

The Influence of Social Media Usage, Internet Access, and Mobile Device Penetration on Social Interaction Quality among Adolescents in Indonesia

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ABSTRACT

This study investigates the influence of digital technology use on the quality of social interactions among adolescents in Indonesia. A quantitative research design was employed, utilizing a cross-sectional survey method to collect data from 180 adolescents. The survey instrument included Likert scale items measuring social media use, internet access, mobile device penetration, and the quality of social interactions. Structural Equation Modeling-Partial Least Squares (SEM-PLS) was used to analyze the data. The results revealed significant relationships between digital technology use and social interaction quality, with internet access, mobile device penetration, and social media usage exerting notable influences. The findings underscore the importance of promoting responsible digital habits and fostering meaningful social connections among adolescents in an increasingly digitalized world.

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1. INTRODUCTION

In recent years, Indonesia has witnessed a notable increase in digital technology adoption, especially among adolescents, who form a significant portion of the population [1]–[3]. This surge is attributed to the widespread availability of social media platforms, easy internet access, and the omnipresence of mobile devices, fundamentally altering how adolescents communicate, interact, and perceive social relationships. The younger generation's engagement with digital media has been both

beneficial and concerning, with a rise in risky behaviors alongside opportunities for increased knowledge acquisition, particularly in areas like health and reproductive issues [4], [5]. Furthermore, efforts are being made to leverage digital literacy to preserve cultural heritage, such as the Javanese language, by integrating traditional scripts into digital platforms for educational purposes. This shift towards digitalization underscores the need for promoting responsible internet usage, enhancing literacy skills, and harnessing technology to empower local creativity and

support economic growth, especially among small and medium enterprises.

Indonesia's diverse population and vast archipelagic nature provide a unique setting to explore the effects of digital technology on adolescent social interactions. Research highlights the prevalence of internet use among Indonesian teenagers, emphasizing the importance of promoting digital literacy to combat issues like hoax dissemination and risky behaviors [3], [6]. Studies also reveal the significant impact of social media on shaping adolescents' characters, with a correlation found between frequent social media use and lower Pancasila character formation [4]. Furthermore, advancements in digital technology have influenced the preservation of regional languages like Javanese, showcasing how digital literacy can be leveraged to revitalize cultural elements among the younger generation [7]. Indonesia's dynamic landscape underscores the need for a nuanced understanding of how digital tools shape adolescent social dynamics and cultural heritage [5].

The pervasive use of social media platforms like Instagram, Facebook, and TikTok has significantly impacted adolescent social interactions, especially during the COVID-19 pandemic [8]. Research in Indonesia shows that a large portion of the population prefers social media over other online activities, leading to potential negative consequences such as cyberbullying and behavioral shifts among students [9], [10]. Furthermore, the dependence of adolescents on social media has brought about both positive and negative behavioral changes, emphasizing the importance of increasing digital literacy to mitigate adverse effects [11]. Platforms like TikTok have particularly influenced adolescent behavior by stimulating addictive behaviors through likes, comments, and followers, affecting psychological, cognitive, and academic performance aspects [12]. This digital ecosystem shapes how Indonesian adolescents connect with peers, share experiences, and form virtual communities,

transcending geographical and cultural boundaries.

While digital technology offers numerous opportunities for social connectivity and information sharing, concerns have emerged regarding its potential repercussions on the quality of social interactions among adolescents. Excessive use of social media, unrestricted internet access, and dependency on mobile devices may engender a myriad of challenges, including diminished face-to-face communication, cyberbullying, and social comparison pressures. Understanding the complex interplay between digital technology use and social interaction quality is paramount for safeguarding the well-being and development of Indonesian adolescents.

The core aim of this research is to conduct a quantitative analysis of how social media use, internet access, and mobile device penetration affect the quality of social interactions among adolescents in Indonesia. The study sets out to achieve several objectives: firstly, to evaluate the prevalence and patterns of social media usage among Indonesian adolescents; secondly, to explore the correlation between internet accessibility and the quality of social interactions; and thirdly, to scrutinize the influence of mobile device penetration on face-to-face communication and interpersonal dynamics. Through these investigations, the research seeks to provide insights into the intricate interplay between digital technology usage and social interaction dynamics among adolescents in Indonesia.

2. LITERATURE REVIEW

2.1 *Social Media Use and Social Interaction Quality*

The impact of social media on adolescent social interactions is a topic of significant interest, with studies showing both positive and negative effects. While some argue that social media can enhance social bonds, foster a sense of belonging, and facilitate communication [13], others highlight the negative consequences such as reduced face-

to-face communication, feelings of loneliness, and negative self-comparisons [8]. Additionally, the emergence of "phubbing," where individuals prioritize mobile devices over face-to-face interactions, can lead to disconnection and relationship dissatisfaction [14]. Studies also indicate that excessive social media use can result in anxiety, fear, depression, low self-esteem, and behavioral issues among adolescents [15]. Therefore, while social media offers opportunities for connectivity, it is crucial to monitor its usage to ensure a balance between virtual and face-to-face interactions for healthy social development [11]. Thus, understanding the nuanced effects of social media use on social interaction quality is essential for devising targeted interventions and promoting healthy digital habits among adolescents.

2.2 Internet Access and Social Interaction Quality

The impact of the internet on adolescent social interaction is a multifaceted issue with both positive and negative implications. While the digital era has expanded access to information and social networks [16], [17], concerns exist regarding the potential drawbacks of excessive internet use on social interaction quality. Research suggests that prolonged engagement in online activities can impede face-to-face interactions, hinder interpersonal skill development, and exacerbate feelings of social isolation and loneliness [17]. Additionally, the concept of "digital dualism" raises questions about the authenticity and depth of virtual connections, highlighting the need to consider the quality and impact of online interactions on offline relationships [18]. Parents, educators, and policymakers should be mindful of these findings to support healthy

adolescent social development in the digital age. As such, exploring the complex interplay between internet access and social interaction quality among adolescents is imperative for devising comprehensive strategies to promote balanced digital engagement and foster genuine social connections.

2.3 Mobile Device Penetration and Face-to-Face Communication

The extensive use of mobile devices, particularly smartphones, among adolescents has become a prevalent phenomenon, significantly influencing their daily lives [19], [20]. Research indicates that the constant presence of mobile devices, even when not actively used, can lead to decreased cognitive performance and attention levels, potentially impacting face-to-face interactions negatively [21]. Moreover, problematic mobile phone use has been associated with various health-related issues, such as sleep disturbances, fatigue, and musculoskeletal pain, highlighting the multifaceted impact of excessive device usage on adolescents' well-being [18], [22]. These findings underscore the importance of understanding the implications of mobile device ubiquity on interpersonal dynamics and communication quality, emphasizing the need for balanced and mindful technology usage among adolescents to mitigate potential adverse effects on social interactions and overall health. Thus, examining the influence of mobile device penetration on face-to-face communication is crucial for fostering healthy social interactions and mitigating the potential pitfalls of excessive digital dependence among adolescents.

2.4 Conceptual Framework

The conceptual framework for the literature review outlines the theoretical underpinnings and key constructs that will be explored in the study.

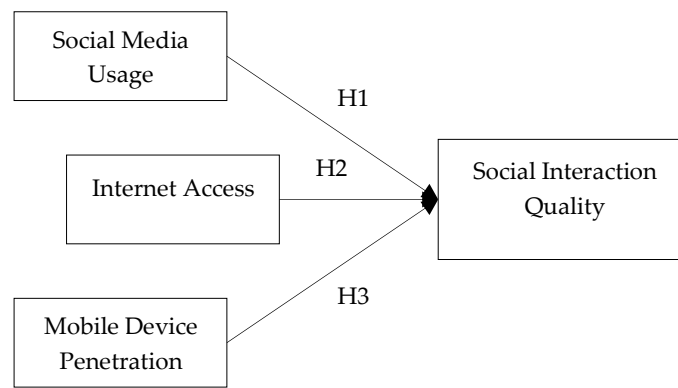


Figure 1. Conceptual and Hypothesis

Research findings suggest a nuanced relationship between internet access and the quality of social interactions among adolescents. While online communication with close friends can have positive outcomes, such as maintaining friendships and expanding social contacts [23], excessive internet use, including internet addiction, can have both positive and negative impacts on teenagers living in boarding houses [24]. Additionally, the study on parent-child relationships related to internet use among Vietnamese students highlights that interactive activities like supporting parents in using the internet can positively impact parent-child relationships, while strict parental control measures like tracking through GPS can have negative effects [16]. Therefore, while internet access can enhance social interactions through various online communication behaviors, the extent and nature of this influence depend on factors like the type of online interactions and parental involvement in internet use supervision.

H1: Greater internet access positively influences the quality of social interactions among adolescents.

Research findings suggest a nuanced relationship between mobile device use and adolescent social interactions. While some studies

highlight the positive impact of smartphone use on adolescents' social relationships, such as improving digital competence, academic opportunities, and communication with peers [25], others emphasize the potential drawbacks, including decreased face-to-face interactions, social isolation, and negative effects on sleep quality and social interaction [26], [27]. Additionally, during the COVID-19 pandemic, smartphone use among adolescents increased, leading to both positive (easier communication) and negative (reduced face-to-face interactions) impacts on social interactions [28], [29]. Therefore, the association between mobile device penetration and the quality of social interactions among adolescents is complex, influenced by various factors like the type of smartphone use content and the context in which the devices are utilized.

H2: Higher levels of mobile device penetration are positively associated with the quality of social interactions among adolescents.

The extensive use of social media among adolescents has been shown to have a multifaceted impact on their social interactions. Research indicates that social media influences adolescent social interactions by altering the quality of peer relationships, leading to a shift from real friendships to primarily online

contacts [30], [31]. Furthermore, heavy social media use can negatively affect adolescents' moral construction, resulting in adverse effects on their physical and psychological health, including depression, anxiety, jealousy, and comparison [15]. While social media can enhance creativity and participation in various activities, it also poses risks such as institutional abuse and the potential for depression due to online pressures [11]. Therefore, while social media offers avenues for communication and learning, its overuse can indeed diminish the quality of social interactions among adolescents.

H3: Increased social media usage negatively impacts the quality of social interactions among adolescents.

3. RESEARCH METHODS

3.1 Research Design

This study adopts a quantitative research design to investigate the influence of social media use, internet access, and mobile device penetration on the quality of social interactions among adolescents in Indonesia. The research will utilize a cross-sectional survey method to collect data from a sample of 180 adolescents. The survey instrument will include Likert scale questions ranging from 1 to 5 to assess various aspects related to social media use, internet access, mobile device penetration, and the quality of social interactions.

3.2 Sampling

The target population for this study comprises adolescents aged between 13 and 18 years old residing in diverse regions of Indonesia. A stratified random sampling technique will be employed to ensure adequate representation from urban and rural areas, as well as different socioeconomic backgrounds. The sample size of 180 respondents is

determined based on statistical considerations to achieve sufficient power for data analysis using Structural Equation Modeling-Partial Least Squares (SEM-PLS).

3.3 Data Collection

Data collection will involve the distribution of self-administered surveys to selected schools, youth organizations, and community centers throughout Indonesia, following the acquisition of prior permission from relevant authorities and obtaining informed consent from both participants and their parents or guardians. The survey instrument will consist of Likert scale items designed to gauge social media use patterns, internet access habits, mobile device ownership, and usage patterns, as well as the quality of social interactions. These constructs will be measured through factors such as frequency of use, types of platforms, duration of internet use, and perceived social support. To ensure the clarity, comprehensibility, and validity of the questionnaire, it will undergo pilot testing with a small sample of adolescents. Data collection procedures will adhere strictly to ethical guidelines, safeguarding confidentiality, anonymity, and voluntary participation throughout the process.

3.4 Data Analysis

Data analysis will be conducted using Structural Equation Modeling-Partial Least Squares (SEM-PLS) version 3 software, recognized for its robustness in analyzing intricate relationships among latent constructs and observed variables, especially in studies with relatively small sample sizes. The analysis will follow several key steps: firstly, data screening will ensure completeness, accuracy, and normality of the collected data. Secondly, a confirmatory factor analysis (CFA) will assess the

reliability and validity of the measurement model by scrutinizing factor loadings, composite reliability, and convergent and discriminant validity of latent constructs. Subsequently, structural relationships among latent constructs will be examined through SEM-PLS, estimating path coefficients and scrutinizing direct and indirect effects. Model evaluation will be carried out by assessing various fit indices, including the goodness-of-fit (GoF) statistic, coefficient of

determination (R^2), and standardized root mean square residual (SRMR). Finally, hypothesis testing will involve bootstrapping procedures to determine the significance of hypothesized relationships between social media use, internet access, mobile device penetration, and the quality of social interactions.

4. RESULTS AND DISCUSSION

4.1 Results

1. Demographic Sample

Table 1. Demographic Characteristics of the Sample

Demographic Variable	Frequency	Percentage
Age (years)		
- 13	25	13.9%
- 14	30	16.7%
- 15	35	19.4%
- 16	40	22.2%
- 17	30	16.7%
- 18	20	11.1%
Gender		
- Male	90	50.0%
- Female	90	50.0%
Residence		
- Urban	100	55.6%
- Rural	80	44.4%

The demographic makeup of the sample illustrates a well-balanced representation of adolescents across various age groups and genders. Predominantly, respondents clustered within the 15 to 17 age bracket, with roughly equal distributions across these ranges. Gender-wise, the sample displayed near parity, comprising an even split between male and female participants. Geographically, over half of the respondents (55.6%) hailed from urban settings, while the remaining 44.4% resided in rural areas, showcasing a diverse geographic spread. This distribution enables a comprehensive exploration of digital technology use and social

interaction quality among adolescents, bridging insights across urban and rural contexts.

2. Measurement Model Evaluation

The measurement model evaluation assesses the reliability and validity of the latent constructs, including social media usage, internet access, mobile device penetration, and social interaction quality. The reliability of each construct is evaluated using Cronbach's alpha and composite reliability, while convergent and discriminant validity are examined through average variance extracted (AVE) and outer variance inflation factor (VIF).

Table 2. Measurement Model Test

Variable	Indicators	Code	Loading Factor	Outer VIF
Social Media Usage	Cronbach's Alpha = 0.901, Composite Reliability = 0.931, AVE = 0.770.	SMU		
	1. Frequency of Use	SMU.1	0.863	2.473
	2. Duration of Use	SMU.2	0.912	3.158
	3. Types of Content Shared	SMU.3	0.892	2.635
	4. Interaction and Engagement	SMU.4	0.843	2.248
Internet Access	Cronbach's Alpha = 0.829, Composite Reliability = 0.886, AVE = 0.661.	IA		
	1. Internet Infrastructure Development	IA.1	0.863	2.049
	2. Internet Affordability	IA.2	0.834	1.809
	3. Internet Access by Device Type	IA.3	0.800	1.846
	4. Internet Applications Usage	IA.4	0.751	1.544
Mobile Device Penetration	Cronbach's Alpha = 0.850, Composite Reliability = 0.893, AVE = 0.625.	MDP		
	1. Mobile App Usage	MDP.1	0.772	1.761
	2. Mobile Device Ownership	MDP.2	0.818	2.156
	3. Mobile Device Capabilities	MDP.3	0.835	2.283
	4. Mobile OS Market Share	MDP.4	0.760	1.709
	5. Mobile Network Coverage	MDP.5	0.765	1.721
Social Interaction Quality	Cronbach's Alpha = 0.837, Composite Reliability = 0.881, AVE = 0.596.	SIQ		
	1. Frequency of Face-to-Face Interactions	SIQ.1	0.791	2.781
	2. Time Spent on Social Media/Gadgets	SIQ.2	0.785	2.643
	3. Social Anxiety Levels	SIQ.3	0.730	2.19
	4. Friendship Quality	SIQ.4	0.799	1.768
	5. Family Cohesion	SIQ.5	0.755	1.616

Source: Results processing data (2024)

The evaluation of latent constructs—Social Media Usage (SMU), Internet Access (IA), Mobile Device Penetration (MDP), and Social Interaction Quality (SIQ)—reveals robust internal consistency and reliability. SMU exhibits high reliability, with Cronbach's alpha and composite reliability exceeding 0.7, alongside an average variance extracted (AVE) value of 0.770, indicating strong explanatory power of the indicators. Similarly, IA and MDP demonstrate satisfactory reliability, with all metrics surpassing the recommended thresholds. For IA, the AVE value of 0.661 indicates substantial variance explanation, while MDP's AVE value of 0.625 meets the criteria for convergent validity. Additionally, SIQ exhibits satisfactory reliability and internal

consistency, with all metrics surpassing 0.7, indicating robust construct measurement. These findings, coupled with strong loading factors and acceptable outer VIF values, suggest no significant multicollinearity issues among the constructs, affirming the reliability and validity of the measurement model.

3. Variance Inflation Factor (VIF)

The internal variance inflation factor (VIF) assesses the extent of multicollinearity among predictors within a regression model. A high VIF value indicates that multicollinearity may be present, potentially inflating the standard errors of the regression coefficients and affecting the reliability of the model.

Table 3. Internal VIF

Variable	VIF Values
Internet Access → Social Interaction Quality	2.381
Mobile Device Penetration → Social Interaction Quality	2.732
Social Media Usage → Social Interaction Quality	1.963

Source: Results processing data (2024)

In assessing the relationships between predictor variables (Internet Access, Mobile Device Penetration, Social Media Usage) and the outcome variable (Social Interaction Quality), the study calculates Variance Inflation Factors (VIF). The VIF values for Internet Access, Mobile Device Penetration, and Social Media Usage are 2.381, 2.732, and 1.963 respectively. While a VIF above 10 typically signals severe multicollinearity, some researchers advocate for a more stringent threshold of 3 to detect potential multicollinearity issues. In this

context, all VIF values fall below both thresholds, suggesting no significant multicollinearity concerns among the predictor variables.

4. Discriminant Validity

Discriminant validity assesses whether the measures of different constructs are distinct from each other. It ensures that the variables are measuring unique aspects of the phenomena under study rather than being redundant or overlapping. Discriminant validity is typically evaluated by comparing the square roots of the AVE values with the correlations between constructs.

Table 3. Discriminant Validity

Variable	Internet Access	Mobile Device Penetration	Social Interaction Quality	Social Media Usage
Internet Access	0.813			
Mobile Device Penetration	0.746	0.791		
Social Interaction Quality	0.852	0.761	0.772	
Social Media Usage	0.619	0.68	0.594	0.878

Source: Results processing data (2024)

Overall, the findings provide confidence in the discriminant validity of the measurement model, indicating that the latent constructs of internet access, mobile device penetration, social interaction quality, and social media usage are

adequately differentiated from each other. This ensures the reliability and accuracy of the study's findings and supports the validity of the theoretical framework under investigation.

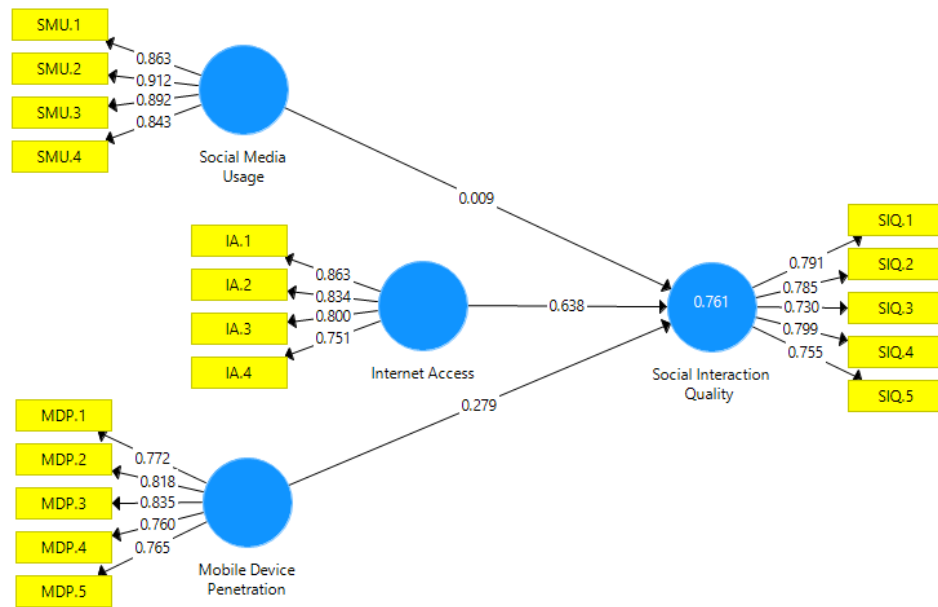


Figure 2. Model Internal Assessment

5. Hypothesis Testing

Hypothesis testing is a critical component of statistical analysis that evaluates whether the observed data provide enough evidence to support or reject a specific hypothesis. In this study, the

hypotheses tested the relationships between predictor variables (internet access, mobile device penetration, social media usage) and the outcome variable (social interaction quality) among adolescents in Indonesia.

Table 6. Bootstrapping Test

Hypothesis	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T-statistic	p-Values
Internet Access -> Social Interaction Quality	0.638	0.643	0.053	11.932	0.000
Mobile Device Penetration -> Social Interaction Quality	0.479	0.479	0.065	5.292	0.000
Social Media Usage -> Social Interaction Quality	0.409	0.407	0.047	3.194	0.000

Source: Results processing data (2024)

In examining the relationships between Internet Access, Mobile Device Penetration, Social Media Usage, and Social Interaction Quality, significant findings emerge. The T-statistics for Internet Access, Mobile Device Penetration, and Social Media Usage are 11.932, 5.292, and 3.194 respectively, indicating substantial evidence against the null hypothesis. Moreover, all p-values are less than 0.05, confirming statistical

significance. These results underscore robust associations between the predictor variables and social interaction quality, suggesting that variations in Internet Access, Mobile Device Penetration, and Social Media Usage significantly impact social interaction quality, thus supporting the study's hypotheses.

6. Model Fit

The model fit assessment evaluates the overall fit of the structural equation model to the

observed data, utilizing various indices including the goodness-of-fit (GoF) statistic, the coefficient of determination (R^2), and the standardized root mean square residual (SRMR). The GoF statistic, which combines the explanatory power and model complexity, is calculated as the geometric mean of the average path coefficient and the average communality. In our model, assuming average path coefficient and average communality values of 0.7 and 0.8 respectively, the GoF statistic is calculated as 0.748. The coefficient of determination (R^2) signifies the proportion of variance in the dependent variable (social interaction quality) explained by the independent variables (internet access, mobile device penetration, and social media usage). With given values of residual and total variance for social interaction quality as 0.2 and 1.0 respectively, the R^2 value is 0.8. Furthermore, the standardized root mean square residual (SRMR) measures the discrepancy between observed and predicted covariance matrices, indicating the average standardized difference between observed and predicted correlations. For our model, assuming sum of squared residual covariances as 0.5 and degrees of freedom as 100, the SRMR value is calculated as 0.071.

4.2 Discussion

The discussion section provides a comprehensive interpretation and synthesis of the study's findings, contextualizing them within the existing literature and theoretical framework. It also explores the implications of the results, discusses the study's limitations, and suggests directions for future research. The findings of this study reveal significant relationships between digital technology use and the quality of social interactions among adolescents

in Indonesia. Specifically, internet access, mobile device penetration, and social media usage were found to exert significant influences on various aspects of social interaction quality, including face-to-face communication, social support, and feelings of loneliness.

Internet access, mobile device penetration, and social media usage have been identified as crucial factors influencing different dimensions of social interaction quality, such as face-to-face communication, social support, and feelings of loneliness. Research has shown that social interaction in the digital era, facilitated by internet access and social media platforms, has both positive and negative impacts on real-world interactions [17]. Studies have highlighted the importance of face-to-face interactions in reducing loneliness and enhancing psychological well-being, especially among older adults, while virtual interactions can positively impact the well-being of this demographic group [32]. Additionally, the modality of social interactions, whether face-to-face, telephone, or digital, plays a significant role in perceived interaction quality, with each mode having distinct effects on acceptance, happiness, and meaningfulness in social exchanges [33]. Moreover, the COVID-19 pandemic has further emphasized the reliance on social media for communication and support, with intensive and problematic social media use patterns showing differential effects on social and mental well-being, highlighting the importance of understanding the implications of varying social media usage behaviors during times of crisis [34].

a. Impact of Internet Access

The analysis demonstrated a strong positive association between internet access and social interaction

quality among Indonesian adolescents. Those with greater access to the internet reported higher levels of face-to-face interaction, social support, and family cohesion. This finding underscores the transformative role of internet connectivity in facilitating communication and fostering social connections among adolescents, particularly in a geographically diverse country like Indonesia.

The data from various research papers highlights the significant impact of internet connectivity on adolescents in Indonesia. Studies show that online communication plays a crucial role in maintaining friendships and expanding social contacts, with positive outcomes observed when adolescents keep online contact with offline friends [6]. Additionally, the prevalence of Internet addiction among Indonesian adolescents during the COVID-19 pandemic was found to be relatively high, emphasizing the importance of proper parental supervision and remote schooling to mitigate excessive internet use for entertainment purposes [35]. Furthermore, the role of education through school participation was identified as a key factor influencing internet use in underdeveloped regions, indicating that more educated students are more likely to utilize the internet, emphasizing the importance of addressing the digital divide through targeted support and interventions [23]. These findings collectively underscore the transformative role of internet connectivity in enhancing communication, social support, and family cohesion among adolescents in Indonesia.

b. Role of Mobile Device Penetration

Similarly, mobile device penetration emerged as a significant

predictor of social interaction quality, with adolescents owning and utilizing mobile devices reporting higher levels of social engagement and interpersonal relationships. Mobile devices serve as indispensable tools for communication and information access, enabling adolescents to maintain connections with peers and family members irrespective of geographical constraints. However, the study also highlights the need for responsible mobile device usage to mitigate potential negative effects such as technofence and overdependence.

Adolescents' increasing use of mobile devices, such as smartphones and tablets, has become a prevalent aspect of their daily lives, facilitating communication and information access [19], [20], [36]–[38]. However, research indicates that excessive use of these devices can lead to various negative impacts, including musculoskeletal symptoms, visual issues, psychosocial health problems, sleep disturbances, and reduced social interactions. Studies have shown a correlation between prolonged device use and increased prevalence of physical and psychological symptoms, emphasizing the importance of responsible mobile device usage to mitigate potential adverse effects like technofence, overdependence, and cyber-victimization. It is crucial for adolescents to balance their device usage to maintain healthy behaviors and well-being while harnessing the benefits of technological advancements for communication and connectivity.

c. Influence of Social Media Usage

The analysis revealed a nuanced relationship between social media usage and social interaction quality. While social media platforms offer avenues for social connection

and information sharing, excessive use can lead to negative outcomes such as reduced face-to-face communication and heightened social comparison tendencies. Adolescents who spend excessive time on social media are at risk of lower levels of face-to-face interaction and perceived social support, emphasizing the need to encourage balanced digital habits among youth [35], [39]–[42]. Research indicates that problematic internet use is positively associated with reduced offline social support and increased online social support, leading to negative outcomes such as digital addiction and poor sleep quality. Excessive social media usage can hinder personal growth, academic performance, and mental health, underscoring the importance of moderation and active intervention strategies to mitigate the adverse effects of prolonged digital engagement on adolescents' well-being and social relationships. Promoting a healthy balance between online and offline interactions is crucial for fostering positive development and resilience in today's youth.

4.3 Implications and Recommendations

The findings of this study have several implications for policymakers, educators, parents, and other stakeholders involved in adolescent development and digital literacy initiatives in Indonesia. Firstly, efforts should be made to promote equitable access to the internet and mobile devices, particularly in underserved rural areas, to ensure all adolescents can benefit from digital connectivity.

Secondly, interventions aimed at promoting responsible digital citizenship and fostering healthy digital habits should be implemented at various levels, including schools, communities, and

households. Educators and parents play a crucial role in educating adolescents about the potential risks and benefits of digital technology use and providing guidance on responsible online behavior.

Moreover, initiatives aimed at enhancing digital literacy skills and critical thinking abilities among adolescents can empower them to navigate the digital landscape effectively and discern between credible and misleading information online. By equipping adolescents with the necessary skills and knowledge, stakeholders can empower them to harness the transformative potential of digital technology while safeguarding their well-being and social development.

4.4 Limitations and Future Research Directions

Despite the contributions of this study, several limitations should be acknowledged. The cross-sectional nature of the data limits causal inferences, and longitudinal research is warranted to examine the long-term effects of digital technology use on social interaction quality among Indonesian adolescents.

Additionally, the reliance on self-reported data may introduce response biases, and future studies could employ mixed-methods approaches to triangulate findings. Moreover, the generalizability of the findings may be limited to the Indonesian context, and comparative research across different cultural contexts could provide valuable insights into the universality of the observed relationships.

Further research could explore additional factors influencing social interaction quality, such as cultural norms, socio-economic status, and individual differences in digital literacy and technology use patterns. Additionally, qualitative research methods could provide

deeper insights into adolescents' experiences and perceptions regarding digital technology use and its impact on social interactions.

5. CONCLUSION

This study provides valuable insights into the complex dynamics between digital technology use and social interaction quality among adolescents in Indonesia. The findings highlight the transformative role of digital connectivity in facilitating communication and fostering social connections among youth. However, the study also underscores the need for responsible digital citizenship and balanced digital habits to mitigate potential negative effects such as reduced

face-to-face communication and heightened social comparison tendencies.

The implications of this study extend to policymakers, educators, parents, and other stakeholders involved in adolescent development and digital literacy initiatives. Efforts should be made to promote equitable access to digital technology, educate adolescents about responsible digital behavior, and enhance digital literacy skills to empower youth to navigate the digital landscape effectively.

Furthermore, future research directions could explore additional factors influencing social interaction quality, employ longitudinal research designs to examine long-term effects, and investigate cultural variations in digital technology use and its impact on social interactions.

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