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# Interactive digital modules and teachers' understanding of autistic students' reproductive health

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**ABSTRACT**

Reproductive health education presents significant challenges for autistic students due to communication barriers and the abstract nature of the topic, which often requires specialized learning media to ensure understanding. This study aims to evaluate the effectiveness of interactive digital modules in improving Sekolah Luar Biasa (SLB) teachers' experience and competence in delivering reproductive health materials to autistic students. Using a quasi-experimental, one-group, pre-test and post-test design, this study involved 18 teachers from SLBN Mutiara Bahari Sukabumi. Participants follow a structured mentoring program that uses digital modules integrating visual simulations, interactive elements, and clear audio explanations to simplify complex concepts. The results showed a statistically significant increase in teacher competence, evidenced by a substantial increase in the average comprehension score from pre-test to post-test. The improvement is very evident in key aspects such as understanding body boundaries, managing puberty changes, and implementing autism-friendly pedagogical strategies. This study concludes that interactive digital modules are an effective tool for bridging the teacher competency gap, facilitating the delivery of sensitive health topics in a concrete and structured manner.

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***ABSTRAK***

*Pendidikan kesehatan reproduksi menghadirkan tantangan signifikan bagi murid autis karena hambatan komunikasi dan sifat topik yang abstrak, yang sering kali memerlukan penggunaan media pembelajaran khusus untuk memastikan pemahaman. Penelitian ini bertujuan untuk mengevaluasi efektivitas modul digital interaktif dalam meningkatkan pemahaman dan kompetensi guru Sekolah Luar Biasa (SLB) dalam menyampaikan materi kesehatan reproduksi kepada murid autis. Menggunakan desain kuasi-eksperimental dengan pendekatan pre-test dan post-test satu kelompok, penelitian ini melibatkan 18 guru dari SLBN Mutiara Bahari Sukabumi. Peserta mengikuti program pendampingan terstruktur menggunakan modul digital yang mengintegrasikan simulasi visual, elemen interaktif, dan penjelasan audio yang jelas untuk menyederhanakan konsep yang kompleks. Hasil penelitian menunjukkan peningkatan signifikan secara statistik dalam kompetensi guru, yang dibuktikan dengan kenaikan nyata pada skor rata-rata pemahaman dari pre-test ke post-test. Peningkatan terlihat sangat jelas pada aspek-aspek kunci seperti pemahaman batasan tubuh, manajemen perubahan masa pubertas, dan penerapan strategi pedagogis yang ramah autis. Studi ini menyimpulkan bahwa modul digital interaktif merupakan alat yang sangat efektif untuk menjembatani kesenjangan kompetensi guru, memfasilitasi penyampaian topik kesehatan sensitif secara konkret dan terstruktur.*

***Kata Kunci:*** *guru pendidikan khusus; kesehatan reproduksi; kompetensi guru; modul digital interaktif; murid autis*

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## INTRODUCTION

Reproductive health is a critical aspect that must be understood by all individuals, including students with autism, who frequently have specialized educational needs (Maulidiyah, 2020). Knowledge regarding reproductive health is essential for all adolescents, including both neurotypical individuals and those with disabilities (Yuliyanik, 2021). An understanding of reproductive health helps them recognize and interpret bodily changes and the importance of maintaining personal health, particularly as they transition into adolescence. However, for students with autism, reproductive health education is often fraught with various challenges, both in terms of information reception and the instructional process. The onset of adolescence in autistic children varies across individuals. Autism itself is defined as a complex developmental disorder that typically manifests between the ages of one and three (Maharani & Nadhirah, 2024). Children with autism experience developmental impairments encompassing verbal and non-verbal communication issues as well as social interaction difficulties (Sari & Rahmasari, 2022). This theory is further supported by research stating that individuals with autism are those diagnosed before the age of three, characterized by three primary developmental disturbances: social interaction impairment, communication impairment, and behavioral disturbances (Nugraheni & Tsaniyah, 2020).

Children with autism generally exhibit behavioral, communication, and social interaction difficulties associated with developmental abnormalities of the nervous system. These conditions cause children to face difficulties in understanding and expressing communication, responding to social stimuli, and establishing effective interpersonal relationships (Ilafi & Ambarsari, 2024). Such impediments not only affect the child's ability to interact with their environment but also impact their overall learning process. Limitations in communication and social skills also contribute to various learning difficulties, including skills related to independence and activities of daily living (ADL) (Rafikayati *et al*., 2022). Consequently, it is imperative for educators and parents to understand these characteristics to provide appropriate and targeted instructional support.

Teachers, as vital elements of the educational process, play a strategic role in shaping educational quality, from the process to the final outcomes. Competent teachers should be able to maintain focus during sexual education instruction. To make learning more meaningful, teachers need to involve children with autism actively in sexual education (Zulia *et al*., 2023). Teachers in special education schools (*Sekolah Luar Biasa* or SLB) play a key role in delivering this material to students with autism. Beyond providing information, teachers must be capable of explaining material in a manner understandable to students with varying levels of communication and cognitive impairments. Students with autism generally require more visual and concrete approaches; thus, conventional teaching methods are often ineffective (Supriyadi *et al*., 2023). Given that students with autism may exhibit diverse reactions or struggle to comprehend abstract concepts such as reproductive health, teachers require media and auxiliary tools to facilitate this understanding.

Student characteristics necessitate that teachers employ various methods, models, and strategies. However, in reality, many students still struggle to comprehend teacher explanations (Adikusuma & Maharani, 2023). Therefore, teachers must possess methods, models, strategies, and media that are more engaging for children with autism to develop their knowledge of reproductive health (Holmes *et al*., 2023; Pandia *et al*., 2024; Tarsidi *et al*., 2024). Teachers can create comfortable and enjoyable learning variations, such as through diverse media and methods, the selection of learning environments, and the provision of varied instructional materials. Another approach to encourage active participation among children with autism is to provide instructions that prompt a mandatory response. Such instructional variations are essential to increase students' interest and activity levels in the classroom (Nurmayani *et al*., 2025). Furthermore, the integration of technology is necessary to enhance interest and participation levels among students with autism.


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Previous studies have discussed the development of specialized learning variations for students with autism through different media and methods. One study attempted to develop Android-based social stories to enhance the social interaction skills of children with autism. That study utilized the ADDIE development model and received positive feasibility ratings from validators regarding both material and media aspects (Aisyah *et al*., 2025). Meanwhile, to evaluate the effectiveness of multimedia-based learning models in developing the language skills of children with autism, a Research and Development (R&D) study demonstrated that multimedia models are highly effective in improving language abilities, based on t-test analysis between pre-test and post-test scores (Wulandari *et al*., 2025).

Nevertheless, most prior research has focused primarily on the effectiveness of digital media for students and has not extensively examined its impact on teacher understanding within the context of reproductive health for children with autism. Addressing this gap, the present study developed an interactive digital module tailored to the instructional needs at SLBN Mutiara Bahari Sukabumi and assessed its influence on enhancing teacher understanding in delivering reproductive health material. This module is designed to assist teachers in presenting reproductive health topics in a more adaptive, visual, and comprehensible manner. With the aid of digital technology, material can be presented through animations, interactive images, and step-by-step instructions, which help students with autism grasp the material more easily. Additionally, digital modules enable teachers to provide simulations and concrete visual explanations, thereby reducing potential misunderstandings or confusion among students with autism.

## LITERATURE REVIEW

### Reproductive Health for Students with Autism

Reproductive health is a critical aspect that must be understood by every individual, including students with autism. Adequate understanding of reproductive health assists students in recognizing physical changes occurring in their bodies, understanding appropriate versus inappropriate behaviors, and managing these transitions healthily, particularly as they enter puberty (Alomair *et al*., 2022; Raj, 2025; Walker *et al*., 2021). However, delivering reproductive health material to children with autism often presents significant challenges, as the subject matter tends to be abstract and requires clear, visual explanations.

Reproductive health education for children with special needs frequently encounters obstacles, primarily because the material consists of conceptual themes that are difficult to explain concretely (Maulidiyah, 2020). The social and communication limitations inherent in autism necessitate more visual and structured learning media to facilitate better information processing. Digital-based learning that utilizes visualization and interaction has been proven to help clarify abstract concepts (Ashary & Komara, 2023; Hadiapurwa *et al*., 2023). Visual and interactive media can significantly enhance the understanding of children with autism, especially for topics requiring step-by-step explanations (Husein *et al*., 2025). Research indicates that digital modules in the form of animations, interactive images, or concrete illustrations are more effective than conventional methods such as lectures or standard textbooks.

According to Martiningsih in the study *"E-Pub as a Supporting Technology for Learning for the Visually Impaired,"* the use of interactive technology in special education schools (SLB) provides substantial benefits for learning that requires strong visualization, such as reproductive health material. Teachers find these tools helpful because digital media allow them to convey sensitive topics more clearly, systematically, and in a way that students with autism easily understand. The use of instructional videos can also increase the effectiveness of information delivery for autistic children, as stated by Tamimi in the study *"The Influence of Audio-Visual Media on Vocabulary Mastery of First-Grade Autistic Students at SLB Negeri Karanganyar for the 2023/2024 Academic Year."* Because videos are audio-visual and feature motion, this media aligns with the learning characteristics of children with autism, who tend to excel in


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visual processing. Furthermore, instructional videos allow children to learn independently at their own individual pace.

### Interactive Digital Modules

Interactive digital modules are technology-based learning media that present instructional material through a combination of visual, auditory, and interactive elements. These modules allow users to explore content independently via navigation, motion graphics, simulations, or animations, thereby making information more accessible and easier to comprehend (Wijaya *et al*., 2025). Previous research indicates that interactive digital modules not only enhance student understanding but also improve teacher competence (Mutia *et al*., 2025). The presence of digital modules increases teachers' confidence when delivering abstract or sensitive subject matter, such as reproductive health (Rosyiddin *et al*., 2023). These modules provide concrete visualizations that are difficult to achieve through conventional methods, helping educators mitigate concerns when explaining complex topics.

Instruction based on interactive modules is capable of increasing student engagement, particularly among students with autism who tend to be more responsive to structured visual materials (Izzah *et al*., 2024). Nevertheless, research also emphasizes that the successful implementation of digital modules is highly dependent on the availability of adequate infrastructure and technology training for teachers in special education schools (SLB). Other studies assessing the effectiveness of digital media in supporting children with special needs' learning further support the use of interactive modules. In addition to improving understanding, digital modules offer more flexible learning opportunities as they can be used independently or with guidance (Alfiyansyah, 2025). Overall, various studies demonstrate that students with autism require visual, concrete, and interactive learning media to comprehend complex materials, including reproductive health. Digital media—such as videos, animations, and interactive modules—have proven effective in enhancing their understanding, engagement, and learning responses. Beyond supporting students, several studies confirm that interactive digital modules can strengthen teachers' competence, as these media help explain abstract concepts more clearly and systematically.

## METHODS

This study utilizes a quasi-experimental design with a one-group pre-test and post-test approach. A quasi-experimental design is employed to test the impact of an intervention without the use of random assignment. In other words, while the researcher applies a specific treatment, they do not have full control over the allocation of research participants into experimental or control groups.

The subjects of this research consist of 18 teachers at SLBN Mutiara Bahari Sukabumi. The assistance sessions were conducted over several periods, utilizing an interactive digital module as the primary medium for delivering reproductive health material. Data collection was performed through assessments conducted before (pre-test) and after (post-test) the intervention. The pre-test and post-test design without a control group is a common quasi-experimental form used to observe changes in understanding following a treatment. In the initial phase, a pre-test was administered to establish the teachers' baseline understanding. Subsequently, a series of assistance sessions was provided, leveraging the interactive digital module as the core instructional tool. Upon completion of the intervention, a post-test was conducted to evaluate shifts in teacher comprehension. The resulting data from both assessments were statistically analyzed to determine the effectiveness of the interactive digital module.

## RESULTS AND DISCUSSION



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**The Success of Digital Modules in Facilitating Visual and Interactive Learning**

**Table 1.** Teacher Comprehension Test Scores Regarding Reproductive Health for Students with Autism

| Aspects of Understanding | Pre-test Average | Post-test Average | Information |
|---|---|---|---|
| Knowledge of reproductive organs | 58% | 85% | Significant increase |
| Personal hygiene and body care | 62% | 88% | Teachers need to better understand practical steps |
| Privacy & body boundaries | 48% | 82% | The sharpest increase |
| Puberty in autistic children | 45% | 80% | It was very low at first |
| Autism-friendly learning strategies | 50% | 87% | Teachers are more skilled at choosing methods |
| **Overall Average** | **52,6%** | **84,4%** | **Up 31.8 points** |

*Source: 2025 Research*

In the initial phase of the study, a pre-test was administered to 18 teachers at SLBN Mutiara Bahari Sukabumi to measure their baseline understanding of reproductive health education for students with autism. The pre-test results, presented in **Table 1**, indicate that most teachers were within the basic to intermediate understanding categories. While the teachers were able to identify general concepts—such as the names of reproductive organs and principles of personal hygiene—they had not yet mastered other critical aspects, including body boundaries education, the concept of privacy, specific pubertal changes in autistic children, and delivery strategies tailored to the sensory and communication characteristics of students with autism. These findings align with Ramadani's (2020) research, titled *"The Implementation of Interactive Media in Information Services to Enhance Adolescent Reproductive Health Understanding at SMKN 1 Padang Panjang,"* which suggests that low teacher comprehension of reproductive health is often caused by limited training and a lack of systematic learning media.

In Indonesia, reproductive health is not a standalone subject; instead, it is typically integrated into the existing curriculum through intra-curricular activities, extra-curricular programs, or counseling services. Reproductive health materials are usually embedded within Biology, Physical Education, or Religious Education (Oktaria & Martha, 2023). However, to date, there is no direct government mandate requiring reproductive health as a compulsory subject. Consequently, schools can only implement reproductive health education based on their individual capacities and facilities.

Following a series of assistance sessions utilizing the interactive digital module, the teachers' understanding improved significantly, as evidenced by the post-test scores in **Table 1**. Teachers demonstrated the ability to explain reproductive health concepts in greater detail, identify physical and psychosocial developmental stages related to puberty, understand self-protection principles, and determine autism-friendly delivery methods, such as the use of concrete visuals, simple instructions, and individualized approaches. The interactive digital module facilitated a deeper understanding of the material through visual features, interactive simulations, and audio explanations that clarified previously abstract content.

These findings support Mayer's Multimedia Learning Theory, which posits that the combination of images, text, and interactive elements enhances information comprehension and retention. In other words, integrating interactive and visual elements into instructional materials significantly aids in understanding complex concepts (Handoyo *et al*., 2025). This is also consistent with Kusum et al., in the book *"Dimensions of Learning Media,"* which states that digital learning media are proven to increase teacher competence by presenting information in a more concrete, structured, and comprehensible manner. Furthermore, digital learning media encourage teachers to be more creative and innovative in developing


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instructional materials (Ahunaya *et al*., 2025). Thus, the comparison between the pre-test and post-test scores of the 18 teachers indicates a significant influence of the interactive digital module on enhancing their understanding of reproductive health for students with autism.

### The Role of Mentorship and Targeted Training in Maximizing Module Utilization

Beyond the inherent quality of the digital module, targeted training and mentorship play a significant role in enhancing teacher competence. During the mentorship sessions, teachers not only studied the module's content but also directly applied its use through instructional simulations. This active approach helped teachers adapt their teaching methods to suit the comprehension levels of students with autism, including pacing adjustments, the selection of supporting visuals, and the use of simplified instructions. The utilization of digital modules has been proven to offer numerous benefits for educators, such as making material presentation more interactive and engaging, thereby aligning with the current needs and characteristics of students (Khaira *et al*., 2023; Mangasak *et al*., 2025; Taufik *et al*., 2024). Effective utilization of digital modules by teachers fosters a more creative learning environment, stimulates student interest and motivation in comprehending the lessons, and encourages active participation (Arienie & Azmah, 2024; Zulkarnaen *et al*., 2023). Consequently, the increase in post-test scores stems not only from the digital module itself but also from the practical experience gained during the mentorship sessions.

Throughout the implementation, teachers also tailored the module content to the specific needs of autistic students in their respective classrooms. This involvement resulted in a more contextual and applicable module, as it reflected real-world classroom situations. This sense of ownership toward the module increased teacher motivation, leading to greater confidence in its instructional use. Such confidence has a profound impact, as it makes students feel more connected to the learning process (Pilenia *et al*., 2025). This factor further strengthens the module's effectiveness because teachers utilize materials they perceive as appropriate, relevant, targeted, and enjoyable (Dafit *et al*., 2024).

### Implementation Challenges of Digital Modules and Future Recommendations

Despite the proven effectiveness of the module, several challenges emerged during its implementation. Teachers identified limitations in technological infrastructure, such as the shortage of digital devices in some special education schools (SLB), as well as the variability in technological literacy among educators. Some teachers required a longer adaptation period to fully master the module's functions. To address these issues, it is recommended that additional digital literacy training, the enhancement of digital facilities, and the development of simplified user guides be implemented across all special education schools in Sukabumi Regency. Professional development programs must include routine training on the utilization of current technologies (Egok, 2024). Furthermore, this module has the potential to be integrated into the SLB curriculum, accompanied by **continuous mentorship** to ensure optimal utilization. The module can also be further expanded to encompass other subject areas within special education.

## Discussion

The results of this study demonstrate that the use of interactive digital modules can enhance teacher understanding of reproductive health for students with autism, which was previously limited to basic and abstract concepts. This finding is consistent with Mayer's Multimedia Theory, which posits that combining visual and interactive elements can improve information comprehension and retention (Pareng & Mayer, 2021). Digital modules that integrate animation, interactive imagery, and audio instructions help convey information that is difficult to grasp verbally, particularly for students with autism who have difficulty



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understanding abstract concepts. This is further supported by previous research showing that the use of visual media in reproductive health education can clarify concepts that are otherwise challenging for autistic children to comprehend (Husein *et al*., 2025; Holmes *et al*., 2023). The implementation of digital modules facilitates the delivery of material for teachers who previously relied heavily on conventional methods, which are often less effective for students with special needs.

Furthermore, the findings offer a new perspective on teachers' active involvement in using digital modules. During the mentorship sessions, teachers were provided with not only theoretical knowledge but also hands-on training on implementing the material in daily instruction. This is consistent with prior research emphasizing the importance of active training to maximize the use of technology in education (Wekerle *et al*., 2022; Zulkarnaen *et al*., 2023). Teachers who feel a sense of ownership over the module and can tailor its content to their students' classroom needs tend to be more confident and motivated to use it. This involvement makes learning more personalized and relevant to real-world conditions, thereby enhancing the overall quality of instruction.

Despite the effectiveness of these digital modules, this study also identified challenges in their implementation. Limited technological infrastructure in several special education schools (SLB) and varying levels of **technological literacy** among teachers remain major obstacles. This aligns with previous studies stating that a lack of technological training for teachers can hinder the effectiveness of technology in education (Taufik *et al*., 2024). Consequently, it is recommended that continuous training programs and the enhancement of digital facilities become part of educational policy to support more optimal technology utilization in special education settings.

From a practical standpoint, this research has significant implications for the development of instructional modules in special education. Interactive digital modules not only improve teacher understanding but also make the learning process more engaging and enjoyable for students with autism. This reinforces the theory that innovative learning media can increase student engagement and motivation (Mangasak *et al*., 2025). The success of this module highlights the importance of developing more flexible materials that can be adapted to meet the diverse needs of students, particularly within the context of inclusive education.

For future research, it is recommended that studies examine the impact of digital modules on teachers' understanding and skills in teaching other sensitive topics, such as mental health or emotional management, which are equally vital for students with autism. Further exploration could also investigate whether a correlation exists between improved teacher comprehension and enhanced engagement or learning outcomes among autistic students.

## CONCLUSION

This study demonstrates that the use of interactive digital modules significantly enhances teacher understanding of reproductive health education for students with autism. Modules that integrate visual, interactive, and auditory elements have proven effective in facilitating the comprehension of material that was previously difficult to explain through conventional methods. These findings support Mayer's Multimedia Theory, which emphasizes the importance of combining visual and interactive elements to improve information comprehension and retention. The practical implications of these findings underscore the need to develop and implement digital modules in education for students with special needs, particularly in special education schools (SLBs). Furthermore, this research underscores the need for improved technological infrastructure and continuous training for teachers to ensure the effective application of digital modules. Future research is expected to examine the long-term impact of digital module utilization on student learning outcomes and to expand the scope to include other sensitive instructional topics.


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## AUTHOR'S NOTE

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