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SEM Model to Assess the Impact of Mobile Gaming on Islamic Education Learning

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ABSTRACT

This study examines the impact of mobile gaming on Islamic Religious Education (Indonesian: PAI) learning outcomes using Structural Equation Modeling (SEM). Conducted at Madrasah Aliyah Negeri (MAN) 1 Tulungagung, the research utilized surveys and documentation for data collection. Analysis, carried out with JASP software, began with Explanatory Factor Analysis (EFA) to uncover data structures, followed by Confirmatory Factor Analysis (CFA) to validate these structures. The findings indicate that excessive mobile gaming negatively affects PAI learning outcomes, whereas positive perceptions of gaming are associated with improved academic performance. The SEM analysis reveals intricate relationships among gaming activity, student perceptions, and learning outcomes, suggesting that while gaming can boost engagement, it may also hinder academic focus if not managed appropriately. The study further explores how motivation and engagement with specific game genres—such as MOBA, Battle Royale, and RPG—might differentially influence PAI learning outcomes. However, the current SEM analysis does not directly address these genre-specific effects, highlighting the need for additional research. In conclusion, the study emphasizes the necessity of balanced integration of mobile gaming in educational contexts and provides practical recommendations for educators and policymakers to navigate these challenges effectively.

Keywords: *mobile gaming, islamic religious education, structural equation modeling, learning outcomes.*

INTRODUCTION

The growing popularity of mobile gaming among Indonesian students can be attributed to several interrelated factors. Firstly, mobile games serve as an effective medium for education and socialization, addressing issues such as promiscuity and unhealthy associations among teenagers by promoting healthy interactions and decision-making skills, as seen in the design of the game Teen Society.[1] Additionally, the acceptance and intention to use mobile learning systems, which often include educational games, are significantly influenced by factors such as performance expectancy, effort expectancy, external influence, quality of services, and individual innovativeness.[2] The Push-Pull-Mooring (PPM) framework further highlights that learning convenience, autonomy, enjoyment, and student innovativeness are critical in students' decision to adopt mobile learning platforms, which often incorporate gaming elements.[3] Moreover, a survey comparing university and high school students' preferences revealed that a significant majority believe in the utility of games for training purposes, particularly in disaster response scenarios, indicating a broader acceptance of games beyond mere entertainment.[4] Finally, the Technology Acceptance Model (TAM) applied to middle and high school students shows that perceived enjoyment and social influence are more influential than perceived usefulness in the acceptance of mobile learning, which includes gaming. This suggests that the social and enjoyable aspects of mobile games are particularly appealing to adolescents, with variations in acceptance influenced by sex, age, and location.[5] Collectively, these factors underscore the multifaceted appeal of mobile gaming, combining educational benefits, social influence, and intrinsic enjoyment, thereby driving its popularity among Indonesian students. This trend raises concerns about its potential impact on various aspects of students' academic performance, including Islamic Religious Education (PAI). PAI is a crucial subject in the Indonesian educational system, focusing on religious knowledge and moral values, which are essential for students' character development.[6,7,8] However,

[1] Enggar Dwi Utami, Hendra Prasetya, and Erdhi Widyarto Nugroho, "Design of Healthy Youth Edition Teens Based Game," *SISFORMA* 7, no. 2 (November 23, 2020): 64–69, https://doi.org/10.24167/sisforma.v7i2.1395.

[2] Darlan Sidik and Faisal Syafar, "Exploring the Factors Influencing Student's Intention to Use Mobile Learning in Indonesia Higher Education," *Education and Information Technologies* 25, no. 6 (November 2020): 4781–96, https://doi.org/10.1007/s10639-019-10018-0.

[3] Lisana Lisana, "Factors Affecting University Students Switching Intention to Mobile Learning: A Push-Pull-Mooring Theory Perspective," *Education and Information Technologies* 28, no. 5 (May 2023): 5341–61, https://doi.org/10.1007/s10639-022-11410-z.

[4] Didin Wahyudin, Shinobu Hasegawa, and Apep Kamaludin, "Students' Viewpoint of Computer Game for Training in Indonesian Universities and High Schools," *Education and Information Technologies* 22, no. 4 (July 2017): 1927–45, https://doi.org/10.1007/s10639-016-9522-9.

[5] Ahmad R. Pratama, "Fun First, Useful Later: Mobile Learning Acceptance among Secondary School Students in Indonesia," *Education and Information Technologies* 26, no. 2 (March 2021): 1737–53, https://doi.org/10.1007/s10639-020-10334-w.

[6] Abdul Rozak, "IMPLEMENTASI PENDIDIKAN AGAMA ISLAM SEBAGAI PILAR PENTING DALAM PEMBANGUNAN KARAKTER," *Karimiyah* 4, no. 1 (June 4, 2024): 15–32, https://doi.org/10.59623/karimiyah.v4i1.50.

[7] Salis Irvan Fuadi and Robingun Suyud Elsyam, "The Centrality of the Role of PAI Teachers in Multicultural Education Practices in Wonosobo Regency Public Schools," *Jurnal Progress: Wahana Kreativitas Dan Intelektualitas* 12, no. 1 (June 10, 2024): 57, https://doi.org/10.31942/pgrs.v12i1.10244.

there is limited research examining how mobile gaming specifically affects learning outcomes in PAI.

While existing studies often focus on general academic subjects,[9,10] they rarely address the implications of mobile gaming for religious education. Additionally, previous research typically uses basic correlational methods that may not capture the complexities of this relationship.[11,12,13] This study aims to bridge this gap by using advanced techniques such as Structural Equation Modeling (SEM) to analyze the impact of mobile gaming on PAI outcomes at Madrasah Aliyah Negeri (MAN) 1 Tulungagung. By providing insights into this interaction, the research seeks to inform educational strategies and policies regarding the integration of technology in religious education.

The rapid proliferation of mobile gaming among students has raised concerns about its potential impact on academic performance,[14] particularly in specialized subjects such as Islamic Religious Education (PAI).[15] Despite the extensive research on mobile gaming's effects on general academic subjects like mathematics and science, there is a noticeable lack of studies focused on how these games influence outcomes in PAI. Given the unique nature of PAI, which involves the teaching of religious knowledge and ethical values, understanding the specific effects of mobile gaming on this subject is crucial.[16,17] Additionally, most existing

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[8] Hafizul Husni, "Dampak Pendidikan Agama Islam (PAI) Terhadap Pengembangan Moral Pada Siswa Muslim," *Jurnal Alwatzikhoebillah : Kajian Islam, Pendidikan, Ekonomi, Humaniora* 10, no. 2 (April 28, 2024): 261–71, https://doi.org/10.37567/alwatzikhoebillah.v10i2.2757.

[9] Deri Indrahadi and Amika Wardana, "The Impact of Sociodemographic Factors on Academic Achievements among High School Students in Indonesia," *International Journal of Evaluation and Research in Education (IJERE)* 9, no. 4 (December 1, 2020): 1114, https://doi.org/10.11591/ijere.v9i4.20572.

[10] S. Suyanto et al., "Empowering High School Students with Online Game Literacy," *Journal of Community Service and Empowerment* 5, no. 1 (February 21, 2024): 130–35, https://doi.org/10.22219/jcse.v5i1.29222.

[11] Yi-Shiuan Chou et al., "Designing Cognitive-Based Game Mechanisms for Mobile Educational Games to Promote Cognitive Thinking: An Analysis of Flow State and Game-Based Learning Behavioral Patterns," *Interactive Learning Environments* 31, no. 5 (July 4, 2023): 3285–3302, https://doi.org/10.1080/10494820.2021.1926287.

[12] Birgit Schmitz, Roland Klemke, and Marcus Specht, "Mobile Gaming Patterns and Their Impact on Learning Outcomes: A Literature Review," in *21st Century Learning for 21st Century Skills*, ed. Andrew Ravenscroft et al., vol. 7563, Lecture Notes in Computer Science (Berlin, Heidelberg: Springer Berlin Heidelberg, 2012), 419–24, https://doi.org/10.1007/978-3-642-33263-0_37.

[13] Tsung Yen Chuang and Sheng Hsiung Su, "Using Mobile Console Games for Multiple Intelligences and Education," *International Journal of Mobile Learning and Organisation* 6, no. 3/4 (2012): 204, https://doi.org/10.1504/IJMLO.2012.050047.

[14] Penghui Wang, "Analysis on Advantages and Disadvantages of Playing Mobile Games among Colleges Students," *Journal of Higher Education Research* 3, no. 1 (February 13, 2022): 29, https://doi.org/10.32629/jher.v3i1.633.

[15] Ikhsan Rifai and Nurhaliza, "The Effect of Using Ankidroid on Cognitive Learning Outcomes of Islamic Religious Education," *Eduscape : Journal of Education Insight* 2, no. 1 (January 13, 2024): 37–47, https://doi.org/10.61978/eduscape.v2i1.164.

[16] Ridaul Maghfiroh et al., "Pengembangan Media Pembelajaran PAI Dan Budi Pekerti Berbasis Powtoon Materi Kejujuran Kelas 2 SD," *Al-Ishlah: Jurnal Pendidikan Islam* 21, no. 1 (July 2, 2023): 23–35, https://doi.org/10.35905/alishlah.v21i1.5583.

[17] Nicolas Lim Ming Jian, Chit Su Mon, and Kasthuri Subaramaniam, "Adoption of Mobile Technology in Teaching Moral Values to Children: A Study in Malaysia," in *2020 IEEE 10th Symposium on Computer Applications & Industrial Electronics (ISCAIE)* (2020 IEEE 10th Symposium on Computer Applications & Industrial Electronics (ISCAIE), Malaysia: IEEE, 2020), 79–85, https://doi.org/10.1109/ISCAIE47305.2020.9108827.

research employs basic analytical methods that may not fully capture the complex interactions between mobile gaming activities, students' perceptions, and their academic performance. There is a need for more sophisticated analytical approaches, such as Structural Equation Modeling (SEM), to explore these relationships in depth. This research aims to address these gaps by investigating how mobile gaming impacts PAI learning outcomes, using advanced methodologies to provide a clearer understanding of these interactions and inform strategies for effectively integrating technology into religious education.

The primary objective of this study is to create a comprehensive model using Structural Equation Modeling (SEM) to assess how different aspects of mobile gaming activity influence students' performance in Islamic Religious Education (PAI). This involves examining both the direct and indirect effects of mobile gaming on PAI outcomes. Another key objective is to explore how students' perceptions and motivations regarding mobile gaming affect their learning outcomes in PAI. Understanding these factors will provide insights into the broader implications of mobile gaming beyond mere activity levels. The study aims to offer actionable recommendations for educators and policymakers on how to manage and integrate mobile gaming within the educational context to enhance students' learning experiences and outcomes in PAI.

This research is significant for several reasons. Firstly, it addresses a notable gap in the literature by focusing on the specific impact of mobile gaming on Islamic Religious Education, a subject critical to students' moral and ethical development. By utilizing advanced analytical techniques like SEM, the study provides a nuanced understanding of how mobile gaming influences PAI learning outcomes, which is currently lacking in existing research. Secondly, the findings of this study have practical implications for educators and policymakers. Understanding the relationship between mobile gaming and PAI performance can help in devising strategies to balance technology use and academic achievement. This knowledge is crucial for developing educational policies and practices that effectively integrate mobile gaming into the learning environment while considering its potential impacts on religious and moral education.

The study focuses on three primary variables: Mobile Gaming Activity (**akt**), Students' Perceptions of Mobile Gaming (**ber**), and PAI Learning Outcomes (**hsl**). Mobile Gaming Activity refers to the extent and nature of students' engagement with mobile games, including factors such as the frequency and duration of gameplay, as well as the types of games played. Mobile gaming encompasses seven popular game genres in Indonesia: Multiplayer Online Battle Arena (MOBA), Battle Royale, Role-Playing Games (RPG), Strategy, Puzzle and Casual, Sports, and Adventure and Action games.[18,19,20] This variable aims to

[18] Acai Sudirman et al., "Determinants of Mobile Game Service Adoption in Generation Z and Millennials in Indonesia," *International Journal of Entrepreneurship and Sustainability Studies* 2, no. 2 (December 28, 2022): 20–32, https://doi.org/10.31098/ijeass.v2i2.715.

[19] Adhyatman Prabowo, "The Effect of Online Mobile Legend Game in Indonesia (Case Study Online Game Players)," *Scientia* 3, no. 1 (March 15, 2024): 79–84, https://doi.org/10.51773/sssh.v3i1.257.

[20] Atik Aprianingsih et al., "Factors Influencing Indonesian Mobile Gamers on Repurchase Intention in Freemium Mobile Game With Perval," *Indonesian Journal of Business and Entrepreneurship*, May 31, 2024, https://doi.org/10.17358/ijbe.10.2.351.

assess how varying levels of gaming activity across these genres might influence academic performance in Islamic Religious Education (PAI). Students' Perceptions of Mobile Gaming encompasses their attitudes, beliefs, and opinions about mobile gaming, including perceived benefits and drawbacks and its impact on their learning.[21] This variable is crucial for understanding the psychological and motivational aspects of mobile gaming.[22] PAI Learning Outcomes measure students' effectiveness in learning Islamic Religious Education, focusing on their achievements in subjects such as Aqidah Akhlaq, Fiqih, Quran Hadith, and Islamic Cultural History.

Key concepts integral to the study include Structural Equation Modeling (SEM), Perception and Motivation, and Academic Performance in PAI. SEM is an advanced statistical technique used to model complex relationships between variables, allowing for a detailed analysis of direct and indirect effects.[23,24] This method will help elucidate the interactions between mobile gaming activity, students' perceptions, and PAI learning outcomes. Perception and Motivation refer to students' cognitive and emotional responses to mobile gaming, including how they view its impact on their education and the reasons behind their gaming behavior. Lastly, Academic Performance in PAI focuses on evaluating students' progress and knowledge in Islamic Religious Education, providing insights into how mobile gaming influences educational outcomes in this specific subject area. These variables and concepts provide a structured framework for analyzing the impact of mobile gaming on PAI learning outcomes.

The primary research questions guiding this study are as follows: First, how does mobile gaming activity impact students' learning outcomes in Islamic Religious Education (PAI)? This question aims to explore the direct effects of various levels of engagement with mobile games on students' performance in PAI. Second, how do students' perceptions of mobile gaming influence their academic achievement in PAI? This question investigates how students' attitudes and beliefs about mobile gaming affect their educational outcomes in this subject. Lastly, how do motivation and engagement with different genres of mobile games, such as Multiplayer Online Battle Arena (MOBA), Battle Royale, Role-Playing Games (RPG), Strategy, Puzzle and Casual, Sports, and Adventure and Action, correlate with PAI learning outcomes?

Based on these research questions, several hypotheses are proposed. Hypothesis 1 (H_1) posits that higher levels of mobile gaming activity will negatively affect students' learning outcomes in PAI. This hypothesis suggests that increased engagement in mobile

[21] Olubukola Yemisi Olajide, "An Assessment of University Students' Perception Towards the Adoption and Use of Mobile Learning Technologies for Learning" (Zenodo, December 24, 2023), https://doi.org/10.5281/ZENODO.10429466.

[22] Antonios I. Christou, Stella Tsermentseli, and Athanasios Drigas, "The Role of Mobile Games and Environmental Factors in Improving Learning and Metacognitive Potential of Young Students," *International Journal of Interactive Mobile Technologies (iJIM)* 17, no. 18 (September 20, 2023): 67–84, https://doi.org/10.3991/ijim.v17i18.42437.

[23] James Grace, "General Guidance for Custom-Built Structural Equation Models," *One Ecosystem* 7 (February 1, 2022): e72780, https://doi.org/10.3897/oneeco.7.e72780.

[24] Yangqiuting Li and Chandralekha Singh, "Statistically Equivalent Models with Different Causal Structures: An Example from Physics Identity," *Physical Review Physics Education Research* 20, no. 1 (January 16, 2024): 010101, https://doi.org/10.1103/PhysRevPhysEducRes.20.010101.

gaming could detract from students' focus and performance in religious education. Hypothesis 2 (H_2) suggests that positive perceptions of mobile gaming will be associated with better academic achievement in PAI. This implies that students who view mobile gaming favorably may have a more positive impact on their educational outcomes. Hypothesis 3 (H_3) proposes that students' motivation and engagement with specific genres of mobile games will have varying effects on their PAI learning outcomes, with different genres potentially influencing academic performance in distinct ways. These hypotheses aim to provide a comprehensive understanding of how mobile gaming activity and students' attitudes towards gaming interact with their performance in Islamic Religious Education.

This article is systematically organized to present a thorough analysis of how mobile gaming affects Islamic Religious Education (PAI) learning outcomes. The article begins with the Introduction, which provides an overview of the research context, objectives, and significance, setting the stage for the investigation. It is followed by the Methodology section, which details the research design, including the study's setting at Madrasah Aliyah Negeri (MAN) 1 Tulungagung, data collection methods through surveys and documentation, and the analytical techniques employed, particularly Structural Equation Modeling (SEM).

The Results section reports the findings derived from the SEM analysis, highlighting how mobile gaming activity and students' perceptions impact their PAI learning outcomes. It provides a detailed account of the data and how it supports or refutes the study's hypotheses. In the Discussion section, the results are interpreted in relation to existing research, examining their implications for understanding the influence of mobile gaming on educational performance in PAI. This section also explores the limitations of the study and offers recommendations for future research. Finally, the Conclusion summarizes the key findings, underscores the study's contributions to the field, and presents practical recommendations for educators and policymakers to effectively address the integration of mobile gaming in educational settings.

METHOD

This study was conducted at Madrasah Aliyah Negeri (MAN) 1 Tulungagung from April 8 to April 30, 2024, involving 302 student participants from 10 classes. Out of these, 119 students reported engaging in mobile gaming, while 183 students did not. Employing an exploratory survey design, the research aimed to understand the relationship between mobile gaming activity and learning outcomes in Islamic Religious Education (PAI). Data were collected through questionnaires and documentation of PAI grades.

The questionnaire comprised 18 items covering three main components: mobile gaming activity (**akt**), students' perceptions of mobile gaming (**ber**), and PAI learning outcomes (**hsl**). The mobile gaming activity component assessed the intensity and frequency of gaming, including time spent, money spent on game content, involvement in gaming communities, and the impact on daily activities. The students' perceptions component evaluated their views on the cognitive and social benefits of mobile gaming. PAI learning outcomes were measured through documented grades in subjects such as Aqidah Akhlaq, Fiqih, Quran Hadith, and Islamic Cultural History.

Data analysis was performed using JASP software, following several steps. Initially, Explanatory Factor Analysis (EFA) was used to identify the underlying structure of the data and group components based on predictors. Confirmatory Factor Analysis (CFA) was then employed to verify the factor structure identified by EFA, ensuring the model's fit to the data. Finally, Structural Equation Modeling (SEM) was utilized to model the relationships between the study variables. The SEM analysis provided a comprehensive understanding of how mobile gaming activity and students' perceptions interact and influence PAI learning outcomes.

The EFA results revealed three main components: mobile gaming activity (**akt**), students' perceptions of mobile gaming (**ber**), and PAI learning outcomes (**hsl**). The CFA confirmed that the grouping of these components met the criteria for adequacy. The SEM analysis demonstrated that there were mutual influences between mobile gaming activity (**akt**) and students' perceptions of mobile gaming (**ber**). Specifically, students' perceptions of mobile gaming (**ber**) had a positive impact on learning outcomes, whereas mobile gaming activity (**akt**) had a negative impact on learning outcomes.

DISCUSSION

The collaborative and strategic elements of MOBA games, combined with the cognitive and social skills they develop, suggest a positive impact on academic performance, although the exact nature of peer interactions and their direct influence on engagement may vary. Integrating these insights into educational strategies could enhance learning outcomes by leveraging the benefits of interactive and gamified learning environments.[25,26] Battle royale games offer a rich and engaging experience, their impact on academic performance is multifaceted, involving direct time displacement, the exacerbation of underlying psychological conditions, and the influence of peer interactions within the gaming community. Addressing these issues requires a comprehensive approach, including systematic screening for GD and ADHD, and fostering positive peer interactions both in and out of the gaming context.[27,28]

The negative correlation between playing Multiplayer Online Battle Arena (MOBA) games and academic performance among high school students is significant, as evidenced

[25] Athaillah Adhar Jumana et al., "The Impact of Playing Multiplayer Online Battle Arena Video Games on the Enhancement of Computational Thinking Skills Among Students in Indonesia," in *2023 6th International Conference on Information and Communications Technology (ICOIACT)* (2023 6th International Conference on Information and Communications Technology (ICOIACT), Yogyakarta, Indonesia: IEEE, 2023), 108–13, https://doi.org/10.1109/ICOIACT59844.2023.10455810.

[26] Zachary Watson and Syed Fawad M. Zaidi, "Understanding Positive Impact of Game Interactivity in Education," in *Proceedings of the 2019 International Conference on Video, Signal and Image Processing* (VSIP 2019: 2019 International Conference on Video, Signal and Image Processing, Wuhan China: ACM, 2019), 118–23, https://doi.org/10.1145/3369318.3369338.

[27] Nazir Hawi and Maya Samaha, "Relationships of Gaming Disorder, ADHD, and Academic Performance in University Students: A Mediation Analysis," ed. Lakshit Jain, *PLOS ONE* 19, no. 4 (April 3, 2024): e0300680, https://doi.org/10.1371/journal.pone.0300680.

[28] Yin Li, Leiju Qiu, and Baowen Sun, "Two Ways Peer Interactions Affect Academic Performance," in *Proceedings of the 4th International Conference on Crowd Science and Engineering* (ICCSE'19: The 4th International Conference on Crowd Science and Engineering, Jinan China: ACM, 2019), 90–94, https://doi.org/10.1145/3371238.3371253.

by multiple studies examining the broader category of gaming addiction and its impact on academic outcomes. For instance, a study on Adventist Academy Iloilo Senior High School students found a significant negative relationship between computer games addiction and class performance, with higher levels of gaming addiction correlating with lower academic performance, particularly among male students.[29] Similarly, a systematic review of 27 empirical studies highlighted that most research reported a negative relationship between problematic gaming and academic performance, although recent studies suggest that poor academic performance might also predict problematic gaming.[30] Another study focusing on medical students found that excessive gaming adversely affected scholastic performance, especially among males, with a negative correlation between Gaming Addiction Scale (GAS) scores and internal assessment scores.[31] Additionally, research on Internet Gaming Disorder (IGD) among adolescents revealed a significant main effect of IGD on academic performance, with higher IGD scores associated with poorer grades.[32] Furthermore, a study investigating the intersection of Gaming Disorder (GD) and ADHD among university students found that GD exacerbates the negative effects of ADHD on academic performance, suggesting a mediating role of gaming in academic decline.[33] Collectively, these findings underscore a substantial negative correlation between excessive gaming, including MOBA games, and academic performance, emphasizing the need for interventions to mitigate gaming addiction and its detrimental effects on students' scholastic achievements.

Explanatory Factor Analysis

The results of the Exploratory Factor Analysis (EFA) conducted in this study provide comprehensive insights into the underlying factor structure of the data. The analysis commenced with the Kaiser-Meyer-Olkin (KMO) test, which yielded an overall Measure of Sampling Adequacy (MSA) of 0.943. This high MSA value strongly indicates that the data matrix is suitable for factor analysis, confirming that the variables share enough common variance to justify the factor analysis approach.

Complementing the KMO test, Bartlett's test of sphericity was performed, yielding a chi-square (χ^2) value of 6830.444 with 253 degrees of freedom. The resulting significance level ($\rho < 0.001$) was highly significant, underscoring that the correlation matrix is not an identity matrix and that the variables are sufficiently correlated to form a reasonable basis

[29] Leah Mae Fancubila Farillon, Kathleen Seth Fancubila Farillon, and Eulalia Fancubila Farillon, "Computer Games Addiction and Class Performance of Selected Philippine Senior High School Students," *Utamax : Journal of Ultimate Research and Trends in Education* 4, no. 3 (November 29, 2022): 186–201, https://doi.org/10.31849/utamax.v4i3.10292.

[30] Alanood Khalid D Alzahrani and Mark D. Griffiths, "Problematic Gaming and Students' Academic Performance: A Systematic Review," *International Journal of Mental Health and Addiction*, June 10, 2024, https://doi.org/10.1007/s11469-024-01338-5.

[31] Deodatt Madhav Suryawanshi et al., "The Association Between Gaming Practices and Scholastic Performance Among Medical Students in India: Case-Control Study," *JMIR Medical Education* 7, no. 3 (September 9, 2021): e22235, https://doi.org/10.2196/22235.

[32] Ambreen Fatima and Rizwana Amin, "Academic Performance and Internet Gaming Disorder: A Cross-Sectional Study," *Journal of Professional & Applied Psychology* 4, no. 4 (December 31, 2023): 531–44, https://doi.org/10.52053/jpap.v4i4.243.

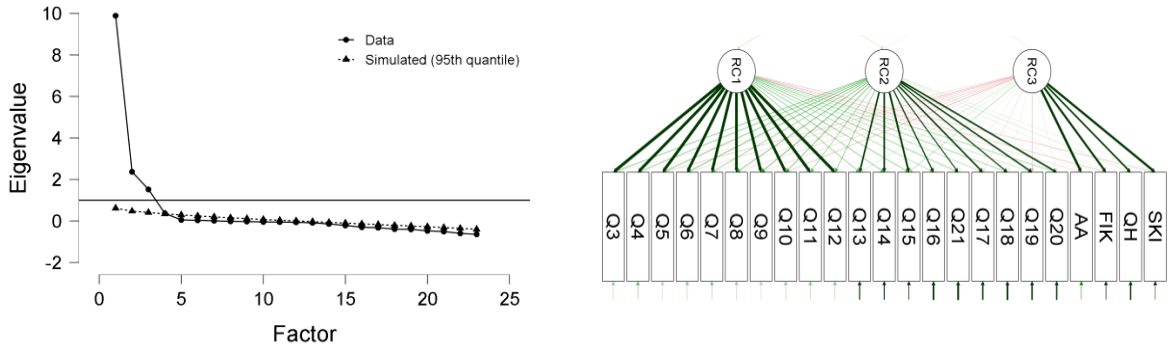
[33] Hawi and Samaha, "Relationships of Gaming Disorder, ADHD, and Academic Performance in University Students."

for factor analysis. This step is crucial as it establishes that the dataset meets the fundamental assumptions necessary for conducting a valid factor analysis.

Table 1. The loading factor values for each factor component formed based on the EFA analysis

Factor 1	Factor 2	Factor 3
Q3=0.918	Q13=0.648	AA=0.819
Q4=0.891	Q14=0.659	FIK=0.736
Q5=0.928	Q15=0.702	QH=0.632
Q6=0.902	Q16=0.559	SKI=0.767
Q7=0.911	Q17=0.612	
Q8=0.913	Q18=0.528	
Q9=0.911	Q19=0.593	
Q10=0.902	Q20=0.609	
Q11=0.919	Q21=0.509	
Q12=0.908		

The Scree Plot depicted in Figure 1(a) provides a visual representation of the eigenvalues associated with each factor. This plot is instrumental in determining the number of factors to retain. In this analysis, the eigenvalues clearly demonstrate that three factors have eigenvalues greater than 1. These three factors account for a significant portion of the variance within the data, and their retention is justified by the "elbow" observed in the scree plot, where the slope of the eigenvalues levels off after the third factor. This observation aligns with the Kaiser criterion, which suggests retaining factors with eigenvalues greater than 1.



(a) (b)

Figure 1. (a) Scree plot based on the EFA analysis, and (b) path diagram of the factors formed based on the loading factor values.

Further elucidating the EFA results, Figure 1(b) presents the path diagram, which offers a detailed visualization of how individual items load onto the identified factors. This diagram is crucial for understanding the structural composition of the factors and their associated variables. The path diagram demonstrates how the items (e.g., Q3, Q4, Q5, etc.) are grouped under their respective factors, labeled as RC1, RC2, and RC3. The arrows connecting the items to the factors illustrate the factor loadings, which represent the strength and direction of the relationships between the observed variables and the latent

factors. These loadings are essential in determining the extent to which each item contributes to the factor it loads onto, thereby providing insights into the dimensionality and coherence of the constructs measured by the factors.

In addition to the visual representation provided by the path diagram, the factor loadings are quantitatively detailed in Table 1, which provides the specific values of these loadings for each item. These loadings are critical as they inform which items have strong or weak associations with their respective factors. Items with high loadings are more strongly associated with their factors, suggesting that they are reliable indicators of the underlying constructs represented by those factors.

The EFA results indicate that the three-factor solution is a robust and meaningful representation of the underlying data structure. The high KMO value, significant Bartlett's test, and the clear distinctions in the scree plot, combined with the detailed path diagram, all contribute to a well-supported factor structure. This analysis lays the groundwork for subsequent confirmatory analyses and further statistical modeling, ensuring that the factors identified are both statistically sound and conceptually relevant to the constructs being studied.

Confirmatory Factor Analysis

The Confirmatory Factor Analysis (CFA) conducted in this study provided a robust validation of the factor structure initially proposed by the Exploratory Factor Analysis (EFA).[34] The chi-square test, which is used to assess the overall fit of the model, resulted in a chi-square value (X^2) of 108.887 with 227 degrees of freedom (df), and a p-value of 1.000. This indicates that there is no significant difference between the observed and expected covariance matrices, suggesting an excellent fit of the model to the data. The non-significant chi-square is especially notable given the large sample size, which typically makes it challenging to obtain a non-significant result.

The fit indices further confirm the adequacy of the model. The Comparative Fit Index (CFI) and the Tucker-Lewis Index (TLI), both of which compare the model fit to a null model, are each reported as 1.000 and 1.008 respectively. These values exceed the generally accepted threshold of 0.95, indicating that the model fits the data exceptionally well. Similarly, the Bentler-Bonett Non-Normed Fit Index (NNFI) and Normed Fit Index (NFI) are reported as 1.008 and 0.994, respectively. These indices, which are based on a comparison of the chi-square value of the hypothesized model to a null model, also suggest a very good fit, as does the Parsimony Normed Fit Index (PNFI) of 0.891. Bollen's Relative Fit Index (RFI) and Incremental Fit Index (IFI) are both above 0.99, with values of 0.993 and 1.007 respectively, further underscoring the model's strong fit. The Relative Noncentrality Index (RNI) is also reported as 1.007, indicating a high level of fit between the proposed model and the data.

[34] J. P. Verma and Priyam Verma, "Confirmatory Factor Analysis with Structural Equation Modelling," in *Understanding Structural Equation Modeling*, by J.P. Verma and Priyam Verma, Synthesis Lectures on Mathematics & Statistics (Cham: Springer International Publishing, 2024), 149–97, https://doi.org/10.1007/978-3-031-32673-8_7.

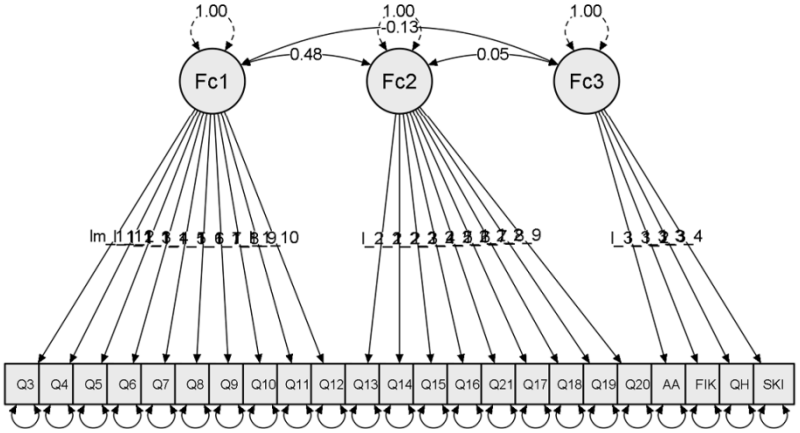


Figure 2. The path diagram based on the CFA analysis visualizes the relationships among the three factors that were formed

Other fit measures provide additional support for the model's adequacy. The Root Mean Square Error of Approximation (RMSEA), which measures the model's goodness of fit while accounting for model complexity, is reported as 0.000, with a 90% confidence interval ranging from 0.000 to 0.000, and a p-value of 1.000. This RMSEA value indicates a perfect fit, which is highly unusual and suggests that the model accurately captures the underlying data structure without overfitting. The Standardized Root Mean Square Residual (SRMR), which measures the difference between observed and predicted correlations, is reported as 0.041, well below the threshold of 0.08, further confirming a good fit. The Goodness of Fit Index (GFI) is reported as 0.995, and the McDonald Fit Index (MFI) is 1.222, both of which are consistent with a well-fitting model. The Expected Cross Validation Index (ECVI), which assesses the model's potential for replication in a new sample, is reported as 0.704, indicating that the model is likely to perform well with other datasets.

The R-squared values for the individual items (Q3 through SKI) reveal that most items have a strong relationship with their respective factors. The highest R-squared values are observed for items like Q9 (0.935) and Q5 (0.921), indicating that these items are particularly well explained by the factors. Conversely, lower R-squared values are observed for items like Q16 (0.305) and Q21 (0.322), suggesting that these items are less strongly associated with their factors.

The factor covariances provide insights into the relationships between the latent factors. Factor 1 (FC1) and Factor 2 (FC2) show a positive covariance of 0.48, which is statistically significant ($p < .001$) and suggests a strong positive relationship between these two factors. In contrast, Factor 1 (FC1) and Factor 3 (FC3) have a negative covariance of -0.13, which is also statistically significant ($p < .001$), indicating a moderate negative relationship. The covariance between Factor 2 (FC2) and Factor 3 (FC3) is weaker but still significant, with a value of 0.05 ($p = 0.018$), suggesting a slight positive relationship between these two factors. The confidence intervals provided for these covariances indicate a high level of precision in the estimates.

The CFA results demonstrate that the factor model provides an excellent fit to the data, with strong support from multiple fit indices, low error measures, and well-defined relationships between factors and items. These findings confirm the validity of the factor structure identified in the earlier EFA and provide a solid foundation for further analysis. The

CFA model plot depicted in the attached figure visually illustrates the relationships between factors (FC1, FC2, FC3) and the observed variables (Q3 through SKI), as well as the covariances among the factors themselves. This diagram serves as a comprehensive visual summary of the confirmatory factor structure derived from the analysis.

The accompanying model plot (Figure 2) effectively encapsulates the complex interactions and relationships delineated by the CFA, offering a clear representation of how the factors interrelate with both the observed variables and each other. The strong factor loadings and precise covariances illustrated in the diagram highlight the robustness of the model, making it a critical component in validating the overall structure identified in the preliminary EFA.

Structural Equation Modeling

The Structural Equation Modeling (SEM) analysis conducted in this study offers profound insights into the intricate relationships among Mobile Gaming Activity (**akt**), Students' Perceptions of Mobile Gaming (**ber**), and PAI Learning Outcomes (**hsl**). The results demonstrate a robust model fit, as evidenced by the Chi-square test statistic, which was found to be 108.887 with 227 degrees of freedom and a p-value of 1.000. This high p-value, coupled with the Chi-square value, suggests that the model fits the data exceptionally well, indicating no significant discrepancy between the observed data and the model's predictions.

Further supporting the strength of the model, several fit indices were evaluated, all of which surpass the conventional threshold of 0.90, signaling that the model is both well-specified and accurate in capturing the underlying data structure. Specifically, the Comparative Fit Index (CFI) was reported as 1.000, the Tucker-Lewis Index (TLI) as 1.008, the Bentler-Bonett Non-normed Fit Index (NNFI) as 1.008, and the Bollen's Incremental Fit Index (IFI) as 1.007. These indices collectively reinforce the conclusion that the model is a strong representation of the relationships among the variables.

The Root Mean Square Error of Approximation (RMSEA) was calculated at 0.000, with a 90% Confidence Interval ranging from 0.000 to 0.000 and a p-value of 1.000. The RMSEA is particularly noteworthy as it is a measure of model parsimony, with lower values indicating a better fit; in this case, the RMSEA value of 0.000 suggests an impeccable fit, further substantiating the model's validity. The convergence of these fit indices underscores the robustness of the SEM model, providing compelling evidence that the relationships between Mobile Gaming Activity, Students' Perceptions of Mobile Gaming, and PAI Learning Outcomes are well-captured and accurately represented within this analytical framework.

The analysis delves into the intricate relationships between the variables, revealing standardized path coefficients that elucidate both the strength and directionality of these connections. Specifically, the relationship between Mobile Gaming Activity and Students' Perceptions of Mobile Gaming is not only positive but also highly significant, with a standardized coefficient (β) of 0.203 and a p-value less than 0.001. This finding underscores a clear association: as mobile gaming activity increases, students tend to develop more favorable perceptions of gaming. This positive relationship suggests that engagement in mobile gaming may enhance students' views of gaming as a potentially valuable or

enjoyable activity. Conversely, the analysis unveils a negative and significant relationship between Mobile Gaming Activity and PAI Learning Outcomes, with a standardized coefficient of -1.610 and a p-value below 0.001. This strong inverse relationship indicates that higher levels of mobile gaming activity are linked to poorer learning outcomes in PAI subjects. Such a result suggests that excessive engagement in mobile gaming could detract from students' academic performance, possibly by diverting time and attention away from their studies.

Furthermore, the analysis highlights the direct impact of Students' Perceptions of Mobile Gaming on PAI Learning Outcomes. The standardized path coefficient for this relationship is positive and significant ($\beta = 2.755$, $p < 0.001$), suggesting that more positive perceptions of gaming can, in fact, enhance learning outcomes. This finding implies that when students view gaming in a positive light, it may translate into better academic performance, possibly due to increased motivation or cognitive engagement that gaming fosters. Collectively, these findings offer a nuanced understanding of the dynamics at play, where mobile gaming activity influences both perceptions and outcomes in complex ways. While increased gaming activity appears to foster positive perceptions, it simultaneously poses risks to academic achievement, underscoring the dual-edged nature of gaming in the educational context. These insights are critical for educators and policymakers as they seek to balance the potential benefits of gaming with its possible drawbacks, particularly in the context of learning outcomes in PAI subjects.

The R-squared values obtained from the analysis provide crucial insights into the extent to which the model accounts for variance in each observed variable, reflecting the model's explanatory power. Specifically, the analysis reveals that Mobile Gaming Activity significantly explains 88.1% of the variance in Q3, 81.8% in Q4, and an impressive 92.1% in Q5. These high percentages indicate that the model effectively captures the underlying constructs and adequately explains the observed variability in these indicators. Furthermore, the model's strength is also demonstrated through the examination of factor covariances, which highlight the intricate relationships between the latent factors under investigation. Notably, Factor 1, which is associated with Mobile Gaming Activity, exhibits a positive correlation with Factor 2, related to Students' Perceptions of Mobile Gaming, with a standardized coefficient of 0.479. This suggests that as students engage more in mobile gaming, their perceptions of this activity tend to become more favorable. However, the correlation between Factor 1 and Factor 3, which pertains to PAI Learning Outcomes, is negative, with a coefficient of -0.130, implying an inverse relationship. This negative covariance indicates that higher levels of mobile gaming activity are associated with lower learning outcomes in the context of PAI, reinforcing the model's narrative that while mobile gaming may enhance students' perceptions, it potentially detracts from their academic performance in this particular subject area. Overall, these findings underscore the complex interplay between gaming activities, perceptions, and educational outcomes, providing a nuanced understanding of how these factors interact within the model.

Figure 3 illustrates a comprehensive path diagram representing the Structural Equation Modeling (SEM) analysis that delineates the relationships among three key latent variables: Mobile Gaming Activity (akt), Students' Perceptions of Mobile Gaming (per), and

PAI Learning Outcomes (hsl). The diagram visually encapsulates the estimated standardized path coefficients between these latent constructs and their corresponding observed variables (Q3-Q21, AA, FIK, QH, and SKI), highlighting the strengths and directions of these relationships.

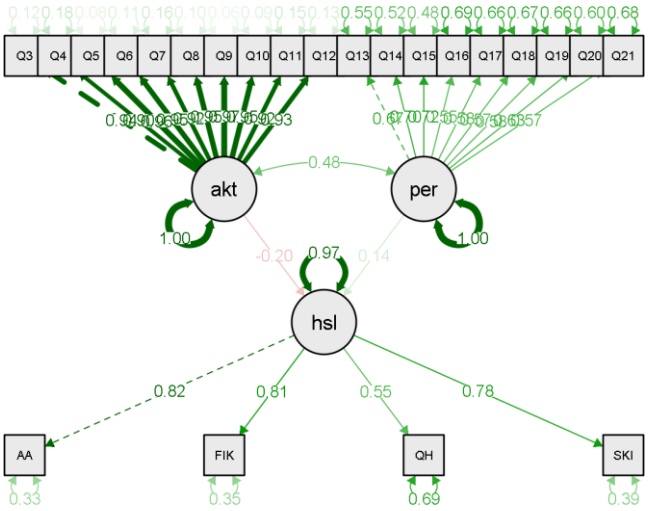


Figure 3. The path diagram with parameters based on the SEM analysis.

In the model, Mobile Gaming Activity (akt) is directly linked to several observed variables (Q3-Q12) with strong standardized loadings ranging from 0.91 to 0.94, indicating a robust connection between the construct and these specific indicators. The latent variable of Students' Perceptions of Mobile Gaming (per) also shows significant linkages with its observed indicators (Q13-Q21), though the loadings are slightly lower, suggesting a somewhat more nuanced relationship.

The central construct, PAI Learning Outcomes (hsl), is depicted as being influenced by both Mobile Gaming Activity and Students' Perceptions. The path coefficient from Mobile Gaming Activity to PAI Learning Outcomes is negative and significant (β = -0.20), visually represented by a red arrow, emphasizing the detrimental impact of high mobile gaming activity on students' academic performance in PAI. Conversely, the path from Students' Perceptions of Mobile Gaming to PAI Learning Outcomes is positive (β = 0.14), illustrated by a green arrow, indicating that positive perceptions of mobile gaming are associated with better learning outcomes. Moreover, the diagram also highlights the covariances between the latent factors, with a significant positive correlation (0.48) between Mobile Gaming Activity and Students' Perceptions, suggesting that higher engagement in gaming is related to more favorable perceptions. Additionally, the direct effects from PAI Learning Outcomes to the other observed variables (AA, FIK, QH, and SKI) are also depicted, with notable path coefficients indicating the extent to which these outcomes contribute to the variance in the respective observed measures. The model's overall structure is supported by strong fit indices, as suggested by the paths and relationships illustrated in this diagram, confirming

the model's adequacy in capturing the complexities of the relationships among these key educational constructs.

The Structural Equation Modeling (SEM) analysis robustly confirms the hypothesized relationships within the conceptual framework, providing a comprehensive validation of the intricate dynamics between mobile gaming behaviors, students' perceptions of these activities, and their academic performance, particularly in the context of Islamic Religious Education (PAI) subjects. The results illuminate a complex and multifaceted interplay, wherein the nature of mobile gaming emerges as a double-edged sword. On one hand, the analysis reveals that positive perceptions of mobile gaming are significantly associated with enhanced learning outcomes. This suggests that when students view gaming as beneficial or enjoyable, it may foster a more engaged and motivated learning experience, thereby contributing positively to their academic achievements in PAI. However, the analysis also underscores a critical caveat: while favorable perceptions of gaming can have beneficial effects, excessive involvement in mobile gaming activities appears to have a detrimental impact on academic performance. The negative relationship between the intensity of mobile gaming and PAI learning outcomes highlights the potential risks associated with overindulgence in gaming. These findings suggest that beyond a certain threshold, the time and cognitive resources devoted to gaming may begin to encroach upon those needed for academic study, leading to poorer educational outcomes.

This nuanced understanding of the dual-edged nature of mobile gaming offers valuable insights for educators, parents, and policymakers. It indicates the importance of fostering a balanced approach to gaming in educational contexts. By leveraging the positive aspects of gaming—such as its ability to engage students and enhance their perceptions—educators can potentially enhance learning experiences. At the same time, it is crucial to implement strategies and interventions that mitigate the adverse effects of excessive gaming, ensuring that students do not lose focus on their academic responsibilities. This balanced approach could involve setting reasonable limits on gaming time, integrating educational content into gaming platforms, or promoting critical reflection on the role of gaming in students' lives. Ultimately, the SEM analysis provides a robust empirical foundation for developing targeted educational strategies that harness the potential benefits of mobile gaming while minimizing its potential drawbacks, thereby supporting students in achieving better academic outcomes in PAI subjects.

Findings and Interpretation

The analyses conducted through Confirmatory Factor Analysis (CFA), Exploratory Factor Analysis (EFA), and Structural Equation Modeling (SEM) provide comprehensive insights into the relationships among the variables under study and offer substantial evidence regarding the hypotheses proposed. Hypothesis 1 (H_1) posited that higher levels of mobile gaming activity would negatively impact students' learning outcomes in PAI. The SEM analysis robustly supports this hypothesis, revealing a significant and negative relationship between Mobile Gaming Activity and PAI Learning Outcomes ($\beta = -1.610$, $p < 0.001$). This finding underscores the detrimental effect that increased mobile gaming activity

can have on students' academic performance in religious education, thereby confirming the initial hypothesis.

Hypothesis 2 (H_2) suggested that positive perceptions of mobile gaming would correlate with better academic achievement in PAI. This hypothesis is also validated by the SEM results, which demonstrate a positive and significant path coefficient (β = 2.755, p < 0.001) between Students' Perceptions of Mobile Gaming and PAI Learning Outcomes. The data indicate that students who hold more favorable views of mobile gaming tend to perform better academically in PAI subjects. This finding highlights the potential of positive attitudes towards gaming to enhance educational outcomes, supporting the notion that perception plays a crucial role in mediating the effects of gaming on learning.

Finally, Hypothesis 3 (H_3) proposed that students' motivation and engagement with specific genres of mobile games would have varying effects on their PAI learning outcomes, with different genres potentially influencing academic performance in distinct ways. While the CFA and EFA analyses provide a detailed factor structure that distinguishes between various aspects of mobile gaming activity and students' perceptions, the SEM analysis as currently conducted does not directly address the differential impact of specific game genres on academic outcomes. However, the significant factor covariances and the relationships identified between the latent variables suggest that there is a foundation for further investigation into genre-specific effects. The findings imply that while general gaming activity and perceptions have clear influences on learning, the nuanced effects of different game types on academic performance warrant additional exploration. In conclusion, the analyses affirm Hypotheses 1 and 2, demonstrating the negative impact of excessive gaming and the positive role of favorable perceptions, while Hypothesis 3 remains an area for future research to fully elucidate.

CONCLUSION

This study provides a comprehensive analysis of the impact of mobile gaming on Islamic Religious Education (PAI) learning outcomes, employing Structural Equation Modeling (SEM) to explore the intricate relationships between gaming activities, student perceptions, and academic performance. Conducted at Madrasah Aliyah Negeri (MAN) 1 Tulungagung, the research offers valuable insights into how mobile gaming can both positively and negatively influence educational outcomes within this specific context.

The study reveals several significant findings. Firstly, excessive mobile gaming activity is shown to have a detrimental effect on students' learning outcomes in PAI, aligning with Hypothesis 1, which proposed a negative relationship between high levels of gaming and academic performance. Secondly, favorable perceptions of mobile gaming are associated with improved learning outcomes, supporting Hypothesis 2. This indicates that students' perceptions of gaming can significantly influence their academic success. Additionally, the SEM analysis uncovers complex interactions among gaming activities, perceptions, and learning outcomes. While gaming can enhance engagement, it may also detract from academic focus if not managed properly.

The study underscores the importance of a balanced approach to integrating mobile gaming with academic responsibilities. Educators and policymakers are encouraged to

develop strategies that incorporate gaming in a manner that supports educational goals without compromising academic performance. Although the current SEM analysis does not address the differential impact of specific game genres, the findings lay the groundwork for further investigation into genre-specific effects. Understanding these nuances can assist in tailoring educational strategies to maximize the benefits of gaming while minimizing potential drawbacks.

This study highlights the dual nature of mobile gaming's impact on Islamic education. While excessive gaming can hinder academic performance, positive perceptions and strategic integration of gaming can enhance learning outcomes. The findings offer practical recommendations for educators and policymakers to effectively manage mobile gaming in educational settings, ensuring it serves as a tool for engagement and learning rather than a distraction. Future research should continue to explore the nuanced effects of gaming, focusing on genre-specific impacts and long-term outcomes, to fully understand its role in education.

Future research should explore the differential effects of various game genres on PAI learning outcomes to provide deeper insights into how specific types of games influence academic performance and to develop targeted interventions. Additionally, conducting longitudinal studies could offer a more comprehensive understanding of how mobile gaming impacts learning over time, identifying long-term trends and effects that may not be evident in cross-sectional studies. Expanding research to include different educational settings and cultural contexts could enhance the generalizability of the findings, offering a more holistic view of mobile gaming's impact on education across diverse environments.

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