

DEVELOPMENT OF INTERACTIVE QUIZZES BASED ON AUGMENTED REALITY THROUGH USE TIKTOK FILTERS FOR REDUCE STUDENTS' MATH ANXIETY

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ABSTRACT

This research and development study focuses on creating interactive quiz media using Augmented Reality (AR) technology via TikTok filters to reduce students' mathematical anxiety. The development process follows the ADDIE model, which encompasses the phases of analysis, design, development, implementation, and evaluation. The subjects involved in this study are seventh-grade students of SMPN 2 Ciruas. The data collection instruments used were media feasibility questionnaire, media practicality, and media effectiveness. The results of the feasibility test by material experts amounted to 88.46% with very feasible criteria and the feasibility test by media experts amounted to 93.75% with very feasible criteria. The results of the media practicality test by the teacher were 96.15% with very feasible criteria and the student practicality test was 81.18% with very feasible criteria. The normality test results on (pre-survey) obtained a significance value of 0.134 and on (post-survey) obtained a value of 0.565. These results indicate that the significance value of pre and post > 0,05. The results of the paired sample T-Test analysis showed that $t_{hitung} > t_{tabel}$ namely $14,992 > 1,699$. It can be concluded that there is an effect of developing Augmented Reality-based interactive quiz media through the use of TikTok filters to reduce students' mathematical anxiety. Based on the results of the feasibility test, practicality, and effectiveness of the media, the media in the form of Augmented Reality-based interactive quiz through TikTok Filter Utilization can be used to reduce students' mathematical anxiety.

Keywords: augmented reality; interactive quiz; mathematical anxiety.

ABSTRAK

Penelitian pengembangan ini berfokus pada penciptaan media kuis interaktif dengan teknologi Augmented Reality (AR) melalui filter TikTok guna mereduksi tingkat kecemasan matematis siswa. Proses pengembangan mengacu pada model ADDIE yang mencakup fase analisis, desain, pengembangan, implementasi, serta evaluasi. Adapun subjek yang terlibat dalam penelitian ini adalah siswa kelas VII SMPN 2 Ciruas. Instrumen pengumpulan data yang digunakan berupa angket kelayakan media, kepraktisan media, dan keefektifan media. Hasil uji kelayakan oleh ahli materi sebesar 88,46% dengan kriteria sangat layak dan uji kelayakan ahli media sebesar 93,75% dengan kriteria sangat layak. Hasil uji kepraktisan media oleh guru sebesar 96,15% dengan kriteria sangat layak dan uji kepraktisan siswa sebesar 81,18% dengan kriteria sangat layak. Hasil uji normalitas pada (pre-angket) memperoleh nilai signifikansi 0,134 dan pada (post-angket) memperoleh nilai 0,565. Hasil tersebut menunjukkan bahwa nilai signifikansi pre dan post > 0,05. Hasil analisis uji paired sample T-Test, diperoleh hasil bahwa $t_{hitung} > t_{tabel}$ yaitu $14,992 > 1,699$. Hasil penelitian menyimpulkan bahwa pengembangan kuis interaktif berbasis Augmented Reality melalui filter TikTok memberikan dampak signifikan dalam mereduksi kecemasan matematis siswa. Berdasarkan hasil uji kelayakan, kepraktisan, dan efektivitas media, maka media berupa kuis interaktif berbasis Augmented Reality melalui Pemanfaatan Filter TikTok dapat digunakan untuk mengurangi kecemasan matematis siswa.

Kata kunci: *augmented reality; kecemasan matematis; kuis interaktif*



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Introduction

The swift evolution of technology has profoundly impacted multiple facets of modern society, with the educational sector being no exception. Technology refers to various tools utilized to meet human needs and support the sustainability and comfort of life (Wicaksana & Rachman, 2023). Technology essentially functions as a supporting tool that can enhance human capabilities. Technology has a significant influence on advancing the world of education and improving the quality of teaching and learning (Miasari et al., 2022). In the world of education, the application of technology brings many changes and innovations (Taib et al., 2019). This situation creates new opportunities for teachers to improve the quality of learning and make the learning process more interesting and efficient, including in mathematics learning. Mathematics is a subject present at almost every level of education and plays a crucial role in the educational system. Mathematics is essential in daily life, particularly in the fields of science and technology, making it a subject that all students must master (Nurulaeni & Rahma, 2022). Despite its importance, mathematics is not a subject that students enjoy. Mathematics learning is often perceived as difficult and uninteresting by students (Amalia et al., 2022). Students' negative perceptions of mathematics as a difficult subject trigger mathematical anxiety (Azainil et al., 2024). The feelings of tension, fear, and anxiety experienced by someone when they face mathematics learning are called mathematical anxiety (Hakim & Adirakasiwi, 2021). They tend to panic and feel restless when first confronted with abstract and complex mathematical problems, such as those in the topic of algebraic forms. Many students feel anxious when working on algebra problems because this material marks their transition from concrete concepts to more abstract concepts (Fajriah et al., 2022).

One of the causes of math anxiety in students is the teacher's method of delivering material, which is often monotonous and lacks variety. The way teachers currently present math material is still mostly manual, making math learning feel rigid and uninteresting. High levels of math anxiety among students can lead to low academic achievement (Ririk et al., 2022). One of the mathematics learning media that can be used to reduce students' mathematical anxiety is by applying interactive quiz learning media. An interactive quiz can be defined as a learning medium containing a series of questions with multiple-choice answers, where users can select answers and immediately know whether their answers are correct or incorrect (Masdar Limbong et al., 2022). Information technology can be used to design interactive quizzes that can function as a tool for final assessment (Triatmaja et al., 2021). With the current advancement of technology, teachers need to continue learning and participating in technological developments to keep students' knowledge up-to-date and to prevent obstacles in the application and use of technology (Supit et al., 2023). One technology that can be applied to create interactive quizzes is Augmented Reality. Augmented Reality (AR) is a technology that integrates two-dimensional or three-dimensional virtual objects into the real

world, projecting them in real-time through specific markers captured by a camera (Satria et al., 2023). Augmented Reality (AR) is a technology that combines the real world with the virtual world. Augmented Reality can display visualizations of objects through the camera directly in the real world (Nindiasari et al., 2024). The use of Augmented Reality in learning can help reduce anxiety toward mathematics (Hidayat & Asmalah, 2022). By using Augmented Reality, students can see and interact with mathematical concepts in a more concrete visual form, thereby increasing student interest and reducing mathematical anxiety. This is in line with (Fathurrohman et al., 2022) that the appropriate learning media for students is media that can present positive images, impressions, and experiences of mathematics, as well as focus on a deep understanding of basic concepts. With increasingly sophisticated technology, the use of Augmented Reality is also widely found on various digital platforms known as social media. Among various social media platforms, TikTok is the most widely used by users today (Oktafiani & Haryanto, 2022).

TikTok functions as a social media application designed for the creation and sharing of short-duration videos, specifically within a 15 to 60 second timeframe. Based on a Statista report released in August 2024, Indonesia's TikTok user base reached 157.6 million as of July 2024. This total exceeds the 120.5 million users in the United States, establishing Indonesia as the global leader in TikTok usage (Ceci, 2024). Currently, the TikTok app offers a variety of filters tailored to user needs, including a virtual try-on feature using Augmented Reality technology (Kasuma & Oktarina, 2024). TikTok filters based on Augmented Reality can be utilized to create interactive quizzes as a form of mathematics learning. Therefore, based on the description of the problem and the solutions presented, it is necessary to conduct research to develop an interactive quiz based on Augmented Reality through the use of TikTok filters. This quiz is expected to help students increase their enthusiasm for learning and reduce their anxiety about mathematics.

Research methods

This study uses the development method, also known as Research and Development (R&D). The Research and Development (R&D) method is utilized to design particular products and conduct rigorous testing to evaluate their overall efficacy. (Muthohir, 2019). This developmental study utilizes the ADDIE model, which comprises five distinct stages: Analysis, Design, Development, Implementation, and Evaluation. The ADDIE model was chosen for this research because its process is relatively easy to understand, has structured stages, and facilitates research planning and implementation. The steps of the ADDIE development model are as follows:

Analysis

The analysis stage is the first step in the research process. The analysis in question is a needs analysis. At this stage, observations were made at a junior high school by interviewing one of the mathematics teachers and seventh grade students. Based on this analysis, technology-based mathematics learning media was determined to reduce students' mathematical anxiety.

Design

The second stage of the ADDIE model is the design stage or the design of the product to be developed. Here, we begin with the process of designing an Augmented Reality-based quiz, starting from the material to be used in the quiz to the interactive design created for the quiz. The quiz filter display will be filled with questions tailored to the needs analysis. The goal is to ensure that it is suitable for use.

Development

The third stage in the ADDIE development model is the development or production stage. At this stage, interactive quizzes are created using the Effect House application. Afterward, the products are reviewed and validated by media and material experts to measure eligibility criteria before being tested on students.

Implementation

After undergoing development and refinement, the quiz was implemented for seventh-grade junior high school students. At this stage, a questionnaire was administered to assess the reduction in students' mathematical anxiety. Later, students will be given non-test instruments as tools to analyze the effectiveness of the developed product, namely pre-non-tests and post-non-tests. Non-test instruments are distributed as tools to analyze the effectiveness of the developed interactive quiz.

Evaluation

Evaluation is the final step in the implementation of ADDIE in the development of interactive quizzes. In this study, evaluation was actually conducted at each stage of ADDIE to identify shortcomings at each stage. During the final phase, the implemented learning media was evaluated to measure its practicality and its impact on increasing students' mathematical learning motivation after utilizing TikTok-integrated Augmented Reality quizzes.

The objective of this research is to develop an innovative interactive quiz leveraging Augmented Reality (AR) via TikTok filters, specifically designed to alleviate mathematical anxiety among students. The interactive quiz based on Augmented Reality will be designed and validated by a team of experts to assess the validity of the developed product. After validation and improvement, the next step is to conduct a trial on seventh-grade students in junior high school. The result of this development is a learning medium in the form of a quiz on the TikTok filter with an interactive display that can be accessed via a laptop or smartphone. The Augmented Reality-based quiz was created using the Effect House application.

The subjects used in this study are seventh-grade junior high school students. The students selected as test subjects are those who meet specific criteria, namely seventh-grade students who have a TikTok account. These criteria were established through purposive sampling, a sampling technique where subjects are selected based on specific considerations or predefined criteria (Sugiyono, 2022). The test subjects in this study also included subject matter experts, media experts, and seventh-grade mathematics teachers as research subjects. Three instruments were used in this study: interviews, questionnaires, and documentation. The data analysis

technique used in this development study was data analysis from the results of the feasibility, practicality, and effectiveness questionnaires.

feasibility

According to (Sugandi & Rasyid, 2019), The following formula was employed to calculate the feasibility percentage:

$$P = \frac{\text{Number of scores given by validators}}{\text{Maximum Score}} \times 100\%$$

Practicality

According to (Sugandi & Rasyid, 2019), The following formula was employed to calculate the practicality percentage:

$$P = \frac{\text{Number of scores given by validators}}{\text{Maximum Score}} \times 100\%$$

Effectiveness

In this study, the data analysis used was a statistical test, namely the paired sample t-test. The data analysis used in this study was parametric statistics. Parametric statistics are used with the condition that the sample data must have a normal distribution (Sujarweni, 2019). Therefore, before conducting the paired sample t-test, a normality test was first carried out as a prerequisite test. The normality test used in this study was the Shapiro-Wilk statistical test. The significance level used was 0.05 or 5%. Data was considered to have a normal distribution if the significance was greater than 0.05 or 5%. This normality test was conducted using SPSS 29.0 software.

The decision-making process is based on the guidelines outlined by (Sujarweni, 2019) as follows:

1. If significance > 0.05, then the data is normally distributed
2. If significance < 0.05, then the data is not normally distributed

After the data was distributed normally, it was calculated using a paired sample t-test. This paired sample t-test was used to analyze the research results before and after the application of the media.

This test was conducted using SPSS 29.0 software. The formula for the paired sample t-test according to (Nuryadi et al., 2017) is as follows:

$$t = \frac{\bar{B}}{\frac{S_B}{\sqrt{n}}}$$

Explanation:

t = Calculated t value

\bar{B} = Average difference between *pre* and *post*

B = Difference between *pre* and *post*

n = Number of samples

S_B = Standard deviation of B

This hypothesis testing uses a significance level of $\alpha = 0.05$ or 5%. The hypothesis to be tested is as follows:

Hipotesis:

1. H_0 : There was no decrease in students' mathematical anxiety between before and after learning using interactive quizzes based on Augmented Reality through the use of TikTok filters.
2. H_1 : There was a decrease in students' mathematical anxiety between before and after learning using interactive quizzes based on Augmented Reality through the use of TikTok filters.

Hasil dan Pembahasan

The result of this research is an interactive quiz filter based on Augmented Reality that can be accessed through the TikTok application, containing questions on Algebraic Forms. This study employs the ADDIE model, which encompasses five stages: Analyze (*analisis*), Design (*perancangan*), Development (*pengembangan*), Implementation (*penerapan*), and Evaluation (*evaluasi*). The following are the ADDIE development stages that have been carried out:

1. Analyze (*Analisis*)

A needs analysis was conducted by interviewing seventh-grade mathematics teachers at SMPN 2 Ciruas. Based on the results of interviews with teachers and seventh-grade students at SMPN 2 Ciruas, it was found that mathematics learning still minimizes the use of technology, making students less enthusiastic and anxious when learning, especially when studying algebraic forms. Therefore, an interactive quiz media based on Augmented Reality was developed through TikTok filters, which was designed to present real-time algebraic exercises and reduce students' mathematical anxiety.

2. Design (*Perancangan*)

At this stage, the analysis results are used to design the product to be developed. In creating interactive quizzes, the main software used is Effect House and TikTok. Additional software used includes Canva Studio to create quiz backgrounds, questions, answers, and scores, which will become the main elements in the creation of interactive quizzes.

3. Development (*Pengembangan*)

This stage consists of product development, product validation and assessment, and product revision. After the product is developed, the next step is validation by experts to determine the suitability of the developed product. Suitability testing is carried out by 4 validators, namely 2 material experts and 2 media experts. The purpose of this validation is to assess the suitability of the product, whether it can be used immediately, needs revision, or is not suitable for use as a learning medium.

- a. Material Expert Feasibility Test

The assessment conducted by subject matter experts can be seen in the following Table 1

Table 1. Material Expert Feasibility Results

Aspects	Total Skor	Maximum Skor	Persentase	Criteria
Content Feasibility Aspects	24	24	100%	Very Feasible
Presentation Feasibility Aspects	36	40	90%	Very Feasible
Language Aspects	32	40	80%	Feasible
Total	92	104	88,46%	Very Feasible

Based on Table 1, it shows that the interactive quiz received a very Feasible rating in terms of content feasibility, with a percentage of 100%. For the presentation aspect, a percentage of 90% was obtained, categorized as very Feasible. The language aspect received a score of 80% and was categorized as feasible. Overall, the total score given by the subject matter experts for the interactive quiz reached 88.46%, placing it in the very Feasible category.

b. Media Expert Feasibility Test

The assessment conducted by media experts can be seen in the following Table 2.

Table 2. Media Expert Feasibility Results

Aspects	Total Skor	Maximum Skor	Persentase	Criteria
Media Display Aspects	83	88	94,31%	Very Feasible
Aspek Pemrograman	29	32	90,62%	Very Feasible
Aspek Augmented Reality	23	24	95,83%	Very Feasible
Total	135	144	93,75%	Very Feasible

Based on Table 2, it shows that the interactive quiz received a Very Feasible rating in terms of media display with a percentage of 93.31%. In terms of programming, the rating reached 90.62%, and in terms of Augmented Reality, it received a score of 93.83%, all of which fall under the Very Feasible category. Overall, the total score given by media experts for the interactive quiz is 93.75%, indicating that this media is Very Feasible for use.

c. Product revision

After validating the media, the experts provided suggestions and feedback with the aim of improving or revising the media so that it would be more suitable for use by students in the future. The results of the

revision of the Augmented Reality-based interactive quiz media developed are as follows:

1) Writing questions that are too long

In the interactive quiz, some questions still use fairly long sentences. Therefore, subject matter experts suggest simplifying the sentences so that students can immediately understand the questions without having to reread them. The results of the repairs are shown in the image below in Figure 1.

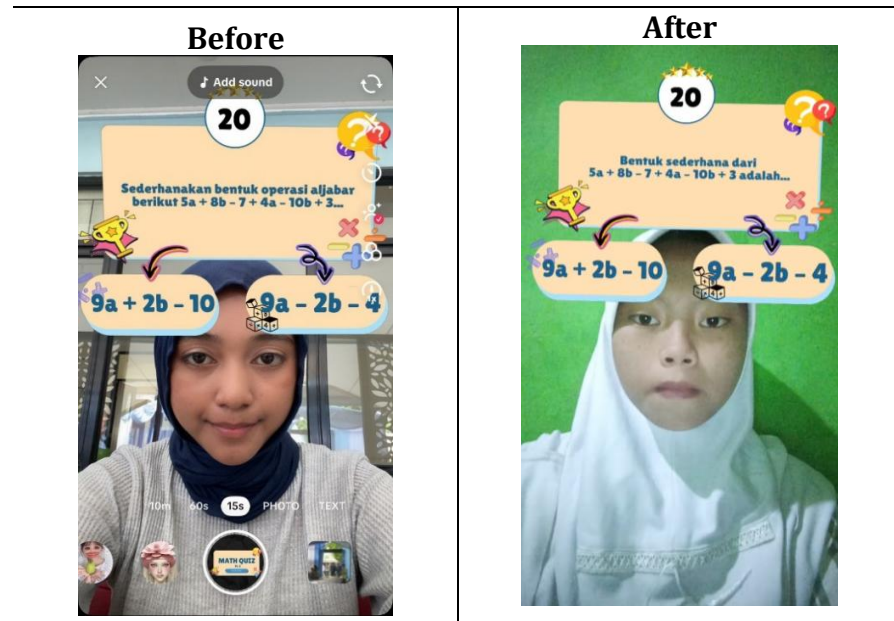


Figure 1 Question Revision

4. Implementation (*Penerapan*)

After the interactive quiz was validated and revised according to expert advice, it was then implemented to students in classroom learning to determine how the Augmented Reality-based interactive quiz, utilizing TikTok filters, could reduce students' mathematical anxiety after learning using the developed product.

Before the Augmented Reality-based interactive quiz was implemented to the research subjects, a 22-item pre-questionnaire on students' math anxiety was administered. After the students completed the pre-questionnaire, they were instructed to activate their smartphones and open the TikTok app. They could then access the interactive quiz filter by scanning a barcode. After using the Augmented Reality-based interactive quiz, teachers and students were given a response questionnaire to assess the practicality of the interactive quiz. Subsequently, students were given a post-questionnaire on mathematical anxiety to measure the reduction in students' mathematical anxiety after using the interactive quiz.

a. Practical testing of media by teachers

The results of the teacher practicality questionnaire assessment are shown in the following Table 3.

Table 3. Result of Media Practicality Tests by Teachers

Aspects	Total Skor	Maximum Skor	Persentase	Criteria
Appearance	24	24	100%	Very Practical
Ease of Use	29	32	90,62%	Very Practical
Question Presentation	16	16	100%	Very Practical
Benefits	31	32	96,87%	Very Practical
Total	100	104	96,15%	Very Practical

Based on Table 3, it shows that the practicality assessment of the media indicates that the appearance aspect scored 100%, the ease of use aspect scored 90.62%, the question presentation aspect scored 100%, and the usefulness aspect scored 96.87%. Overall, the total assessment of teachers towards this media reached 96.15%, which is categorized as very practical.

b. Practical testing of media by students

The results of the student practicality questionnaire assessment are shown in the following Table 4.

Table 4. Result of Media Practicality Tests by Students

Aspects	Total Skor	Maximum Skor	Persentase	Criteria
Appearance	299	360	83,05%	Very Practical
Ease of Use	374	480	77,91%	Practical
Question Presentation	200	240	83,33%	Very Practical
Benefits	296	360	82,22%	Very Practical
Total	1.169	1.440	81,18%	Very Practical

Based on Table 4, it shows that the practicality assessment of the media indicates that the appearance aspect scored 83.05%, the ease of use aspect scored 77.91%, the question presentation aspect scored 83.33%, and the usefulness aspect scored 82.22%. Overall, the total assessment of teachers towards this media reached 81.18%, which is categorized as very practical.

c. Media Effectiveness Test

Following the implementation of the media in class VII-G at SMPN 2 Ciruas, the pre- and post-questionnaire data were analyzed using a paired sample t-test. Prior to this analysis, a normality test was performed as a prerequisite to ensure that the sample was drawn from a normally distributed population. The results of the normality test can be seen in the Test of Normality table processed using SPSS version 30. The normality test used was the Shapiro-Wilk statistical test. The normality test calculations can be shown in the following Table 5.

Table 5. Shapiro-Wilk Normality Test

	Kolmogorov - Smirnov ^a			Shapiro - Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
<i>Pre</i>	.174	30	.021	0.946	30	.134
<i>Post</i>	.096	30	.200	0.971	30	.565

Based on Table 5, the results of the normality test using the Shapiro-Wilk test show that the pre-questionnaire obtained a significance value of 0.134 and the post-questionnaire obtained a value of 0.565. These results indicate that the pre- and post-significance values are >0.05 , so it can be concluded that the data is normally distributed.

After going through the prerequisite testing stage, the next step is to apply hypothesis testing. The hypothesis test used is a parametric statistical test, namely the Paired Sample T-Test. The results of the paired t-test are shown in the Table 6 below:

Table 6. Paired Sample T-Test

t hitung	df	Sig.
14,992	29	0,001

Based on Table 6, the results of the hypothesis testing above show a significant difference between the results before and after using interactive Augmented Reality-based quizzes in learning. To determine the t-table value, it is based on the degrees of freedom (df), which is $N-1$, i.e., $30-1 = 29$. With $df = 29$ at a significance level of 5%, the t-table value is 1.699. Based on the results of the paired sample T-Test analysis, it can be concluded that $t_{calculated} > t_{tabel}$, i.e., $14.992 > 1.699$, so H_0 is rejected and H_1 is accepted. It can be concluded that there is an effect of developing interactive quiz media based on Augmented Reality through the use of TikTok filters to reduce students' mathematical anxiety.

Based on Table 6, the significance value is 0.001, which is lower than the threshold of 0.05. Consequently, H_0 is rejected and H_a is accepted. This indicates a significant reduction in students' mathematical anxiety following the use of Augmented Reality-based interactive quizzes via TikTok filters compared to their initial state.

Based on the discussion above, interactive quizzes based on Augmented Reality through the use of TikTok filters have proven to be feasible, practical, and effective in reducing students' math anxiety. This aligns with (Hidayat & Asmalah, 2022), who stated that the use of Augmented Reality among students shows an increase in learning motivation and a decrease in anxiety levels in mathematics. According (Tasrif et al., 2020), Augmented Reality (AR) learning media can positively impact learning activities by offering efficient and easy-to-use resources. This occurs because Augmented Reality displays objects in a realistic visual form, thereby creating a more interactive and enjoyable learning experience for students. The theory supporting this research is constructivism, which states that knowledge development is actively built by individuals through independent experience and environmental

interaction. Learning that integrates digital platforms is one approach within constructivist learning (Lathifah, 2024)

5. *Evaluation* (Evaluasi)

During implementation, several obstacles were encountered in the use of interactive quizzes, particularly in moving between questions, which students found difficult due to the navigation sensitivity settings being too high. In addition, some students experienced network problems due to limited internet quotas. The use of TikTok as a learning tool is constrained by the fact that not all students own a smartphone. However, in general, Augmented Reality-based interactive quizzes can still be used effectively in mathematics learning.

Conclusion and Suggestion

The development of an interactive quiz based on Augmented Reality using TikTok filters was conducted to reduce mathematical anxiety among seventh-grade junior high school students in algebraic forms, using the ADDIE model. This media was deemed very feasible based on assessments by subject matter experts (88.46%) and media experts (93.75%). In terms of practicality, teachers gave a rating of 96.15% and students 81.18%. The use of this media was proven effective in reducing students' anxiety, as evidenced by an increase in questionnaire scores from 51.33 to 75.03, and statistical test results showed significance at $0.001 < 0.05$.

Based on the results of development, research, discussion, and conclusions that have been compiled, several recommendations can be made: (1) the variety of answer options needs to be increased, (2) teachers and schools are advised to be more active in using technology, especially Augmented Reality through the TikTok platform, in various subjects, (3) this research is expected to inspire future researchers to develop learning media for higher education levels and expand learning outcome measurements to include other aspects such as cognitive and psychomotor skills.

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