, 2022). Based on these considerations, we conclude that internet addiction has a negative impact on pro-environmental behavior. Accordingly, we propose the following hypothesis:

H1: Internet addiction has a significant negative effect on children's pro-environmental behavior.

Family background and child behavior

Numerous studies have demonstrated the influence of family on children's behavioral outcomes. Internet addiction, for instance, is influenced by social factors such as family and school environments (Theopilus et al., 2024). Parents have an important role as agents of children's character formation (Agustina & Tago, 2024). Demographic factors and family environment have also been found to significantly affect internet addiction behavior (Zhang et al., 2022). Economically disadvantaged families are more likely to have children who experience emotional and behavioral issues, including disciplinary violations, aggression, and internet addiction (Shen et al., 2024). Additionally, parental conflicts have been shown to contribute to internet addiction among children (Yang et al., 2016). Parents with lower educational attainment or who are divorced are also more likely to overshare photos and other personal content on social media (Kılıç et al., 2024). Based on these findings, we propose the following hypotheses:

H2: Family structure has a significant and negative effect on children's internet addiction.
H3: Father's education has a significant and negative effect on children's internet addiction.
H4: Mother's education has a significant and negative effect on children's internet addiction.
H5: Family economic status has a significant and negative effect on children's internet addiction.
H6: Family structure has a significant and positive effect on children's pro-environmental behaviour.
H7: Father's education has a significant and positive effect on children's pro-environmental behaviour.
H8: Mother's education has a significant and positive effect on children's pro-environmental behaviour.
H9: Family economic status has a significant and positive effect on children's pro-environmental behaviour.

School role

On the school role, we propose the following hypotheses

H10: School type has a significant and positive effect on children's internet addiction.
H11: Grade level has a significant and positive effect on children's internet addiction.
H12: School type has a significant and positive effect on children's pro-environmental behaviour.
H13: Grade level has a significant and positive effect on children's pro-environmental behaviour.

Gender as moderator

Internet addiction differs between males and females. Females tend to be addicted to social media, while males are more likely to be addicted to online gaming (Zhang et al., 2022). The theory of gender differences in child development suggests that gender may influence preferences and participation in various physical activities (Livia et al., 2024). Gender strengthens the relationship between interpersonal issues and internet addiction, with a greater effect on females (Guo et al., 2024). Socioscientific issues (SSI) are issues that describe social problems in society related to a conceptual, procedural, or

technological context of science (Mukti & L.F.X, 2025). Based on these studies, we conclude that there are gender differences in internet usage behavior and pro-environmental behavior. Therefore, we formulate the following hypotheses:

H14: Internet addiction positively influences pro-environmental behavior in children, with gender as a moderator.
H15: Family structure positively influences pro-environmental behavior in children, with gender as a moderator.
H16: Father's education positively influences pro-environmental behavior in children, with gender as a moderator.
H17: Mother's education positively influences pro-environmental behavior in children, with gender as a moderator.
H18: Family economic status positively influences pro-environmental behavior in children, with gender as a moderator.
H19: School type positively influences pro-environmental behavior in children, with gender as a moderator.
H20: Grade level positively influences pro-environmental behavior in children, with gender as a moderator.

Theoretical framework

This study will examine the effects of exogenous variables and the moderating role of gender on children's pro-environmental behavior. The relationships between the variables in this study are illustrated in Figure 1.

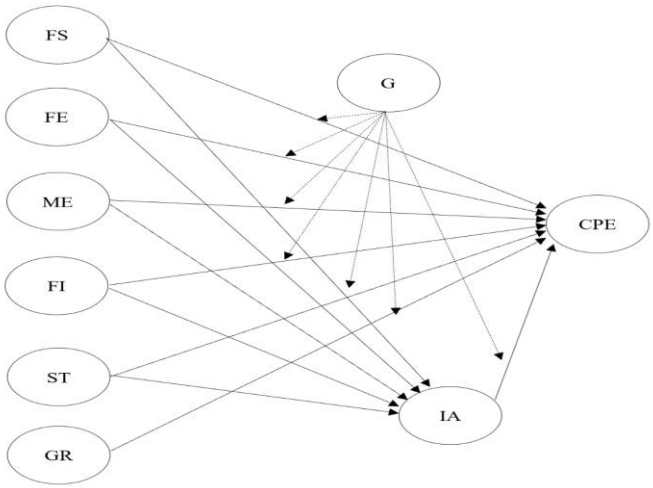

Figure 1. Theoretical Framework

Note :
FS = Family structure (single or two-parent household), FE = Father education, ME = Mother education, FI= Family income, ST = School type (Islamic or general school), GR = Grade, IA = Internet addiction, CPE = Children pro-environmental behavior, G = Children gender.

Methods

The participants in this study consisted of 210 individuals (F = 150, M = 60), including parents of students in grades 4, 5, and 6 from General Elementary Schools (GES) and Islamic Elementary Schools (IES) in Banjarmasin, South Kalimantan. Banjarmasin is the largest city in South Kalimantan and serves as a hub for the development of Islamic education in the region. All participants provided written consent on the questionnaire

when responding.

Convenience sampling was employed to select the participants. This method was chosen due to its speed, ease, and cost-effectiveness. Additionally, we utilized a snowballing technique to gather as many participants as possible in a short time. Participants were asked to share the survey link with their friends who were potential participants.

Convenience sampling took form of a non-probability sampling method that is highly susceptible to bias. To enhance the credibility of the convenience sample, we distributed the link at different times and increased the number of participants as much as possible (Stratton, 2021). This study achieved a sample size exceeding the minimum required sample of 15 with a standard f^2 value of 0.15, an error probability of 0.05, a power of 0.95, and 7 predictor variables.

F tests - Linear multiple regression: Fixed model, R^2 deviation from zero

Analysis:	A priori: Compute required sample size		
Input:	Effect size f^2	=	0.15
	α err prob	=	0.05
	Power (1-β err prob)	=	0.95
	Number of predictors	=	7
Output:	Noncentrality parameter λ	=	22.9500000
	Critical F	=	2.0732820
	Numerator df	=	7
	Denominator df	=	145
	Total sample size	=	153
	Actual power	=	0.9503254

We adapted the indicators for measuring children's pro-environmental behavior from Evans et al. (2007)while the indicators for measuring internet addiction were adapted from Lin et al. (2017). These questionnaire items were translated into Indonesian and reviewed by experts in both English and Indonesian. This process was undertaken to ensure that the substance of the questionnaire items was consistent with the original English version. In the next stage, the questionnaire was reviewed by three participants to ensure that the items were understood clearly by the respondents.

After the questionnaire items were revised based on the reviews, we created the questionnaire using Google Forms. The questionnaire consisted of two sections. The first section contained 11 items about the participants' background, such as name, gender, the father's and mother's highest education level, the children's allowance as an indicator of family economic status, and school type (1 for GES, 2 for IES). The second section included 17 items, comprising measurements of smartphone addiction (10 items) and children's pro-environmental behavior (7 items).

The questionnaire link was distributed to the parents of students at GES and IES with the assistance of the teachers. The distribution process was conducted through WhatsApp messages at different times to enhance the credibility of the sample. The survey was distributed from February 1 to March 27, 2025.

Results and Discussion

Result

Reliability and validity

We tested the reliability of the indicators using outer loading values. The outer loading should be at least greater than 0.4 (Henseler et al., 2009). An outer loading greater than 0.5 has sufficiently contributed to the construct, thus meeting the requirements (J. Hair &

Alamer, 2022). Chin (1998) states that indicators should have a minimum loading value of 0.6. In this study, the indicator values exceeded 0.6, indicating that the reliability requirements have been met. Some indicators were removed because they did not meet the threshold. Other indicators were removed due to failure to meet convergent validity.

Next, the constructs have met the reliability criteria, as shown by the composite reliability (CR rho-c) value exceeding 0.7. Internal consistency reliability is reflected in a CR rho-c value of at least 0.6 (J. F. Hair et al., 2021). We used CR rho-c because it is more precise than Cronbach's alpha, which does not account for the contribution of each indicator (J. F. Hair et al., 2011).

The constructs in this study have also met the criteria for convergent validity, as evidenced by the average variance extracted (AVE) value exceeding the minimum requirement of 0.5. J. F. Hair et al. (2019)state that convergent validity is satisfied when the construct value is 0.5 or higher (AVE ≥ 0.5). The test results are shown in Table 1. The heterotrait-monotrait ratio (HTMT) of the correlations for all constructs is also below 0.9 (J. F. Hair et al., 2019). Thus, all constructs meet the discriminant validity criteria. The HTMT of the correlations can be seen in Table 2. Meanwhile, the variance inflation factor (VIF) values below 3 also indicate that there are no multicollinearity issues with the indicators (Ringle et al., 2023). Therefore, all constructs meet the criteria for further testing.

Table 1. Reliability, Validity, And Collinearity Testing Result

	VIF	OL	CR rho-c	AVE
FE	1.000	1.000		
ME	1.000	1.000		
G	1.000	1.000		
FS	1.000	1.000		
ALL	1.000	1.000		
ST	1.000	1.000		
GR	1.000	1.000		
CP_1	1.219	-0.462*	0.710	0.558
CP_2	1.302	-0.255*		
CP_3	1.214	-0.373*		
CP_4	1.049	0.612		
CP_5	1.034	0.861		
CP_6	1.066	0.239*		
CP_7	1.027	0.112*		
SA_1	1.498	0.591**	0.851	0.535
SA_2	1.554	0.616**		
SA_3	1.234	0.546**		
SA_4	1.582	0.581**		
SA_5	1.746	0.652		
SA_6	1.247	0.532**		
SA_7	1.759	0.722		
SA_8	1.849	0.803		
SA_9	1.752	0.774		
SA_10	1.432	0.696		

Note : Removed due to not meeting the outer loading threshold (< 0.5); ** removed due to issues with convergent validity.

Table 2. Discriminant Validity Assessment - Heterotrait-monotrait Ratio of Correlations (HTMT)

	CPE	FE	FI	FS	G	GR	IAD	ME	ST	G x FS	G x IAD	G x GR	G x ST	G x FI	G x ME	G x FE
CPE																
FE	0.129															
FI	0.220	0.328														
FS	0.405	0.073	0.165													
G	0.016	0.063	0.030	0.036												
GR	0.234	0.083	0.108	0.092	0.094											
IAD	0.451	0.161	0.249	0.048	0.147	0.093										
ME	0.135	0.706	0.327	0.012	0.074	0.139	0.134									
ST	0.155	0.502	0.297	0.091	0.089	0.223	0.083	0.470								
G x FS	0.153	0.040	0.041	0.100	0.006	0.026	0.168	0.072	0.041							
G x IAD	0.170	0.059	0.040	0.151	0.020	0.02	0.305	0.063	0.101	0.006						
G x GR	0.056	0.029	0.022	0.026	0.014	0.069	0.080	0.015	0.109	0.092	0.070					
G x ST	0.259	0.056	0.028	0.041	0.014	0.110	0.108	0.016	0.015	0.095	0.080	0.232				
G x FI	0.249	0.023	0.013	0.041	0.005	0.022	0.077	0.006	0.028	0.162	0.227	0.109	0.297			
G x ME	0.062	0.182	0.006	0.072	0.012	0.015	0.079	0.127	0.016	0.021	0.125	0.131	0.468	0.335		
G x FE	0.097	0.162	0.024	0.040	0.010	0.03	0.062	0.182	0.056	0.079	0.155	0.073	0.496	0.339	0.692	

Hypothesis testing

The results of the analysis demonstrate that several hypotheses are supported by this study. Our research shows that family economic status has a small but positive effect on internet/smartphone addiction in children. This is evidenced by the T-statistic value (t) greater than 1.96 (2.534 > 1.96) and a p-value smaller than 0.05 (0.011 < 0.05) at the 0.05 significance level. This is further supported by the confidence interval bias-corrected (CIBC) value, which does not include zero [0.034; 0.350]. However, the effect is small as indicated by the f^2 value, which is greater than 0.02 but less than 0.12 ($0.02 < f^2 < 0.12$). Our findings suggest that children from higher economic backgrounds are more likely to develop smartphone addiction compared to children from lower-income families.

Furthermore, our study indicates that family structure has a significant and positive effect on children's pro-environmental behavior. This is demonstrated by the t-value and p-value meeting the significance criteria of 0.95 ($t > 1.96$, $p < 0.05$). Similar to the family economic effect, the effect of family structure is small ($0.04 < f^2 < 0.12$). Our findings indicate that children living with both parents are more likely to exhibit pro-environmental behavior, while children from single-parent families or those not living with parents are more likely to display non-pro-environmental behavior. These findings reflect the crucial role of the family in fostering pro-environmental behavior in children.

Additionally, we found that internet/smartphone addiction has a significant and negative effect on children's pro-environmental behavior ($t > 1.96$, $p < 0.05$). The effect of addiction is small ($f^2 < 0.12$), reflecting that children addicted to smartphones are less likely to engage in pro-environmental behavior. In other words, the higher the level of addiction, the lower the pro-environmental behavior.

In contrast, the school type did not significantly affect internet addiction or children's pro-environmental behavior. This indicates that education in schools/madrasahs (Islamic elementary schools) does not contribute to increasing pro-environmental behavior or reducing smartphone addiction in children. Therefore, our findings emphasize the critical role of the family, particularly parents, in shaping pro-environmental behavior and preventing internet addiction in children.

The moderation analysis confirms that gender significantly moderates the effects of family economic status and mother's education on children's pro-environmental behavior ($t > 1.96$, $p < 0.05$). These effects vary notably between boys and girls. Specifically, the effect of mother's education on pro-environmental behavior is stronger among boys compared to girls (ß = 0.212). Conversely, the influence of family economic status on pro-environmental behavior is more pronounced among girls than boys (ß = -0.151). The results of the hypothesis testing are presented in Table 3.

Table 3. Hypothesis testing result

	ß	f^2	2.5%	97.5%	t	P	Hypotheses
IAD -> CPE	-0.172	0.028	-0.314	0.034	2.008	0.045	H1 was supported
FS -> IAD	-0.068	0.005	-0.229	0.105	0.790	0.429	H2 was rejected
FE -> IAD	0.098	0.005	-0.100	0.277	1.020	0.308	H3 was rejected
ME -> IAD	-0.002	0.000	-0.177	0.170	0.028	0.978	H4 was rejected
FI -> IAD	0.204	0.036	0.034	0.350	2.534	0.011	H5 was supported
FS -> CPE	0.195	0.040	-0.014	0.362	2.051	0.040	H6 was supported
FE -> CPE	-0.109	0.006	-0.306	0.096	1.061	0.289	H7 was rejected
ME -> CPE	-0.015	0.000	-0.211	0.169	0.152	0.879	H8 was rejected

FI -> CPE	-0.03	0.001	-0.211	0.186	0.302	0.763	H9 was rejected
ST -> IAD	-0.006	0.000	-0.186	0.186	0.060	0.952	H10 was rejected
ST -> CPE	0.128	0.012	-0.117	0.327	1.139	0.255	H11 was rejected
GR -> IAD	0.068	0.004	-0.085	0.212	0.899	0.369	H12 was rejected
GR -> CPE	0.119	0.014	-0.046	0.264	1.512	0.130	H13 was rejected
G x IAD -> CPE	0.025	0.001	-0.124	0.182	0.317	0.751	H14 was rejected
G x FS -> CPE	0.050	0.003	-0.138	0.220	0.538	0.590	H15 was rejected
G x FE -> CPE	-0.071	0.005	-0.272	0.113	0.727	0.467	H16 was rejected
G x ME -> CPE	0.212	0.006	0.039	0.392	2.293	0.022	H17 was supported
G x FI -> CPE	-0.151	0.020	-0.298	-0.012	2.037	0.042	H18 was supported
G x ST -> CPE	-0.103	0.008	-0.294	0.104	1.017	0.309	H19 was rejected
G x GR -> CPE	-0.006	0.000	-0.151	0.140	0.078	0.938	H20 was rejected

Note : Effect size $f^2 > 0.02$ = Small, $f^2 > 0.12$ = medium, $f^2 > 0.35$ = large effect size (Cohen, 1988). Moderation effect size: $f^2 > 0.005$ = Small, $f^2 > 0.01$ = medium, $f^2 > 0.025$ = large effect size (J. F. Hair et al., 2021).

Model fit

We assessed the model fit using the Standardized Root Mean Square Residual (SRMR) (Guenther et al., 2023). The constructed model can be considered a good fit, as indicated by an SRMR value below the threshold of 0.080 (J. F. Hair et al., 2022). In other words, the model is consistent with the empirical data, and no misspecification is evident.

The coefficient of determination (R^2) indicates that the exogenous variables in the model explain 13.1% of the variance in children's pro-environmental behavior. On the other hand, the measured exogenous variables account for 6.7% of the variance in children's internet/smartphone addiction. Although the R^2 values are relatively low, a value of 0.1 is still acceptable, particularly in social science research (J. F. Hair et al., 2019). In studies concerning attitudes, behaviors, and human perceptions, high R^2 values may even suggest model overfitting (J. F. Hair et al., 2021). Therefore, the R^2 values in this study adequately support the explanatory power of the model toward the endogenous variables. The overall model quality is presented in Table 4.

Table 4. Model Quality

	R-square	R-square adjusted	SRMR	
			Saturated	Estimated
CPE	0.131	0.064	0.065	0.068
IAD	0.067	0.04		

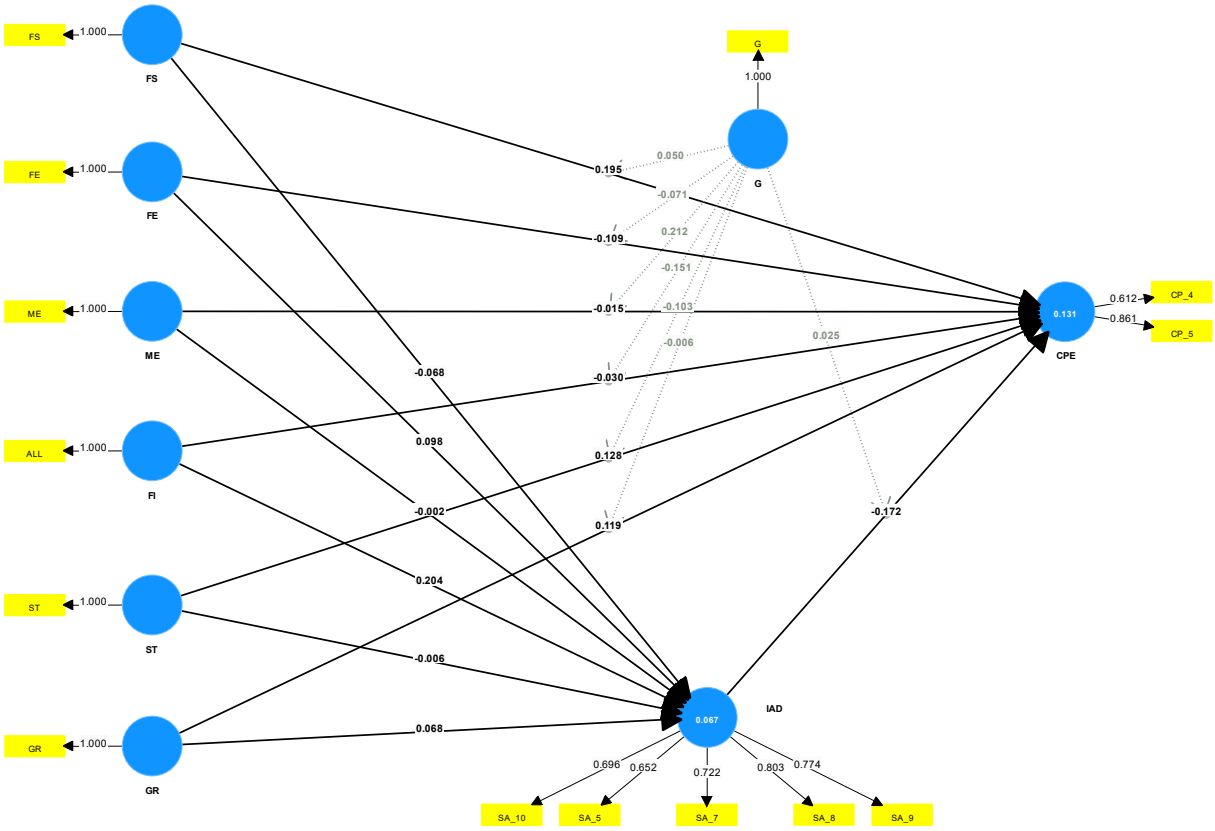

Figure 2. Structural Model

Discussion

This study found a significant effect of economic background on internet addiction. Our findings support previous research suggesting that children from higher-income families are more likely to develop internet addiction (Malak et al., 2017). This may be due to the greater access these families have to internet facilities and smartphones, making it easier for children to engage in frequent internet use. In contrast, our results differ from those of Lee et al., (2022) and Pazarcikci (2024), who found that children from lower-income families are more at risk of internet addiction. Our findings complement earlier studies identifying key factors contributing to internet addiction, such as parental rejection and overprotection (Kong et al., 2025), as well as anxiety (Y. Liu, 2024).

Furthermore, we found that children from two-parent families tend to exhibit more pro-environmental behaviour. Children living with both parents generally receive better parenting, greater emotional well-being (Zehl et al., 2023), closer supervision at home, and tend to perform better academically (Lim, 2024). This aligns with (Marrese et al., 2024), who highlighted the role of family in shaping children's pro-environmental attitudes. Parental pro-environmental values are likely to influence those of their children (Leppänen et al., 2012). as family values have been shown to shape pro-environmental behaviour (Kollmuss & Agyeman, 2002). However, our findings differ from Parth (2024) who argued that single mothers often encourage efficient behaviour due to limited income.

Our study also demonstrates that children addicted to the internet tend to exhibit less pro-environmental behaviour. These students often show little concern for anything beyond their smartphones. This finding extends previous research on the negative effects of internet addiction, which has been linked to reduced self-control and diminished social

interaction among children (Matsunaga et al., 2023), as well as self-injury (Wang et al., 2025) and suicidal tendencies (S. Li et al., 2025).

Lastly, Islamic education in this study was not found to significantly reduce internet addiction or enhance pro-environmental behaviour. Theoretically, Islamic education should help mitigate internet addiction and foster environmental responsibility, as it incorporates Islamic values in its curriculum. However, religious education in state-influenced systems may reduce religiosity and religious action (Masuda & Yudhistira, 2020).

This indicates persistent challenges in the implementation of Islamic education, particularly in integrating pro-environmental values into the curriculum in a meaningful and actionable way. Key supporting factors such as the role of schools, students' intrinsic motivation, and parental involvement are crucial in shaping educational outcomes (Bamrara & Bamrara, 2024). By integrating environmental education into existing subjects, schools can promote interdisciplinary learning and nurture students as responsible, environmentally conscious decision-makers—an outcome that may positively influence broader societal attitudes and behaviors toward environmental sustainability (Yarkandi, 2012).

Conclusion

This study found that family economic status and family structure have a significant and positive influence on children's internet addiction. Students from affluent families and two-parent families present are more likely to develop smartphone/internet addiction. On the other hand, we found that internet addiction has a significant and negative effect on students' pro-environmental behavior. This indicates that students addicted to smartphones are less likely to engage in pro-environmental behaviors. The findings also showed that maternal education had a greater impact on shaping pro-environmental behaviour among male students, while family economic status played a more influential role in shaping such behaviour among female students.. Furthermore, Islamic education was found to have no significant effect on internet addiction or pro-environmental behavior.

Our study makes a theoretical contribution to the literature on primary education, particularly in relation to internet addiction and pro-environmental behavior. It demonstrates that Islamic primary education has no significant impact on students' pro-environmental behavior. This finding has practical implications for Islamic education stakeholders. We recommend that policymakers, school administrators, and curriculum developers place greater emphasis on digital citizenship and pro-environmental behavior as explicit components of the curriculum and teaching processes.

Nevertheless, this study has several limitations. First, the use of convenience sampling may introduce bias and limits the generalizability of our findings. Additionally, the study was conducted in a limited geographical area. Second, the study assessed a narrow range of exogenous variables. We did not examine other potentially influential factors, such as parenting style or the learning context in schools.

Therefore, future studies could employ probability sampling techniques across broader regions, for instance, at the national level, to enhance the generalizability of the findings. We also recommend that future studies explore additional variables that may influence students' pro-environmental behavior, such as parenting style, the quality of instruction, and other relevant factors.

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