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The Use of Visual Instructional Media and Diagnostic Assessment in Identifying Early Learning Difficulties

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Abstract

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Visual instructional media and diagnostic assessment are two essential approaches in identifying early learning difficulties among students. Visual media can facilitate the understanding of abstract concepts by providing concrete representations that support comprehension, especially for learners with different cognitive profiles. On the other hand, diagnostic assessment serves as a critical tool to detect specific obstacles in the learning process, including cognitive, linguistic, and psychosocial barriers. This literature study aims to examine the contribution of both approaches within the context of primary education. The review of selected international articles reveals that the integration of diagnostic assessment with visual media significantly enhances the accuracy of pedagogical interventions. Furthermore, the combination of these strategies allows for a more tailored instructional response to individual student needs. The study highlights the importance of a multimodal approach that aligns instructional delivery with diagnostic feedback, thereby improving inclusive practices and ensuring early support for learners with potential difficulties.

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1. Introduction

Learning difficulties represent a complex and multidimensional phenomenon, encompassing various interconnected and mutually influential aspects such as cognitive, linguistic, motor, and social-emotional factors. Children experiencing learning difficulties tend to face obstacles in understanding information, processing instructions from teachers, or even applying various learning concepts that should, in principle, align with their developmental stage. In this context, it can be said that early identification of learning difficulties is crucial and cannot be overlooked. The purpose of this identification is to prevent more serious and prolonged academic delays in the future and to facilitate targeted and needs-based interventions for each student. One approach that is increasingly recognized for its effectiveness in supporting the learning of children with learning difficulties is the use of visual instructional media.

This media generally not only serves to clarify information conveyed by educators but also helps overcome various limitations in verbal processing, which often becomes a major obstacle for students with learning disabilities. Visual media, such as illustrative images, informative graphs, animated videos, and interactive digital simulations, have been proven to provide concrete and real representations of various abstract concepts. Furthermore, visual media also accelerate students' comprehension of learning materials and facilitate their long-term memory of learned information (Wang, 2020). On the other hand, diagnostic assessment also plays an equally important role in understanding students' learning profiles comprehensively. Unlike summative assessments, whose primary focus is to evaluate

final results or academic achievements, diagnostic assessments emphasize identifying the root causes of learning problems actually faced by students.

Through the implementation of this assessment technique, educators can obtain detailed and in-depth data or information regarding students' strengths and weaknesses in various aspects of learning abilities, including basic skills such as reading, writing, arithmetic, and also motor skills (Kulasegaram & Rangachari, 2018). With the results of diagnostic assessments, teachers and educators can use this data as a strong foundation for designing more personalized, adaptive, and targeted learning approaches in accordance with individual student needs. Given the significant urgency of early identification of learning difficulties, the combination of using visual instructional media and implementing diagnostic assessment is considered a highly effective and efficient strategy. Visual media not only enriches content and material in the learning process but can also be utilized as an aid in the diagnostic assessment itself. For example, visual assessment forms such as interactive videos, sequential images, visual classification tasks, or patterned diagrams can be used to explore and reveal students' thinking patterns and cognitive processes (Brass & Lynch, 2020).

In other words, visual media can be part of an assessment strategy that allows teachers to observe how students process and respond to information, thereby enabling more accurate identification of learning difficulties. The combination of these two approaches also indirectly supports the implementation of a holistic and responsive educational approach to the diversity of students' learning needs. Through this approach, students with special needs or learning barriers will be more

easily recognized and handled early on. The main objective of this literature review is to deeply explore the significant contribution of visual media and diagnostic assessment in the process of identifying students' learning difficulties in the early stages of education. This study specifically reviews a selection of relevant international academic literature published, to formulate various strategic recommendations that can be practically applied by educators, curriculum developers, and policymakers in the field of education.

2. Literature Review

2.1. Visual Instructional Media in Learning

Visual media plays a significant role in simplifying complex concepts and accelerating students' comprehension processes. In learning, much material is abstract and difficult to understand solely through verbal explanations or written text. This is where the role of visual media becomes vital as an instructional aid. Research by Nouri (2019) shows that the use of infographics, animations, and data visualizations can increase information retention by up to 30% higher compared to text-based learning alone. This occurs because visual media can present information concisely, engagingly, and easily digestible, especially for students with a visual learning style. Visualization also helps students develop strong mental representations of concepts, particularly in mathematics and science, where the relationships between symbols and logic are often confusing if not supported by concrete representations.

In another study, the use of visual media was proven to increase student participation and motivation (Aprianto & Amir, 2022). Students feel more interested and motivated when interacting with attractive and relevant visual content. Media such as instructional videos provide a deeper multimodal learning experience, which suits various student learning styles (visual, auditory, kinesthetic). Thus, visual media enables more inclusive and adaptive learning. This is very important in the context of differentiated instruction that supports educational inclusion, especially to meet the needs of diverse student cognitive profiles in heterogeneous classrooms.

2.2. Integration of Visual Media and Diagnostic Assessment

Diagnostic assessment is an initial evaluation designed to identify students' strengths and challenges comprehensively within the learning process context. This approach not only assesses final outcomes but also explores students' thinking processes and cognitive responses during learning. According to Kulasegaram and Rangachari (2018), this assessment is formative and in-depth, as it can reveal cognitive, linguistic, and psychosocial conditions that may be underlying causes of learning difficulties. Furthermore, diagnostic assessment can provide a comprehensive overview of each student's unique characteristics, including how they process information, understand instructions, and respond to academic challenges. One frequently used assessment tool is Dynamic Assessment, which is interactive and process-oriented. This method allows educators to observe a child's developmental potential, not just their current abilities.

Thus, this assessment provides space for exploring learning potential that may not be visible in traditional assessments. That systematic and continuous diagnostic

assessment enables educators to adjust learning interventions more accurately to individual student needs. In addition, the use of Artificial Intelligence (AI)-based software to support assessment is increasingly common, as it can provide faster, more efficient, and more in-depth data analysis. This technology allows for automatic detection of difficulty patterns and provides data-driven strategic recommendations.

2.3. Integration of Visual Media and Diagnostic Assessment

The integration of visual media and diagnostic assessment offers complementary and synergistic approaches in education, particularly in the context of identifying students' early learning difficulties. Visual media not only functions as an aid in delivering learning material but can also be strategically used in the assessment process as a visual stimulus to observe students' cognitive and affective responses to a particular concept or instruction. In practice, visual media can be designed to stimulate critical thinking and exploration of student ideas, and to assess their understanding non-verbally. A successful example is the visual storytelling technique in literacy assessment. This method has proven effective in helping identify reading comprehension disorders and students' narrative abilities through the interpretation of images or sequences of illustrations (Wang, 2020).

This strategy is especially helpful for students who have limitations in verbal communication but show good visual comprehension. A study by Cunningham and Zhang (2019) shows that the integration of visual media with diagnostic assessment not only supports the process of identifying learning difficulties but also provides immediate feedback to students in the form of easy-to-understand visual

representations. Visualizing assessment data, such as progress graphs or concept maps, simplifies interpretation for teachers and parents. Furthermore, these visual representations accelerate the process of making more precise and data-driven instructional decisions.

3. Methods

This study employed a systematic literature review approach (library research) to collect, analyze, and synthesize various academic literatures relevant to the theme of using visual media and diagnostic assessment in identifying early learning difficulties in students. This approach was chosen because it allows researchers to examine empirical findings from various previous studies comprehensively and objectively. The search focus was directed at international journal. All articles were accessed through the Google Scholar database, which is a widely used open-access scientific reference source for global academic needs. In the selection process, the researcher applied a number of inclusion and exclusion criteria to ensure the relevance and quality of the articles reviewed. Inclusion criteria included articles examining the use of visual instructional media in the context of primary education, articles discussing diagnostic assessment with a focus on identifying learning difficulties, and studies that focused on the practical implementation and real impact of these approaches on student learning outcomes.

Meanwhile, exclusion criteria were applied to avoid articles that were only conceptual or theoretical without including valid empirical data, as well as studies published outside the specified time frame, i.e., before 2018 or after 2023. The article

selection process was carried out in three main steps. The first stage was an initial search using a combination of keywords such as "visual instructional media", "diagnostic assessment", and "learning difficulties". After that, filtering was done based on abstracts and publication year to ensure suitability with the study topic. The last step was an in-depth review of the full content of the 11 articles that had passed the initial selection. All articles were analyzed qualitatively using a thematic approach. The analysis technique involved coding the article content to identify important patterns, make comparisons between study findings, and understand the contribution of each study to the formulation of research questions. The results of this analysis were then arranged in a systematic and structured narrative, based on the main themes that emerged from the data.

4. Results and Discussion

The results of the review of 12 international articles published and indicate that the integration of visual media in the learning process and diagnostic assessment significantly contributes positively to the effectiveness of identifying early learning difficulties in students. The review highlights that the utilization of visual media not only helps in enhancing understanding of taught learning concepts but can also serve as a reliable early detection tool in indirectly revealing cognitive and affective barriers experienced by students. Visual media can be a concrete representation of various abstract information that is typically difficult for students with learning disabilities to interpret. Visual media has been empirically proven to enhance students' attention, concentration, and active engagement in teaching and learning activities.

For instance, research conducted by Wang (2020) states that students who participated in image, video, or animation-based learning showed significantly better cognitive performance compared to students who only received material in plain text.

This is due to the characteristic of visual media that can convey meaning simultaneously through visual and auditory channels. This multimodal presentation combination helps information processing run faster, more efficiently, and more comprehensively in students' working memory. Moreover, media such as concept graphs, mind maps, and infographics can facilitate students, especially those with a visual learning style, in understanding the interrelationships between concepts systematically and hierarchically. On the other hand, several articles also show that students experiencing learning difficulties, particularly in the areas of literacy and numeracy, often demonstrate slow and less adaptive responses to conventional learning methods that are verbal and abstract. Diagnostic assessment is crucial in distinguishing temporary learning difficulties, caused by unsupportive learning environments, from permanent learning disabilities that require continuous special intervention.

With the help of diagnostic assessment tools, teachers can evaluate students' abilities and limitations in various developmental domains, such as working memory, information processing speed, visual perception, and language comprehension. This provides a strong foundation for designing relevant and contextual learning strategies. One of the most prominent findings from the literature review is that when visual media is used as an integrated part of diagnostic assessment, the accuracy

in identifying learning problems tends to increase significantly. Research by Cunningham and Zhang (2019), found that presenting visual-based tasks such as arranging geometric patterns, sequencing story pictures, and labeling visual objects provides richer and deeper information about the thinking strategies and cognitive processes used by students in understanding and completing a task. Furthermore, various studies also mention that students with verbal impairments, such as dyslexia or expressive language disorders, tend to be easier to evaluate through visual-based tasks compared to essays, long descriptions, or complex oral instructions. Therefore, visual media has great potential to be used as an effective non-verbal assessment tool in an inclusive education context.

The capability of visual assessment has also been proven to play an important role in assessing students' social-emotional aspects, as explained in Guo's (2020) research. In one experiment, students were asked to express their feelings through drawings after completing a challenging learning task or experiencing frustration. The visual results collected from these students were then analyzed by the teacher to understand affective barriers that might not be revealed in conventional assessments. This shows that visual media not only functions in conveying academic information but also can be an authentic and valid means of self-expression in formative assessments oriented towards students' emotional well-being. Furthermore, visualizing diagnostic assessment results offers several additional benefits for teachers, parents, and other educational personnel.

A study by Weissgerber et al. (2019) mentions that assessment results data can be displayed in visualizations such as skill growth graphs, learning difficulty maps,

and charts of recommended learning strategies that can be directly implemented. Such visualizations not only accelerate the overall understanding of students' academic situations but also strengthen collaborative communication between teachers and parents in devising appropriate support strategies. These visual representations facilitate stakeholders in intuitively understanding student development trends over time. However, the use of visual media in the context of learning and diagnostic assessment is not without its challenges. One of the main challenges is the lack of specific training for teachers in designing effective and instructional visual media. Many teachers are still unfamiliar with using visual media strategically, so the media presented is often merely decorative and does not optimally support learning objectives.

Anderson and Kachorsky (2019) highlights the importance of professional training based on visual instructional design for educators so that the media they design is not only aesthetically appealing but also aligns with pedagogical goals and supports assessment accuracy. In addition, technological aspects are also a major concern in the integration of visual media and assessment. Several articles, such as those written by Karacan and Akoglu (2021), emphasize the importance of utilizing digital-based assessment software that combines visual, audio, and interactive response elements. For example, the use of tablet-based applications with eye-tracking features can help teachers identify areas of difficulty in reading or comprehending visual text. This technology allows for real-time analysis of how students scan visual information and provides objective data that is very useful in detailed assessment of students' cognitive difficulties.

In the context of differentiated instruction, students with different learning styles show varied responses to visual media. In a study by Alexiou and Schippers (2018), it was found that students with a visual learning preference showed an increase in learning outcomes of up to 45% after using interactive visual modules. Meanwhile, students with an auditory learning tendency only showed an increase of 15%. This fact confirms that the selection of learning media must be tailored to the learning profile of each student for optimal learning. Visual media enables a more adaptive and personalized pedagogical approach. The study by Kulasegaram and Rangachari (2018) emphasizes that diagnostic assessment should not be positioned as a one-time activity, but rather as a continuous and dynamic process. This is crucial because learning difficulties can evolve over time or even emerge in response to changes in environment and psychological pressure. With regular monitoring carried out through flexibly adapted visual media, teachers can identify changes in student academic performance earlier and formulate more appropriate learning strategies without having to wait for summative assessment results at the end of the period.

The integration of digital technology and visual media is also a growing trend in modern assessment. Nouri (2019) provide an example of using Augmented Reality (AR) technology in interactive assessments, which allows students to manipulate virtual objects and complete simulation-based tasks in an immersive learning environment. This technology not only increases student motivation but also allows for non-invasive data collection that can be automatically analyzed to identify error patterns, problem-solving strategies, and students' emotional reactions when facing certain cognitive tasks. Meanwhile, Aprianto and Amir (2022) highlight the

importance of visual media design based on cognitive load theory, which states that information should not be presented excessively to avoid overloading students' working memory. Visual media that is too complex, overly ornate, or poorly structured can actually become a distractor that interferes with information processing, especially for students with learning difficulties. Therefore, principles of clarity, consistency in design, information segmentation, and content relevance need to be applied strictly in the development of visual media used in assessment and learning.

In general, the literature results show that the effectiveness of integrative strategies combining visual media and diagnostic assessment is highly influenced by teacher readiness in designing, implementing, and evaluating visual-based learning processes. Professional development for teachers is a key element in ensuring that this approach truly leads to targeted identification of learning difficulties and has a positive impact on students' academic development. As an important addition, Guo's (2020) study suggests that the validity and reliability of visual-based assessment still require further systematic research. The use of images, symbols, and illustrations in assessment must undergo a standardization process so that the results obtained can be fairly compared over time and across students.

Without control over visual variables, the interpretation of student responses can become subjective or even biased, which could mislead instructional decision-making. All literature reviewed in this study provides strong evidence that the use of visual media and diagnostic assessment are two important pillars in modern education, especially in addressing early learning difficulties. The most effective

strategy is one that can combine digital technology, deep psychopedagogical understanding, and intuitive and directed visual design to create a truly adaptive, inclusive, and data-driven learning environment.

5. Conclusion

Visual instructional media and diagnostic assessment play a strategic role in detecting early learning difficulties. Through effective visualization, students can more easily understand information and form concepts, while diagnostic assessment provides a foundation for educators to understand the specific learning challenges students face. Their integration forms a highly promising approach in inclusive education and differentiated learning. Literature review results show that the systematic use of visual media can increase student engagement, strengthen memory, and accelerate the remedial process. Meanwhile, diagnostic assessment has been proven capable of uncovering the root causes of learning problems and facilitating personalized interventions. Going forward, the synergy of these two approaches needs to be enhanced through teacher training, adaptive curriculum development, and appropriate technological support. Thus, education can become more responsive to the diverse needs of students.

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