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Efficacy of Technology-Enhanced Assessment Tools in Measuring Adolescent Emotional Intelligence

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Abstract
Emotional intelligence (EI) is a critical component of adolescent development, influencing social, academic, and personal outcomes. Traditional EI assessment methods, such as self-report questionnaires, are often limited by subjectivity and reduced engagement. This study explores the effectiveness of technology-enhanced tools in addressing these limitations. By focusing on EI components such as self-awareness, empathy, and emotional regulation, the study evaluates the accuracy, engagement, and user satisfaction of technology-driven assessments compared to traditional methods. The study employed a quasi-experimental research design, conducted among public secondary school students (aged 13 to 18 years) in Lagos State, Nigeria. Using a multi-stage sampling procedure, 238 participants were drawn from 12 local government areas across six educational districts. Participants were divided into control and experimental groups, with traditional self-report questionnaires used for the former and an AI-driven gamified platform for the latter. Quantitative data were collected over six weeks and analyzed using descriptive statistics, independent samples t-tests, ANOVA, and Pearson's correlation. Results indicated that technology-enhanced tools were significantly more effective in the measurement of adolescents' emotional intelligence, yielding a mean EI score of 85.12 compared to 72.34 for traditional methods ($p < 0.05$). Adolescents rated technology-driven tools highly for engagement (mean = 4.72) and satisfaction (mean = 4.68). Furthermore, a positive correlation was observed between user engagement and accuracy in measuring EI components, affirming the efficacy of these tools in capturing nuanced emotional responses. The findings highlight the transformative role of technology in EI assessment, offering educators and counsellors accurate and engaging tools to support adolescent emotional development. Recommendations include the adoption of such tools in schools, training programs for educators, and further research on their long-term impacts. By bridging gaps in traditional assessments, this study contributes to the growing body of literature on the intersection of technology and emotional intelligence.

Keywords: Emotional Intelligence (EI), Technology-Enhanced Assessment, Adolescent Development, Educator and Counsellor Support, Engagement and Accuracy in EI Measurement

1. Introduction

Adolescence is a critical stage in human development marked by rapid psychological, emotional, and social changes. Emotional Intelligence EI which is the ability to perceive, interpret, demonstrate, control, evaluate and use emotions to communicate with and relate to others effectively and constructively (Kendra 2024), has emerged as a key predictor of success in academic, social, and personal domains (Petrides, Mikolajczak, & Mavroveli, 2018). In this context, assessing EI in adolescents has become increasingly important for educators, psychologists, and policymakers aiming to foster holistic development.

Traditional methods of assessing EI, such as self-report questionnaires and observer ratings, have provided foundational insights into emotional competencies (Mayer, Salovey, & Caruso, 2018). However, these approaches are often criticized for their susceptibility to social desirability biases, limited scalability, and lack of interactivity, particularly in diverse and resource-constrained settings like public schools in Lagos State, Nigeria (Adeoye & Tunde, 2020). These limitations necessitate innovative and contextually relevant methods to accurately measure EI, especially among adolescents who are digital natives and may respond better to technologically mediated approaches.

The proliferation of digital technology has introduced novel opportunities to enhance psychological assessments. Technology-enhanced assessment tools, including gamified platforms and artificial intelligence (AI) driven systems, are gaining traction for their potential to address the limitations of traditional EI measurement methods (Keefer, Parker & Saklofske, 2018). These tools leverage interactive elements, real-time feedback, and data analytics to create engaging and accurate assessments, making them particularly suited for adolescent populations (MacCann, Joseph, Newman & Roberts, 2020). By incorporating elements

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such as virtual simulations and adaptive testing, technology-enhanced tools can provide a more nuanced understanding of emotional competencies while maintaining participant engagement.

In Lagos State, Nigeria, public schools face unique challenges that make the integration of technology in educational and psychological practices particularly relevant. Factors such as large class sizes, limited access to trained psychologists, and diverse student backgrounds underscore the need for scalable and efficient assessment methods (Olowoduro, 2022). Technology-enhanced tools offer a promising solution by facilitating widespread implementation and overcoming logistical barriers associated with traditional assessments.

Moreover, the role of technology in enhancing learning and assessment outcomes has been extensively documented. Studies suggest that interactive and gamified assessments improve learner motivation and engagement, particularly among adolescents (Chaudhry, Malik & Ahmed, 2021). Additionally, AI-based systems can provide personalized insights, enabling educators and counsellors to design targeted interventions that address individual emotional and social needs (Kretschmer, Mohr, & Symanzik, 2020).

Despite the potential benefits, limited research exists on the application of technology-enhanced tools for assessing EI in Nigerian contexts, particularly in public school settings. This gap highlights the need for empirical studies to evaluate the effectiveness, feasibility, and acceptability of such tools among adolescents in Lagos State. By exploring this intersection of technology and emotional intelligence, the present study seeks to contribute to the growing body of knowledge on innovative assessment practices and their implications for adolescent development.

1.1 Statement of the Problem

Traditional methods of assessing emotional intelligence (EI), such as self-report questionnaires and observer ratings, have been widely used but face significant challenges in terms of reliability, engagement, and scalability. Adolescents, as digital natives, often find these methods monotonous, leading to decreased motivation and inconsistent responses (Keefer et al., 2018). These limitations are particularly pronounced in public school settings in Lagos State, where large class sizes and limited resources exacerbate the challenges of administering and interpreting EI assessments (Olowoduro, 2022).

Moreover, there is a gap in empirical evidence regarding the effectiveness of technology-enhanced tools in improving the measurement of specific EI components, such as self-awareness, empathy, and emotional regulation, among adolescents. While the integration of technology in education has been explored, its application in psychological assessments, particularly for EI, remains under-researched in the Nigerian context.

The need for scalable, real-time, and interactive tools is becoming increasingly evident. Technology-enhanced assessments, with their capacity for immediate feedback, adaptive testing, and engaging formats, hold promise for addressing the challenges faced by traditional methods. However, without robust empirical studies, their practical utility, especially in resource-constrained environments like Lagos State, remains uncertain.

1.2 Research Objectives

1. To evaluate the effectiveness of technology-enhanced tools in measuring adolescent emotional intelligence.
2. To identify the relationship between specific EI components—self-awareness, empathy, and emotional regulation—and their measurement using technology-enhanced tools.
3. To assess adolescents' engagement and perception of technology-driven EI assessments.

1.3 Research Questions

1. How effective are technology-enhanced tools in accurately assessing emotional intelligence in adolescents?
2. Is there a significant difference in the measurement of EI components between traditional and technology-enhanced methods?
3. What is the level of engagement and user satisfaction among adolescents using technology-driven EI tools?

1.4 Significance of the Study

The findings of this study will equip educators, psychologists, and counsellors with effective tools to measure and support emotional intelligence among adolescents. The real-time feedback and interactive features of technology-enhanced tools can help professionals design targeted interventions to foster emotional development, ultimately improving students' academic performance and social skills.

The results will provide empirical evidence to inform policies on integrating technology-driven assessments into school curricula and counselling programs. Policymakers can leverage this study to promote the adoption of scalable and innovative solutions for student development, especially in under-resourced public schools.

The study will contribute to the growing body of research on the role of technology in psychological assessments, specifically for adolescents. By exploring the application of technology-enhanced tools in a Nigerian context, the research will offer unique insights into their effectiveness, feasibility, and acceptance in diverse and resource-constrained

settings.

2. Literature Review

Emotional intelligence encompasses core components such as self-awareness, empathy, emotional regulation, and relationship management. These competencies affect adolescents' academic achievements, social interactions, and mental well-being (Keefer et al., 2018). Assessing these components accurately is essential for developing targeted interventions.

Traditional EI assessments, such as self-report questionnaires and performance-based tests, have long been utilized in educational and psychological settings. However, these methods face limitations, including social desirability bias, reduced engagement, and logistical challenges in resource-constrained environments like Lagos State public schools (Chaudhry et al., 2021; Olowoduro, 2022).

2.1 Technological Advancements in EI Assessment

Advancements in technology have introduced innovative tools that address the limitations of traditional methods. AI-driven platforms, gamified assessments, and wearable devices are increasingly used to evaluate emotional competencies. For example, AI-based tools analyze facial expressions and physiological responses to measure emotional states, while gamified platforms enhance engagement through interactive activities and real-time feedback (MacCann et al., 2020; Kretschmer et al., 2020).

Wearable devices further complement these tools by providing objective data on physiological responses like heart rate and skin conductance, offering insights into emotional regulation (Keefer et al., 2018). These technologies are not only more engaging but also scalable, making them suitable for large student populations.

2.2 Adolescents and Technology

Adolescents' familiarity with technology makes it an effective medium for engaging them in emotional intelligence assessments. Research shows that interactive and gamified platforms are highly engaging for adolescents, promoting active participation and accurate self-reflection (Chaudhry et al., 2021). In Nigeria, the increasing accessibility of smartphones and internet connectivity provides an opportunity to integrate technology into educational and psychological practices (Olowoduro, 2022).

2.3 Theoretical Framework

Daniel Goleman's Emotional Intelligence (EI) theory provides the foundation for understanding the competencies necessary for emotional and social well-being, particularly among adolescents. Goleman identifies EI as encompassing self-awareness, emotional regulation, empathy, motivation, and social skills, which are critical for personal and interpersonal success (Goleman, 1995). These competencies are especially relevant during adolescence, a period characterized by significant emotional and social development.

The Technology Acceptance Model (TAM) complements this theoretical framework by explaining how individuals adopt and interact with new technologies. The model highlights perceived usefulness and ease of use as the primary drivers of technology acceptance (Davis, 1989). For adolescents, who are digital natives, these factors significantly influence their engagement with technology-driven assessments (Chin, Khoo & Low, 2020).

2.4 Empirical Review

Emotional intelligence assessments have traditionally relied on tools such as self-report questionnaires and performance-based methods. However, studies have repeatedly highlighted their limitations. Schutte, Malouff, and Bhullar (2018) noted that self-report methods often succumb to social desirability bias, where participants tend to provide responses they believe are socially acceptable rather than accurate reflections of their emotional states. Hodge, Lonsdale, and Allen (2019) further emphasized the lack of scalability and reliability associated with traditional assessments, particularly in resource-limited settings, making them unsuitable for large-scale use in contexts like Nigerian public schools.

In response to these challenges, recent research has explored technology-enhanced tools as a means of improving the reliability and engagement of EI assessments. Kretschmer, Mohr, and Symanzik (2020) conducted a study examining AI-based platforms capable of analyzing facial expressions and vocal intonations. Their findings indicated that such platforms not only provided real-time insights into emotional regulation and empathy but also yielded more accurate and objective data compared to traditional approaches. Similarly, MacCann et al. (2020) investigated the role of gamified assessments, which incorporate interactive features and scenario-based tasks to measure self-awareness and interpersonal skills. Their results demonstrated that gamification significantly increased participants' engagement and motivation, factors that are particularly important when assessing adolescents. Chaudhry, Malik, and Ahmed (2021) also highlighted the effectiveness of wearable devices, which track physiological markers such as heart rate and skin conductance, providing an additional layer of objectivity to EI assessments.

Adolescents, being digital natives, are particularly well-suited for technology-driven assessments. Chin, Khoo, and Low (2020) found that adolescents demonstrate a preference for interactive, visually stimulating tools over static questionnaires, which often result in higher engagement and data reliability. This finding is supported by Olowoduro (2022), who observed the increasing adoption of digital tools in Nigerian public schools, driven by initiatives to

improve internet connectivity and access to technological resources. While infrastructural and socioeconomic challenges remain, these advancements provide an opportunity to integrate technology-driven psychological assessments into school systems.

Despite the promising findings from these studies, gaps persist in the literature, particularly regarding the application of technology-enhanced EI tools in low-income and developing contexts. Most studies have focused on populations in high-income countries, leaving a lack of empirical data on their efficacy and feasibility in regions such as Lagos State, Nigeria. Additionally, the specific impact of technology-enhanced tools on distinct EI components, such as empathy, self-awareness, and emotional regulation, remains underexplored. Moreover, the long-term developmental outcomes of using these tools in adolescence have not been adequately addressed.

The reviewed studies collectively underscore the potential of technology-driven tools to overcome the limitations of traditional EI assessments by enhancing accuracy, scalability, and participant engagement. However, they also reveal the necessity for localized research to evaluate these tools in culturally and contextually relevant settings, such as Nigerian public schools. This study aims to fill these gaps by examining the role of technology-enhanced tools in measuring adolescent EI in Lagos State, Nigeria while providing actionable insights for educators, policymakers, and psychologists.

3. Methodology

The study employed a quasi-experimental research design to evaluate the effectiveness of technology-enhanced tools in measuring adolescent emotional intelligence (EI) compared to traditional methods. This design was chosen to facilitate a controlled comparison between the two approaches while capturing data in a real-world educational context. The research was conducted among public secondary school students in Lagos State, Nigeria, leveraging the stratified structure of the state's educational districts for comprehensive coverage and generalizability.

The population comprised students aged 13 to 18 years across the six educational districts of Lagos State. A multi-stage sampling procedure was utilized to draw the sample. In the first stage, two local government areas (LGAs) were randomly selected from each educational district, resulting in a total of 12 LGAs. In the second stage, one public secondary school was randomly selected from each LGA, ensuring geographical diversity and inclusion of schools from urban, semi-urban, and rural settings. In the third stage, stratified random sampling was employed within each selected school to recruit students. Stratification was based on class levels (Junior Secondary 3 and Senior Secondary 2) to include participants at different stages of adolescence. A total of 238 students were recruited, ensuring proportional representation from each school. Participation was voluntary, and parental consent, along with student assent, was obtained before inclusion in the study.

Data collection involved dividing participants into two groups: the control group, assessed using traditional EI self-report questionnaires, and the experimental group, assessed using technology-enhanced tools. The traditional method utilized a validated EI scale with subscales measuring self-awareness, empathy, emotional regulation, and interpersonal skills. For the experimental group, assessments were conducted using an AI-driven gamified platform specifically designed to measure the same EI components. The platform provided interactive scenarios, real-time feedback, and physiological data integration through wearable devices.

Quantitative data analysis was performed using IBM SPSS Statistics. Descriptive statistics, including means and standard deviations, were used to summarize the data. Inferential statistics were employed to test the hypotheses. An independent samples t-test was conducted to compare the accuracy of EI measurement between traditional and technology-enhanced methods. A one-way ANOVA was used to examine differences in engagement and user satisfaction levels across the six educational districts. Pearson's correlation analysis assessed the relationship between specific EI components and the measurement tools used.

Ethical considerations were adhered to throughout the study. Approval was obtained from the Lagos State Ministry of Education and the respective school authorities. Confidentiality of participants was ensured by anonymizing data and restricting access to authorized researchers. Students were debriefed after the study, and findings were shared with participating schools to promote awareness of the potential benefits of technology-enhanced EI assessments.

4. Results

A total of 238 students participated in the study, with 119 students in the control group (traditional EI assessments) and 119 in the experimental group (technology-enhanced tools). Participants were distributed proportionally across the six educational districts of Lagos State, with an even gender representation (52% female, 48% male). The age range of participants was 13–18 years, with a mean age of 15.6 years (SD = 1.2).

Research Question 1: How effective are technology-enhanced tools in accurately assessing emotional intelligence in adolescents?

An independent samples t-test was conducted to compare the accuracy of EI measurement between traditional methods and technology-enhanced tools. Accuracy was measured using the total EI scores obtained from each group.

Table 1: Comparison of EI Scores between Groups

Group	Mean EI Score	SD	t-value	p-value
Traditional Method	72.34	8.67	-7.89	0.000
Technology-Enhanced	85.12	6.45		

Table 2: Mean Scores for EI Components by Group

Component	Group	Mean	SD	F-value	p-value
Self-Awareness	Traditional Method	24.18	4.12	15.67	0.001
	Technology-Enhanced	29.45	3.87		
Empathy	Traditional Method	22.63	4.25	10.34	0.002
	Technology-Enhanced	26.71	3.98		
Emotional Regulation	Traditional Method	25.53	4.14	12.89	0.001
	Technology-Enhanced	29.32	3.56		

Results show that the mean EI score for the technology-enhanced group (M = 85.12, SD = 6.45) was significantly higher than that of the traditional group (M = 72.34, SD = 8.67), with a p-value of <0.05. This indicates that technology-enhanced tools are significantly more effective in accurately assessing adolescent EI.

Research Question 2: Is there a significant difference in the measurement of EI components between traditional and technology-enhanced methods?

A one-way ANOVA was conducted to compare the scores for specific EI components (self-awareness, empathy, and emotional regulation) between the two groups.

The analysis revealed statistically significant differences in the measurement of all three EI components between the two groups, with the technology-enhanced tools yielding higher mean scores. These findings suggest that technology-enhanced methods more effectively measure specific EI components.

Research Question 3: What is the level of engagement and user satisfaction among adolescents using technology-driven EI tools?

Descriptive statistics were used to analyze engagement and satisfaction ratings collected from the experimental group. Engagement was measured on a 5-point Likert scale (1 = Low Engagement, 5 = High Engagement), and satisfaction was assessed on a similar scale.

Table 3: Engagement and Satisfaction Ratings for Technology-Enhanced Tools

Metric	Mean Rating	SD
Engagement	4.72	0.41
User Satisfaction	4.68	0.37

Participants reported high levels of engagement (M = 4.72, SD = 0.41) and satisfaction (M = 4.68, SD = 0.37) with the technology-driven tools. Qualitative feedback indicated that the interactive features and real-time feedback were particularly appreciated.

5. Discussion

The results of this study highlight the superior effectiveness of technology-enhanced tools in measuring adolescent emotional intelligence. These tools not only provided higher accuracy but also improved engagement and satisfaction among adolescents. The interactive and real-time features of the technology-enhanced tools addressed key limitations of traditional EI assessments, such as low engagement and reliance on self-report biases. The findings contribute to the growing body of evidence supporting the integration of technology in psychological assessments, particularly for adolescents in diverse educational contexts.

The findings of this study confirm the significant potential of technology-enhanced tools in accurately measuring emotional intelligence (EI) among adolescents. Statistical analysis demonstrated that technology-driven assessments yielded higher scores across all EI components—self-awareness, empathy, and emotional regulation—when compared to traditional self-report questionnaires. For instance, an independent samples t-test revealed a mean EI score of 85.12 for the technology group compared to 72.34 for the traditional group, with a p-value of <0.05, highlighting the statistical significance of these differences.

These results align with prior research that critiques the limitations of traditional EI assessments, such as subjectivity, social desirability bias, and reduced engagement. Studies by Mayer and Salovey (2018) and Goleman (2021) emphasize that traditional methods often fail to capture real-time emotional responses, leading to potential inaccuracies. In contrast, the interactive nature of technology-enhanced tools provides dynamic scenarios, real-time feedback, and physiological data integration, addressing these gaps. The significant improvement in measurement accuracy

in this study corroborates findings from similar studies employing AI-driven assessments, such as those reported by Brannon (2022), which demonstrated that gamified platforms enhance both the precision and engagement of psychological evaluations.

Technology-enhanced engagement among adolescents by leveraging interactive features that resonate with their familiarity and comfort with digital tools. The mean engagement rating of 4.72 (on a 5-point scale) and a satisfaction rating of 4.68 highlight the positive reception of technology-enhanced assessments. These tools gamified features and real-time feedback created an engaging and immersive experience, reducing assessment fatigue and encouraging authentic responses. Adolescents, being digital natives, showed an increased willingness to participate and interact with the assessments, which likely contributed to more accurate results.

6. Conclusion and Recommendations

This study concludes that technology-enhanced tools are significantly more effective than traditional methods in measuring adolescent emotional intelligence. The findings demonstrate the accuracy and engagement benefits of these tools, particularly in capturing the core EI components of self-awareness, empathy, and emotional regulation. The integration of gamified features, real-time feedback, and physiological data collection was instrumental in addressing the limitations of traditional self-report questionnaires, offering a more holistic and reliable assessment framework.

To maximize the benefits of these findings, the following recommendations are proposed:

1. Schools should integrate validated technology-driven platforms for regular EI assessments.
2. Training initiatives should be designed to equip educators and counsellors with the skills needed to effectively implement and interpret technology-enhanced EI tools.
3. Future studies should explore the long-term effects of using technology-enhanced assessments on adolescent development, particularly in building emotional resilience, improving academic performance, and fostering interpersonal relationships.

In conclusion, this study underscores the transformative potential of technology-enhanced tools in measuring and supporting adolescent emotional intelligence. By adopting these innovations, educators, counsellors, and policymakers can take significant strides toward promoting emotionally intelligent and socially capable future generations.

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