



Utilizing Wordwall Puzzles as Teaching Materials for Theme 3 in Fifth Grade

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Abstract: Technology serves a crucial role in supporting teachers as a valuable teaching tool. Class activities require engaging and creative teaching materials that can motivate students to actively participate in the learning process. The study aims to develop educational materials in the form of puzzles using Wordwall to enhance students' creativity and promote effective learning. A Research and Development (R&D) approach was utilized to create puzzle products using Wordwall. An experimental design was then implemented to examine the impact of using puzzle teaching materials from Wordwall on reading literacy, creativity, and learning outcomes. The product's viability was assessed by media and materials experts. Following an assessment of its viability, a small-scale product trial was conducted with 10 students, followed by a larger-scale test involving 32 students. A study discovered the practicality and efficiency of the product for implementation in primary schools. The findings of this study suggest that utilizing Wordwall puzzles media in theme 3 material is both practical and beneficial for facilitating learning. According to this, the research findings can serve as a valuable teaching strategy for educators to effectively guide their students. This research can serve as an effective strategy for teachers to support and guide students in their learning.

Keywords: puzzles, wordwall, learning, elementary school

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Introduction

Globalization and information technology make developing creativity a top priority to excel in facing intense competition (Gasper & Mabic, 2015). It has been shown that in the last decade, many studies have found that digital games can increase learning motivation and learning outcomes (Ahmad & Jaafar, 2012; Chen & Matahari, 2016; Hung et al., 2012; Hwang et al., 2017; Perrota et al., 2013). However, only a few studies have focused on creativity (Kao et al., 2017; Yeh et al., 2015). However, few researchers have developed a Wordwall puzzle-based learning system regarding creativity for elementary school children. Creativity, skills, and critical thinking are very important in today's learning.

Learning refers to a flexible state of mind where students are actively involved in learning, aware of new things, and sensitive to the context of the subject matter. Puzzle teaching materials are expected to help improve attention, cognitive flexibility, problem-solving, emotions and memory. Puzzle teaching materials can stimulate students to develop experiences through reading materials for successful learning. Puzzle teaching materials using Wordwall can attract students' attention and encourage repetition of the behavior or skills that are the learning objectives. Well-designed Wordwall puzzles help enhance the experience of reading mastery and creativity. This experience can be influenced by the need to achieve goals and determine students' abilities. Achievement goals help build a framework for how students interpret and experience learning events, which guides learning efforts toward competency-relevant activities.

In developing this puzzle teaching material, we chose to develop interactive multimedia teaching materials in the form of a picture or word arranging game (puzzle) using the Wordwall application so that it could make the learning process more effective. Use of Wordwall software as the main tool for interactive multimedia teaching materials. This software was chosen because of its superiority as

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universal software that is easily accessible to all cell phone users. This software also has operational capabilities at various use levels, including multimedia, graphics, animation, and uncomplicated and effective object-oriented programming. Wordwall software as the authoring tool or main tool was also based on research by Lim (2012), which encouraged teachers to utilize existing technology or 're-use the technology.' Considering research from Lin et al. (2018), using Wordwall software to develop puzzles as interactive multimedia teaching materials on the theme of healthy elementary school food allows teachers to be directly involved as designers in the improvement process. Teachers can access interactive multimedia teaching materials that have been developed, allowing them to add new information occasionally.

Puzzles as teaching materials with Wordwall can also be said to be digital teaching material puzzles having several alternatives that overcome the limitations of printed books where teaching material puzzles with Wordwall provide various learning resources, learning support, and a curriculum that is tailored to motivate students and increase collaboration and sharing information. Puzzle teaching materials with Wordwall display content in a multimedia format and allow students to explore different information. Students increase their interaction and further achieve their goals in the learning process by searching for and navigating content, reflecting on learning activities and feedback, and communicating with friends, classmates, and teachers through the puzzle function of teaching materials with Wordwall (Moreno & Mayer, 2011; Nelson et al., 2011). Puzzle is a game that requires the patience and perseverance of children to assemble. Puzzle is a game of compiling an image or object into several parts.

Wordwall is a web-based word application that can create learning media through quizzes, scrambled words, anagrams, matchmaking, grouping words or pictures, and others. With Wordwall, students can create amazing 3D magazines, catalogs, e-brochures, e-books, or e-newspapers. In other words, this software can create online magazines or e-papers by making flash files and then embedding them into the HTML page of a web page or blog. This software is great for creating books from office files with 3D views and nice templates, besides being able to embed linked video files into them (Ardi, 2013).

Scholars have used different definitions to describe the features of digital textbooks (Byun et al., 2016); (McMahon & Williams, 2011). Several opinions regarding the features of digital textbooks as learning media. Seon et al., (2014) define digital textbooks as multimedia learning materials and electronic books that provide educational services regardless of time and place. Students can adapt and interact based on their characteristics with diverse and abundant resources and technology. From a learning support-focused perspective, digital textbooks can be defined as digital learning materials that are used to maximize the convenience and effectiveness of learning by providing learning support functions (for example, animation and 3D) and additional functions (for example, search and navigation), based on the advantages traditional textbook. Generally, digital textbooks have been considered the primary textbooks for learners, combining general textbooks, workbooks, and glossaries with multimedia (e.g., videos, animations, virtual reality), which provide interactive and self-directed learning regardless of time and place.

The main features of digital textbooks are as follows: First, digital textbooks maintain the basic functions of general textbooks and provide an easy-to-use interface. Not only does it contain text and pictures like in a normal textbook, but it can also implement the functions of underlining, noting, bookmarking, page-turning, etc. Second, digital textbooks include multimedia (e.g., video and animation) and provide new learning resources by updating and searching data. Third, students can actively interact with fellow students and teachers through synchronous (real-time chatting) and asynchronous (discussion boards) interaction activities in digital textbooks. Finally, digital textbooks can serve as comprehensive materials, which will include a variety of learning resources such as reference books, workbooks, and dictionaries, and support personalized and advanced learning through a self-evaluation function.

The theory of creativity shows that the creative process involves an interaction between divergent and convergent thinking (Yeh, 2017). It has also been suggested that the creative process is heavily influenced by working memory emotions (Yeh et al., 2016; Yeh et al., 2015; Lin & Vartanian, 2017), as well as two keys to the process of creative cognition: possible solutions or ideas to solve problems, and evaluation of the value or usefulness of ideas in terms of their novelty and usefulness (Liu et al., 2018).

This study aims to develop teaching materials in the form of puzzles using Wordwall to increase students' creativity in learning. The experimental design tested the effect of learning after using Wordwall-based teaching material puzzles on reading literacy, creativity and learning outcomes.

Methods

This research was conducted at Kampung Rambutan Elementary School, Bogor City, which was chosen to determine students' responses and learning outcomes to use puzzle media using Wordwall. This research is categorized as development research, which aims to improve student learning outcomes. This ADDIE model R & D research consists of the following stages:

1. Analysis: the stage consists of literature studies on curriculum analysis, teaching materials or teaching tools, and articles related to the research problems. At this stage, a preliminary study is also conducted by conducting interviews with teachers, students, school principals and parents about the needs of students and the school.
2. Design: the stage begins with reviewing theory for designing learning media, designing puzzles using Wordwall according to the curriculum, materials, and student characteristics, designing learning models according to the curriculum, and designing instruments to measure the success of puzzle media products.
3. Development: the stage of developing Puzzle media using Wordwall after there is a prototype design. Development was carried out by creating puzzle media using Wordwall. After this stage is completed, media and material experts carry out a validation test. A limited trial was conducted on 10 students to determine how the students responded. After that, revisions were carried out, and the Puzzle media product using Wordwall was ready to be implemented.
4. Implementation: the stage after product revision by conducting extensive trials on grade 5 students.
5. Evaluation: the final stage after extensive testing to determine the advantages and disadvantages of Puzzle media products using Wordwall. After that, product effectiveness and refinement tests are disseminated to users in proceedings, journals, or product outreach.

At the implementation stage, the research used a quasi-experimental method, where puzzles as a medium using Wordwall were tested in two groups/classes. This research was designed into two groups: the experimental/treatment class, which carried out learning using puzzles as Wordwall teaching materials, and the control class, whose learning used printed book teaching materials. The research design can be seen in the table below.

Table 1. Research Design.

Group	Pretest	Treatment	Post-Test
K _K Control	O ₁	Class without treatment	O ₂
K _E Experiment	O ₁	X <i>Wordwall teaching material puzzle</i>	O ₂

Information:

O₁ : Giving Pretest

O₂ : Giving Posttest

The test was carried out twice before and after the experiment or treatment. The test before the experiment (O₁) is called the pretest and observation, while the posttest after the experiment (O₂) is called the posttest. The influence and difference between O₁ and O₂, namely O₁-O₂ is the result of treatment or experiment.

The procedure or steps in the research are as follows:

1. Provide an initial ability test (pretest) on theme 2, Saving Energy.
2. Provide treatment by using puzzles as teaching materials to classes used as research subjects to discuss theme 2, Saving Energy.
3. With the treatment of printed books and using puzzles for Wordwall teaching materials.
4. Give a final ability test (posttest) on energy-saving material 2 in both experimental classes with the same questions.
5. Provide the value of the test results obtained from the two treatment groups, namely the experimental class group and the control class.
6. Then, the data obtained is processed and analyzed using the N-Gain formula.

7. The data that has been analyzed is then made into the form of a research report.

The following is a flowchart for doing Wordwall puzzles.

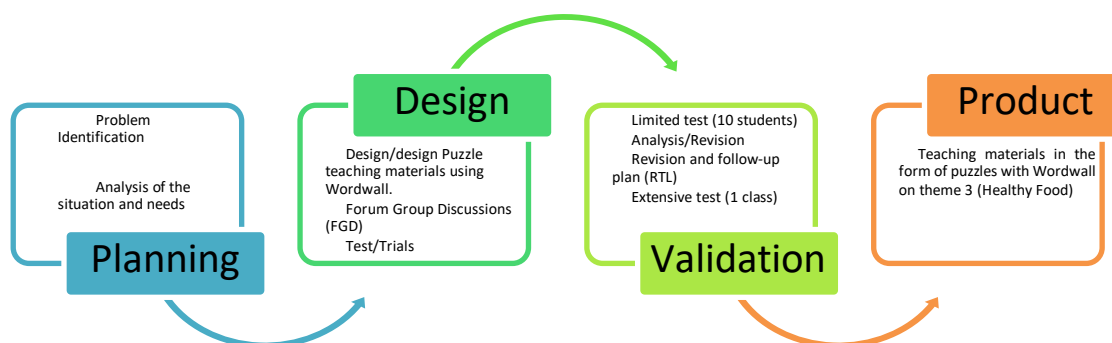


Figure 1. Puzzle Research Flowchart as Wordwall Teaching Material

In addition to the flowchart above, a design for doing puzzles as teaching materials was also made using Wordwall. The build plan is shown below.

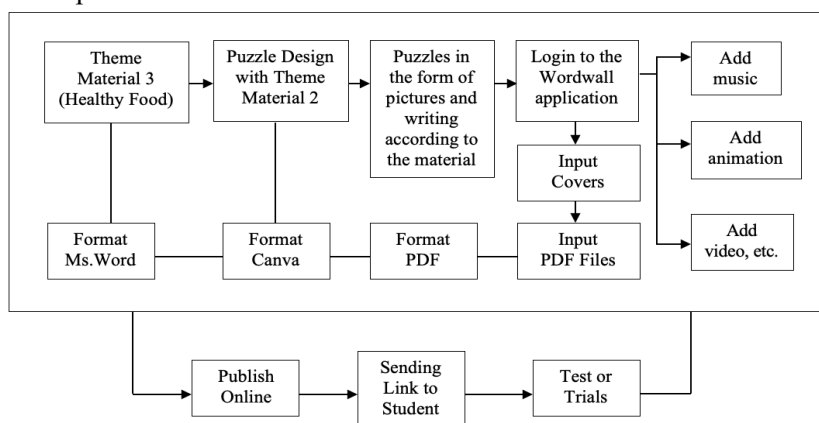


Figure 2. Chart of Design for Making Puzzles as Teaching Materials

Results and Discussion

Results

Potential and Problems

The results of interviews given to VA class teachers at Kampung Rambutan Bogor City Elementary School regarding implementing the Healthy Food Theme learning show that they have used various methods, namely discussion, question and answer, and assignments. Learning media that have been used in learning are only limited to simple pictures. These limitations are due to the lack of availability of learning media, and not all material is supported by these media. The teachers' learning resources are student books, teacher books already available at school, and student worksheets. Students have very active characteristics and like to play. Still, this activity has no support, causing students to be often busy, play alone, and pay less attention to learning. Students feel bored being shown by busy students alone. Students' lack of enthusiasm in the lesson is reinforced by data on student learning outcomes that are not optimal. The average value of student learning outcomes is 65, which does not exceed the KKM determined by the school of 70.

Results of Information Collection

This study's information collection was carried out using a media development needs questionnaire by students and teachers. The instructional media needs questionnaire was given to teachers and VA students at Bojong Salaman 01 Semarang Elementary School. Based on the questionnaire results, the teacher believes that the media developed for elementary school students should be packaged as attractively as possible to attract students' attention. The expected media

development is media that can be used directly, trains independent learning, is challenging and leads to fun learning for students.

The teacher already knows and has used puzzles commonly found on the market but has never made and applied them to classroom learning. Teachers have never encountered match-based puzzle media, so teachers are interested in using match-based puzzle media as learning media. The components expected by the teacher in making a match-based puzzle media are images related to the material, question cards, and answers. The results of the needs questionnaire given to teachers and students are used to develop the media design that will be made. The media development needs questionnaire given to students explains that the media commonly used by teachers is media images whose use does not involve students directly. Students agree that learning in class is fun by inserting games. Students already know and have played ordinary puzzles not used as learning media. Making a match-based puzzle media is not yet known by students, but students are interested in using it. According to the students, they make a match-based puzzle. The media should be in color, the loaded illustrations should be in the form of cartoon images, and they should have rectangular pieces of sufficient size for students. The questions on the question cards are long questions and short answers. Based on the needs questionnaire analysis results, the development of make-a-match-based puzzle media was adapted to the needs of students and teachers.

Results of the Puzzle Design (Draft 1)

The results of the analysis of the puzzle development need a questionnaire given to the teacher and the questionnaire to students. Wordwall-based puzzles are developed by combining various components. The design of combining various components in Wordwall-based puzzle media is arranged in a product design prototype. Product design prototypes are used as initial descriptions in developing ideas. The product design prototype is a reference in making products so that the products developed are on the initial product development ideas.

The Wordwall-based puzzle media design prototype is as follows.

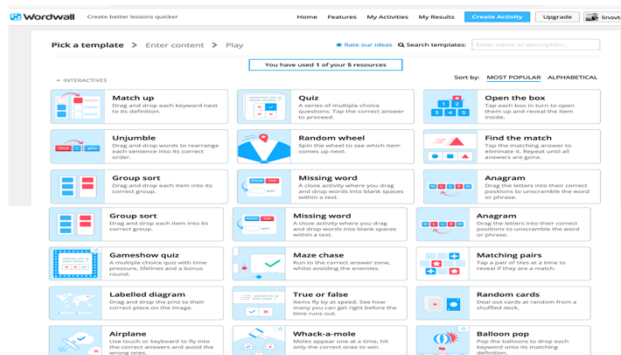


Figure 3. Puzzle Design Prototype

The Wordwall-based puzzle media development design prototype is used as a reference in product creation. Manufacture of products that have been carried out to produce Wordwall-based puzzle components.

Media Expert Validation Results

The feasibility or effectiveness of Wordwall puzzles was demonstrated through validation from media and material experts. Validation was carried out 2 times: the initial stage and after the revision. The media validation questionnaire includes media and graphic aspects. The Wordwall-based puzzle assessment of healthy food material by media experts obtained a percentage of 83.33% with very decent criteria.

Table 1. Media Expert Validation Results

Indicator	Score obtained	Score Maximal
General Principles of Visual Media		
Media Concept	30	40
Graphic Feasibility Aspects		
Desain	45	50
Total score	75	90
Presentation	$75:90 \times 100 = 83,33$	
Criteria	Very Worth it	

The material validation questionnaire includes content feasibility, learning design, and language aspects. The Wordwall-based puzzle assessment of healthy food material by material experts obtained a percentage of 85.6% with very decent criteria. The following are the results of the material expert validation:

Table 2. Material Expert Validation Results

Indicator	Score obtained	Score Maximal
Content Eligibility Aspects		
Theory/Material	25	30
Learning Design Aspects		
Learning	22	25
Language Aspect		
Language	30	35
Total score	77	90
Presentation	$77:90 \times 100 = 85,6$	
Criteria	Very appropriate	

Product Trial Results (Small Scale)

In the product trial, the value of student learning outcomes was obtained before and after using Wordwall-based puzzles and student responses regarding the teaching materials developed. Student learning outcomes obtained an average score of 63.5 before using the puzzle and an average score of 80.5 after using the Wordwall-based puzzle.

Table 3. The Product Trial Student Learning Outcomes (Small Scale)

1. Variation		2. Use of Wordwall-based puzzles	
		3. Before (Pretest)	4. After (Posttest)
5. Highest score	6. 75	7. 75	8. 86
8. Lowest value	9. 52	10. 52	11. 75
11. Mean	12. 63.5	12. 63.5	13. 80.5
14. The number of students	15. 10	15. 10	15. 10
16. Number of students completed	17. 6	17. 6	18. 8
19. Percentage of students complete	20. 60	20. 60	21. 80

The results of product trials obtained student response data by providing student response questionnaires. Students were also asked to provide suggestions and comments about Wordwall-based puzzles on healthy food material. Student responses were classified into four categories: strongly agree = 4, agree = 3, disagree = 2, and strongly disagree = 1. The percentage of responses from 10 (all) grade V students at Kampung Rambutan Elementary School in the product trial showed positive responses with very good criteria.

Revision Result and Final Product (Draft 2)

The suggestions and comments given by media experts as revisions are revisions to the text of the instructions for using the media. The advice is to simplify the pictures according to the characteristics of the students.

Table 4. Media Expert Revision Suggestions

Suggestions/Comments	Improvements/Revisions
Pictures need to be adjusted to the characteristics of students	Drawings are made according to the characteristics

Table 5. Material Expert Revision Suggestions

Suggestions/Comments	Improvements/Revisions
Statements on the puzzle need to be simplified according to the student's language, character and learning style.	Statements are made according to the student's language.

Result of Product Usage (Experiment)

The value of learning outcomes is obtained by providing pretest and posttest learning to all students using the product in class to compare the two. In the first study using the teachers' and students' books, the average value of student learning outcomes is 63.5 due to pretest learning. The second study, using Wordwall-based puzzles, obtained an average score of 80.5 due to post-test learning.

The N-gain test is used in product trials (small scale) to analyze pretest and posttest learning outcomes in a descriptive percentage manner. The average pretest value classically in the small-scale trial is 63.5, and the posttest learning outcome is 80.5. The N-gain calculation results are 0.43 with moderate criteria.

Table 6. Results of N-Gain Test Analysis of Student Learning Outcomes in Small-Scale Product Trials

Pretest average	Posttest average	N-gain	Criteria
63.5	80.5	0.46	Currently

The N-gain test is used for product usage in classes with an average classical pretest score of 71 and a posttest learning outcome score of 86. The N-gain calculation result obtained is 0.48 with moderate criteria.

Table 7. Results of N-Gain Test Analysis of Student Learning Results in Product Use

Pretest average	Posttest average	N-gain	Criteria
71	86	0.48	Currently

Discussion

Based on the analysis of the questionnaires given to teachers and students, there is a need for a variety of interesting and fun teaching materials for students. One of the media that can be developed is a Wordwall-based puzzle on healthy food material. Teaching materials developed can provide interesting and fun learning for students, as well as train students' ability to solve problems. Wordwall-based puzzle components include images, material text, statements, and answers that can be used for learning and playing individually or in groups. These three components aim to train problem-solving skills, increase activity, attract attention, and provide meaningful learning for students. This goal is based on the opinion of Elfanany (2011) that the benefits of playing puzzles are improving children's problem-solving skills.

This development research regarding classroom management has also been carried out (Hermanto, 2022). The development of teaching materials is researched (Aji & Pujiastuti, 2022), then research (Anggito & Sartono, 2022) on the development of comic books, different from research (Basuki & Kurniawan, 2022) on career services for school students basic, with quasi-experimental methods, and finally research (Andini et al., 2023) which develops syntax to accommodate diversity.

Wordwall-based puzzle media on healthy food material that has been made then gets validation from media and material experts. Then, a small-scale product trial was conducted on 10 grade V students at Kampung Rambutan Elementary School Bogor. Data on learning outcomes after and before applying Wordwall-based puzzles and student responses have been taken in product trials. Suggestions and

comments from media experts and material experts were used as material for revision. At the same time, the results of the analysis of responses to product trials did not contain suggestions and comments for product revisions.

The revised media was applied in class to all (32) class V students of Kampung Rambutan Elementary School Bogor as an experiment to determine the effectiveness of the teaching materials developed. Using products in class is done by learning twice with the same material in one day to obtain learning outcomes and student responses. The first lesson uses media that teachers usually use, namely posters. The second lesson uses word-based puzzles. Learning outcome data from the two studies was used to compare the effectiveness of Wordwall-based puzzles. The results show increased learning outcomes after using Wordwall-based puzzles, and the classical percentage shows students' positive responses to Wordwall-based puzzles.

The validation carried out by media and material experts aims to determine the suitability of teaching materials based on rational thinking. The assessment was carried out using a validation questionnaire. Media experts and material experts validate the suitability, weaknesses and strengths of teaching materials and provide suggestions and comments on Wordwall-based puzzles.

Product trials were conducted on 10 class V students at Kampung Rambutan Elementary School. Product trials were carried out by asking students to use Wordwall-based puzzles. In this trial, learning outcome data was obtained in the form of pretest and post-test scores and data on student responses to learning media. These findings have similarities with research results (Anagün Assoc & Osmangazi Üniversitesi, 2018); (Novita et al., 2019; Wahyu P. et al., 2016). In previous research, it was found that learning media had a positive influence on students' interest and learning outcomes, but it differed depending on the object and place of research.

All students (32 people) in class V at Kampung Rambutan Elementary School Bogor use the product in class. Teaching materials are used directly by students through group discussions. This stage is carried out twice in class in one day with the same material, and then learning results from the two lessons are obtained as a comparison and response data regarding Wordwall-based puzzles. Learning using Wordwall-based puzzles has proven to be effective for student learning outcomes. Student learning outcomes in product trials and product use in class have increased after implementing Wordwall-based puzzles. The KKM determined by the school is ≥ 70 . In the product test, student learning outcomes before implementing the Wordwall-based puzzle had a classical average score of 63.5 and an average score of 80.5 after implementing the Wordwall-based puzzle. The increase in student learning outcomes also occurred in classroom use, which showed that the average score of student learning outcomes in learning using teacher books and student books was 71, and the average score of student learning outcomes in learning using Wordwall-based puzzles was 86. N-test results of gain amounting to 0.48 with medium criteria and shows the effectiveness of the t-test results using SPSS 17.0 with significant results between the pretest and posttest learning outcomes, namely $0.000 < 0.05$, so that H_a is accepted. The increase in student learning outcomes shows that the puzzle-based healthy food wordwall material effectively improves student learning outcomes. The results are research (A'yun, 2018; Aziz, 2015; Pah, 2016; Sun & Cheng, 2017) that found the effectiveness of puzzle media in learning. Due to this, teacher creativity and innovation are expected in learning to increase student activity, interest and learning outcomes. Teachers must be able to take advantage of increasingly developing technology, learning with technological, pedagogical, and content knowledge, or TPACK, which needs to be implemented in innovative learning.

Conclusion

Based on the data presentation and research analysis above, it can be concluded that puzzle teaching materials using Wordwall are suitable for use in the learning process on the theme of healthy food in class V. Research on developing puzzle media using Wordwall affects student activity, motivation, interest, and student learning outcomes. Puzzle media using Wordwall also fosters self-confidence, critical thinking, and group collaboration. Apart from that, teachers receive information about puzzle media using Wordwall and provide input for teachers to design learning media and develop it. This research can be a good input to improve learning for schools. This research also adds insight into the skills of researchers to develop learning media as provisions for when they become teachers in the future. This research indicates that Wordwall-based puzzle media is feasible and effective to use as

a medium for learning. Based on this, this research can be used as an appropriate strategy in the teaching carried out.

References

- Ahmad, I., & Jaafar, A. (2012). Computer games: Implementation into teaching and learning. *Procedia - Social and Behavioral Sciences*, 59, 515–519. <https://doi.org/10.1016/j.sbspro.2012.09.308>.
- Aji, I. A. B., & Pujiastuti, P. (2022). Development of natural science supplement books based on local wisdom in integrative thematic learning in elementary schools. *Jurnal Prima Edukasia*, 10(1), 82–95. <https://doi.org/10.21831/jpe.v10i1.40173>
- Andini, D. W., Annisa, F. Y., Praheto, B. E., & Taryatman, T. (2023). The development of the Sariswara method in accommodating the students' diversity in thematic learning material of elementary school. *Jurnal Prima Edukasia*, 11(1), 72–80. <https://doi.org/10.21831/jpe.v11i1.53254>
- Anggito, A., & Sartono, E. K. E. (2022). The development of multicultural education comics to embed tolerance character for 4th grade of elementary school. *Jurnal Prima Edukasia*, 10(1), 66–81. <https://doi.org/10.21831/jpe.v10i1.40504>
- Anagün Assoc, Ş. S., & Osmangazi Üniversitesi, E. (2018). Teachers' perceptions about the relationship between 21st century skills and managing constructivist learning environments. In *International Journal of Instruction* (Vol. 11, Issue 4). www.e-iji.net
- Anjani, D.A., NurJanah, S. 2014. Puzzle games influence the development of visual-spatial intelligence in children aged 4-5 years at Al-Fath Kindergarten, Keboan Anom Village, Gedangan, Sidoarjo. *Jurnal Ilmiah Kesehatan*. 7(2). 186-192. <https://doi.org/10.33086/jhs.v7i2.507>.
- Ardi. (2018). *Create a book with flipbook*. HTML5. <https://fliphtml5.com/boxgo/xlwm/basic>
- A'yun, N. Q. (2018). Development of Si Pintar interactive media based on android applications KPK and FPB material for mathematics class IV elementary school. *JPGSD*. 6(2), 47–56. <https://ejournal.unesa.ac.id/index.php/jurnal-penelitian-pgsd/article/view/23410/21404>.
- Aziz, M. K. (2015). *Development of android-based learning media to increase student participation and learning outcomes in pai subjects*. Skripsi. UIN Sunan Kalijaga.
- Basuki, A., & Kurniawan, R. (2022). The effectiveness of career information services with CEV media on elementary school students. *Jurnal Prima Edukasia*, 10(2), 180–186. <https://doi.org/10.21831/jpe.v10i2.49963>
- Byun, H. S., Choi, J. L., & Song, J. S. (2016). Research on the development of electronic textbook prototypes. *Journal of Korean Educational Technology*, 22(4), 1e24. <https://dx.doi.org/10.17232/KSET.22.4.217>
- Chen, L. X., & Sun, C. T. (2016). Self-regulation influence on game play flow state. *Computers in Human Behavior*, 54, 341–350. <https://doi.org/10.1016/j.chb.2015.08.020>.
- Gaspar, D., & Mabic, M. (2015). Creativity in higher education. *Universal Journal of Educational Research*, 3, 598–605. <https://eric.ed.gov/?id=EJ1074814>
- Hermanto, H. (2022). The teacher performance evaluation in learning management in inclusive settings. *Jurnal Prima Edukasia*, 10(1), 28–36. <https://doi.org/10.21831/jpe.v10i1.37511>
- Hung, P. H., Hwang, G. J., Lee, Y. H., & Su, I. (2012). A cognitive component analysis approach for developing game-based spatial learning tools. *Computers & Education*, 59(2), 762–773. <https://doi.org/10.1016/j.compedu.2012.03.018>

- Hwang, G. J., Hsu, T. C., Lai, C. L., & Hsueh, C. J. (2017). Interaction of problem-based gaming and learning anxiety in EFL students' English listening performance and progressive behavioral patterns. *Computers & Education, 106*, 26–42. <https://doi.org/10.1016/j.compedu.2016.11.010>.
- Kao, Y. M., Chiang, C. H., & Sun, C. T. (2017). Customizing scaffolds for game-based learning in physics: Impacts on knowledge acquisition and game design creativity. *Computers & Education, 113*, 294–312. <https://doi.org/10.1016/j.compedu.2017.05.022>
- Lin, C. J., Hwang, G. J., Fu, Q. K., & Chen, J. F. (2018). A flipped contextual game-based learning approach to enhancing EFL students' English business writing performance and reflective behaviors. *Journal of Educational Technology & Society, 21*(3), 117–131. <https://www.jstor.org/stable/26458512>.
- Liu, Y. C., Chang, C. C., Yang, Y. S., & Liang, C. (2018). Spontaneous analogising caused by text stimuli in design thinking: Differences between higher- and lower-creativity groups. *Cognitive Neurodynamics, 12*, 55–71. <https://doi.org/10.1007/s11571-017-9454-0>.
- McMahon, G., Yeo, S., & Williams, M. (2011). Making a difference: Student perceptions of E-learning blended with traditional teaching methods. In C. Ho, & M. Lin (Eds.). *Proceedings of E-learn 2011—World conference on E-learning in corporate, government, healthcare, and higher Education* (pp. 759–764). Honolulu, Hawaii, USA.
- Moreno, R., & Mayer, R. (2011). Interactive multimodal learning environments. *Educational Psychology Review, 19*(3), 309e326. <https://link.springer.com/article/10.1007/s10648-007-9047-2>
- Nelson, L. L., Arthur, E. J., Jensen, W. R., & Van Horn, G. (2011). Trading textbooks for technology: New opportunities for learning. *Phi Delta Kappan, 92*(7), 46e50. <http://dx.doi.org/10.2307/25822837>
- Novita, L., Guru Sekolah Dasar, P., Pakuan Bogor, U., & Novianty, A. (2019). The influence of the use of animated audio visual learning media on learning outcomes of single and mixed object subthema. In *JTIEE* (Vol. 3, Issue 1). <http://dx.doi.org/10.30587/jtiee.v3i1.1127>
- Perrotta, C., Featherstone, G., Aston, H., & Houghton, E. (2013). *Game-based learning: Latest evidence and future directions (NFER research programme: Innovation in education)*. Slough: NFER.
- Seon, B. G., Seo, Y. K., & Byun, H. S. (2014). Case investigation research of Korea and foreign digital textbooks (RR2004e05). Retrieved from http://www.keris.or.kr/board/pb_downloadNew.jsp?bbs_num/41784&ix/43019.
- Sun, P. C., & Cheng, H. K. (2007). The design of instructional multimedia in e-Learning: A Media Richness Theory-based approach. *Computers and Education, 49*(3), 662–676. <https://doi.org/10.1016/j.compedu.2005.11.016>
- Wahyu P., D., Nugroho, A. P., & Puspitarini, E. W. (2016). Android-based educational games as learning media for early childhood. *Jurnal Informatika Merdeka Pasuruan, 1*(ISSN. 2502-5716). <http://dx.doi.org/10.51213/jimp.v1i1.7>
- Yeh, Y., Lai, G. J., Lin, C. F., Lin, C. W., & Sun, H. C. (2015). How stress influences creativity in game-based situations: Analysis of stress hormone, negative emotions, and working memory. *Computers & Education, 81*, 143–153. <https://doi.org/10.1016/j.compedu.2014.09.011>
- Yeh, Y. (2017). Research development of creativity. In J. Stein (Ed.). *Reference module in neuroscience and biobehavioral psychology*. Elsevier.
- Yeh, Y., Lai, S. C., & Lin, C. W. (2016). The dynamic influence of emotions on game-based creativity: An integrated analysis of emotional valence, activation strength, and regulation focus. *Computers in Human Behavior, 55*, 817–825. <https://doi.org/10.1016/j.chb.2015.10.037>.