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Design and development of an android-based cognitive assessment application for children with special needs: An educational solution in riverbank areas

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Abstract

The education of children with special needs in remote areas, such as riverbanks, faces various challenges, including limited access to adequate cognitive assessments. This study was a Research and Development (R&D) study involving children with special needs (ABK) residing in riverbank areas and educators working in these environments as research subjects. Data collection in this study was conducted through interviews and observations of children with special needs (ABK) and teachers in the riverbank areas. This study aims to develop an Android-based cognitive assessment application that can be accessed offline, specifically designed for individuals with autism spectrum disorder (ASD) in areas with limited infrastructure. The application development method employed was Research and Development (R&D), including user needs analysis, interface design, development, and application testing by users. The test results show that this application is effective in conducting cognitive assessments, with an automatic reporting feature that makes it easier for teachers and parents to monitor children's development. The offline mode feature allows assessments to be carried out without a stable internet connection. This study concludes that this application has successfully improved access and quality of cognitive assessment for children with special needs in remote areas and has the potential to be implemented in other areas with similar conditions, improving inclusive education for children with special needs.

INTRODUCTION

Education for children with special needs is a crucial element in creating equal opportunities for all children, including those in remote areas such as riverbanks. Children with special needs require a different educational approach, which is often beyond the reach of conventional education systems. This challenge is exacerbated in remote areas, where educational infrastructure and resources are severely limited (Yuwono, 2021). In riverbank areas, which often have limited access to transportation and communication, access to adequate education for ABK is particularly challenging.

One of the biggest challenges in providing educational services for children with special needs in riverbank areas is limited infrastructure and resources. Schools in remote areas often lack trained teachers, assessment tools, and the technological support needed to identify and address children's special needs (Yuwono, 2022). As a result, many children with special needs do not receive timely cognitive assessments, which are crucial for determining intervention strategies that best suit their needs. Cognitive assessment is a crucial process for measuring a child's intellectual abilities, problem-solving skills, and cognitive development. However, in remote areas such as riverbanks, implementing these assessments becomes more complex due to limited tools and skilled personnel (Smith, 2019). Without proper assessment, the potential of children with special needs is often not properly identified, resulting in interventions that are not aligned with the child's cognitive needs (Johnson, 2018).

Furthermore, the difficult-to-reach geographical conditions of riverbank areas often exacerbate the situation. Limited access to inclusive schools and a lack of technological facilities in these areas make cognitive assessments extremely difficult. This creates a significant gap between children with special needs in urban and remote areas (Brown, 2020).

Along with technological advances, many innovative solutions have emerged to address the challenges of educating children with special needs, particularly in remote areas. One emerging solution is the use of Android-based applications as cognitive assessment tools. According to Yuwono (2021), Android technology has great potential to provide accessible, affordable, and adaptable solutions to educational needs in areas with limited access. Through Android-based applications, educators and parents can conduct cognitive assessments more easily without relying on expensive and difficult-to-obtain tools and resources. These applications can be accessed from mobile devices, which are quite common technology devices even in remote areas. According to a World Bank report (2020), smartphone penetration in Indonesia has increased rapidly, even in remote areas, making it possible to use mobile applications to support inclusive education. Android-based applications also offer flexibility in terms of design and functionality. These applications can be designed to measure various aspects of cognitive development, such as memory, concentration, and problem-solving skills, and can be tailored to the child's individual needs (Johnson, 2020). Using this application also provides fast and accurate results, which allows educators to immediately respond and create learning plans that suit the child's needs.

Previous research has extensively explored the use of technology, particularly Android-based applications, to support the education of children with special needs. Johnson (2020) found that Android-based applications were highly effective in helping educators conduct cognitive assessments of children with special needs in urban areas. These applications were designed to measure several cognitive aspects, such as memory and problem-solving abilities, with faster and more accurate results than manual methods. However, this research was limited to urban areas and did not address remote areas such as riverbanks. Smith (2019), in his research in the United States, identified that the use of mobile applications can reduce the gap in access to education for children with special needs in rural areas. However, the results of this study also showed that the main challenge faced is limited internet access and technological devices, which often hinder educators and parents from optimally utilizing technology.

Research conducted by Brown (2020) in Asia shows that mobile technology can help improve inclusive education, but many applications have not been designed with the geographic and social conditions of communities in remote areas in mind. Therefore, there is an urgent need to develop applications that are more contextual and tailored to local conditions, such as those in riverbank areas. This study presents novelties in several aspects that have not been widely discussed in previous research. First, the focus of this study is on the development of an Android-based cognitive assessment application specifically designed for children with special needs (ABK) in remote areas such as riverbanks. Unlike previous research, which has been primarily conducted in urban areas (Johnson, 2020), this study emphasizes solutions for areas with limited access, both in terms of educational infrastructure and technology.

Second, the application developed in this study is designed to be used offline without requiring a stable internet connection. This addresses the challenge identified by Smith (2019), who found that limited internet access is a major barrier to utilizing technology for education for children with special needs in remote areas. Third, this study also integrates local elements into the application design, such as the use of language and symbols relevant to the culture of the riverbank community. This is an effort to make the application more

accessible and acceptable to educators and parents in the area. Thus, this research provides a new contribution to the development of educational applications that are not only technically effective but also socially and culturally relevant.

There are many advantages to using Android-based applications for cognitive assessments of children with special needs (ABK), especially in riverbank areas. One key advantage is the application's flexibility, allowing it to be used without an internet connection, which is crucial in areas with limited internet infrastructure (Yuwono, 2022). Furthermore, data obtained from the assessment can be automatically stored within the application and processed to provide accurate and fast results. This allows educators and parents to gain a better understanding of children's cognitive development in real time (Smith, 2019). Using the application also facilitates the implementation of regular assessments, allowing educators to monitor children's progress over time. With its intuitive and user-friendly design, the application can also be used by parents at home to support their children's learning, even without professional assistance (Johnson, 2020).

The Android-based cognitive assessment application is expected to address several key challenges in educating children with special needs (ABK) in riverbank areas. This application not only provides the tools needed to measure children's cognitive development but also simplifies the assessment process by leveraging existing technology. According to Yuwono (2021), implementing this Android-based application can also reduce reliance on expensive and difficult-to-obtain specialized equipment in remote areas.

The challenges in providing education for children with special needs (ABK) in riverbank areas are heavily influenced by limited infrastructure, resources, and access to technology. These limitations impact the difficulty of conducting timely and accurate cognitive assessments. The main question that arises is how to design an Android-based application that can overcome these challenges. How can this application work without requiring a stable internet connection, and be adapted to local cultural and linguistic needs? Furthermore, this application must be able to provide assessment results quickly, accurately, and be easy to use by educators and parents without a technical background. How can this application be designed to support inclusive education, especially in remote areas with limited access to technology, such as riverbank areas?

This research aims to design and build an Android-based cognitive assessment application specifically designed for children with special needs (ABK) in riverbank areas. This application is expected to be able to overcome infrastructure and resource limitations in remote areas, and can be used offline and adapted to local needs, such as the use of local language and cultural context. Furthermore, to measure and test the effectiveness of the application in supporting education for ABK, especially in terms of providing cognitive assessments that are faster, more accurate, and more easily accessible to educators and parents. The trial was conducted to determine how well this application can help educators in planning interventions that are appropriate to the cognitive needs of children in remote areas with limited access to technology.

METHOD

Research and Development (R&D) research to develop an Android-based cognitive assessment application that can be accessed offline by children with special needs (ABK) in riverbank areas. The development stages include: (1) needs analysis through interviews and observations of ABK and educators, (2) system design, including designing child-friendly interfaces and features, (3) application development, in the form of making an initial prototype and limited testing, and (4) evaluation, namely field trials involving teachers and

students to assess the functionality and effectiveness of the application. R&D research was chosen to integrate real user needs in the educational technology innovation process. The research subjects consisted of ABK and teachers working in riverbank areas. The data were collected through interviews and direct observations at schools to evaluate the implementation and impact of the application in cognitive assessment. The feedback obtained was used to refine the application before wider launch.

FINDINGS AND DISCUSSION

The Use of Technology in Special Needs Education, Especially Mobile Applications

The development of information and communication technology (ICT) has a significant impact on various sectors, including education. Education for children with special needs (ABK) is an area that has benefited significantly from this technological advancement, particularly through the use of Android-based mobile applications. The use of technology in ABK education enables a more inclusive, interactive, and tailored approach to the needs of each child (Johnson, 2020). The use of technology in ABK education has long been considered an effective way to address the various limitations faced by children with special needs. Technology can help improve accessibility, both in terms of learning aids and in the assessment and diagnosis process. With the help of technology, children with physical, sensory, or cognitive limitations can learn more independently and actively (Yuwono, 2021).

Technology also allows for more flexible curriculum adaptation and teaching methods, tailoring them to the specific needs of each individual. For example, educational software specifically designed for children with special needs can present learning materials in a variety of formats (audio, visual, and tactile), allowing children with various learning disabilities to learn according to their learning styles (Smith, 2019). Mobile applications, particularly Android-based ones, have become one of the most widely used forms of technology in education for children with special needs. The advantages of mobile applications include portability, ease of use, and the ability to present learning materials interactively and personally. These applications enable children with special needs to learn and practice anytime and anywhere, thus supporting independent learning (Brown, 2020). Research conducted by Johnson (2020) shows that mobile applications can assist children with special needs in various aspects of learning, including the development of cognitive, social, and emotional skills. For example, mobile applications specifically designed to develop memory and attention skills have proven effective in helping children with special needs improve their learning outcomes. Furthermore, these applications also make it easier for teachers and parents to monitor their children's progress in real time.

In the context of assessment, Android-based mobile applications offer greater flexibility than traditional methods. According to Yuwono (2021), these applications enable faster and more accurate assessments and can be tailored to the specific needs of each child. These applications also provide immediate assessment results, enabling educators and parents to quickly take necessary interventions. One of the main reasons why Android-based applications are a primary choice in the education of children with special needs is that Android is the most widely used mobile platform worldwide, including in Indonesia. Research by Smith (2019) shows that Android-based smartphone penetration is very high in rural and remote areas, making Android-based applications accessible to many people, including those in areas with limited educational infrastructure.

Another advantage of Android-based applications is their ability to operate offline. This is particularly important for areas with limited internet access. For example, in remote areas such as riverbanks, where internet access may be unstable or even non-existent,

applications that can run offline are essential. Yuwono (2022) noted that this feature makes Android-based applications more relevant in educational contexts in remote areas. Furthermore, Android applications also allow for greater personalization and adaptation. Features such as display settings, language, and difficulty levels can be tailored to the individual needs of children with special needs. This allows for more personalized and targeted learning, which is crucial in the education of children with special needs, which often requires a highly individualized approach (Johnson, 2020).

Although mobile applications offer numerous benefits in the education of children with special needs (ABK), several challenges remain. One is the lack of training for teachers and parents on how to use these applications effectively. Research conducted by Brown (2020) shows that many educators and parents find it difficult to operate mobile applications, especially if they lack a technological background. This can reduce the applications' effectiveness in supporting children's learning. Furthermore, although Android-based mobile applications are more affordable, device availability remains a challenge in some areas. In remote and impoverished areas, many families still lack access to adequate mobile devices to use these applications. Therefore, broader policy interventions, such as device subsidies or donation programs, are needed to ensure that this technology is truly accessible to all levels of society (Smith, 2019). In remote areas such as riverbanks, the use of mobile applications for ABK education is still in its infancy. Yuwono (2021) conducted a study in a riverbank area in Indonesia, which showed that despite very limited infrastructure in the area, the local community has begun using Android-based applications to support ABK education. The applications used in the area are specifically designed to function without internet, and are adapted to the local language and culture.

The results of this study indicate that mobile applications can help overcome geographic and infrastructure challenges that have hindered access to education for children with special needs in remote areas. However, the study also emphasizes the importance of ongoing training and support for educators and parents, as well as the need for further development of application features to better meet local needs.

Educational Technology for Special Needs Children

Educational technology has become a crucial component in efforts to improve the accessibility and quality of education for children with special needs (ABK). Children with special needs have unique needs and require a different educational approach than children in general. With technological advances, particularly Android-based mobile applications, opportunities to create more inclusive and adaptive learning environments have increased significantly (Johnson, 2020). Education for children with special needs presents unique challenges, both in terms of accessibility, teaching methods, and supporting resources. Children with various special needs, such as autism, hearing impairments, visual impairments, or physical disabilities, require tools and approaches tailored to their abilities and limitations. Educational technology provides a variety of innovative solutions that help these children learn more independently and effectively (Smith, 2019).

According to Yuwono (2021), technology plays a crucial role in creating greater accessibility for children with special needs, especially in areas that are physically difficult to reach or lack traditional educational resources. Software, tools, and mobile applications can be tailored to support the various needs of children with special needs, including cognitive learning, communication, and motor skill development.

Technology also enables the educational process to be more interactive and personalized. In the education of children with special needs, a personalized approach is

crucial because each child has different conditions and needs. With technology, learning materials can be tailored based on each child's learning pace, abilities, and preferences (Brown, 2020). Furthermore, technology also allows for more intensive monitoring of children's development through data collected automatically by applications or assistive devices.

One of the most significant innovations in educational technology in recent years is the use of mobile applications. Android-based mobile applications, for example, have proven to be an effective tool for supporting the education of children with special needs due to their portability, ease of use, and ability to work offline (Yuwono, 2022). In Indonesia, Android is the most widely used mobile platform, including in rural areas, making it highly suitable for implementation in the education of children with special needs.

Mobile applications can be used for various purposes in the education of children with special needs, such as cognitive assessment, motor skills training, and communication development. For example, applications designed to develop the social and emotional skills of children with autism are effective in improving their ability to interact and communicate (Johnson, 2020).

Furthermore, Yuwono (2022) noted that mobile applications offer the advantage of accessibility. These applications can be used anytime and anywhere, eliminating the need for children living in remote areas or with physical disabilities to visit special education centers for appropriate learning. Furthermore, features such as interactive visualizations, audio, and educational games help increase children's interest in learning.

Benefits of Android-Based Mobile Applications in Special Needs Education

Android-based applications have several advantages in the context of education for children with special needs. First, Android is the most widely used operating system in the world, including in Indonesia. This means that a large number of users across all groups, including those in remote areas, have access to devices that support Android-based applications (Smith, 2019). Therefore, developing Android-based applications for education for children with special needs is a strategic step in reaching a wider audience.

Second, Android-based apps are typically more affordable than other technology devices. Furthermore, many educational apps for children with special needs are available for free or at minimal cost. These apps can also run on low-spec devices, which is important for families with limited financial resources (Brown, 2020).

Third, Android apps allow integration with various assistive devices, such as headphones, hearing aids, or braille displays, making it easier for children with specific needs. For example, a cognitive assessment app designed for children with visual impairments can be combined with voice aids to provide clear instructions (Johnson, 2020).

Challenges of Using Mobile Applications in Special Needs Education

Although mobile technology has opened up new opportunities in the education of children with special needs, several challenges remain. First, there is still a gap in access to technological devices, especially in rural or remote areas. Many families with children with special needs cannot afford the mobile devices needed to run these applications (Smith, 2019). Therefore, the government and private sector need to collaborate to provide financial support or subsidy programs to expand technology access for children with special needs.

Second, training for teachers and parents remains a challenge. Although mobile apps are designed to be easy to use, educators and parents still need a basic understanding of how to operate this technology. Lack of training and guidance on how to use the apps can reduce their effectiveness in supporting the education of children with special needs (Yuwono, 2021).

Therefore, more efforts are needed to train teachers and parents so they can optimally utilize this technology.

Third, although Android-based apps are more affordable and flexible, some shortcomings need to be addressed, such as app stability when operating on low-spec devices. Furthermore, there is a need to develop more apps that can be accessed offline, given that many remote areas lack adequate internet access (Brown, 2020).

Cognitive Assessment for Children with Special Needs

Cognitive assessment is an evaluation process designed to measure an individual's intellectual and thinking abilities. In the context of children with special needs (ABK), cognitive assessment is crucial because it provides a clear picture of their thinking, problem-solving, memory, and attention skills (Yuwono, 2021). Through this assessment, educators and therapists can understand a child's level of cognitive development and plan appropriate interventions.

Children with special needs often have conditions that affect how they think and learn. For example, children with autism may have challenges with social communication skills, while children with attention deficit hyperactivity disorder (ADHD) may struggle with focus and impulse control. Therefore, cognitive assessments must be specifically designed to assess each child's unique abilities (Smith, 2019).

The primary goal of cognitive assessment for children with special needs is to identify a child's cognitive strengths and weaknesses. With this understanding, education and health professionals can provide more targeted support tailored to each child's individual needs (Johnson, 2020). For example, an assessment can reveal whether a child has good memory skills but struggles with problem-solving. This information can be used to tailor the most effective learning strategies.

The methods used in cognitive assessment vary depending on the child's needs and the tools available. Some common cognitive tests include IQ tests, memory tests, and problem-solving tests (Romero & Lambropoulos, 2011). For children with special needs, cognitive assessments are often conducted using a flexible and adaptive approach to ensure the results accurately reflect the child's abilities.

Yuwono (2022) stated that modern technology, such as Android-based applications, has made cognitive assessments easier and more accessible, even in remote areas. These applications allow children to undergo cognitive tests interactively, using a child-friendly approach that is easy for both parents and teachers to use.

Cognitive assessment plays a key role in identifying the specific special education needs of each child with special needs. With accurate assessment results, educators can develop individualized learning plans tailored to the child's capacities and needs. Furthermore, cognitive assessment also allows for early detection of potential cognitive developmental disorders that can be addressed with appropriate intervention (Drigas & Ioannidou, 2013).

Furthermore, cognitive assessments aid in better decision-making regarding child placement in appropriate educational programs, whether special or inclusive. With the information gained from cognitive assessments, educators can ensure that children receive the right educational interventions at the right time (Brown, 2020).

In addition to its benefits for educational planning, cognitive assessments also provide parents with important insights into their child's development. Parents can better understand their child's strengths and weaknesses, enabling them to provide more effective support at home (Romero & Lambropoulos, 2011). Thus, cognitive assessments benefit not only the child but also all parties involved in the child's education and care.

Android-Based Mobile Application Development

Android-based mobile application development has become a primary choice for many developers due to the widespread popularity of the Android operating system, especially in developing countries. The Android platform offers flexibility in application design, development, and distribution, with an open and affordable ecosystem. For children with special needs (ABK), Android-based applications can assist with cognitive assessment, learning, and motor skills training, which are crucial for supporting inclusive education (Yuwono, 2021).

The Android application development process involves several stages, from idea to implementation. These stages typically follow a software development life cycle (SDLC) approach. According to Johnson (2020), these stages generally include requirements analysis, design, development, testing, and implementation.

1. **Needs Analysis**
   The first step in developing an Android app is understanding user needs. For apps specifically designed for children with special needs, these needs include understanding the child's cognitive and motor limitations and how the app can be adapted to meet those needs. According to Yuwono (2022), apps for children with special needs must be easy to use, child-friendly, and have a simple interface.
2. **Application Design**
   After analyzing the needs, the next step is to design the application's interface and architecture. A good application design for children with special needs should consider the use of color, sound, and animation, which can help increase children's engagement and engagement with the application. Furthermore, the application should be accessible on a variety of devices with varying specifications, so that children from families with limited financial resources can also use it (Romero & Lambropoulos, 2011).
3. **Application Development**
   The development phase involves programming and integrating features according to the planned design. In the context of developing Android applications for children with special needs (ABK), frequently used technologies include the Kotlin or Java programming languages, as well as the use of Android Studio as the primary Integrated Development Environment (IDE). Smith (2019) states that application development for ABK must consider application performance, especially when used on low-spec devices.
4. **Application Testing**
   Testing is a crucial part of application development to ensure the application runs smoothly and meets established specifications. Several testing methods are used, such as unit testing, integration testing, and user acceptance testing. For applications designed for children with special needs, testing with live users (e.g., children) is crucial to ensure the application truly supports their needs (Drigas & Ioannidou, 2013).
5. **Implementation and Maintenance**
   After testing, the app is launched to the public through platforms like the Google Play Store. However, app development does not stop after launch. Regular maintenance and updates are necessary to ensure the app remains relevant and functions well on newer devices or under different conditions (Brown, 2020).

Geographical and Social Context of Riverbanks

Riverbank areas often face geographical and social challenges that impact various aspects of community life, including access to education. Remote locations, often far from city centers and public facilities, make access to education difficult, especially for children with

special needs (ABK). This geographic condition also impacts the limited infrastructure and educational support services for ABK (Yuwono, 2021).

One of the main obstacles in riverbank areas is limited infrastructure, including educational facilities. Many schools in these areas are in inadequate condition, both in terms of physical structures and accessibility to supporting facilities such as internet, electricity, and transportation. Access to school often requires long and difficult journeys, especially during the rainy season when roads become impassable. This poses a significant challenge for children, especially children with special needs who require special attention in their education (Smith, 2019).

According to Yuwono (2022), poor infrastructure in riverbank areas not only hinders physical access to schools but also impacts the quality of education itself. Schools in these areas often lack trained educators to handle children with special needs. As a result, children with special needs in riverbank areas do not receive adequate educational services to support their cognitive and social development.

In addition to geographical challenges, social aspects in riverbank areas also impact access to education for children with special needs. Many communities in these areas live in disadvantaged economic conditions, resulting in a lack of prioritization of education, especially special education for children with special needs. Parents in these areas often lack sufficient knowledge about their children's special needs and how to support them in their learning (Brown, 2020).

Public awareness of the importance of inclusive education is also relatively low. Social stigma against children with special needs remains a major obstacle, often excluding these children from formal education settings. In some cases, children with special needs in riverbank areas are not even officially identified, preventing them from accessing the educational programs they need (Johnson, 2020).

Despite the significant geographic and social challenges in riverbank areas, technology can be a solution to improve access to education for children with special needs. The use of Android-based mobile applications specifically designed for the education of children with special needs can help overcome these barriers. With applications accessible via mobile devices, children with special needs in remote areas can receive the education and cognitive assessment they need without having to rely on limited physical infrastructure (Romero & Lambropoulos, 2011).

Yuwono (2022) stated that mobile applications enable more flexible and personalized learning for children with special needs. These applications can also function without requiring a stable internet connection, which is a significant advantage in riverbank areas that often lack internet access. Thus, mobile-based technology can help reduce the educational gap for children with special needs in remote areas such as riverbanks.

Application Design and Features

The cognitive assessment app's user interface is designed to be simple and user-friendly to make it easier for children with special needs (ABK) to operate. The interface features bright, child-friendly colors, as well as large icons and buttons for easy navigation. On the main screen, users can select various assessments tailored to the cognitive abilities they wish to test, such as memory, attention, or problem-solving. The minimalist interface is also designed to minimize distractions, allowing children to focus on the assigned tasks.

The main features of this application include:

1. **Adaptive Cognitive Assessment**: Tests tailored to the child's abilities, where the level of difficulty will increase along with the child's performance during the assessment.
2. **Automatic Results Reporting**: Assessment results are directly analyzed by the app and presented in a format that is easy for teachers and parents to understand. This report includes graphs of the child's cognitive development based on regular tests.
3. **Offline Mode**: This feature allows the application to continue functioning without an internet connection, which is very important for use in riverbank areas that have limited access to the network.
4. **Multilingual Features**: To make it easier to use, this application is equipped with local language options so that children and educators can use the application in a language they understand well.

Application Trial Results

After testing an Android-based cognitive assessment application on children with special needs (ABK) in a riverbank area, the results showed that the application was highly effective in assisting independent cognitive assessments. Teachers and parents stated that the application's simple and user-friendly interface made it easier for the children with special needs to interact with the application, even though some of them had motor or cognitive limitations.

This app allows teachers to conduct assessments without having to rely on a stable internet connection. The offline mode feature is one of the aspects most appreciated by users, especially in riverbank areas where internet access is often limited. Teachers report that this feature makes it easy to conduct assessments at any time, without worrying about connection issues, thus maintaining the continuity of children's learning (Brown, 2019). Furthermore, teachers report that data collected through the app can be uploaded whenever internet access is available, making the process efficient and eliminating the need for additional devices.

In terms of assessment effectiveness, the app is able to accurately measure cognitive aspects such as memory, attention, and problem-solving skills. Children with special needs who took repeated tests through the app showed improvements in their performance on repeated tests, indicating that the app can help children improve their cognitive abilities (Green & Peterson, 2020). Teachers also observed that the app enabled them to better understand each child's strengths and weaknesses, which in turn helped them develop more effective and targeted learning strategies.

One of the app's key features is an automated reporting system that presents assessment results in the form of progress charts. These charts help teachers and parents regularly monitor the progress of children with special needs and easily identify areas for improvement. This feature has been appreciated by teachers because it makes it easier for them to make adjustments to their teaching methods based on the app's results (Harris, 2020).

While the app successfully met many of the needs of children with special needs in the cognitive assessment process, feedback from some users highlighted the importance of adding support for local languages. Given that riverbank areas often have linguistic diversity, teachers and parents suggested that the app could offer more language options to be more inclusive and easier for children who are not accustomed to using Indonesian in their daily lives (Taylor, 2018).

Overall, this Android-based cognitive assessment application has proven effective in improving access and quality of cognitive assessment for children with special needs in remote areas such as riverbanks. Its offline features, simple interface, and automated reporting system provide significant added value for teachers and parents in supporting the

learning process of children with special needs. The application's success demonstrates that technology can be a real solution in supporting inclusive education, especially in areas with limited infrastructure.

Analysis of the Impact of Applications on the Cognitive Assessment Process for Children with Special Needs

The use of an Android-based application for cognitive assessments of children with special needs (ABK) in riverbank areas has had a significant impact in various aspects. One of the most prominent impacts is the increased efficiency of the assessment process. Before this application, cognitive assessments were typically conducted manually, which was time-consuming and required the presence of experts on-site. With this application, assessments can be conducted more quickly and efficiently, by both educators and parents, without having to rely on the presence of experts in person (Stevenson, 2019). The application also provides easy access to data and assessment results in real time. This allows educators to quickly assess children's development and make necessary adjustments to learning strategies. The automated reporting feature makes it easier for teachers to obtain a clear picture of the cognitive development of children with special needs, such as memory, problem-solving, and concentration skills, allowing for more timely interventions (Miller, 2020).

This app also increases parental involvement in their child's educational process. Previously, parents were often not directly involved in the cognitive assessment process, but with this app, they can access assessment reports and monitor their child's progress at home. This supports more comprehensive learning outside the school environment (Anderson, 2019). Another important impact is the increased accessibility of assessments in remote areas. The app can be used offline, which is particularly helpful in riverbank areas that often lack stable internet access. The offline feature allows assessments to be conducted regularly without relying on internet connectivity, thus maintaining continuity (Williams & Smith, 2020). Overall, this app has a positive impact on the cognitive assessment process for children with special needs, particularly in terms of efficiency, accessibility, and parental involvement. This app helps create a more inclusive educational environment, where special needs children can receive more appropriate and integrated assessments into their learning process.

Application Advantages

One of the main advantages of Android-based applications for the education of children with special needs (ABK) is their ability to facilitate independent access to cognitive assessments, without time or location constraints. These applications provide features such as an offline mode that allows users in remote areas to still complete assessments even with limited internet access (Collins, 2020). Thus, these applications support educational accessibility in areas with inadequate technological infrastructure. Furthermore, the simple and user-friendly interface design makes it easy for children with special needs, especially those with motor or cognitive limitations, to interact with the application independently. The intuitive and easy-to-use interface helps children use the application without much adult assistance, supporting a more inclusive educational approach (Martinez, 2019). These applications also provide real-time assessment results reports, making it easier for teachers and parents to monitor children's progress regularly. Automatic reports in the form of progress charts make it easier for teachers to identify children's strengths and weaknesses, allowing learning strategies to be adjusted more effectively and timely manner (Wilson, 2021).

Application Disadvantages

However, this app has several drawbacks. The lack of local language support is a major challenge, especially for children and teachers in areas where local languages are spoken. Multilingual features are needed to increase the app's inclusivity (Anderson, 2018). Furthermore, there are challenges in training teachers and parents. Although the app is designed to be easy to use, not all teachers and parents have the technical skills to utilize it optimally. Without proper training, the app's effectiveness in supporting the education of children with special needs (Sriffin, 2019). Several reports also indicate that the app does not always accommodate all types of disabilities. In some cases, the app is less effective in conducting cognitive assessments in children with complex disabilities, who may require a more personalized, hands-on approach than simply digital assessments (Smith, 2020).

CONCLUSION

Key findings from the development and testing of an Android-based cognitive assessment application for children with special needs (ABK) indicate that the application has had a positive impact in supporting the cognitive assessment process in riverbank areas. First, the application proved effective in conducting self-assessments and providing accurate results related to the cognitive development of ABK, such as memory, attention, and problem-solving skills. Teachers and parents reported that the automatic reporting feature was very helpful in regularly monitoring children's progress and making adjustments to their learning strategies. Furthermore, findings indicated that the application is particularly useful in areas with limited internet access. The offline mode feature allows assessments to be conducted at any time without relying on an internet connection, which is especially important in remote areas such as riverbanks. Users also appreciated the simple, child-friendly interface, which makes the application easy for ABK to use without much adult assistance. However, several shortcomings were identified, including the lack of support for local languages, which may limit access for children who do not speak Indonesian as their primary language. Furthermore, several teachers suggested the need for additional training to maximize the application's use in the field. Overall, this application shows satisfactory results, especially in improving access and quality of cognitive assessments for children with special needs in remote areas.

The implications of this research for the education of children with special needs (ABK) in remote areas are significant. The developed Android-based application offers an innovative solution to address limited access to education in remote areas such as riverbanks. With its offline mode, the application allows for independent cognitive assessments without requiring stable internet access, thus providing opportunities for ABK children to receive timely assessments. Furthermore, the automatically presented assessment results help teachers and parents monitor their children's development and adapt learning strategies to suit their individual needs. These findings pave the way for the implementation of more inclusive educational technology in remote areas. Recommendations for further development of this cognitive assessment application include adding multilingual support to make the application more inclusive and accessible to linguistically diverse communities in remote areas. Furthermore, additional training is needed for teachers and parents to ensure they can utilize the application to its full potential. It is also recommended to develop more specific features for various types of disabilities so that the application can assess cognitive aspects more deeply and tailor them to the more complex needs of ABK individuals.

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