

Meta-Analysis of Puzzle Media in High School Lessons by Practicality Test

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Abstract

Learning media innovation requires educators to be able to create learning media by utilizing technology-based media to suit students' learning characteristics. Apart from that, the use of learning media used by teachers still does not support students' interest in the learning process. E-puzzle media can be used as a complement to innovative learning media so that it can stimulate students' creative thinking abilities. This research aims to collect similar articles from search results of several journals on internet sites. The sample used in this research was 10 articles related to e-puzzle development. This research method uses a meta-analysis method, where data collection techniques use statistical techniques that combine several studies related to puzzle development in biology learning collected via internet sites so that combined quantitative data is obtained. The research results found that the average level of practicality in using e-puzzles by teachers was 87.84% in the very practical category, while the average level of practicality by students was 86.51% in the very practical category. Based on the results of the practicality analysis, the e-puzzle developed can be categorized as practical so that it is suitable for use in the learning process.

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INTRODUCTION

The education system in the era of the Industrial Revolution 4.0 requires the world of education to use information and communication technology in learning activities at school so that educators and students can be more literate in digital developments in the learning process. According to Kahar, et al (2021), mentioning the Era of Industrial Revolution 4.0 is used to support learning patterns and thinking patterns as well as develop creativity and innovation from students, which aims to produce the next generation of a superior and competitive nation. In the current Era of Revolution 4.0, the field of education is required to equip students with 21st-century skills. The Directorate General of Primary and Secondary Education of the Ministry of Education and Culture (2017) explains that 4C skills are designed to follow the development of the 21st Century, namely critical thinking skills, creative thinking skills and innovation, communication skills, and collaborative skills. 21st Century learning requires teachers to be able to develop learning media, this is supported by the opinion (Lufri, et al., 2020), stating that one of the basic teaching skills that a teacher must possess is being able to use and develop learning media and resources.

Based on the opinion explained by Erfan, et al. (2020), learning media is one of the five important aspects that must exist in the learning process in addition to goals, materials, methods, media, and learning evaluation. These five important aspects are interrelated with each other so that the selection of certain teaching methods will have an impact on the selection of learning media by all aspects without forgetting the other three important aspects, namely learning objectives, materials, and evaluation. The use of media can also improve concept understanding of the material being studied and tends to make learning activities interesting. The selection of the use of learning media must be by the characteristics of students and learning media is important to use during the

learning process to arouse students' interest in participating in the learning process. Nengsih, et al (2021), state that learning media is seen as important by teachers and students in learning activities to achieve learning objectives. One of the media developed is puzzle game media which can be done to make the learning atmosphere fun and make students play an active role in ongoing learning so that it can increase students' interest in learning. In addition, the use of learning media in the form of games is also able to provide a pleasant learning experience that it can increase students' interest in learning (Oktaviatna, 2017).

Puzzle media is visual media and requires creativity from the students themselves in arranging existing puzzles. The puzzle is a type of game often done in the learning process, namely a puzzle game compiling images. The benefits of puzzle games are that they can sharpen the brain, train eye and hand coordination, train reasoning, patience, and knowledge (Yulianti, et al. 2010). The advantages of this puzzle media, according to Harahap (2013), puzzle media can help teachers control the sequence of learning materials so that teachers can find out where students master the subject matter presented, is easy to carry and practical, and can be applied in any area where we teach, easy to present in learning, train students' concentration, solidarity, creativity and cooperation between students, and students are involved during the presentation or learning process.

The construct 2-based puzzle game on the material of the circulatory system has been applied by Hardiyanti (2020), stating that the use of construct 2-based puzzle games in the learning process makes students' learning interest high and has high learning motivation because the puzzle game makes its attraction in using in learning. This is in line with research from Pawestri (2021), stating that the puzzle media developed can help students understand biology material, especially primate material in the learning process. Therefore, e-puzzle media can support biology learning, especially material that has images that make it easier for students to understand the material. As stated by Ratnayanti (2021), this form of e-puzzle can challenge students' creativity and remember deeply because it encourages them to try to use it and this media can also be used repeatedly. The challenge in this puzzle game can have the effect of always trying until success.

The media developed in this research is designed to invite students to think actively and creatively so that the puzzle media developed can support the learning process (Pawestri, et al. 2021). This puzzle game method can record and summarise facts, concepts, and examples of learning material that are outlined in the concept organization by arranging the pieces of the puzzle itself so that it can train the critical thinking skills and creativity of the students themselves in solving the puzzle of the picture pieces into a complete picture arrangement. The advantages of this puzzle media for teachers can control the sequence of learning materials, so that teachers can find out the extent to which students can master the material that has been given, easy to carry, practical, and can be applied to several materials that teachers teach, easy to present, train the memory and concentration of students and many more advantages of this media, (Rahayu, 2017).

With the number of developments in puzzle-based learning media both conventionally and digitally, it is necessary to analyze the research. This aims to determine the meta-analysis of puzzle media development in terms of practicality test results in biology learning. Meta-analysis is a set of statistical methods that connect the results of several studies that contain a comprehensive summary based on empirical knowledge on a particular topic (Utami and Indriani, 2021). This research focuses on evaluating various studies that have been conducted on the use of both conventional and digital puzzle media as educational aids, to identify how effective and practical puzzle media are in the learning process. Through a comprehensive analysis of data collected from various sources, the research seeks to build a comprehensive picture of the advantages, challenges, and factors that influence the implementation of puzzles in educational contexts. The results of this meta-analysis are expected to help educators in developing learning media and applying this media effectively to students understand biology learning materials.

RESEARCH METHODS

This research was conducted in January 2023 and the research site was conducted at the biology department, at Padang State University and was not limited to a specific physical location because the data used in this meta-analysis were collected from various scientific publications spread across various Indonesian journals. using the meta-analysis method, this research is a review of several research results in similar or related problems (Zaputra, 2021). The method used is Meta-analysis.

The population of this study uses all published studies on the use of puzzle media, one of which is in biology learning by reviewing several books, theses, or scientific journals while the sample used uses a purposive sampling technique. The population in the study was all written documents regarding educational research that discussed e-puzzle. The sample used was 10 articles from several national journals.

The data collection technique uses statistical techniques that combine several studies related to puzzle development in biology learning collected through internet sites so that quantitative data is obtained. The requirement for data collection and analysis is coding. The variables used in coding and producing information needed in calculating the level of practicality of e-puzzle learning media are the name of the researcher the year of the study, the title of the study, and the percentage of the level of practicality. The steps of meta-analysis are as follows

1. Collect sources of articles related to the theme. This stage is carried out to find articles related to e-puzzle media in biology learning or in other learning. This article can be searched through the Google Scholar site.
2. Identifying research variables, namely in the form of e-puzzle media practicality variables tested on teachers and students, after being found, are entered into the adjusted variable column.
3. Identifying the average level of practicality of the puzzle for each article encountered, namely the average practicality of students and teachers.
4. The next stage is to calculate the final average of practicality in the analysis of e-puzzle media development articles using the following formula.

$$\text{Percentage} = \frac{x}{y}$$

Information:

- X = the sum of the percentages obtained
Y = many data

The criteria for assessing the practicality of puzzle development can be seen in Tables 1 and below.

Table 1. Product Practicality Categories

$0\% \leq NP < 25$	Not Practical
$26\% \leq NP < 54\%$	Less Practical
$55\% \leq NP < 69\%$	Practical enough
$70\% \leq NP < 84\%$	Practical
$85\% \leq NP < 100\%$	Very Practical

(Riduwan, 2012)

RESULTS AND DISCUSSION

Practicality is a trial conducted on teachers and students to determine the level of ease of use of the product developed. In this study, researchers looked at the level of acquisition of the results of the practicality of puzzle development in learning. The results obtained in this study were

adjusted to the research objectives. Based on the analysis of Indonesian journals using the meta-analytic method by looking at the criteria for the practicality of learning media, it can be seen in Table 2.

Table 2. Characteristics of the Analysed Articles

No.	Article Title	Researcher Name and Year of Research	Teacher Practicality (%)	Practicality of Learners (%)
1	Development of Android Mobile Learning "Puzzle of Chemistry" Based on Contextual Learning on Acid-Base Material	Oky Pamungkas (2020)	96,30	87
2	Development of Chem Puzzle Media on Class X Compound Name System Material at Sman 1 Alalak	Harlita, Herlina Apriani and Novrian Dony(2021)	96,43	54,12
3	Development of Flash-based Puzzle Media for Learning Acid-Base Reactions in Class Xi High School: A Pilot Test at Sman 4 Banjarmasin	Alvian Ikhsanul Fatya, Siti Halimah Nurdiniah, and Arif Sholahuddin (2016)	86,60	96,90
4	Development of Trigonometric Puzzle to Increase Motivation Learning Mathematics of Senior High School Students	Liya Nur Laili, MunikaSaras Wati, Sekar Ayu Ramadhianti, Singgih Subiyantoro (2019)	76,16	86,3
5	Development of Stem Structure Puzzle Media Development (PSB) to	Fadhila and Puspitawati (2018)	93	90
6	Development of Interactive Multimedia on Puzzle-Based Set Material with Contextual Approach	Firda Alfiana Patriciaand Kenya Fadhilah Zamzam (2020)	85	84,5
7	Development of Class X Covalent Bond Puzzle Learning Media (Petalen) at Smanegeri 2 Sungai Raya	Anggreini, et al. (2019)	92,81	94,55
8	Development of Manipulative MediaPuzzle Game on Permutation Combination Material	Afin Nur Latifa, Reza Kusuma Setyansah, Maya Kristina Ningsih, and Ibadullah Malawi (2022)	80	78,5
9	Development of Android-based Crossword Puzzle Learning Media on the Material of Respiratory Organs of Living Things	Mu'arofah (2022)	92	95,38
10	Development of E-Puzzle as Biology Learning Media on Cell Material forClass XI High School Students	Silvira Ilhami (2023)	92,81	95,05
Average			87,30	90,15

Based on Table 2, there are two important components that are referred to in this study, namely validity and practicality. The average level of practicality from teachers is 87.85% including the category of very valid and the average level of practicality from students is 86.51 including the category of very practical. Analysis of the first article entitled development of android mobile learning "puzzle of chemistry" based on contextual learning on acid-base material can be seen from the results of practicality results by students obtained a percentage of 87% and the percentage of practicality of educators obtained a result of 96.3% with a very good category. The second journal analysis entitled Chem Puzzle Media Development on Class X Compound Name System Material at Sman 1 Alalak, the percentage results of the practicality test by educators were 96.43% and the percentage results of the practicality test on students were 54.12%. The third journal analysis entitled Flash-Based Puzzle Media Development for Learning Acid-Base Reactions in Class Xi Senior High School: The trial at Sman 4 Banjarmasin obtained the results of the practicality test by educators of 86.60% and the practicality test by students of 96.90%. The fourth journal analysis entitled the development of trigonometric puzzles to increase the motivation to learn mathematics for high school students obtained 76.16% practicality test results by educators and 86.3% by students. The fifth journal analysis entitled Development of Stem Structure Puzzle Media Development (PSB) to Train Concept Understanding Skills on Plant Structure and Tissue Material, obtained the results of a practicality test on educators of 93% and a practicality test on students of 90%.

The sixth journal analysis entitled Interactive Multimedia Development on Puzzle-Based Set Material with a Contextual Approach, obtained the results of a practicality test by educators of 85% and a practicality test on students of 84.5%. The seventh journal analysis entitled Development of Learning Media for Covalent Bond Puzzle (Petalen) Class X at Smanegeri 2 Sungai Raya, obtained the results of the practicality test by educators of 92.81% and the results of the practicality test by students of 94.55%. The eighth journal analysis, Development of Manipulative Media Puzzle Game on Permutation Combination Material, obtained the results of a practicality test by educators of 80% and a practicality test by students of 78.5%. The ninth journal analysis is entitled Development of Android-based Crossword Puzzle Learning Media on the Material of Respiratory. Organs of Living Things obtained the results of a practicality test of 92% and a practical test on students of 95.38%. The tenth journal analysis entitled Development of E-Puzzle as Biology Learning Media on Cell Material for Class XI High School Students, obtained the results of a practicality test by educators of 92.81% and a practicality test by students of 95.05%.

The practicality test by educators is the level of ease of use of puzzle media developed by researchers by educators in the classroom. Based on 10 articles related to practicality by educators analyzed, it is known that the 2nd article shows the highest level of practicality, namely 96.43%. This 2nd article, discusses the development of Chem Puzzle Media on Class X Compound Name System Material at Sman 1 Alalak, while the lowest practicality test was the 4th article of 76.16% with the title of the article Development of Trigonometric Puzzle to Increase Mathematics Learning Motivation of High School Students. The average test of the level of practicality carried out by educators from the 10 articles analyzed was 87.84% with very practical criteria. This shows that the use of puzzle media is easy to use, easy to understand, and provides benefits to educators when in the classroom to streamline learning time. According to Fitria (2017), the level of practicality is reviewed from an explanation of whether teachers or other parties think that learning materials are easy and can be used by teachers and students. The developed product is said to be practical if (1) the developed product can be applied at school; (2) the developed product can attract respondents in the learning process; (3) the material in the developed product is easy to understand.

The practicality test by educators is the level of ease of use of puzzle media developed by researchers by educators in the classroom. Based on 10 articles related to practicality by educators analyzed, it is known that the 10th article shows the highest level of practicality, namely 98.35%. This 10th article, discusses the Development of ANDroid-based biology Crossword Media on Motion System Material to Improve Students' Creative Thinking Skills, while the lowest

practicality test was the 2nd article 54.12% with the title of the article Chem Puzzle Media Development on Class X Compound Name System Material at Sman 1 Alalak. The average level of practicality test conducted by educators from 10 articles analyzed was 86.51% with very practical criteria. The results of the analysis of the puzzle's practicality test by students showed that the use of the puzzle attracted students to take part in class learning. According to Yanto (2019), the high and low level of practicality is seen from the ease of use of the learning media developed, ease to interpretation, time efficiency, suitability for the material, attractiveness, and can be used as an independent learning media.

CONCLUSION

Based on the results of the meta-analysis that has been carried out, it can be concluded that the development of puzzles in learning X, XI, and XII SMA in various fields of study has met the criteria of very valid and very practical. With an average level of practicality by educators of 87.30% very practical category and an average level of practicality by students of 90.15 very practical category. Thus, the puzzle developed is suitable for use in the biology learning process to meet the needs of students in the learning process.

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