Development of Hypermedia-Based E-Module to Enhance Students' Creative Thinking Skills in the Topic of Digestive System for Junior High School Students (SMP/MTs)

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Article Info

ABSTRACT

The education system in Indonesia has undergone changes due to several factors such as 21st century education trends and the impact of the COVID-19 pandemic. These changes have resulted in a shift in student learning behavior towards different learning styles. With the end of the pandemic, students have returned to face-to-face learning, leading to the loss of certain learning behaviors adopted during the pandemic period. This, may result in a decrease in students' thinking ability. The purpose of this study is to develop hypermedia-based e-modules to improve students' creative thinking skills. The method used in this research is the Research and Development (R&D) method. This method follows the ADDIE model which consists of analysis, design, development, implementation, and evaluation. The development in this research includes hypermedia-based e-modules, learning instruments, creative thinking tests. The validity of the hypermedia-based e-module was assessed using the results of media validation. Effectiveness was measured by analyzing student and teacher responses. Effectiveness was determined through pre-test and post-test methods for creative thinking tests. The validation results showed "very valid" criteria with an average score of 95. Practicality, based on student and teacher responses in each session, obtained an average score of 90 with "very practical" criteria. Effectiveness, measured through a pre-test and the mean scores of the pre-test and post-test scores, showed values of 0.61, 0.55, and 0.56 for the small, large, and dispersed classes, with "medium" criteria. Creative thinking scores ranged from 80-90, indicating "very high" criteria. From these two results, it can be concluded that the hypermedia-based e-module on human digestive system material is valid, practical, and effective to improve the creativity of junior high school students.

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1. INTRODUCTION

Currently, the Indonesian educational system is undergoing significant changes in how it teaches and learns. The education sector has faced multiple COVID-19 events, resulting in various impacts (Astini, 2022). As a result, several methods of learning have emerged, ensuring continuous learning amidst the dynamic education environment. To support the culture of 21st century learning, multiple strategies and tools have emerged. Online learning employing digital and electronic media has become the norm. Such learning has impacted student behaviour leading the Indonesian educational entities to adapt their offerings. A more flexible and equitable curriculum is needed to support this change. The independent curriculum seeks to reinstate post-pandemic education with a focus on ensuring a sovereign curriculum. The independent curriculum includes character values, core learning objectives, and flexibility of learning based on context, local content, and students' abilities (Priantini et al., 2022).

The autonomous programme facilitates a novel ambience in the educational system, accentuating an optimal, adaptable and unrestrained study milieu for students. The execution of aforementioned programme is orchestrated to enable learners to attune to the demands of the current era marked by the progress of society 4.0 to the domain of society 5.0 (Astini, 2022). It can be deciphered that the learners are obligated to acquire and

adapt to innovative skills. The notion of Society 4.0 emphasises the confluence of people and technology, so 21st century learning skills need to be linked to technology. As we move towards Society 5.0, collaborative processes between human-centered and technology-based approaches will become more intricate. Technological support, particularly from the internet, will play a more prominent role in learning activities. (Lase, 2022). Where students will need to actively and independently develop 4C skills that are fully integrated with technology (Indarta, et al., 2022).

Technology needs to be used to support students' abilities to face Society 5.0. Changing learning models, methods or media to make them more engaging can help (Norhikmah et al., 2022). E-Modules provide informative and interesting material that can be updated frequently, as well as enhancing students' self-regulated learning skills. abilities (Yulistianti et al., 2022). In principle, modules have several characteristics, such as being media-equipped, self-contained, contextual and easy to understand (Widiantari et al., 2022). For the development of an effective e-module, it is essential to meet the criteria of the module format, followed by an consideration of student learning behaviour. Within the learning process, learning style is a significant aspect of student behaviour, comprising of audio, visual, and kinesthetic modes (Rismen et al., 2022). To cater for different learning styles, it is insufficient to solely rely on e-modules. As such, appropriate media facilities must be made available to suit each student's learning style.

Hypermedia-based e-modules are designed to cater for the different learning styles of students by providing complex content. Hypermedia is a blend or collection of diverse media that takes numerous forms. (Shafira & Wiranda, 2022) It can be seen as an extension of hypertext, which includes text, graphics, audio, photographs or images, animation and video, all integrated into a single, independent software. Hypermedia comprises a wide-ranging assortment of multimedia components and this often leads to misunderstandings with multimedia itself. The concept of hypermedia encompasses a multitude of media formats that combine to create a multimedia platform (Taher et al., 2022). The design of hypermedia-based E-modules relies on multimedia components, and hence the structure and function of the modules should reflect those of hypermedia. E-modules typically take digital forms, including web-based content (Hanifa et al., 2015). The purpose of this module is to serve as a student handbook to support independent learning. This potential can be maximised through the integration of relevant media to aid student learning. One of the advantages of hypermedia is its efficacy in allowing students to independently construct information and knowledge through multimedia collections (Zulfianor et al., 2021).

The implementation of hypermedia-based e-modules is driven by the need to meet students' media requirements based on their learning preferences and the nature of the learning materials. Post-pandemic, students' learning styles are influenced by the learning environment, leading to device dependency in learning. The impact of device dependency due to the prevalence of smartphones and gadgets can significantly affect students' learning behaviour. In addition, challenging learning materials have a significant impact on students' learning behaviour. The biology material on the digestive system contains abstract concepts that are tough for students to grasp (Masruroh et al., 2014). These factors lead to a decrease in student interest in learning, which negatively affects their thinking abilities (Efastri et al., 2022). According to the 2018 PISA report, Indonesia is ranked the lowest out of 79 participating countries, with a score of 73. This represents a decline from the 2015 PISA test, suggesting a decline in students' cognitive skills (OECD, 2023). The lack of development of the right brain (creativity) is still a problem in Indonesian education, which only serves to strengthen the strength of the left brain (intellect) (Mulyana et al., 2022). The findings of Mulyana et al (2022) suggest that the creative thinking skills of junior high school students are underdeveloped due to monotonous teaching methods. According to Mulyana, the learning process only aims at students' understanding of theories, examples and problems without encouraging feedback between teachers and students. Poor communication causes issues for students in comprehending information or materials presented by educators (Pratiwi et al., 2021).

The survey of junior high school science teachers in Jember Regency showed: 6 out of 10 teachers do not produce their own teaching materials. Instead, they rely on books provided by related agencies without any additional resources. Teachers usually use packaged books and LKPD (learner worksheets) for teaching purposes. It is probable that issues arise from teaching materials lacking context, being monotonous, not aligning with student learning characteristics, and lacking interest (Ali, et al., 2020). The research found: 20 students rarely or never use teacher-produced science materials. Instead, they tend to use package books and LKPD, leading to decreased interest in learning. The difficulty for students to understand the structure of content, media and language has a negative impact on students' cognitive abilities, resulting in reduced creativity and weakened argumentation skills. This is an additional consequence of media that fails to promote literacy activities among students (Rahayu et al., 2020).

Therefore, there is a greater need to develop hypermedia-based e-modules that can effectively enhance creative thinking skills. Prior research revealed that the implementation of e-modules in science education resulted in an augmentation of students' creative thinking abilities (Wahyuliani et al., 2022). Additionally, the incorporation of hypermedia has demonstrated an increase in reasoning proficiency (Azizah et al., 2021). Several studies have been conducted on e-modules pertaining to both the circulatory and digestive systems (Rofiyadi & Handayani, 2021; Permana et al., 2021). However, limited research exists on the development of e-modules that

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incorporate the concept of hypermedia on digestive system material. It is imperative that further research is carried out on the development of hypermedia-based e-modules to support science learning in junior high schools / MTs, which ultimately aims to enhance students' creative thinking abilities.

Based on the given description, the study "Development of Hypermedia-based E-Modules on Human Digestive System Material to Improve the Creative Thinking Ability of Junior / MTs Students " was undertaken.

2. RESEARCH METHOD

This study is a research and development (R&D) study. It is designed to produce a product in the form of a Hypermedia-based e-module on the human digestive system to enhance the creative thinking and argumentation skills of junior high school students. The research and development model used in this study is adapted from the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) development model (Hidayatullah et al., 2021). This research, two locations were used. First, the development of hypermedia-based e-modules was conducted at the Faculty of Education, University of Jember. Second, small and large class trials were conducted at SMP Negeri 1 Bangsalsari with different class treatments, while distribution was carried out at SMP Al Baitul Amien Jember and MTs Negeri 2 Jember. The small group trial involved 10 seventh-grade students, while the large group trial was conducted in the seventh grade of the same school with different class treatments. This research was conducted in the even semester, in June of the academic year 2022/2023.

Data analysis used in this study, based on the ADDIE development model, includes instrument validation, including media. Practicality was evaluated based on responses from teachers and students. Meanwhile, to test the effectiveness of hypermedia-based e-modules, a Creative Thinking Test was conducted using the Torrance Tests of Creative Thinking (TTCT) indicators with pretest and posttest models. The measurement of creative thinking was obtained through the scores of the Torrance Tests of Creative Thinking (TTCT). The analysis of the data on creative thinking skills encompasses four indicators: Fluency, Flexibility, Originality, and Elaboration. To represent the scores for each aspect of creative thinking ability, the following equation is employed:

$$Cs = C/N\ldots\ldots\ldots..(1)$$

Explanation:
Cs   : student's creative thinking ability
C   : the total score obtained by the student
N   : the total possible score

The creative thinking ability of the students is assessed based on the indicators and criteria for creative thinking ability (as presented in a table, which is not provided in the text).

Table 1 Indicators of Students' Creative Thinking Ability

Aspect	Indicator	Score
Fluency	Not mentioning ideas/concepts on the topic of discussion	1
	Mentioning 1 idea/concept on the topic of discussion	2
	Mentioning 2 ideas/concepts on the topic of discussion	3
	Mentioning 3 ideas/concepts on the topic of discussion	4
	Mentioning 4 ideas/concepts on the topic of discussion	5
Originality	Not generating ideas	1
	Generating ideas only	2
	Generating ideas accompanied by functions or explanations	3
	Generating ideas accompanied by functions and descriptions	4
	Generating ideas accompanied by functions, descriptions, and accurate theories.	5
Elaboration	Not creating a procedure	1
	Creating a procedure with 1 step according to the topic	2
	Creating a procedure with 2 steps according to the topic	3
	Creating a procedure with 3 steps according to the topic	4
	Creating a complete procedure with more than 3 steps according to the topic	5

Table 2 Criteria of Creative Thinking Ability

Score	Feasibility criteria
20 – 39	Not creative enough
40- 59	Moderately creative
60 – 79	Creative
80 – 100	Highly creative

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To obtain the score of media effectiveness, further analysis is required, namely n-gain based on Hakke's calculation (2003). The effectiveness of the media is determined by the range between the pretest and posttest scores, which is equated with the criteria of n-gain, where the value should fall within the range of $0.3 \le (g) \ge 0.7$, indicating effectiveness.

3. RESULT AND DISCUSSION

The hypermedia-based e-module is designed to accommodate various learning styles of students with comprehensive and flexible characteristics. One of its complete advantages is its ability to be used in various learning models, both face-to-face and online, as well as facilitating students' skills development such as creative thinking and argumentation. Moreover, this module also features communicative elements. On the other hand, its flexible advantage refers to the adaptability of the module's content and features to match the learning needs and achievements of students. Validation is conducted to assess the suitability of the e-module to be used in learning. Valid media will support the learning process and minimize bias when utilized. The following are the validation results.

Table 3 Recapitulation of Validation Results

Evaluation	Validator's Assessment Results			Score	Criteria
	1	2	3	%	
Content Suitability	95	91	90	92	Highly Valid
Linguistic Suitability	100	91,1	81	90,7	Highly Valid
Presentation Suitability	100	91,1	91,1	94,06	Highly Valid
Graphic Suitability	90	100	100	96,6	Highly Valid
Website Content and Feature Suitability	88	88	88	88	Highly Valid

The validation results from three experts revealed that the media scores are 92, 90.7, 94.06, 96.6, and 88 respectively, with an average of 92.27, indicating high validity (table 3). Table 4.10 illustrates the experts' recommended revisions to hypermedia-based e-modules, highlighting specific components that need improvement in order to achieve the learning outcomes Table 4.10 illustrates expert-recommended revisions to hypermedia-based e-modules, highlighting specific components requiring improvements to attain learning outcomes aligned with the course objectives. Improvements include revision of writing style, layout and components related to creative thinking.

Data were collected at SMPN 1 Bangsalsari and MTSN 2 Jember with 7th grade students as research participants. A three-session data collection process was implemented using a short learning procedure, where students first took a pre-test to assess their initial skills and then engaged in a problem-based learning instructional process. At the end of the learning sessions, a post-test was administered to assess students' creative thinking skills following the instruction. The students' pre-test and post-test scores yielded the following results.

Table 4 Score Creative Thingking Skill

Aspect	SMPN 1 Bangsalsari		MTs N 2 Jember	
	Score	Feasibility criteria	Score	Feasibility criteria
Pretest				
Fluency	39,7	Not creative enough	46,2	Moderately creative
Originality	21,5	Not creative enough	22,6	Not creative enough
Elaboration	21,8	Not creative enough	22,4	Not creative enough
Posttest				
Fluency	76,3	Creative	82,7	Highly Creative
Originality	64,8	Creative	72,8	Creative
Elaboration	62,4	Creative	65,0	Creative

An improvement in the students' creative thinking skills can be seen in Table 4. The column comparing the pre-test and post-test scores shows that the students' creative thinking skills were insufficient before using the hypermedia-based e-learning module, with an average score of 20 in SMP N 1 Bangsalsari and 30 in MTS N 2 Jember. The data in Table 4, particularly the column for MTS N 2 Jember, shows a difference in fluency: the criterion of 'sufficiently creative' was met with a score of 46.2, which was different from the previous school. After completing the e-module learning process, the post-test scores at SMP N 1 Bangsalsari showed an average total score of 67.8, while the score at MTS N 2 Jember was 73.5. This shows an improvement in the students' creative thinking skills. This result is consistent with the research conducted by Delita et al (2022), which confirms that e-modules can enhance students' creative thinking skills. Furthermore, a t-test was conducted to determine the significance of these results, and the results show a significant improvement in the students' creative thinking skills.

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Table 5 Score n-gain

| Score N-Gain | Small class test | | Large class test | | | |
| | SMPN 1 Bangsalsari | | SMPN 1 Bangsalsari | | MTs N 2 Jember | |
	Score N-Gain	Feasibility criteria	Score N-Gain	Feasibility criteria	Score N-Gain	Feasibility criteria
$(g) < 0,3$	-	-	-	-	-	-
$0,3 \leq (g) \leq 0,7$	0,61	Moderate	0,55	Moderate	0,65	Moderate
$(g) \geq 0,7$	-	-	-	-	-	-

The n-gain results in both schools show a moderate level, with values between 0.3 and 0.7. Such values (g) suggest an improvement in students' creative thinking skills through hypermedia-based e-modules that act as mere containers organising different types of media. When these e-modules combine different interrelated multimedia elements in a non-linear approach, they are referred to as hypermedia (Haryoko et al., 2017). The development of students' creative thinking skills is not only related to the hypermedia e-module, but is also influenced by the components, features and content that shape the media. Media that contain multiple learning components expand the available learning space for students, increasing access to different knowledge information and the likelihood of achieving their learning goals (Schunk, 2012).

The e-module with hypermedia serves as a learning tool for students. However, crucial to learners attaining their learning objectives is how they construct the information and knowledge gained through the e-module. To this end, it is important to ensure that the instructional materials are aligned with the required skills, including creative thinking skills. A problem-based learning (PBL) model was used in this study to develop creative thinking skills. Hmelo (2004) asserts that the PBL approach promotes creative thinking by focusing on problem-solving aspects. The necessary components, including media and instructional models, have been met to achieve creative thinking skills. The key factor, however, lies in the role of facilitator in learning, performed by the teacher or instructor. It is imperative to consider time management for learning due to the use of the e-module and the problem-based learning model. In order to follow the PBL practice, it is necessary to complete the e-module within a single unit or chapter with the guidance of the teacher.

According to table 5, the N-gain value achieved at SMP Negeri 1 Bangsalsari was 0.61, whereas in the large class trial at SMP Negeri 1 Bangsalsari it was 0.55 and at MTs Negeri 2 Jember it was 0.65. These moderately rated N-gain values fall within the range of $0.3 \leq (g) \leq 0.7$ and hence signify an effective improvement in creative thinking skills of students. The range demonstrates an initial increase in effectiveness during the dissemination stage, yet a subsequent decrease from 0.61 to 0.55 is observed in values for small and large classes. This reduction can mainly be attributed to the class character, student characteristics, and environmental factors. Specifically, the small class size of 10 and the larger class size of 21 impact the delivery and processing of information. Specifically, the small class size of 10 and the larger class size of 21 impact the delivery and processing of information. The structure of the small class does not align with the cognitive abilities of students classified as lower, middle, and higher; a model typically representing large class structures with diverse cognitive abilities among students. Wahyuningsih et al. (2022) suggest that the student-to-class ratio impacts the learning process, which encompasses comprehension, focus, and motivation. The presence of diverse cognitive abilities among students necessitates an appropriate ratio. Classes exceeding the teacher's supervisory capacity tend to yield suboptimal learning outcomes. Classes with more students than the teacher can supervise are likely to suffer from inadequate educational outcomes. The maximum and minimum allowable number of students per class, as stipulated in Permendikbud No. 17 of 2017, ranges from 15 to 36. The presence of a small number of students in a class does not necessarily indicate good academic outcomes. Other aspects, such as the cognitive and educational abilities of the students, must be taken into account. While there is a decline in effectiveness as the class size increases, hypermedia-based e-modules are generally considered effective for learning, with a score between 0.3 and 0.7 using moderate criteria (Hakke, 2002).

4. CONCLUSION

The conclusion drawn from the development of the hypermedia-based e-module is that the developed media is highly valid, capable of supporting the students' learning process, and facilitating their learning. The hypermedia-based e-module is effective in enhancing students' creative thinking skills, as evidenced by the n-gain values of 0.55 at SMPN 1 Bangsalsari and 0.57 at MT N 2 Jember, indicating a moderate level of improvement. The (g) values within the criteria of ≥ 0.3 and ≤ 0.7 signify a significant difference between the posttest and pretest scores. Thus, the e-module is considered effective in improving students' creative thinking abilities.

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