



Digital Focus Distortion: Association of Phubbing Perpetrator and Victim Behaviors with High School Students' Physics Scores

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Received: September 2026; Revised: September 2026; Published: October 2026

Abstract

Phubbing may be associated with students' academic experiences through two distinct roles: engaging in phone-focused behavior while interacting with others and experiencing being ignored because another person is focused on a phone. This study examined the association of these roles with documented physics grades in two separate groups of high school students. The sample comprised 200 students: 74 classified in the phubbing-perpetrator group and 126 classified in the phubbing-victim group. Pearson correlation and separate simple linear regression analyses were used for the two groups. The reported analyses showed negative associations between perpetrator phubbing and physics grades ($r = -0.805$, $p < 0.001$) and between victimization by phubbing and physics grades ($r = -0.958$, $p < 0.001$). The corresponding squared correlations are 64.8% and 91.8%, respectively, provided that the reported correlations are verified against the original statistical output. Because the groups were mutually exclusive, the results describe separate subgroup associations and do not establish the independent effects of both roles in a joint model. The findings should be interpreted as associations rather than causal effects.

Keywords: Phubbing; Phubbing perpetration; Phubbing victimization; Physics achievement; High school students

How to Cite: Rachmitasari, B., Habibi, H., & Rizki, I. A. (2026). Digital Focus Distortion: Association of Phubbing Perpetrator and Victim Behaviors with High School Students' Physics Scores. *Prisma Sains: Jurnal Pengkajian Ilmu Dan Pembelajaran Matematika Dan IPA IKIP Mataram*, 14(4), 2462–2474. <https://doi.org/10.33394/j-ps.v14i4.22761>



<https://doi.org/10.33394/j-ps.v14i4.22761>

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INTRODUCTION

Physics education at the secondary level requires higher-order cognitive abilities, logical reasoning, and an understanding of concepts that are both abstract and cumulative. In today's digital era, the integration of technology into the classroom provides broad access to information and a wide range of learning resources (Gerosa et al., 2021; Kalyani, 2024). However, the pervasive presence of smartphones in students' daily lives presents a difficulties that has become increasingly relevant in contemporary education: challenges for school administration and teaching practices (Durnali, 2025). In this context, physics instruction should promote sustained cognitive engagement while addressing this challenge (Al-Kamzari, F., & Alias, N. 2025).

One potential consequence of excessive smartphone use is the emergence of a social phenomenon known as "phubbing" (phone snubbing). Phubbing refers to the act of ignoring face-to-face interactions with others in one's physical environment because one's attention is focused on a device screen (Avgustis, 2023; Sunday et al., 2021). In an educational context, students may be involved as victims when teachers or parents ignore them because of device use, or as perpetrators when they neglect learning interactions to check notifications, browse social media, or play games (Pranoto & Walisyah, 2023). This distinction highlights that

phubbing can occur in both directions and may affect the quality of student engagement in the learning process (Kobicheva et al., 2024).

Previous research has indicated that excessive device use is a significant issue affecting learning activities. A study involving 3,302 adolescents found that 54% exhibited device addiction, indicating a high level of uncontrolled device use (Mauceri & Censi, 2026). Another study involving secondary school students reported that 22.2% experienced difficulties in face-to-face interactions associated with device use (Rękas, M., & Burzyńska, J. 2024). These findings indicate that uncontrolled device use is related not only to usage patterns but also to social interactions and student engagement in academic activities (Daniele & Corrado, 2022; Dvořáková et al., 2023).

This phenomenon can also be understood through Cognitive Load Theory, which emphasizes the limited capacity of working memory to process new information. Consequently, physics learning, which requires mathematical derivations and an understanding of physical phenomena, is highly sensitive to students' concentration levels (Sweller, J. 2011; Zeng et al., 2026). When students engage in "phubbing," such as secretly checking their phones while a teacher explains Newton's laws, divided attention may occur; this fragmentation of focus can hinder conceptual reasoning and may be associated with learning outcomes (He et al., 2022). Conversely, when students are victims of phubbing by their parents at home, the resulting reduction in support and learning interaction can impede the clarification of concepts and the consolidation of understanding of complex physics topics (Wang et al., 2022).

Despite growing research on phubbing and educational outcomes, a gap remains in understanding its relationship with subject-specific academic performance among high school students. Previous studies have linked phubbing to academic engagement, performance-related variables, and learning burnout (He et al., 2022; Kobicheva et al., 2025), but the separate associations of phubbing-perpetrator behavior and phubbing-victim experiences with physics grades remain underexplored. Furthermore, previous research has not specifically investigated phubbing in physics learning. This distinction matters because perpetrating and experiencing phubbing represent different interpersonal experiences, while academic engagement, learning burnout, and overall academic performance are not equivalent to physics grades. Therefore, examining both phubbing roles in relation to physics grades may provide a more specific understanding of their association with academic outcomes in physics education.

To address this gap, the present study examines the associations between phubbing and physics grades through separate analyses of two groups: students classified as phubbing perpetrators and students classified as phubbing victims. The study's contribution lies in distinguishing these two interpersonal roles and examining their respective associations with a subject-specific academic outcome among high school students. By analyzing each group separately, this study provides a focused account of the relationship between phubbing roles and physics grades without assuming that the two roles are measured in the same students or that either role causes changes in academic performance. Accordingly, the study aims to examine the association between phubbing-perpetrator behavior and physics grades in the perpetrator group and the association between phubbing-victim experiences and physics grades in the victim group.

METHOD

Research Design

This study employed a quantitative correlational design to examine the associations between phubbing and documented physics grades among high school students. A correlational approach was used to investigate relationships between the study variables without manipulating participants' behavior (Creswell & Guetterman, 2024). The analysis focused on two groups of students: those classified as phubbing perpetrators and those classified as phubbing victims. The perpetrator and victim questionnaires were analyzed separately within their respective groups, and the corresponding questionnaire scores were related to students'

documented physics grades. Because the two phubbing measures were analyzed in separate groups rather than as variables measured across a common sample, a simple linear regression model containing both measures was not used. As the study employed an observational design, the findings were interpreted as associations rather than causal effects.

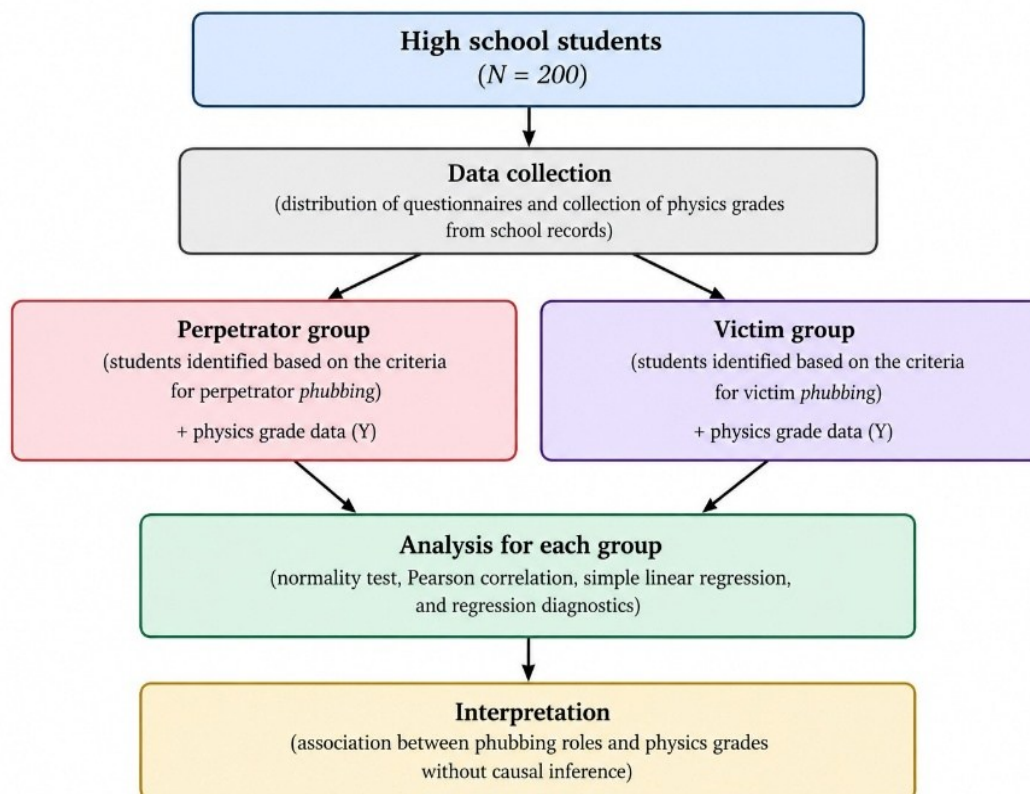


Figure 1. Research Flow (Source: adapted for Gao, W. et al., 2025)

Population and Samples

The study involved 200 high school students selected through purposive sampling. The participants were classified into two separate groups based on their roles in phubbing behavior: phubbing perpetrators and phubbing victims. The perpetrator group comprised students who engaged in phubbing behavior, whereas the victim group comprised students who experienced being ignored by others due to smartphone use. Data analyses were conducted separately for each group to examine the association between phubbing behavior, as a perpetrator or a victim, and students' physics grades (Kaya et al., 2025). The two groups were treated as distinct analytical groups, with the classification criteria determined according to the phubbing measures used in the study.

Ethical Considerations and Data Confidentiality

This study involved high school students; therefore, school authorization and parental consent and student assent were obtained where applicable. Students' physics grades and questionnaire responses were handled confidentially and stored securely, with authorization to link the two data sources. Identifying information was excluded from the analytical dataset to protect participants' privacy. Access to the data was restricted to authorized researchers. Anonymized data or a controlled audit procedure may be made available, subject to ethical and legal requirements, to facilitate verification of the reported statistical results without disclosing participants' identities.

Sample Collection Techniques

The study used phubbing-perpetrator and phubbing-victim questionnaires with Likert-type response formats, together with documented school physics grades. The perpetrator

questionnaire was used for students classified in the perpetrator group, whereas the victim questionnaire was used for students classified in the victim group. This distinction is consistent with research that treats phubbing and the experience of being phubbed as related but distinct interpersonal roles (Barbed-Castrejón et al., 2024; Kaya et al., 2025). Physics grades were obtained from school assessment records rather than from a researcher-developed physics grade.

For reproducibility, the manuscript should identify the original source of each questionnaire, its items and response options, score ranges and directions, and any reverse-coded items. Information about language adaptation, instrument validation, pilot testing, and reliability estimates should also be reported where applicable. In addition, the manuscript should specify the school assessment period, the maximum possible grade, and the procedure used to match questionnaire responses with students' physics-grade records. These details should be confirmed using the original instruments and research records rather than inferred.

Data Analysis

The data were analyzed using SPSS. Descriptive statistics were used to summarize the study variables. The Kolmogorov–Smirnov test was used to assess the distribution of the phubbing questionnaire scores. Pearson correlation analyses were conducted to examine the direction and strength of the association between the relevant questionnaire scores and physics grades within each group. Separate simple linear regression analyses were then performed for the two groups to examine the corresponding statistical relationships. The significance threshold was set at $\alpha = 0.05$.

Table 1. Interpretation of Normality Test

Sig. Value	Interpretation
> 0.05	Normally Distributed
< 0.05	Not Normally Distributed

(Midway, S., & White, J. W. 2025)

The relationship between phubbers, phubbing victims, and physics scores was analyzed using Pearson's correlation with the following equation:

$$r_{xy} = \frac{n \sum XY - (\sum X)(\sum Y)}{\sqrt{(n \sum x^2 - (\sum X)^2)(n \sum y^2 - (\sum Y)^2)}} \quad \dots (3)$$

The correlation coefficient (r) obtained was then interpreted based on the strength and direction of the relationship between variables. The criteria for interpreting the correlation coefficient used in this study are presented in the Table 2.

Table 2. Interpretation of Correlation Coefficient Values (r)

Correlation Interval (r)	Interpretation
0.00-0.199	Very Low
0.20-0.399	Low
0.40-0.599	Moderate
0.60-0.799	Strong
0.80-1.00	Very strong

(Wang, X., et al., 2023)

Because the two phubbing measures were analyzed in separate groups, a simultaneous simple linear regression model was not fitted. Instead, separate simple linear regression models were used to examine the association between each group's phubbing scores and documented physics grades. For each model, the regression slope test assessed whether the linear association between phubbing scores and physics grades was statistically different from zero. These separate models did not estimate mutually adjusted effects of the two phubbing measures.

$$Y = a + b_1X_1 + b_2X_2 + e \quad \dots (2)$$

The values obtained from the simple linear tests were then interpreted based on the strength and direction of the relationship between variables. The interpretation criteria used in this study are presented in the Table 3.

Table 3. Interpretation of the Simple Linear Test

Sig. Value	Interpretation
< 0.05	Significant
Calculated t > Table t	Significant

(Hair, Jr., & Joseph, F. 2014)

The coefficient of determination (R^2) was calculated as the square of the Pearson correlation for each separate bivariate relationship. It represents the proportion of variation in physics grades statistically associated with the corresponding phubbing score in that subgroup; it is not a causal contribution or a unique contribution adjusted for other variables. All tests used a significance level of $\alpha = 0.05$.

Table 4. Interpretation of the Determination Coefficient (R^2)

R^2 Value	Interpretation
≥ 0.75	Strong
≥ 0.50	Moderate
≥ 0.25	Weak

(Hair, Jr., & Joseph, F. 2014)

For each group, R^2 indicates the proportion of variation in physics grades explained by the corresponding phubbing score in the regression model. A higher R^2 value indicates that the phubbing score accounts for a larger proportion of the differences in physics grades among students in that group.

RESULTS AND DISCUSSION

The analysis examined the associations between phubbing and documented physics grades in two separate groups: phubbing perpetrators and phubbing victims. The results are presented separately for each group, including the normality test, Pearson correlation, and simple linear regression analyses.

Normality Test

A normality test was conducted to ensure that the data met the assumptions of parametric analysis used in the subsequent stages. The test was performed using the Kolmogorov–Smirnov test. The data were deemed to be normally distributed if the significance value was greater than 0.05.

Table 5. Normality Test Results

Variables	N	KS Statistics	Sig.	Interpretation
Perpetrator of Phubbing (X1)	74	0.121	0.058	Normally Distributed
Victim of Phubbing (X2)	126	0.168	0.055	Normally Distributed

The test results show that all variables meet the assumption of normality. This indicates that the data distribution does not deviate significantly from a normal distribution, so parametric analysis can proceed to identify relationships among the study variables.

Pearson Correlation Test

After the assumption of normality was met, the analysis continued using Pearson's correlation. This analysis was used to determine the relationship between the perpetrator of phubbing, the victim of phubbing, and physics scores. The results of the correlation analysis are presented in Table 6.

Table 6. Pearson Correlation Results

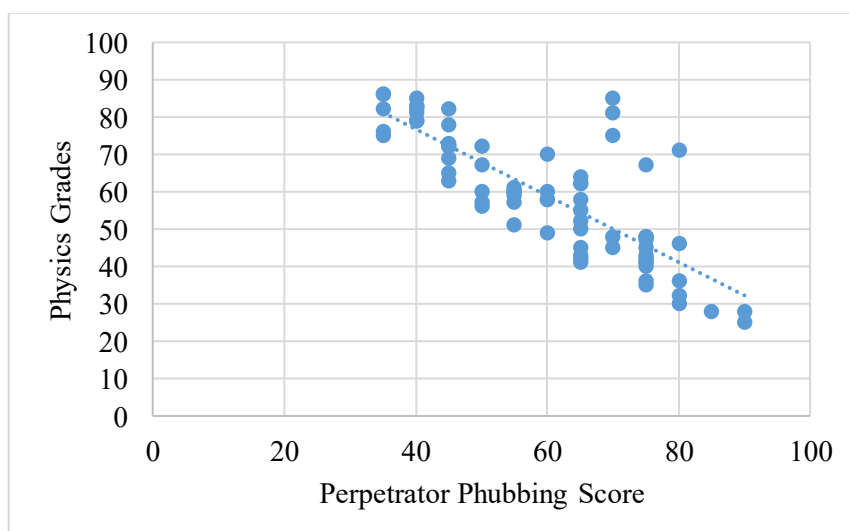
Variable Relationship	Pearson's r	Sig.	Interpretation
(X1-Y)	-0.805	0,000	Very strong
(X2-Y)	-0.958	0,000	Very strong

The research results indicate a very strong negative relationship between being a perpetrator of phubbing and students' physics grades. These findings suggest that students' engagement in using mobile devices while interacting is associated with lower academic achievement. This may occur because students' attention is divided between learning activities and device-related activities, resulting in less-than-optimal engagement in receiving and processing physics information. This finding aligns with Parmaksız (2023), who demonstrated that phubbing is linked to students' academic behavior through its association with academic procrastination and academic self-efficacy.

A very strong negative relationship was also found between being a victim of phubbing and physics grades. These results indicate that students who experience being ignored due to device use also exhibit a link to lower physics grades. In learning situations, disruptions to interaction can reduce students' opportunities to receive explanations, engage in discussions, or get feedback when they struggle to understand the material. These findings align with those of Wang et al. (2023), who found that parental phubbing is associated with problematic smartphone use and learning burnout among adolescents.

The results of the analysis show that perpetrators of phubbing and victims of phubbing contribute to variations in physics scores to different degrees. The contribution of victims of phubbing falls into a higher category than that of perpetrators of phubbing; thus, the experience of being ignored is more strongly associated with physics achievement in this study's data. This difference indicates that the impact of phubbing in a learning context is not only related to device usage behavior but also to the quality of interactions students receive. Therefore, these two roles must be considered separately when examining the relationship between phubbing and academic achievement.

To visually examine the relationship between perpetrator phubbing and students' physics grades, a scatter plot was constructed by plotting perpetrator phubbing scores against physics grades. The distribution of the data points provides an overview of the direction and linearity of the relationship between the two variables, as presented in Figure 2.

**Figure 2.** Scatter Plot of the Relationship Between Perpetrator Phubbing and Physics Grades

As shown in Figure 2, the data points generally exhibit a downward trend, indicating a negative relationship between perpetrator phubbing scores and students' physics grades. This pattern suggests that higher perpetrator phubbing scores tend to be associated with lower physics grades. The visual pattern is consistent with the reported correlation coefficient of ($r=-$

0.805), which indicates a strong negative association. However, this relationship does not establish that perpetrator phubbing directly causes a decrease in physics grades.

A similar analysis was conducted to examine the relationship between victim phubbing scores and students' physics grades. The scatter plot was used to observe the distribution of data points and identify the direction and apparent linearity of the relationship between victim phubbing scores and physics grades, as shown in Figure 3.

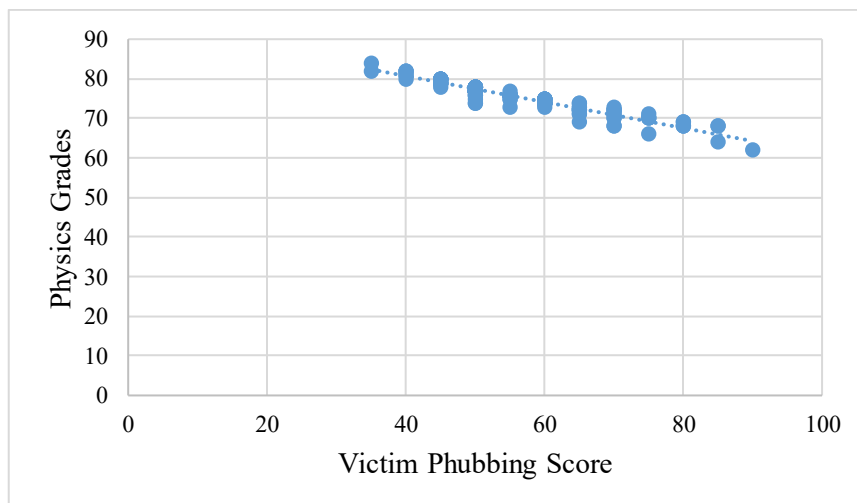


Figure 3. Scatter Plot of the Relationship Between Victim Phubbing and Students' Physics Grades.

Figure 3 shows a clear downward pattern in the distribution of data points, suggesting a negative relationship between victim phubbing scores and students' physics grades. Higher victim phubbing scores tend to correspond to lower physics grades. This visual pattern is consistent with the reported correlation coefficient of ($r=-0.958$), indicating a very strong negative association. Nevertheless, the scatter plot illustrates an association rather than a causal effect, and the interpretation should be considered alongside the results of the statistical analysis.

Simple Linear Regression Test

A simple linear regression test was conducted to determine the direction and significance of the relationship between each form of phubbing behavior namely, perpetrator of phubbing and victim of phubbing and students' physics learning outcomes. This analysis was used to examine changes in learning outcome scores associated with changes in each phubbing variable. The results of the simple linear regression analysis are presented in Table 7.

Table 7. Results of the Simple Linear Regression Test

Variable	B	β	Calculated t-value	Sig.	Interpretation
Phubbing Perpetrator (X1) - Y	-0.890	-0,805	-11.507	0.000	Significant
Victim of Phubbing (X2) - Y	-0.330	-0,962	-39.142	0.000	Significant

The results of the simple linear regression test in Table 7 show that “perpetrator of phubbing” (X1) and “victim of phubbing” (X2) have a negative and significant relationship with physics learning outcomes. The “phubbing perpetrator” variable has a regression coefficient of -0.890 with a calculated t-value of -11.507 and a significance level of 0.000 ($p < 0.001$). These values indicate that an increase in the “phubbing perpetrator” score is followed by a decrease in physics learning outcomes. Thus, the higher the students' tendency to engage in phubbing, the lower their predicted physics learning outcomes scores.

For the “victim of phubbing” variable, a regression coefficient of -0.330 was obtained, with a calculated t-value of -39.142 and a significance level of 0.000 ($p < 0.001$). A negative

coefficient indicates an inverse relationship between the experience of being a victim of phubbing and physics learning outcomes. This means that an increase in students' experiences as victims of phubbing is associated with a decrease in physics learning outcomes. A significance level of less than 0.05 indicates that this relationship is statistically significant.

Conceptually, these two findings indicate that phubbing is not only related to students' behavior of diverting their attention to digital devices, but also to situations in which students are distracted by others' use of digital devices. In the context of physics learning, this situation has the potential to reduce students' engagement in the learning process, particularly because understanding physics concepts requires sustained attention, information processing, and active participation in following explanations and solving problems. Therefore, the negative relationship found may indicate that the greater the exposure to phubbing behavior, the higher the likelihood that students' engagement in academic activities will be disrupted.

Coefficient of Determination (R^2)

The coefficient of determination is used to determine the extent of variation in physical performance that can be explained by each phubbing variable. The analysis was conducted on both the perpetrators and victims of phubbing to examine the differences in their contributions to physical performance. The results of the coefficient of determination analysis are presented in Table 8.

Table 8. Coefficient of Determination (R^2)

Variable Relationship	R	R^2	Contribution	Interpretation
(X1-Y)	0.805	0.648	64.8%	Moderate
(X2-Y)	0.958	0.918	91.8%	Strong

The analysis results show that both variables contribute to the variation in physics scores to different degrees. The contribution of being a victim of phubbing is greater than that of being a perpetrator of phubbing, indicating that students' experiences as victims of phubbing are more strongly associated with variations in physics scores than their tendency to be perpetrators. Nevertheless, both variables explain only a portion of the variation in physics scores, suggesting that other factors beyond the study's variables are also associated with students' academic achievement.

The relationship found is significant when considered in light of the characteristics of physics learning, which require attention, conceptual understanding, and engagement in problem-solving. Distractions or disruptions to interaction can cause students to miss crucial parts of the learning process, especially when the material requires step-by-step reasoning. The use of devices unrelated to learning can increase the likelihood of distraction during the learning process. Therefore, the phenomenon of "phubbing" should be viewed not only as a social communication issue but also as a condition related to students' learning processes.

In physics learning, topics that require sustained attention and step-by-step reasoning, such as sound waves, Newton's laws, electrodynamics, and electromagnetic induction, can provide contexts in which phubbing may interfere with students' concentration. These topics require students to understand concepts while following several stages of problem-solving, as illustrated by the electromagnetic induction equation:

$$\varepsilon = -N \frac{\Delta\Phi}{\Delta t} \quad \dots (1)$$

Where:

ε = induced electromotive force (V)

N = number of coil turns

$\Delta\Phi$ = change in magnetic flux (Wb)

Δt = time interval (s)

The equation requires students to accurately relate changes in magnetic flux, magnetic field, coil area, number of turns, and time. When students' attention is diverted by smartphones,

they may miss explanations or calculation steps needed to solve physics problems comprehensively.

The magnitude of the contribution found indicates that phubbing behavior has a statistically significant association with variations in physics scores in the study sample. However, these results do not suggest that physics achievement is determined solely by phubbing behavior, as there are other variations not explained by the research model. Academic achievement can be related to various factors such as prior knowledge, motivation, learning strategies, engagement during instruction, and the learning environment. Therefore, the research findings should be understood as a statistical relationship between phubbing and physics grades within the context of the students studied, rather than as a cause-and-effect relationship.



Figure 2. Students' Positions in the Phubbing Phenomenon (Source: adapted for Avgustis, I. 2023)

The findings of this study are consistent with previous research linking phubbing to academic-related outcomes. Parmaksız (2023) examined the relationship between phubbing and academic procrastination, whereas Wang et al. (2023) investigated its association with learning burnout among adolescents. However, these outcomes differ from subject-specific academic achievement, particularly in physics. Learning physics involves sustained attention, conceptual understanding, mathematical interpretation, and step-by-step problem-solving. Difficulties in maintaining attention or participating in learning interactions may therefore be relevant when examining students' physics grades. This provides a rationale for investigating phubbing in relation to achievement in a specific subject rather than relying solely on general academic indicators.

The relationship between phubbing and physics grades should be interpreted with caution because several potential confounding factors were not controlled, including prior physics achievement, motivation, attendance, socioeconomic status, classroom smartphone policies, study habits, and teacher differences. Therefore, the observed correlations do not establish that phubbing causes lower physics grades or that being a phubbing victim uniquely explains 91,8% of the variance in physics grades. The magnitude of this statistical association also warrants careful interpretation, considering potential measurement artifacts and the characteristics of the instruments used. Furthermore, mechanisms such as divided attention and disrupted social interactions are theoretically plausible explanations but were not directly tested in this study. Accordingly, the findings should be interpreted in terms of the observed statistical associations rather than as evidence of causal relationships or verified underlying mechanisms.

The novelty of this study lies in examining the associations of two distinct phubbing roles, perpetrators and victims, with documented physics grades among high school students, an area that has received limited attention in previous research on physics learning. Examining these roles separately provides a more differentiated perspective on their relationship with subject-specific academic performance. Students who engage in phubbing may divide their attention between face-to-face interactions and smartphone activities, whereas those who experience phubbing may face disruptions in social interaction that limit opportunities to exchange ideas and receive feedback. These differences suggest that the two roles may be associated with physics achievement through distinct pathways, although the proposed

explanations remain tentative because the underlying mechanisms were not directly measured. Accordingly, the findings identify associations rather than causal effects of phubbing on physics grades.

At the same time, the relationship identified in this study should not be interpreted as evidence that smartphone use is inherently detrimental to physics learning. When integrated appropriately into instructional activities, smartphones can provide access to learning resources, educational applications, and experimental tools that support the observation of physical phenomena, data analysis, and connections between theoretical concepts and real-world situations (Carreño et al., 2022; Kalyani, 2024). The distinction between phubbing and purposeful educational technology use is therefore important. While phubbing involves smartphone-focused behavior that may interfere with interpersonal interaction, educational use can support learning when aligned with instructional objectives. From this perspective, the findings highlight the importance of considering not only whether students use smartphones but also the context in which they use them when examining the relationship between digital behavior and physics achievement.

CONCLUSION

This study revealed very strong negative correlations between perpetrator phubbing and students' physics grades ($r = -0.805$, $p < 0.001$), as well as between victim phubbing and physics grades ($r = -0.958$, $p < 0.001$). The corresponding coefficients of determination were 64.8% for perpetrator phubbing and 91.8% for victim phubbing, indicating that victim phubbing had a stronger statistical association with variations in physics grades in this study. These findings highlight the relevance of students' smartphone use and the quality of their social interactions in the context of physics learning. Teachers and parents may therefore encourage responsible smartphone use and foster supportive learning environments that promote students' concentration and engagement. The findings should be interpreted as statistical associations rather than evidence of a direct causal effect, while recognizing that students' academic performance may also be related to other educational and social factors.

RECOMMENDATION

This study has limitations. It used a correlational design and separate mutually exclusive groups, so it cannot establish causal relationships or estimate mutually adjusted associations between perpetrator and victim roles. The analysis did not report controls for prior physics achievement, motivation, attendance, study habits, family support, classroom phone rules, or school and teacher differences. The measures were based on questionnaires and documented school grades, and the results depend on the properties and comparability of those measures. Future research should document measurement procedures in detail, assess relevant confounders, and use designs that allow direct testing of proposed mechanisms.

ACKNOWLEDGMENTS

The authors would like to express their sincere gratitude to their advisors for their guidance, direction, and valuable constructive feedback during the preparation and completion of this study. The authors would also like to thank the physics teachers and students who participated in this study for their cooperation and contributions to the data collection process, as well as Surabaya State University for the academic support provided throughout the completion of this study.

FUNDING INFORMATION

This research received no external funding.

AUTHOR CONTRIBUTIONS STATEMENT

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
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Iqbal Ainur Rizki	✓		✓	✓			✓			✓	✓		✓	✓

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the research, analysis, or reporting of this study on the associations between phubbing perpetration, phubbing victimization, and physics grades among high school students. The study was conducted independently, and no competing interests are known to have influenced the findings or their interpretation. The authors therefore declare no conflict of interest.

ETHICAL APPROVAL

The research involving human participants was conducted in accordance with applicable national regulations and institutional policies governing research ethics. The study involved high school students, and appropriate measures were taken to protect participants' confidentiality and privacy, particularly regarding questionnaire responses and physics grades. Permission to conduct the research was obtained from the relevant school authorities, and parental consent and student assent were obtained where required.

DATA AVAILABILITY

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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