ARTICLE

VALIDATION OF SISTEM PELATIHAN OTAK OR SIPETA A DIGITAL COGNITIVE REMEDIATION THERAPY FOR CHILDREN

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ABSTRAK

The development of cognitive abilities is closely related to children's academic achievement and behavioral issues. Children prefer media that use visual and auditory elements to optimize their attention. Therefore, media are needed to enhance attention and memory, thus improving their understanding of lessons and impacting academic performance. This study aims to validate SiPETA as a digital cognitive remediation therapy for children to enhance learning abilities. SiPETA was developed based on a prototype of learning methods focused on Attention, Memory, and Self-Regulation. The platform contains social intelligence stories based on Bloom's taxonomy, categorizing cognitive abilities into six levels. The research method includes three stages. In the first stage, face validity was tested by 13 experts in child development and special education who evaluated the platform's narratives using the Delphi method. In the second stage, content and construct validity of SiPETA were tested by experts using the Lawshe method. In the third stage, the usability of the SiPETA application was tested on 12 elementary school children using the Lawshe method. Validity shows CVR value is more than 0.54 based on the minimum value that has been determined based on the number of expert judgments, from CVR value it showed that SiPETA is valid, reliable, and ready for training. SiPETA can be a valuable tool for teachers and parents to help children develop cognitive skills and improve academic achievement.

Keywords: Attention; Cognitive; Remediation; Memory; SiPETA; Self-Regulation

АБСТРАКТ

Развитие когнитивных способностей тесно связано с успеваемостью детей и их поведением. Дети предпочитают средства массовой информации, использующие визуальные и слуховые элементы для оптимизации их внимания. Поэтому необходимы средства массовой информации, которые улучшают внимание и память, тем самым улучшая понимание уроков и влияя на успеваемость. Целью данного исследования является проверка SiPETA в качестве цифровой когнитивной коррекционной терапии для детей с целью повышения способности к обучению. SiPETA была разработана на основе прототипа методов обучения, ориентированных на внимание, память и саморегуляцию. Платформа содержит истории социального интеллекта, основанные на таксономии Блума, классифицирующей когнитивные способности на шесть уровней. Метод исследования включает три этапа. На первом этапе 13 экспертов в области детского развития и специального образования, оценивавших рассказы платформы по методу Дельфи, проверяли их валидность. На втором этапе валидность содержания и конструктива SiPETA проверялась экспертами с помощью метода Лоуша. На третьем этапе удобство использования приложения SiPETA было проверено на 12 детях начальной школы с помощью метода Лоуша. Валидность показала, что значение CVR превышает 0,54 на основе минимального значения, которое было определено на основе количества экспертных оценок, из значения CVR следует, что SiPETA валидна, надежна и готова к обучению. SiPETA может стать ценным инструментом для учителей и родителей, чтобы помочь детям развить когнитивные навыки и улучшить академическую успеваемость.

Ключевые слова: Внимание; когнитивные способности; коррекция; память; SiPETA; саморегуляция

INTRODUCTION

The childhood years are a period where creativity and the spirit of exploration develop rapidly. However, during this phase, children may face challenges in behavior and cognition. These challenges can lead to a decrease in learning motivation, low self-esteem, difficulty in problem-solving, self-regulation limitations, lack of attention, and memory issues, ultimately affecting academic achievement and the quality of education.[1,2,3] Cognitive issues can also hinder the learning process and the development of interests and talents.[4] Data from Dr. Soeharto Heerdjan Mental Hospital in Jakarta indicate that behavioral and learning difficulty, such as attention deficit/hyperactivity disorder or ADHD, behavioral disorders, intellectual disability, autism, and learning disorders, dominate the number of child patients in the Child and Adolescent Mental Health Unit of Dr. Soeharto Heerdjan Mental Hospital Jakarta in 2021, reaching 11,824 patients. Research from the Institute on Community Integration or ICI revealed that in 2019, approximately 7.39 million individuals in the United States faced challenges in cognitive and developmental aspects. Furthermore, about 19% or approximately 1.40 million people received long-term support or services to address cognitive disabilities. In conclusion, both sets of data indicate that cognitive issues are an issue requiring early attention and action.

Based on the discussion and data provided above, there is a need for a training program that can be delivered to children through effective and enjoyable media such as digital cognitive education accessible via smartphones or devices. This will enable the effective management of children with cognitive issues. The development of this digital cognitive education should be conducted through research that can test and measure the effectiveness and validity of cognitive training methods via digital cognitive education for children with cognitive issues. Therefore, this research aims to validate the prototype of the Attention, Memory, and Self-Regulation-based called the Sistem Pelatihan Otak or SiPETA.

This learning media can be used as an intervention for students who have learning difficulties, which can easily be implemented by parents at home and teachers in schools in a continuous manner in the form of cognitive training. This training will be utilized by parents and teachers to enhance attention or focus, concentration, memory, and thinking abilities, thereby enabling children to self-regulate and improve their cognitive capacity. SiPETA is designed as an interactive and enjoyable digital cognitive education with gradually increasing difficulty levels from stage 1 to stage 6, allowing children to enhance their cognitive abilities step by step.

Digital learning media has become crucial in modern education due to its accessibility, personalized learning experiences, and efficient learning processes. Digital learning media enables access to various learning materials that can facilitate the learning process.

SiPETA is a digital cognitive training method developed by researchers based on Bloom's taxonomy theory, where children's cognition is structured and hierarchical, identifying thinking skills from lower to higher levels, with observed and evaluated stages. This training lasts for 40 hours.[5]

The concept of SiPETA program is an the six-stage innovative method developed by researchers drawing upon Bloom's Taxonomy, initially developed by Benjamin Bloom and colleagues in 1956, and revised by David Krathwohl and other experts in 2001. This program adapts the Cognitive Bloom's Taxonomy, which classifies learning objectives based on six levels of thinking abilities.[6]

The concept of SiPETA program is an the six-stage innovative method developed by researchers upon Bloom's Taxonomy, which classifies learning objectives based on six levels of thinking abilities. The taxonomy structures children's cognition in a hierarchical manner, identifying thinking skills from lower to higher levels. Each stage is observed and evaluated.

The first step is memorization, which is the ability to recall or repeat learned information, such as facts, terms, definitions, or concepts. Operational verbs associated with this stage include state, write, explain, identify, and recognize.

The second step is comprehension, which is understanding the meaning or significance of learned information. This can involve explaining in one's own words, providing examples, classifying, or summarizing. The operational verbs at this level include elaborate, interpret, exemplify, summarize, and compare. The third step is application that refers to the ability to use learned information in new situations or different contexts. This could involve solving problems, conducting experiments, or applying rules. Operational verbs for this stage include solve, use, calculate, demonstrate, and implement.

The fourth step is analysis, which is skill involves breaking down the learned information into smaller parts and identifying relationships or connections between them. This might involve comparing and contrasting, organizing, classifying, or evaluating. Operational verbs at this stage include analyze, distinguish, organize, classify, and evaluate. The fifth step is evaluation, which refers to the ability to assess the quality or validity of learned information based on specific criteria.

This can involve giving opinions, determining strengths and weaknesses, providing suggestions, and making decisions. Operational verbs associated with this stage include assess, determine, choose, recommend, and defend. The final stage is creation that focuses on the ability to combine or synthesize learned information into something new or original. This could involve creating a new product, designing a new project, devising a new plan, or creating new art. Operational verbs at this level include create, design, and devise a new plan. SiPETA digital cognitive training consists of six stages with increasing levels of difficulty. Before each stage begins, students complete a pre-test and post-test which aim to measure students' attention, concentration and memory abilities.

The first stage trains attention, concentration and memory by providing reading accompanied by lots of pictures and minimal text that focuses on social intelligence to improve attention and memory. Stages two through five also train attention, concentration, and memory. SiPETA focuses on the activity of reading graded stories. Several studies have confirmed the influence of reading stories on memory, attention, and self-regulation. Gallets found that reading or listening to stories can enhance children's memory and understanding of the story.[7] This explains how reading illustrated stories stimulates the brain to store memories more easily as it stimulates imagination.[7] Koblinsky et al. in an experiment on reading books to children found that through reading stories, children more easily remember their gender roles compared to being directly told.[8]

Reading stories has been found to influence socio-cognitive abilities[9], emotional regulation [10], and self-regulation [11,12],These findings can be explained through the priming hypothesis, where a series of stories read by children help them recall long-term memories stored, which then become considerations in their daily activities, including emotional processing. The key emphasis of this explanation is the need for repeated storytelling for a child to continuously apply recalled memories.[9] Sun et al. found that reading through electronic devices can enhance children's visual attention.[13]

MATERIAL AND METHODS

This study includes stories for all stages in SiPETA, compiled from narratives collected from teachers in inclusive schools and pedagogy experts at the Learning Clinic in Bekasi, West Java, Indonesia. These stories consist of 86 narratives. Out of these 86 stories, evaluations will be conducted involving 13 experts in the fields of education and learning difficulties intervention, and trials will be carried out by 12 elementary school children with varying levels of learning abilities.

The assessment process begins with the Delphi method to select appropriate stories for each stage. This method involves expert panel discussions and decision-making to determine suitable stories for each stage and to reduce the total number of stories. Once the stories to be used in the SiPETA application are selected, validity testing is conducted using the Content Validity Ratio or CVR and Content Validity Index or CVI methods developed by Lawshe.[14] During the assessment, experts are instructed to analyze whether the presented stories are valid for providing cognitive training to elementary school students. The experts' evaluations are recorded and analyzed using the validity ratio.

The steps for validating the instrument are conducted as follows[15]. First, make a list of statements/questions to be analyzed along with the assessment criteria. The assessment criteria are marked with a number one for yes and a number zero for no. Then, select experts with the required competencies and request them to assess the content of the SiPETA website. Next, revise the SiPETA website content based on expert assessments and ask the experts to re-check the content following the revision. After that, compile the final report.

Calculate the evaluation results from the experts using CVR and CVI. First, find the CVR value by subtracting half of the total number of validators from the number of validators who answered "yes," then dividing by half of the total number of validators. After scoring all statement items by calculating the CVR value, the next step is to calculate the CVI value. Simply put, the CVI value is obtained by dividing the average CVR value for items answered "Yes" by the total number of items.

The calculation results for CVR and CVI range from 0 to 1. The values of CVR and CVI will be divided into three categories: the invalid category has values around 0 to 0.33; the valid category has values around 0.34 to 0.67; and the very valid category has values around 0.68 to 1. Lawshe states that an item is considered valid if the CVR value is above 0.78 and the CVI value is above 0.70[14]. However, the minimum value for an item to be considered valid depends on the number of experts. Since the number of experts used in this study is 13, the minimum CVR value used is 0.54.

Once the expert assessments are finalized, the stories deemed valid will become part of the SiPETA digital cognitive training stages based on attention, memory, and self-regulation. The digital cognitive training is designed using Articulate Storyline software to create the UI and design of the SiPETA website. Articulate Storyline is an application used to create presentations, similar to Microsoft PowerPoint, but with more features. It offers built-in objects, quiz creators, JavaScript integration, and more user interactions like drag-and-drop and input boxes. This application is widely used to develop learning media with more interactive and informative formats.[16] An important advantage of this application is its intuitive user interface and the ability to export documents online.[17]The final features found in SiPETA include interactions such as buttons to proceed with the story, typing answers or data, story voiceovers, and exporting data from the application to spreadsheets.

Figure 1. Home Page SiPETA

The SiPETA digital cognitive training consists of six stages with progressively increasing difficulty. Before each stage begins, students complete a pre-test and post-test designed to measure their attention, concentration, and memory abilities. Prior to entering the first stage, students fill out a biodata form to facilitate the analysis of their progress. After completing the biodata,

A test item is considered valid if the CVR value is above the minimum value of 0.54 and the CVI value is above 0.68.

Based on the content validity analysis conducted through the assessment of thirteen expert judgments, a CVI value of 0.94083 was obtained, which is higher than the CVI threshold value of 0.54. This indicates that these 26 stories can be used for cognitive training in SiPETA. The proposed cognitive training content, evaluated by 13 experts, consists of 6 stages with a total of 26 stories, detailed as follows: Stage 1 consists of 5 short stories with more illustrations. Stage 2 consists of 5 longer stories that use conjunctions with fewer illustrations.

Stage 3 contains 5 story problems with more than one paragraph. Stages 4 and 5 each consist of 3 questions with a relatively high level of story complexity and more challenging questions. Stage 6 consists of 5 self-regulation projection questions for students. The SiPETA prototype, which was developed based on 26 validated stories and questions, was subsequently tested on 12 elementary school students to assess the usability of the SiPETA training application. This testing utilized the CVR method with a cutoff value greater than 0.54 and the CVI method with a cutoff value greater than 0.68.

Based on the results of the CVR calculation, it was found that in the Quality of stories and questions aspect, stages 1 to 3 were obtained with CVR values in the valid category, while stages 4 to 6 with CVR values in the very valid category. Furthermore, the Layout design aspect obtained stages 2 to 6 show the CVR value of the very valid category, while stage 1 shows the CVR value of the valid category.

Furthermore, the Sound quality aspect obtained stages 2, 4, 5, and 6 show the CVR value of the very valid category, while stages 1 and 3 show the CVR value of the valid category. Finally, the Application efficiency aspect is found that all stages show a CVR value in the very valid category.
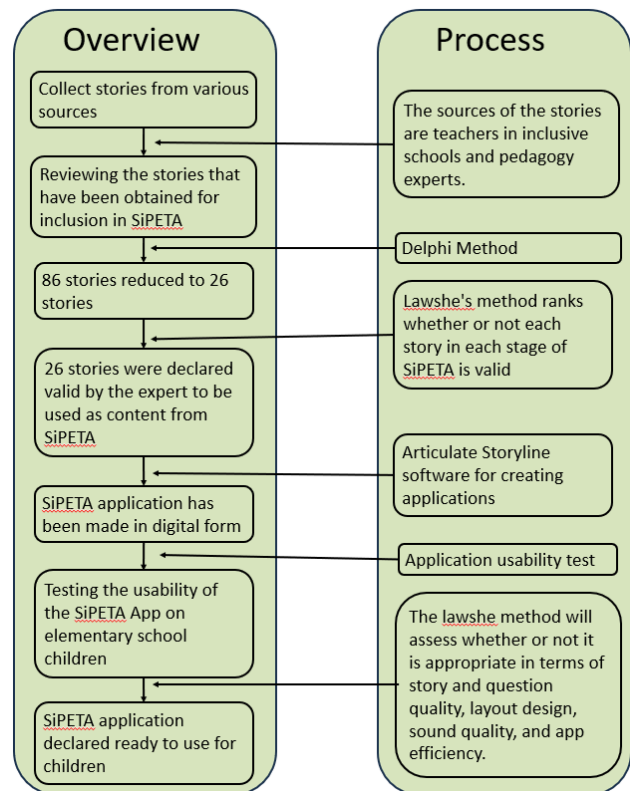

Figure 3. SiPETA Flow Scheme

DISCUSSION

Based on the assessments by experts, 26 stories at each stage of the SiPETA application are considered valid for use with elementary school students. According to the experts, these stories use language that is easy to understand and do not cause children to feel bored or lose focus. This is supported by research indicating that a good educational application for elementary school children should use language that is easy for them to understand and should make the learning process enjoyable.[18]

Subsequently, a trial was conducted with 12 elementary school students to assess the validity of the SiPETA training application based on the quality of stories and questions, layout design, audio quality, and application efficiency using the CVR value > 0.54 and CVI value > 0.68.

The quality of stories and questions refers to whether children understand each sentence in the stories and questions in SiPETA. This is important to note because children usually

have the ability to understand that words can be grouped, rely too much on pictures to learn new words, and understand longer instructions containing 2-3 parts.[19] Based on the CVR and CVI results, the quality of stories and questions in SiPETA shows that children can easily understand the stories and questions.

Layout design refers to whether SiPETA has an appealing layout design for children. This is because layout design can influence children's attraction to using SiPETA, especially the use of colors can play a crucial role in creating an environment that encourages concentration and engagement.[20] Based on the CVR and CVI results, the layout design in SiPETA shows that children are interested in the presented layout design.

Audio quality refers to whether SiPETA has audio that can be heard by children. Children can hear sounds at a minimum of 10 dB to 15 dB.[21] Based on the CVR and CVI results, the audio quality in SiPETA shows that children can easily hear the audio in SiPETA.

Application efficiency refers to whether SiPETA is easy to use. Good application efficiency is important for visual appeal to children, helping them identify the application, and providing crucial support for content and usability.[22]

Based on the CVR and CVI results, the application efficiency of SiPETA shows that children can easily use the SiPETA application during learning.This study shows that the SiPETA application can be used by elementary school students. It is expected that the SiPETA application can remediate the cognitive skills of children with learning difficulties, as it provides them with an engaging and easily accessible way to enhance their cognitive abilities. Many studies indicate that digital cognitive remediation can improve cognitive performance in children with learning problems. [23] [24]

CONCLUSION
This study was conducted to test the validity of SiPETA as a web-based interactive training application designed to improve memory, attention, and self-regulation in elementary school children. The SiPETA application prototype is valid, effective, and ready to be used as a web-based cognitive remediation therapy for children with learning difficulties.

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