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Bioedutainment-Based Jenga Board Game: A Learning Media Development for Human Digestive System Material

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ABSTRACT

The research aimed to determine the characteristics, validity, and practicality of the bioedutainment-based Jenga board game for teaching the digestive system topic to eighth-grade students of SMPN Sinjai. This research employed the research and development method with the ADDIE development model, involving 25 eighth-grade students as subjects. The ADDIE development model comprises five stages: analyze, design, develop, implement, and evaluate. The research instruments were questionnaires to obtain data on practicality and test items to obtain data on effectiveness. The analysis showed that the media had an attractive design and received a 100% validation rating. It was determined as highly practical by students and educators. The score of effectiveness was 77, reaching 96% completeness. Thus, the bioedutainment-based Jenga board game is valid, practical, and effective for classroom learning.

Media Board Game Jenga Berbasis Bioedutainment: Pengembangan Media Pembelajaran Materi Sistem Pencernaan Manusia

ABSTRAK: *Penelitian ini bertujuan untuk mengetahui karakteristik, validitas, dan kepraktisan media permainan papan Jenga berbasis bioedutainment untuk pembelajaran sistem pencernaan pada siswa kelas VIII SMPN Sinjai. Penelitian ini menggunakan metode penelitian dan pengembangan berdasarkan model pengembangan ADDIE, dengan melibatkan 25 siswa kelas VIII sebagai subjek. Model pengembangan ADDIE terdiri dari lima tahapan yaitu menganalisis, merancang, mengembangkan, menerapkan, dan mengevaluasi. Instrumen penelitian berupa angket untuk data kepraktisan, serta soal tes untuk data keefektifan. Hasil penelitian menunjukkan bahwa media tersebut memiliki desain yang menarik dan mendapat nilai validitas 100%. Itu dinilai sangat praktis oleh siswa dan pendidik. Data keefektifan menunjukkan skor 77, mencapai ketuntasan 96%. Dengan demikian, media permainan papan Jenga berbasis bioedutainment valid, praktis, dan efektif untuk pembelajaran di kelas.*

INTRODUCTION

Education plays a crucial role in developing a well-rounded Indonesian individual.Therefore, education management must focus on creating positive changes. Education aims to develop people's skills and abilities to become highly qualified individuals, which is relevant to the national education system (Hamalik, 2013). The quality of education primarily originates

from the teaching and learning processes in the classroom environment. In essence, the overall quality of education commences with the teacher's commitment to delivering high-quality instruction inside the classroom (Siahaan & Wahyuni, 2018).

Furthermore, the quality of education is closely related to the learning process, which is the most important aspect of education. Effective learning helps achieve high-quality education by fulfilling its objectives and functions. As stated by Haryono, (2015), good quality learning became necessary for every educator to create a learning environment that allows every student to achieve maximum performance. A quality learning environment requires a good interaction between lecturers and students and between students and other students. The faculty would select cooperative learning as a method to improve the student's learning activities and the quality of learning. Teachers play a pivotal role in enhancing the educational standard by directly engaging students during classroom instruction.

The students' attitudes that exhibit passivity in learning activities can lead to a lack of interest or motivation. Motivation refers to the energy shift within a person, marked by the emergence of a feeling and preceded by a response to a goal. This idea follows Audriansyah et al. (2022). The lack of motivation and interest in students is due to less varied and innovative learning media. Educators must make real efforts to increase students' motivation, as motivation supports learning objectives' achievement. Educators can promote creativity and innovation in designing learning tools, such as creating interesting learning media. Amirullah et al. (2021) also state that it is advisable to introduce media innovations that ignite curiosity and interest among students to enhance the effectiveness of teaching methods and boost the motivation of both students and teachers.

Learning media is a term used to describe any tool that can be used to convey messages or teach content and stimulate the thoughts, emotions, attention, and abilities of students, thereby promoting the teaching and learning process. Different media types can improve learning by making it more practical and tangible (Ibrahim, 1996). Chairunnisa et al. (2021) argue that learning media are arranged to be practical and aesthetic for students' independent learning needs.

Learning media conveys messages or lessons, supports students' cognitive, emotional, and sensory engagement, and enhances the teaching and learning process. Previously, media was referred to as an "audio-visual aid," but now it is widely known as teaching or learning media. Using various forms of media can help create a more concrete and meaningful learning experience. According to Brom et al. (2019), game-based learning operates on the premise that the motivation to play games can positively impact the learning process and improve learning outcomes. Tan, Ling, et al. (2007), as cited in Tahir & Wang (2020), describe game-based learning as an innovative educational approach that uses games to facilitate knowledge transfer. Educational games are recognized for engaging learners deeply in various topics and encouraging active participation in the learning process.

One media type to effectively motivate students is the education-based Jenga Board Game Astuti, (2021). The Jenga board game is an example of Game-based learning (GBL), which integrates play elements with educational goals to enhance teaching and learning and establish a meaningful learning environment that fosters knowledge acquisition. Research has shown that GBL is beneficial for students facing learning challenges. Therefore, when incorporating game elements, it is important to include enjoyable and interactive features that motivate students to learn and promote a sense of competitiveness (Ramli et al., 2022). According to their research, Mukhoyyaroh et

al. (2022) believe that games create lively learning and a fun learning atmosphere.

Based on interviews conducted with the biology subject teacher at SMPN Sinjai, students needed learning media besides books, especially for learning the human digestive system. Observations showed that students did not understand or remember the material taught, resulting in passive and less enthusiastic learning. This finding aligns with Agprianti et al. (2022) that students' understanding of the material is lacking because they rely only on teachers to explain it. To address this issue, a bio-edutainment-based Jenga board game was developed to increase students' participation in learning and improve memory and understanding of the digestive system. Gutierrez (2014) claims that a prevalent issue faced by students studying biological sciences is the challenge of comprehending biological concepts. This idea agrees with Nurutstsany et al., (2020) that abstract material becomes less interesting, so interesting media is needed to attract students' learning motivation.

Even though there have been many previous studies on Game-based learning media, there has been no research on making a bioedutainment-based Jenga board game, especially for teaching digestive system material. The development of the bioedutainment-based Jenga board game was intended to improve memory and facilitate a quick understanding of learning material. One advantage of this product is that it allows students to easily understand the material on the human digestive system and improve their memory retention, as the game is designed to include questions presented on cards. Haka et al. (2021) believe that learning using games will build an exciting atmosphere even though it discusses complex material. However, it should be noted that before playing this educational game, students must already possess provisions or initial knowledge related to the determined material. Based on the background, the researchers researched the development of bioedutainment-based Jenga board game learning media on the human digestive system learning material. The research aimed to determine the characteristics, validity, and practicality of the bioedutainment-based Jenga board game media for teaching the digestive system.

METHOD

This research employed the research and development method (R&D). The development model used was the ADDIE model, which consists of 5 stages: analyze, design, develop, implement, and evaluate (Branch, 2009).

During the analysis stage, the objective was to understand the current conditions and issues in the learning process by observing and interviewing educators and students. The design stage began by selecting a theme and formulating the essential competencies to be mastered. Evaluation and research tools were also determined, and a media design was created by gathering relevant materials, such as images, videos, and simulations related to the digestive system. Attractive colors and images were chosen to enhance learning.

The development stage involved creating the learning media, focusing on problem-solving. The research instruments employed were questionnaires for educators and students and observation sheets for learning outcomes developed to assess the product's validity, practicality, and efficiency. Several experts reviewed the teaching media, and feedback was used to improve and revise it. Expert lecturers validated the teaching medium and assessed its suitability for learning. The edutainment-based Jenga board game was revised accordingly based on the validation results and input from the validator.

The next stage was implementing the learning media in a real classroom setting. The evaluation stage was the final stage of the ADDIE development model. It involved assessing the product at each previous stage. Feedback and input from experts were used to improve the product by addressing its

strengths and weaknesses. The evaluation results contributed to knowledge enhancement and facilitated further improvements in product development (Laranjeiro, 2021). The research design can be seen in Figure 1.

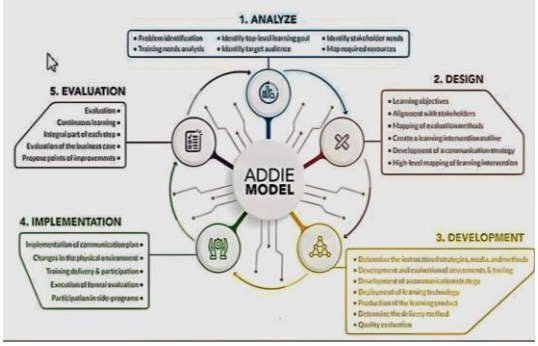

Figure 1. ADDIE Development Model
(Source: Desi et al., 2021)

The location of this research was SMPN Sinjai, with 31 eighth-grade students as research subjects. The research instrument used was the validation sheet to obtain validity data from experts. Also, a questionnaire about learning media was created and distributed to educators and students as respondents. Information from respondents was collected to measure the practicality of the products. Learning outcomes were used to determine the effectiveness of the developed media. The data collection technique involved validity, practicality, and effectiveness tests. The validity category is shown in Table 1.

$$Ai=\frac{\Sigma_{i}^{n}=1\ Kij}{n} \quad \text{.....(Eko, 2016)}$$

Notation:
$\overline{Ai}$ = The average aspect of the i
K_{ij} = The average for the i-th aspect
n = The number of criteria in the i-th aspect

Table 1. Validity Criteria

Value	Criteria
3,5 <M ≤ 4	Very valid
2,5 <M ≤ 3,5	Valid
1,5 <M ≤ 2,5	Valid enough
M ≤ 1,5	Invalid

The media practicality test can be measured based on the teacher and student response questionnaire analysis results. The practicality category can be seen in Table 2.

$$\bar{x} = \frac{\sum_{j}^{n} = o^{Ai}}{\text{n}} \text{ (Widoyoko, 2016)}$$

Notation:
X = Total average
Ai = Aspect average
n = The number of aspects

Table 2. The Practicality Criteria

Value	Criteria
3,5 < Xi ≤ 4	Very Practical
2,5 < Xi ≤ 3,5	Practical
2,5 < Xi ≤ 2,5	Practical enough
2,5 < Xi ≤ 1	Not practical

Source: (Sugiyono, 2014)

The media effectiveness test was measured based on student learning outcomes tests. Learning is said to be successful classically if at least 80% of students achieve a complete score. The effectiveness level category can be seen in Table 3.

$$\text{N} = \frac{\text{W}}{n}$$

Notation:
N = The value obtained by students
w = The number of correct answears of questions
n = The number of questions

Table 3. The Effectiveness Criteria

Completeness Percentage	Classifications
P > 80	Very effective
60 < P≤80	Effective
40 < P ≤ 60	Moderately Effective
20 < P ≤ 40	Less effective
P ≤ 20	Very Less Effective

RESULTS AND DISCUSSION

This research aimed to develop bioedutainment-based Jenga board game learning media that meets valid, practical, and effective criteria using the ADDIE model. The game concept encompasses both physical and mental activities that are voluntary and intended for enjoyment and amusement rather than being forced. Parry and Archer in Gündüz et al. (2017) proposed

two aspects to playing: the first is to keep children engaged on the playground, and the second is to facilitate their educational development. This learning media was designed to develop students' education aspect. Haka et al., (2022) argue that technological advances provide convenience for students to obtain attractive learning material.

The media characteristics were obtained from the results of the media characteristic sheet assessment by the validator. This validation was carried out to determine the level of feasibility (Wulandari & Nofina, 2022). Results and description of the Validator's Assessment of the characteristics of bioedutainment-based jenga board game learning media can be seen in Table 4 and Table 5.

Table 4. Results of the Validator's Assessment of the Characteristics of Bioedutainment-Based Jenga Board Game Learning Media

Statements	**Validator Assessment**			
	I		**II**	
	Yes	**No**	**Yes**	**No**
• Block-shaped jenga	√	-	√	-
• The Jenga block consists of 48 blocks.	√	-	√	-
• The length is equal to three times the height of the block, and the width of the block is equal to the height of the block.	√	-	√	-
• The basic arrangement of Jenga is 16 levels high.	√	-	√	-
• The basic arrangement of Jenga is 16 levels high.	√	-	√	-
• Played in groups	√	-	√	-

Table 5. Description of the Validator's Assessment of the Characteristics of Bioedutainment-Based Jenga Board Game Learning Media

Statement	Percentage	Categogry
1	100%	Excellent
2	100%	Excellent
3	100%	Excellent
4	100%	Excellent
5	100%	Excellent
6	100%	Excellent
7	100%	Excellent
Average	100%	Excellent

Furthermore, the validation results and suggestions from the two validators are used as a reference in revising the product to produce prototype II. The comparison of the results of the prototype I and prototype II which were made based on suggestions and input from the two validators can be seen in Table 6. These features make the game engaging and fun for students. Widya Sari & Aisyah (2017) state that playing Jenga requires physical, cognitive, and mental skills. Incorporating game media into learning can facilitate students' understanding and retention of the material they have learned, as noted by Maryanti et al. (2021) and Brom et al. (2019). Akdogan (2017) similarly suggests that children are naturally inclined towards games, which provide enjoyment, movement, and competition. Games are seen as enjoyable activities that involve problem-solving and competing with others or groups to achieve victory. Ultimately, when students are interested in the learning material, they are more likely to pay attention, creating favorable conditions for effective teaching and understanding between teachers and students. This agrees with Novitasari et al. (2022); learning conditions with problem-solving in groups through learning media will create effective learning skills.

A validator evaluated the characteristics of the product. The assessment consisted of seven statements related to the form and function of the media. Students found it easy to arrange the Jenga blocks, and the game's challenge increased as they stacked 48 blocks higher.

An expert validator used the Guttman scale to analyze the assessment data, and the bioedutainment-based Jenga board learning media received an average rating of 100% in all aspects, indicating that it is considered "excellent." This result aligns with Gumanti & Teza (2021), which suggests that an

assessment with a percentage between 76%-100% is categorized as "excellent." The result is consistent with Botes (2022), that while learners are initially attracted to games for fun and entertainment, the captivating learning experience offered by educational board games results from specific approaches designed to promote positive learning outcomes. These approaches enable students to improve their cognitive abilities, such as memorization, comprehension, reasoning, and information analysis (Botes, 2022).

Table 6. The Comparison between Prototype 1 and Prototype 2

***Prototype* 1 (Before Revision)**	
	
Fig 1. The front box of Jenga before the revision	**Fig 2.** The inside box of Jenga was before the evision
***Prototype* 2 (After Revision)**	
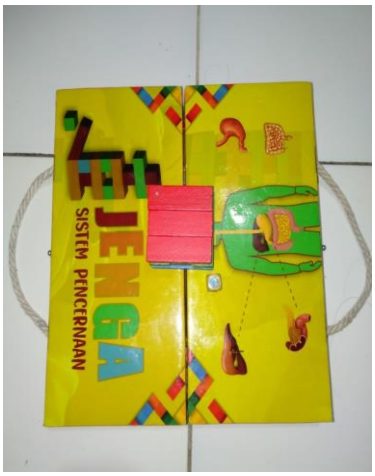	
Figure 3. The front box of Jenga after revision	**Figure 4.** The inside box of Jenga after Revision

The bioedutainment-based Jenga board game is an excellent learning medium, as it captures students' attention with its colorful blocks (red, blue, and green). The utilization of colorful pictures in the classroom enhances student engagement and prevents monotony and boredom during lessons, as highlighted by Fitriana et al. (2021) and Damayanti et al. (2020). Visual aids play a crucial role in supporting kinesthetic and visual learners, as emphasized by Seven (2019).

Additionally, the game has question cards that challenge students' scientific

knowledge and develop their problem-solving skills. Pramono (2017) supports this notion by stating that Jenga can educate students in a fun way. After incorporating suggestions from two validators, prototype II was developed and evaluated. The validators found the media to be effective and engaging, confirming the success of the Jenga board game based on bioedutainment as a learning tool (Table 7.)

Table 7. Validator's Suggestions and Input on Bioedutainment-Based Jenga Board Game Media

Assessment Aspects	Assessment values	Category
• Appearance	3,7	Very valid
• Fill in the bioedutainment-based jenga board game	3,75	Very valid
• Technical quality	3,6	Very valid
• Size	3,75	Very valid
• Communicative language	4	Very valid
• Appropriate use of terms	3,75	Very valid
• Average	3,75	Very valid

The validity of learning media can be assessed through the validator's evaluation, which is adjusted to the validity level category table of the bioedutainment-based Jenga board game. The average result of validity in this media is classified as very valid, as the average result of the assessment of two validators is 3.75. All aspects, including appearance, content, technical quality, size, language, and suitability for long-term use, yielded highly valid results.

The appearance aspect assessment obtained an average value of 3.7 in a "very valid" category. The predominant color selection used in developing the media includes red, blue, green, and yellow. Red is an attractive and dynamic color, while blue can calm tense people and increase feelings of well-being. Green can create a calming atmosphere, and yellow can stimulate optimism, hope, and balance. The font color used is red, which is also attractive and emotive (Damayanti et al., 2020).

The assessment of the content aspect of the bioedutainment-based board game Jenga obtained an average score of 3.75 in the "very valid" category. This value indicates that the material contained in the developed media is appropriate and refers to the core competencies and basic competencies of the 2013 curriculum.

The technical quality aspect of the media assessment obtained an average score of 3.6 in a "very valid" category. The learning media developed are classified as "valid" because they follow the demands of the curriculum, meaning that the characteristics of the curriculum are one of the guidelines in compiling learning media. The learning media can also motivate students to learn (Dwijayani, 2017).

The media size aspect obtained an average value of 3.75, which is in the "very valid" category. The size of the media is medium, making it easy to carry anywhere.

The communicative language aspect averaged 4 in the "very valid" category. The language used is easy for users to understand and appropriate for using the Indonesian Spelling Guidelines (EYD). However, choosing a more communicative vocabulary is necessary when conveying media content (Syahputra & Alvindi, 2022). According to Akdogan (2017), games are effective methods or techniques to actively engage students in learning. Thoughtfully selected and well-designed games serve as valuable tools, giving students a refreshing break from traditional instructional methods. Simultaneously, these games allow learners to practice and develop their language skills.

The Appropriateness Aspect of the Use of Terms obtained an average value of 3.75 in the "very valid" category. The terms used on the card meet the criteria, and the writing in Latin follows the applicable rules.

The practicality of the learning media was measured using research instruments in the form of student response questionnaires

and educator responses. The results of student and educator responses to the practical aspects of the bioedutainment-based Jenga board game are presented in Table 8.

Table 8. Results of the Educator and Student Response Questionnaire

No.	Response types	Average value
1.	Student response	3,4
2.	Educator response	3,7
Total Average		**3,5**
Assessment criteria		**Very Practical**

After the implementation stage of the bioedutainment-based board game Jenga, the researcher conducted a practicality analysis. The implementation stage aimed to apply the learning media to the learning process and obtain feedback from students and educators through student response questionnaires. The researcher assessed the practicality of the learning media based on several indicators, including instructions, response coverage, and language.

Practical learning media is easy to use and can be implemented by educators and students in the learning process. The student and educator response questionnaires showed that the developed learning media was practical, with an overall average score of 3.5 based on the Likert scale. That indicates that educators and students can apply the media to the learning process effectively and efficiently. This aligns with Sale's (2022) assertion that game media is accessible for free, supported by harmless and appropriate advertisements for players of all ages. Most students find the gameplay enjoyable, and since they are accustomed to game advertisements, they perceive the experience as a delightful and engaging approach to learning (Khoridah,2022).

The bioedutainment-based jenga board game is an effective learning media that can generate enthusiasm and interest in learning for students. Brophy (2004), as cited in Nurnberger-Haag et al. (2023), emphasizes that this definition sets game-based learning apart from extrinsic and intrinsic motivation, which rely on rewards and enjoyment, respectively. Game-based learning focuses on a distinct approach to motivation by emphasizing the learning objectives of activities. Researchers measured the effectiveness of the learning media by giving a written test with multiple-choice questions to 24 students in class VIII of SMPN Sinjai. The results of the student test can be seen in Table 9.

Table 9. Percentage of Mastery Analysis of Science Learning Outcomes of Students

No	Names	Learning outcomes
1.	AF	76
2.	AS	76
3.	AA	76
4.	AI	80
5.	AN	70
6.	AYN	53
7.	DA	73
8.	EA	80
9.	FA	80
10.	FI	76
11.	FAU	70
12.	FIT	80
13.	IR	90
14.	MR	80
15.	MAM	80
16.	MF	80
17.	MI	76
18.	MRN	73
19.	NAA	83
20.	NZZ	73
21.	NIQ	80
22.	NIN	70
23.	RM	80
24.	RSM	80
25.	TM	73
	Average	**77**
	Category	**Effective**

Table 10. Percentage of Mastery of Science Learning Outcomes of Students

No.	Score	Frequency	Percentage (%)
1.	0-70	1	4
2.	71-100	24	96

The effectiveness of the bioedutainment-based jenga board game learning media was analyzed based on

student learning outcomes. After using the learning media, students took a test with 30 multiple-choice questions aligned with competencies and indicators. The passing grade for class VIII C biology at SMPN Sinjai is 70. A student is deemed unsuccessful or incomplete if they do not receive the required passing grade. Learning is considered successful if at least 80% of students achieve a complete score. (Putri, 2021). Of the 25 students who took the test, 24 achieved a complete score, and one scored below the passing grade, indicating that the developed learning media is very effective (Table 10).

Researchers categorized the bioedutainment-based Jenga Board Game media they developed as "very effective." The results of the students' learning tests show scores above the school's passing grade of 77, which is in the very effective category. Suriata et al. (2022) further support this notion, as it achieved a high validation score of 89% from design experts, falling within the "very valid" category. That indicates that the learning media effectively improved student learning outcomes related to the digestive system material. The effectiveness is attributed to the learning media, which contain simplified material information and pictures that facilitate student comprehension. This finding aligns with the theory of (Milala et al., 2022) that effective and efficient learning media support learning achievement.

The development of effective learning media involves adhering to certain principles, such as incorporating visuals, delivering clear messages through well-written content, considering student characteristics, and aligning the content with learning goals (Afandi, 2015). Astuti's (2021)research supports this notion by highlighting that media with accurate content and learning objectives can serve as stimulating learning materials that capture students' interest and attention. Moreover, developing such media can enhance the effectiveness and comprehensibility of the learning process (Haka et al., 2021). Puspitarini & Hanif, (2019) emphasizes that learning media, whether in the form of hardware or software, are essential tools for teachers to facilitate effective and efficient learning aligned with specific objectives.

According to Farrell (2005) and Okanlawon et al. (2017), as cited in Sale, (2022), there is evidence suggesting that the use of games in instruction, particularly for complex concepts, not only increases student satisfaction but also enhances mastery of learning objectives. Additionally, Yüceant (2022) highlights the significance of educational games, which can be played individually or in groups, in fostering cognitive, affective, and psychomotor development. These games contribute to developing skills such as creativity, problem-solving abilities, self-confidence, self-expression, proper behavior habits, fairness, empathy, and a sense of belonging to the school or a course.

CONCLUSIONS AND SUGGESTIONS

The research and discussion led to the following conclusions: (1) The Bioedutainment-based jenga board game has excellent characteristics, scoring an average of 100% for its appealing design, effective use of images, and appropriate background that boosts student engagement; (2) The media has a high level of validity for the digestive system material, with an average validation score of 3.75; (3) The media is practical for educational use, as confirmed by educators and students with an average score of 3.5 in a questionnaire; (4) The media is highly effective, as evidenced by student learning outcomes tests with an average score of 77 and a 96% completeness rate.

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