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Adolescent Executive Function Measurements in Indonesia : Systematic Review and Implications in Educational Settings

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Abstract: This study examines the landscape of executive function (EF) assessments for Indonesian adolescents, focusing on their psychometric properties. The adolescent development phase, marked by cognitive growth, presents opportunities and risks, especially in education settings where well-developed EF is beneficial. This research used a qualitative approach, with a systematic literature review method using the PRISMA (Preferred Reporting Items for Systematic Review and Meta-analysis), analyzing peer-reviewed empirical studies from databases such as SCOPUS and others, focusing on EF measurements for adolescents in Indonesia from 2014 to 2024. Nine studies met the inclusion criteria, highlighting tools like the Behavior Rating Inventory of Executive Function (BRIEF)-Indonesian version, Executive Skills Questionnaire-Revised (ESQ-R), Executive Function Questionnaire (EFQ), and performance-based measures like the Wisconsin Card Sorting Test and Stroop Test. Using content analysis, this study reveals that while the BRIEF is widely used in clinical studies, its applicability in educational settings requires improvement. The findings highlight the importance of adapting EF tools with cultural sensitivity and developing new comprehensive assessments with clear psychometric properties regarding all critical EF components. In recommendations, the study pinpoints a multi-method approach combining inventory-based and performance-based measures to provide a thorough understanding of EF while maintaining practicality for educational settings. The implications for advancing EF research and practice in Indonesia, particularly in education, are discussed, emphasizing the need for reliable, valid, culturally sensitive, and accessible assessment tools.

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Introduction

Research on executive function (EF) has a long history over these past five decades, with its origins tracing back to Phineas Gage (Harlow, 1848; Goldstein et al., 2013; Ardila, 2018). Pribram (1973) was among the first to introduce the term 'executive,' shedding light on the brain's executive programs responsible for maintaining organization. Since then, many researchers have studied executive function across various domains of human development, notably in learning behavior, self-regulation, and goal-directed behavior (Goldstein et al., 2013; Baggetta & Alexander, 2016; Ardila, 2018; Zelazo et al., 2020; Doebel & Muller, 2023).

The definition of executive function has developed over the decades, with researchers initially studying its components and whether it constitutes a unitary or diverse construct (Goldstein et al., 2013; Xu et al., 2013; Ardila, 2018; Karr et al., 2018). Miyake et al. (2000) significant contribution has established a tripartite model of executive function, delineating three separable yet correlated components: working memory (updating), shifting (cognitive

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flexibility), and inhibitory control. This model has become widely researched across various disciplines (Doebel & Muller, 2023). These past few years, the executive function has been defined as a set of complex and interrelated cognitive processes that maintain goal-directed behavior. The tripartite model provides a comprehensive framework for understanding the executive function's multifaceted nature and its role in guiding behavior and cognition.

Through these past decades, researchers have found robust correlations between executive function and various variables in human development, particularly in educational settings. Meta-analyses and reviews of research have highlighted the direct and indirect roles of executive function in learning and neurodevelopmental disorders (e.g. reading comprehension (Follmer, 2018); student's math and reading achievement (Jacob & Parkinson, 2015); mathematics proficiency (Cragg & Gillmore, 2014); Theory of Mind in Children with ADHD (Pineda-Alhucema et al., 2018); ASD & ADHD (Margari et al., 2016)). Children with developed executive function skills tend to have higher school readiness and academic achievement (Baggetta & Alexander, 2016). Moreover, the executive function holds a crucial role in adolescence regarding self-regulation, thereby impacting achievement in educational settings, as well as the prevention of involvement in risky behaviors such as smoking, drinking, drugs, reckless driving, and unsafe sex (Berthelsen et al., 2017; Walshe et al., 2017; Mak et al., 2018; Claro et al., 2022).

However, research on executive function in the Indonesian adolescent population has yet to flourish to the same extent as research on early childhood and adult populations. Despite its scarcity, available research consistently shows the importance of executive function for adolescents, particularly in educational and clinical contexts. Studies have demonstrated positive correlations between executive function and academic achievement (Siregar, 2018; Fauziyah, 2020), as well as associations between executive function deficits and various adolescent problems, including externalizing and internalizing symptoms (Zulnida, 2020; Nurany et al., 2022).

Nevertheless, the utilization of executive function studies for the best interest of Indonesian adolescents remains limited, just as the adolescent executive function measurements in the Indonesian context. While some measurements are available, they may require considerable time and resources to implement, if not limited to their psychometric qualities. Therefore, this study aims to systematically review available assessment tools for adolescent executive function in Indonesia, focusing on their psychometric properties. To the author's knowledge, there has been no prior systematic literature review in Indonesia regarding assessments of executive function for adolescents. This study examines the landscape of executive function (EF) assessments for Indonesian adolescents, highlighting the need for reliable, valid, culturally sensitive, and accessible assessment tools. The implications of this study for advancing research and practice in the field of adolescent executive function assessment, especially in educational settings, will also be discussed.

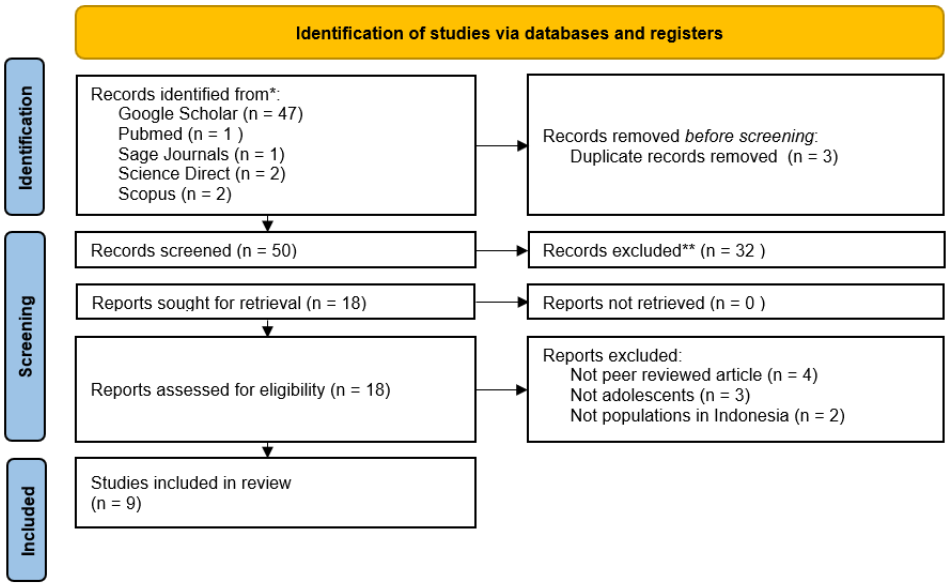
Research Method

This research used a qualitative approach, with a systematic literature review method using the PRISMA (Preferred Reporting Items for Systematic Review and Meta-analysis) (Page et al., 2021), guidelines for conducting a systematic review to evaluate executive function assessment tools for adolescents. The search was carried out across various databases such as SCOPUS and others. Inclusion criteria involved peer-reviewed empirical studies that utilized executive function assessment tools for adolescents aged 10-18 within the Indonesian language and context and conducted in Indonesia. The search terms used were ("executive function") in the title, ("adolescent" OR "remaja") AND/OR ("Indonesia" OR

"Indonesian") in the keywords, abstract, or author. Articles considered for review were those published in either Indonesian or English between 2014 and 2024.

The articles were gathered using Harzing's Publish or Perish (Windows GUI Edition, 8.12.4612.8838 version) (Harzing, 2007) and manual browsing through university database accesses. The 53 articles collected underwent both manual screening by the authors and automatic screening using Zotero (Roy Rosenzweig Center for History and New Media, 2016) to identify duplicates. Afterwards, Rayyan.io (Ouzzani et al., 2016) was utilized to facilitate further screening based on careful observation of article titles and abstracts. Through this screening process, 18 articles were selected for thorough eligibility assessment. After full-text analysis, nine studies were included for further processing. Using content analysis, the psychometric properties, strengths, limitations, and applicability of executive function assessment tools from the full-text papers were extracted. The article collection and screening procedures are illustrated in diagram number 1.

Diagram 1. Article collection and screening process (PRISMA 2020 flow diagram)



Results and Discussion

These studies explore the complexities of EF measurement among adolescents in diverse educational backgrounds and clinical conditions. Among the eligible papers reviewed, several distinct studies stand out for their detailed exploration of EF measurement for adolescent participants within the Indonesian context. Ayomi (2022) examined EF within a cohort of intellectually gifted adolescent students in Semarang, Central Java, offering perspectives on EF strengths and challenges among these individuals. The study by Ayomi and colleagues (2022) contributes to a more holistic understanding of cognitive abilities across gifted populations. Furthermore, Kosasih et al. (2023) explored EF and self-regulation among adolescents in a specialized coaching clinic for children in conflict with the law in Bandung, West Java. This study provides valuable implications for educational interventions and support systems for this marginalized adolescent group.

Meanwhile, Wiguna et al. (2014) focused on executive dysfunction among adolescents with antipsychotic-treated schizophrenia in Jakarta. This research provides insights into the specific challenges faced by this adolescent population and highlights the importance of understanding EF deficits in clinical settings. Similarly, Hadi et al. (2021) investigated the correlation between the length of untreated psychosis episodes and their

effect on EF in early-onset psychosis among adolescents. This study underscores the relevance of EF research in psychiatric conditions and emphasizes the impact of early intervention on cognitive outcomes.

Across the reviewed studies, several psychometric tools emerged as central in assessing EF across diverse populations. Among the nine papers reviewed, five used inventory measurement tools, including the Behavior Rating Inventory of Executive Function (BRIEF), Executive Skills Questionnaire-Revised (ESQ-R), and Executive Function Questionnaire (EFQ). Additionally, four studies employed performance-based assessment tools such as the Psychology Experiment Building Language/PEBL (computerized) Berg Card Sorting Test-64, Digit Span Backward, Stroop Test, Wisconsin Card Sorting Test (WCST), Trail Making Test (TMT), design fluency test (part of the Delis-Kaplan Executive Function System), and the newly developed Computer-Based Game Inventory for Executive Function (CGIEF).

The BRIEF-Indonesian version, based on the studies reviewed, emerges as the most widely used inventory measuring tool for EF within diverse demographic settings. Evidence of its prevalent utilization across various studies, the BRIEF-Indonesian version has played a crucial role in assessing EF in clinical populations, including children with antipsychotic-treated schizophrenia, those diagnosed with psychosis, and children with chronic kidney disease. According to Hadi et al. (2021), the BRIEF questionnaire's strength lies in its ability to assess daily EF, addressing the limitations of one-time testing instruments that only show a child's current performance influenced by various factors.

Walker and D'Amato (2006) found that the Behavior Rating Inventory of Executive Function (BRIEF) reflects widely accepted constructs of executive functioning, ensuring that the measure is comprehensive and covers essential aspects of these cognitive processes. The BRIEF has demonstrated its utility across various conditions, including attentional and language disorders, learning disabilities, high-functioning autism spectrum disorders, and other medical conditions (Gioia & Isquith, 2011). In addition, the items in the BRIEF were modified to be age-appropriate for adolescents, enhancing its effectiveness as a self-report tool for this age group. This modification ensures that the questions are understandable and relevant to the experiences and developmental stages of adolescents, thereby improving the accuracy and reliability of their responses. (Walker & D'Amato, 2006).

However, despite its many advantages, the BRIEF has several limitations, particularly for assessing executive function in adolescents with ADHD. A study by Davidson, Cherry, and Corkum (2016) noted an inconsistent rating between parents and teachers. Parents might rate most subscales high, while teachers might not, making it difficult to obtain a clear picture of the child's executive function. The parent ratings on the BRIEF-Parent Form were consistent with ADHD diagnostic criteria, while teacher ratings varied significantly, particularly with the Working Memory and Plan-Organize subscales (Mares et al, 2007; Toplak et al., 2009).

In addition to that, Davidson, Cherry, and Corkum (2015) also highlighted a significant overlap between BRIEF items and ADHD diagnostic criteria, such as "interrupts others" and "gets out of the seat at the wrong time," which mirror ADHD criteria like "often interrupts or intrudes on others" and "often leaves the seat when remaining seated is expected". While this overlap can aid in the early identification of ADHD, it also complicates the interpretation of results. Additionally, using the BRIEF may lead to misleading conclusions, particularly in identifying specific executive deficits like working memory in children with ADHD, due to the overlap between EF items and ADHD symptoms (Thorell, 2008).

In summary, while the BRIEF has some limitations, including redundancy with ADHD diagnostic criteria and inconsistent ratings between parents and teachers, it remains an important tool for measuring executive function in adolescents in Indonesia. The BRIEF has been validated across various adolescent populations, though its use has primarily focused on clinical settings rather than educational ones (Wiguna et al., 2014; Hadi et al., 2021; Wijaya et al., 2024). The exclusive copyright and the costs associated with accessing the BRIEF might impact this limited use in educational settings.

In addition to the BRIEF, researchers have utilized other inventory-based EF assessments, such as the Executive Skills Questionnaire-Revised (ESQ-R) and the Executive Function Questionnaire (EFQ) in educational settings for both general and marginalized adolescent populations. ESQ-R was employed in studies focusing on bullying and EF within school environments (Yuniarrahmah et al., 2022), while EFQ was utilized in coaching clinics for adolescents involved in legal conflicts (Kosasih et al., 2023). The study by Kosasih et al. (2023) is noteworthy, as it involved adolescents in specific and challenging settings, specifically a coaching clinic for children in conflict with the law. However, the adaptation process of the Executive Function Questionnaire (EFQ) used in the study needs improvement beyond its reported reliability coefficient of 0.95.

Yuniarrahmah et al. (2022) examined the ESQ-R's content validity and reliability in their study. While they engaged a panel of 10 experts to evaluate content validity, the outcomes of this assessment were yet to be documented clearly. However, the reported Cronbach's alpha coefficient for ESQ-R was 0.907, indicating strong internal consistency. Despite this promising result, the adaptation of ESQ-R still needs improvement to achieve robust psychometric properties, including construct validity and other aspects of validity. Additionally, the components of executive function (EF) measured by the instrument were not explicitly defined, which is concerning given the complexity of EF.

It is crucial to note that the original study of ESQ-R highlighted its strong psychometric properties, such as excellent internal consistency, test-retest reliability, and correlations with other EF and psychological symptom scales (Strait et al., 2020). Furthermore, the instrument covers five distinct factors: plan management, time management, materials organization, emotional regulation, and behavioral regulation. While these findings suggest the potential usefulness of ESQ-R in educational settings, it is essential to adapt it comprehensively and rigorously to ensure its validity and reliability across diverse contexts.

Moreover, the original study focused on a sample of young adults. The adaptation of ESQ-R in Malaysia by Nasir et al. (2021) also considered its applicability to adult workers. This raises concerns about the clarity of the items for early and middle adolescents, highlighting the necessity for further exploration and adaptation to ensure the instrument's relevance across different age groups. By acknowledging these limitations and engaging in additional research and development, ESQ-R has the chance to evolve into a more dependable and effective tool for EF assessment.

In contrast, performance-based measures of executive function (EF) have been employed in various educational settings (Murti et al., 2021; Ayomi, 2022; Kaloka et al., 2024). These studies used performance-based EF measures to explore correlations between variables across different contexts such as critical thinking and intelligence. For instance, Kaloka et al. (2024) utilized performance-based EF measures to evaluate the effectiveness of educational programs. However, these measures have their strengths and limitations.

Holochwost et al. (2022) evaluated EF performance measures through the lens of ecological systems theory. They argued that performance-based EF measures reflect state-like EF performance at a specific moment of measurement, typically in laboratory or specialized

settings, rather than capturing a child's underlying EF capacity or trait. Furthermore, they emphasized the importance of distinguishing between intra-individual (state-like) and inter-individual (trait-like) differences in EF performance and understanding how various factors contribute to these differences. Holochwost et al. (2022) suggested that to accurately assess children's EF, it is beneficial to conduct repeated EF performance measurements over time and combine them with inventory or report-based assessments.

However, performance-based EF tests require significant time, resources, and materials, which can be a limitation, especially when multiple measurements are needed. These findings align with research by Claro et al. (2022), which showed that teacher reports of adolescents' EF were more strongly correlated with adolescents' engagement in risky behaviors. In contrast, performance-based EF measures did not show a relationship with risky behavior. These differences underscore the importance of using multiple sources of measurement to understand EF comprehensively (Wallisch et al., 2018), which has educational implications, such as informing school intervention programs.

Table 1 – Articles Reviewed

First Author, Publication Year	Participants (City/District)	EF Measurement	Psychometric Properties & Results
(Wiguna et al., 2014)	Adolescents (12-18 yo, mean age=16.27, SD = 1.86) (Jakarta)	Behavior Rating Inventory of Executive Function (BRIEF-Indonesian version) – parent report	The BRIEF was reported as valid, and consistent, and the cut-off score has 85% sensitivity and 81% specificity. The paper stated that "..the inconsistency level was less than 9 and the negativity level was less than 7", though specific psychometric indicators were not explicitly stated. Adolescents with antipsychotic-treated schizophrenia had a lower executive function in the emotional control, initiate, and monitor scale, compared to children without schizophrenia. This indicated that the case group had a higher likelihood of experiencing emotional dysfunction, difficulties in monitoring their own emotional regulation, and declining initiative skills compared to those in the control group.
(Hadi et al., 2021)	Children (5-18 years old, mean age 15.9, SD 1.9) (Jakarta)	(BRIEF-Indonesian version) – parent report	The BRIEF was reported to have 85% sensitivity and 81% specificity. Children with longer duration of untreated psychosis (>2 months) had poorer executive function, indicated by higher scores in every subdomain, namely inhibitory, shift, emotional control, initiation, working memory, plan/organize, and monitor.
(Murti et al., 2021)	Psychology students, maximum in their second/third	Berg Card Sorting Test-64; Digit Span Backward; Stroop Test	Reliability coefficient stated only for Stroop Test, which is .67. Participants with higher scores in misconceptions in psychology had lower working memory and inhibitory control.

	year. (Daerah Istimewa Yogyakarta)		
(Ayomi, 2022)	Adolescents (13-15 yo), (Semarang)	Wisconsin Card Sorting Test; Trail Making Test; Digit Span; Stroop Color; Word Task	No psychometric properties are stated clearly Adolescents with higher intelligence tend to have higher working memory and inhibitory control.
(Yuniarrahmah et al., 2022)	Adolescents (15-20 yo, mean age=17,61; SD = 1,472) (Kalimantan Selatan)	Executive Skills Questionnaire-Revised (ESQ-R) – self-report	The paper stated that the ESQ-R underwent content validity and reliability assessment by 10 experts, though the results were not mentioned specifically. The study reported a Cronbach's alpha coefficient of 0.907 for the ESQ-R. Adolescents with higher executive function had a higher tendency towards cyberbullying.
(Kosasih, et al., 2023)	Children in conflict with the law (12-18 yo) (Bandung)	Executive Function Questionnaire – the self-report	Reliability of executive function questionnaire is 0.95. Results showed the level of executive function among participants (children in conflict with the law), namely 4.2% have a very low executive function, 4.2% have a low executive function, 25% have a high executive function, and 66.7% have a very high executive function.
(Kaloka et al., 2024)	Children (mean age=9.96, SD=0.63 (Daerah Istimewa Yogyakarta)	The design fluency test (Delis-Kaplan Executive Function System)	No clear psychometric properties are stated. The paper mentioned that the design fluency test had adequate psychometric qualities and had been used for research participants of young athletes. Results showed that physical activity enhanced the executive function of students.
(Wiguna, et al., 2024)	Children and adolescents (6-17 yo, mean age = 11.80, SD = 2.96), (Jakarta)	Computer-Based Game Inventory for Executive Function (CGIEF)	Confirmatory Factor Analysis confirmed its validity, with a significant result obtained ($p < .05$) using normal theory-weighted least squares and a high construct reliability of 0.91. Structural Equation Modeling further supported its predictive ability for executive function, with a critical t value of 2.45 and normal theory-weighted least squares of 5.74 ($p < .05$). Concurrent validity analysis, comparing CGIEF with BRIEF, revealed good agreement between them and identified specific scores on CGIEF that predict executive dysfunction, behavior regulation problems, and metacognition deficits, with sensitivities ranging from

			0.77 to 0.78 and specificities ranging from 0.41 to 0.42.
(Wijaya, et al., 2024)	Children (6-16 yo (Jakarta)	BRIEF-Indonesian version) – parent report	The paper mentioned the BRIEF validity as good (r = 0.521–0773 in all test domains). It had internal consistency (α = 0.62–0.84) and test-retest reliability (0.87). Results showed that the lower the executive function of children with CKD, the worse the children's HRQoL based on the parents' perspectives.

Wiguna et al. (2024) have developed a Computer-Based Game Inventory for assessing Executive Function (EF) in children and adolescents. This innovative tool has significant potential as it offers participants an engaging and simplified approach. However, further development is needed to determine the specific EF components assessed by the game, as well as its accessibility and practicality for widespread use in diverse and cross-cutting settings. Performance-based measurements can serve as long-term assessments to capture state-like aspects of children's EF. However, developing inventories, self-reports, and teacher/parent reports is also crucial to comprehensively understand EF in daily functioning. These tools are more beneficial for studying inter-individual or trait-like variables, providing a more holistic view of executive function.

Thorell et al. (2008; 2020) have developed publicly available questionnaires to assess deficits in working memory and inhibition, Childhood Executive Functioning Inventory (CHEXI) (Thorrel et al., 2008) and Teenage Executive Functioning Inventory (TEXI) (Thorrel et al., 2020). CHEXI includes parent and teacher ratings, while TEXI consists of self-reports and reports from others (parents/teachers). Both instruments have strong psychometric properties and have been adapted to various languages and cultural contexts. These tools are promising for adaptation to Indonesian, especially for educational use. CHEXI has already been adapted to Indonesian by Yovita and Hendrawan (2023) and used in other research (Yovita & Hendrawan, 2023; Anandiva & Hendrawan, 2024). Adapting TEXI for Indonesian adolescents would be beneficial. However, CHEXI and TEXI only assess working memory and inhibitory control, highlighting the need for tools to measure cognitive flexibility deficits in Indonesian adolescents.

A systematic review of EF measures in low- and middle-income countries, including Indonesia, is long overdue. Kusi-Mensah et al. (2022) conducted "A Systematic Review of the Validity and Reliability of Assessment Tools for Executive Function and Adaptive Function Following Brain Pathology among Children and Adolescents in Low- and Middle-Income Countries (LMICs)." Their findings indicate a global scarcity of EF measures suitable for adolescents in these countries despite the high prevalence of neurodevelopmental disorders, like ADHD and specific learning disorders. Although the development of EF tools is minimal but increasing, the adapted tools generally exhibit good psychometric properties. However, there is a notable lack of consideration for content validity and cultural sensitivity in tools used in LMICs (Kusi-Mensah et al., 2022). This finding aligns with the systematic reviews by Nyongesa et al. (2019) and Berardi et al. (2021), which also note the lack of standardized, valid, and reliable assessment tools to measure EF in children and adolescents. Therefore, it is important to develop or adapt EF measures that are accessible, affordable, and culturally sensitive in Indonesia.

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Conclusion

This review highlights the diverse landscape of executive function (EF) measurement tools used for adolescents in Indonesia and underscores the importance of their psychometric properties and practicality for educational settings. The studies reviewed provide valuable insights into the complexities of EF measurement among adolescents in various educational and clinical circumstances. Notably, tools such as the BRIEF-Indonesian version have been central in assessing EF, each with its strengths and limitations. The BRIEF-Indonesian version emerges as a widely utilized tool with strong psychometric properties, making it suitable for clinical populations but with limitations of practicality and accessibility for educational settings. Aside from the BRIEF-Indonesian version, The ESQ-R, and EFQ have also shown promising outcomes, although their adaptation processes have highlighted the need for more comprehensive psychometric evaluations, especially concerning content validity and cultural sensitivity. While effective in specific contexts, performance-based measures face challenges in capturing the trait-like aspects of EF and require significant resources for implementation. The innovative development of tools like the Computer-Based Game Inventory for EF shows potential but necessitates further refinement for broader applicability. The need for developing or adapting robust, culturally relevant adolescent EF assessment tools is critical for advancing research and practice in Indonesia, especially in educational settings.

Recommendation

To advance the assessment of executive function (EF) among Indonesian adolescents, several key recommendations emerge from this review. First, the adaptation of well-established and accessible EF assessment tools, such as the Teenage Executive Functioning Inventory (TEXI) is essential. This process should involve translating and culturally adapting these instruments to ensure their relevance and comprehensibility for Indonesian adolescents. Rigorous psychometric evaluations must be followed to confirm the reliability and validity of these tools within the Indonesian context. Such adaptations will provide a solid foundation for accurately measuring EF and understanding its role in adolescent development. In addition to adapting existing tools, there is a pressing need to develop new, comprehensive EF assessment tools that can measure all critical components of executive function, including working memory, inhibitory control, and cognitive flexibility. The development process should engage education practitioners and psychologists to ensure the tools are culturally relevant and practical. These new instruments will address the current gap in measuring cognitive flexibility and provide a more holistic assessment of EF in Indonesian adolescents. Furthermore, any adaptation or development of EF assessment tools should prioritize content validity and cultural sensitivity. This involves conducting thorough psychometric testing and consulting with experts to ensure the tools accurately reflect the cognitive and cultural nuances of Indonesian adolescents. Tools that are culturally sensitive and valid will be more effective in capturing the true nature of EF and its impact on adolescents' daily lives and educational performance.

To capture a comprehensive picture of executive function, it is advisable to use a combination of inventory-based assessments and performance-based measures. A multi-method approach can help distinguish between state-like and trait-like EF capacities, providing a more nuanced understanding of adolescents' executive functions. This approach will enable education practitioners and researchers to gain a deeper insight into the various dimensions of EF and how they interact with the educational landscape. Future research should include adolescents in diverse educational backgrounds, such as those with specific

learning disorders and other marginalized groups, to ensure EF assessment tools are applicable across different educational settings. Including a wide range of participants will enhance the generalizability of the findings and ensure that the tools can be effectively used in various educational contexts, aligning with the spirit of inclusive education "No one left behind" echoed by the Ministry of Education and Culture Republic of Indonesia (Hari Disabilitas Internasional 2023, 2023).

Finally, it is crucial to provide adequate training for educators, psychologists, and researchers in the use of these EF assessment tools. Ensuring the availability of necessary resources, including financial and technological support, will facilitate the widespread and effective implementation of these tools. Proper training and resources will empower practitioners to accurately assess and support the development of EF in adolescents, ultimately leading to improved educational and developmental outcomes. By addressing these recommendations, Indonesia can significantly enhance its capacity to assess and understand executive function in adolescents, contributing to better-informed educational practices, interventions, and policies.

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