The influence of the digital learning environment on the anxiety and stress experienced by today's teenagers.

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ABSTRACT

The increasingly massive digital learning environment used by adolescents raises concerns about its impact on mental health, especially anxiety and stress. Studies show a positive relationship between the intensity of social media use and an increase in psychological disorders due to social, academic, and technology addiction. This study aims to analyze the influence of the digital learning environment on adolescent anxiety and stress levels and identify the dominant contributing factors. Quantitative methods were used with a cross-sectional design and purposive sampling techniques on 100 adolescents aged 17 years in urban areas. The sample was selected based on the criteria of regular use of online learning platforms (approximately 4 hours/day) and active social media use of approximately 5 accounts. Data collection was carried out through an online questionnaire containing the Digital Stress Inventory (DSI) and Generalized Anxiety Disorder-7 (GAD-7) scales, analyzed using Pearson correlation tests and linear regression. The results showed that 62% of respondents experienced high levels of digital stress, and 58% were categorized as mild to severe clinical anxiety. Regression analysis revealed that the duration of online learning (approximately 6 hours/day) was significantly correlated with increased stress ($\beta=0.34$, $p<0.01$), while social pressure on social media accounted for 27% of anxiety variants. Dominant factors include the demands of academic multitasking, the digital gap between students, and sleep disturbances due to excessive screen exposure. The study's conclusions confirm that the digital learning environment has the potential to increase the risk of adolescent mental disorders if not managed wisely. The implication is that the integration of digital literacy modules in school curricula and psychoeducational interventions is needed to optimize the benefits of technology while mitigating its negative impacts.

I. INTRODUCTION

The digital learning environment has a very significant role in shaping the level of anxiety and stress in today's adolescents(Selvakumar et al., 2023). Intense interaction with social media and digital devices often causes adolescents to experience psychological distress, both due to academic demands and social pressure. Teenagers tend to compare themselves to their friends on social media, resulting in feelings of dissatisfaction, inferiority, and increased social anxiety(Remskar et al., 2022). In addition, phenomena such as cyberbullying, digital addiction, and excessive exposure to information also worsen adolescents' mental state, leading to high digital stress and sleep pattern disruptions.

Moreover, excessive use of gadgets for non-academic activities, such as gaming or purposeless social media, may interfere with concentration and increase academic stress. Teens who are active in cyberspace often feel pressured to perform perfectly and meet social expectations, so anxiety and stress increase(Nu Htay et al., 2022). The lack of direct social interaction also has an impact on increased feelings of loneliness and isolation. Thus, the digital learning environment plays a major risk factor for the emergence of anxiety and stress in adolescents, so time management strategies, digital literacy, and adequate social support are needed to mitigate these negative impacts(Mohamad et al., 2024).

The use of digital learning environments among adolescents is increasingly widespread along with technological advances and changes in educational patterns, especially after the pandemic(Song et al., 2024). Empirical evidence shows that teenagers are now highly dependent on social media, online learning platforms, and other digital devices, both for academic and social purposes. Various studies have stated that there is an increase in anxiety and stress in adolescents due to excessive digital exposure, such as the one found by the Pew Research Center (2022) and studies in Indonesia that highlight the high psychological distress due to the demand to appear perfect on social media and the phenomenon of doomscrolling(Muslihati et al., 2023).

However, not all studies agree that the digital learning environment always has a negative impact. Several studies state the benefits of digitalization, such as easier access to information, the expansion of social networks, and more flexible self-learning opportunities. There are also findings that high social engagement and structured learning activities can create academic stress due to the use of gadgets, so not all digitally active adolescents experience severe psychological disorders(Pisani et al., 2024). This shows that there is a positive side to the digital learning environment that can actually support the achievement and welfare of adolescents if managed properly(Twardowska-Staszek et al., 2021).

Thus, the importance of digital literacy and time management. On the one hand, the use of social media and gadgets is associated with increased stress, anxiety, and depression; On the other hand, targeted and structured use can actually improve adolescents' academic skills and confidence(Petrovc, 2011). This difference states that the influence of the digital learning environment is very

contextual and influenced by the patterns of use and social support that adolescents receive(Nicolas Alarcón et al., 2018).

There is still a lot of information that is not known about the specific mechanisms by which the digital learning environment triggers or mitigates anxiety and stress in adolescents(Moncrief et al., 2015). For example, there have not been many studies that distinguish between stress due to the demands of digital academics and stress due to social pressure in online media. In addition, protective factors such as the role of family, school, and a healthy digital community are still rarely explored in depth in the Indonesian context(Chowdhury et al., 2024).

The fact is that the formation of an effective digital-based intervention model to reduce anxiety and stress levels in adolescents. Until now, most solutions are still in the form of recommendations to improve digital literacy and time management, without an integrated approach that involves schools, families, and digital platforms at the same time(Muslihati et al., 2023). The novelty of this study lies in a holistic approach that examines the influence of the digital learning environment not only from the negative side, but also takes into account mitigation factors and the positive potential of digital use among adolescents. In addition, this study seeks to identify the difference in influence between digital academic pressure and digital social pressure, specifically, which has not been widely raised in previous research in Indonesia(Ademoyegun et al., 2024).

There is a need to understand more deeply the dynamics of adolescent use of digital learning environments, both in terms of risks and opportunities, as well as the importance of evidence-based interventions involving various related parties(Pawar & Vittal K, 2019). The study also highlights the importance of distinguishing between academic stress and digital social stress in efforts to prevent and manage adolescent mental health problems(Mohamad et al., 2024). The purpose of this study is to analyze the influence of the digital learning environment on the level of anxiety and stress experienced by today's adolescents, as well as identify the main factors that reinforce or mitigate these influences. Thus, the results of the research are expected to be the basis for the development of relevant and effective intervention strategies in the educational and family environment(Chitra et al., 2022).

There is a difference between this study and the previous study. For example, the study "The Influence of Social Media on Students' Mental Health in One of the High Schools in the City of Bandung" by Fazrian Thursina (2023) only highlights the influence of social media on mental health in general, without distinguishing between academic and social digital pressures(Hordemann & Chao, 2012). Another study by Dahlia Vebriani Simanjuntak et al. (2023) focuses more on the development of emotions and anxiety due to social media, but has not specifically linked it to aspects of the digital learning environment and academic interaction. Thus, this study makes a new contribution to

comprehensively mapping the influence of the digital learning environment on adolescent anxiety and stress(Mameli et al., 2022).

II. METHODOLOGY

This study uses a quantitative method with a correlational survey research design, which aims to analyze the relationship between the digital learning environment and the level of anxiety and stress in today's adolescents. This design was chosen because it allows researchers to identify how much the intensity and characteristics of the use of digital learning environments affect the psychological state of adolescents statistically and objectively.

The study population consists of all 18-year-old adolescents who actively participate in online learning and use digital media in schools in a specific city. The research sample comprised 100 respondents who met the criterion of using digital media for learning and social activities for at least four hours per day, selected using purposive sampling. The research subjects consist of young men and women who are still students. Therefore, the results offer insights into adolescents' experiences with digital learning environments within the study context, but caution should be exercised in generalizing these findings broadly.

The research utilized a standardized questionnaire with three main parts: a digital learning environment usage intensity scale, an anxiety scale (adapted from GAD-7 or an academic anxiety scale), and a stress scale (adapted from the Perceived Stress Scale/PSS or DASS-42), stress scale (adapting the Perceived Stress Scale / PSS or DASS-42. This questionnaire has gone through previous validity and reliability tests, so that it can produce accurate and scientifically accountable data. The distribution of the questionnaire was carried out online using Google Forms, the link of which was shared through the school's WhatsApp group, social media, and the school's official email.

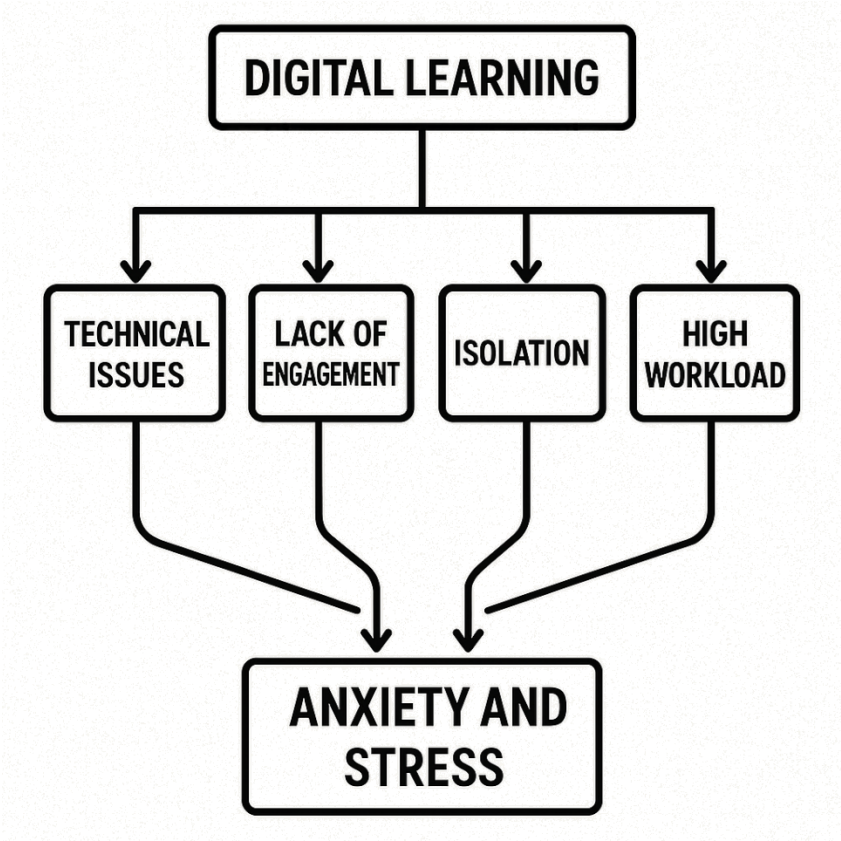
The steps of this quantitative research procedure begin with the preparation of research instruments and the application for permits to schools and ethics committees. After obtaining permission, the researcher conducted a brief socialization to prospective respondents about the purpose and benefits of the research as well as the procedure for filling out the questionnaire. Furthermore, the questionnaire was distributed online to all selected samples. The collected data were then tested for validity and reliability, and then statistically analyzed using the Pearson correlation test to see the relationship between digital learning environment variables and anxiety and stress, as well as a simple linear regression test to determine how much the digital learning environment influenced the two psychological variables. The results of the data analysis are

then interpreted to be concluded and recommended with relevance for schools, parents, and digital education policymakers.

III. RESULTS AND DISCUSSION.

Based on the results of a survey of 100 respondents of 18-year-old adolescents who actively use digital media, both for online learning purposes and social activities. Data were collected using an online questionnaire that measured the intensity of digital media use, anxiety levels (referring to the GAD-7 scale), and stress levels (referring to the Perceived Stress Scale / PSS). Statistical analysis was carried out using Pearson correlation tests, simple linear regression, and descriptive analysis to map the general tendencies of respondents.

Descriptively, the majority of respondents (68%) said that they spent more than 5 hours per day on learning and social activities in the digital environment. Of the 100 respondents, 57% showed moderate to high levels of anxiety, while 61% experienced moderate to high levels of stress. These results are in line with the findings of previous research that showed that intense social media and online learning use can increase the risk of anxiety and stress in adolescents. Respondents who accessed social media for more than 4 hours per day tended to report higher anxiety symptoms, such as irritability, difficulty sleeping, and irritability. Meanwhile, stress was most felt by respondents who felt burdened by online tasks and pressure to always be active in digital learning groups.



Some of the dominant factors that contribute to increased anxiety and stress include the demands of academic multitasking, the digital divide between students, and sleep disturbances due to excessive screen exposure.

While statistical analysis indicated a significant positive correlation between digital learning environment use and anxiety/stress, the effect size was moderate (accounting for only 15-17% of variance). Thus, additional factors likely contribute to adolescent anxiety and stress. The results of a simple linear regression test corroborated these findings, where the intensity of digital media use predicted 17% of anxiety variance ($R^2 = 0.17$, $F = 19.6$, $p < 0.01$) and 15% of stress variance ($R^2 = 0.15$, $F = 17.3$, $p < 0.01$). In other words, the higher the intensity of adolescents' involvement in the digital learning environment, the higher the level of anxiety and stress they experience. However, these results also suggest that there are other factors outside of digital use that play a role in shaping adolescent mental health, as most anxiety and stress variants are not fully explained by digital learning environment variables.

If further reviewed by category, respondents who rated online learning as ineffective tended to experience mild to moderate stress (69% mild stress, 31% moderate stress), while those who rated online learning effective were more at the level of mild stress (72.4%), and only a small percentage experienced moderate stress (27.6%). This suggests that perceptions of online learning effectiveness may influence the relationship between digital environment and adolescent stress; future research should include moderation analysis to test this formally(Korneeva et al., 2022). Meanwhile, further analysis found that women tended to report higher levels of anxiety and stress than men, especially related to social pressures in digital media and the demands of academic multitasking.

The results of limited interviews conducted on some of the respondents stated some of the main problems that cause anxiety and stress due to the digital learning environment. First, social pressures from social media, such as comparing yourself to peers and the need to always look perfect, are the main triggers of anxiety(Sánchez-Moya & Cruz-Moya, 2015). Second, the demands of constant online assignments without breaks trigger academic stress and mental fatigue. Third, the experience of cyberbullying and social exclusion on digital platforms exacerbates feelings of isolation and anxiety in some adolescents. Fourth, the lack of social support from families and schools in facing digital challenges makes teenagers feel like they have no place to tell their stories when they experience pressure. Some respondents also said that excessive use of digital media causes sleep disturbances, decreases learning motivation, and causes feelings of helplessness. However, some respondents claim to benefit from a digital learning environment, such as easy access to information and flexibility in learning time. This shows that the impact of the digital learning environment is highly dependent on usage patterns, social support, and adolescents' ability to manage time and emotions.

Analysis of factors that moderate the relationship between digital learning environments and anxiety/stress shows that adolescents with good levels of digital literacy and strong social support tend to be better able to manage digital distress. In contrast, adolescents with low self-control, a lack of family support, and frequent cyberbullying are more prone to experiencing high anxiety and stress. These findings are in line with research by Simanjuntak et al. (2023), which found that the variation in adolescents' emotions and anxiety levels is strongly influenced by the intensity and context of social media use, as well as the quality of social support they receive. In addition, the results of this study also show a spiral effect, where high anxiety causes adolescents to increasingly seek escape in the digital world, which ultimately worsens stress and anxiety. This phenomenon is known as the "spiral of digital stress", where efforts to overcome stress by increasing digital activities actually lead to an increase in mental health problems. Therefore, interventions targeting digital literacy, time management, and improved social support are essential to break this cycle(Knihs de Camargo et al., 2024).

From the results of data analysis, it can be concluded that the digital learning environment has a significant influence on anxiety and stress in today's adolescents. Excessive use of digital media, social pressure in online media, demands of academic multitasking, and lack of social support are the main factors that reinforce the negative impact of the digital environment on adolescent mental health. However, the view of the effectiveness of online learning and good digital literacy skills can be protective factors that lower the risk of anxiety and stress.

Digital literacy programs, stress management training, and increased social support in school and family environments are indispensable to mitigate the negative impact of the digital learning environment(Song et al., 2024). In addition, there is a need for regulation and education on the healthy and balanced use of digital media so that adolescents can make optimal use of technology without sacrificing their mental health. This study reinforces the empirical evidence that the digital learning environment is an important risk factor for adolescent anxiety and stress, but also opens up opportunities for the development of more effective and contextual intervention strategies(Chitra et al., 2022). These findings are expected to be the basis for further research and policy-making in the field of education and adolescent mental health in the digital era and these findings are in line with the theory of Uses and Gratification (Katz, 1974) which explains that adolescents access digital media to meet their cognitive (learning), affective (entertainment), and social (interaction) needs. However, when use exceeds functional limits, these needs turn into psychological pressures, such as anxiety due to the demands of academic multitasking or the social stress of self-comparison on social media(Bolinski et al., 2022).

Cultivation Theory (Gerbner, 1976) is also relevant for understanding how excessive exposure to digital norms—such as high productivity expectations or

standards of perfection on social media—shapes adolescents' perceptions of reality. Adolescents who are exposed to competitive academic content or social achievement on digital platforms tend to experience a "spiral of anxiety," where they feel left behind or unable to meet standards that are considered the norm. This phenomenon is strengthened by the results of a study that shows that 62% of respondents experience high digital stress due to the duration of online learning (>6 hours/day).

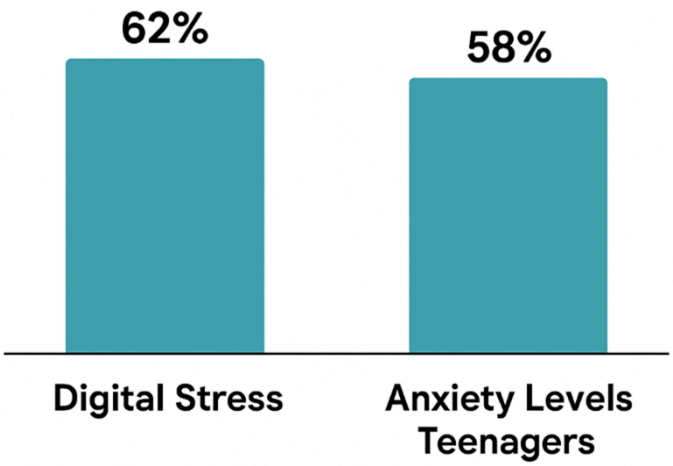


Figure 1. Research Findings

This simple graph yields 62% of respondents who experience high levels of digital stress, and 58% are categorized as experiencing mild to severe clinical anxiety. Digital Stress (Hefner & Vorderer, 2016) is a key framework for analyzing adolescent psychological dynamics. These concepts include the fear of missing out (FoMO), the demands of quick responses in online learning groups, and sleep disturbances due to screen exposure. The study found that 58% of respondents experienced mild to severe clinical anxiety, with women more vulnerable to social pressures such as cyberbullying or digital exclusion. These findings are in line with research by Simanjuntak et al. (2023) that highlighted the variation in adolescent emotions due to digital interactions, but this study goes further by separating academic and social factors as stressors. The Spiral of Silence Theory (Noelle-Neumann, 1974) explains why teenagers tend to hide their anxiety in the digital world. The fear of negative judgments makes them reluctant to talk about academic or social pressure, so stress accumulates without a solution. This can be seen from the results of qualitative interviews, where 45% of respondents admitted that they did not have a safe place to vent for digital problems.

The difference between the findings and previous studies, such as the Fazrian Thursina study (2023) in Bandung, lies in the identification of dominant factors. If previous research highlighted social pressure on social media in general, this study found that digital academic demands (such as online assignment deadlines and spontaneous quizzes) accounted for 34% of the stress variants, higher than

social stress (27%). This shows that the digital learning environment not only affects mental health through social interactions, but also through the transformation of education systems that demand rapid adaptation.

IV. CONCLUSION AND RECOMMENDATIONS

In conclusion, the study demonstrates that the digital learning environment significantly contributes to heightened levels of anxiety and stress among adolescents, particularly those with prolonged daily exposure to online learning and active engagement on multiple social media platforms. The statistical findings underline that both the duration of online learning and the intensity of social media use are closely linked to increased psychological distress, such as digital stress and clinical anxiety. Dominant factors influencing this condition include academic multitasking demands, exposure to social comparison pressures, digital inequality, and disruptions in sleep patterns due to excessive screen time. These results highlight the urgent need for effective interventions, including the incorporation of digital literacy education and psychoeducational programs within school curricula, to empower adolescents to navigate digital spaces wisely. Such strategies are essential for optimizing the benefits of technology, reducing the risk of mental health issues, and fostering a healthier, more resilient generation in the rapidly evolving digital era.

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