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RESEARCH ARTICLE

Developing powerpoint-based interactive multimedia of mathematics learning multiples and factors materials for elementary school

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Abstract: This research aims to describe PowerPoint-based interactive multimedia products in learning multiple material mathematics and class IV factors of the Karangtengah Baru, Imogiri State Elementary School, and describe the feasibility of the product. This research uses a development method or Research and Development (R&D), which includes six stages of development. The results of this development study show that the product developed meets valid and practical criteria. The validity can be categorized as "Very Good", with an average score of 4.6 and a percentage of 92%. The assessment results from media experts are categorized as "Good", with an average score of 3.9 and a percentage of 78.7%. The assessment results from media experts are categorized as "Good", with an average score of 3.9 and a percentage of 78.7%. Assessment from class teachers is categorized as "Very Good", with an average score of 4.7 and a percentage of 95.7%. Practicality seen from student response assessments can be categorized as "Very Good", with an average score of 4.7 and a percentage of 94% of 10 students as respondents. Based on the above exposure, it can be concluded that PowerPoint-based interactive multimedia products are developed and feasible for use in Class IV elementary mathematics learning multiple materials and factors.

Keywords: multimedia, interactive, PowerPoint, mathematics

1 Introduction

Mathematics is a general science that has a fundamental role in the development of modern technology and is very influential in various other disciplines (Dahal et al., 2022; Papadakis, 2020a; 2020b). Moreover, applying mathematics science leads us to daily-life problem-solving. The reason is that almost all problems in life can be related to mathematics. Therefore, the student's understanding of mathematics should be correct and complete following the stages of learning mathematics by applying fun methods and media and implementing mathematical principles (Papadakis & Kalogiannakis, 2019). Fatimah (2009) states that mathematics learning is the process of forming logical thinking, not just teaching students to be adequate at arithmetic. Consequently, the students are taught to solve the problems by implementing logical thinking and analysis (Katsaris & Vidakis, 2021).

Mathematics learning in elementary school has several intentions (Kalogiannakis & Papadakis, 2017). The central purpose is to introduce students to numbers, arithmetic operations, measurements, and simple fields. Heruman in (Suhendri, 2016) states that the learning process in elementary school aims to Instill Basic Concepts, Understanding Concepts, and Coaching skills. Instilling Basic Concepts, Understanding Concepts, and Coaching skills.

Based on the observation conducted on the 7^{th} and 13^{th} October 2020 in SDN Karang Tengah Bantul, particularly on fourth-grade students consisted ten students in total, the researcher observes the learning process held on the 7^{th} and 13^{th} October 2020. The results show that ten fourth-grade students and five students have been assumed not to understand the materials delivered by the teacher, which is caused by students' disinterest in ongoing learning. Moreover, the material delivered by the teacher tends to be monotonous and boring because the teacher delivers the material using conventional learning media, and this has an impact on students' interest in ongoing learning (Dahal et al., 2022).

The rapid development in technology and communication has enormously influenced the world of education, where today's technology has presented computers as a medium of learning (Papadakis et al., 2022). Nowadays, there is already a computer-based interactive learning program that has many advantages over ordinary printed teaching materials. Interactive multimedia is included in the technology-based learning materials. According to Novitasari (2016), Interactive multimedia is a learning medium that combines several aspects of images, videos,

animations, and sounds in a platform and allows users to interact directly (Tsoukala, 2021). Following the opinion, Rahmansyah (2016) states that interactive learning multimedia can display several aspects of the text, sound, images, animation, and video simultaneously in one media. Thus, the interactive multimedia will serve all students with different characteristics (Lazarinis et al., 2022). There are application programs derived from the computer that might be used to design interactive multimedia (Papadakis, 2022a; 2022b). One of the programs is the Powerpoint application. This application is remarkably familiar among teachers and the world of education. Therefore significant difficulties are rarely found when using the application (Mamolo, 2022).

Microsoft PowerPoint is an application program developed by Microsoft cooperation as one of the tools to design and display media. According to Grzeszczyk (2016), PowerPoint is computer software that creates interactivity and requires users to create various activities, ranging from interactive quizzes to games. Moreover, the PowerPoint program is specifically designed to display attractive multimedia programs, which are relatively easy and inexpensive to manufacture and easy to use because they do not require raw materials other than tools for data storage (Rusman et al., 2013).

Munir (2013) states several advantages gained when using interactive media in the learning process, including 1) The learning becomes more innovative and interactive. 2) Teachers would be more creative and innovative in delivering materials. 3) A combination of several aspects such as text, audio, video, and animation in a single unit supports each other to achieve learning objectives. 4) Increase the students' motivation during the learning process. 5) Interactive media could visualize learning materials which hard to deliver using conventional media (Barianos et al., 2022). Moreover, Pujiriyanto (2012) states that the advantage of interactive media is presenting several aspects that functionalize children's sensory senses.

Based on the advantages of using interactive multimedia and the problems of learning mathematics with multiples and grade IV factors at SDN Karangtengah Baru that have been stated previously, the authors assume that multimedia learning can overcome the problems faced and make it easier for teachers to deliver learning materials by sticking to learning centred on the student. Interactive multimedia also attract students' attention and makes the learning process more fun, interactive, and student-centred, as well as changing students' paradigms toward the ease of learning mathematics. In addition, the use of media is increasingly varied, and students become more optimally accepted by Messages or learning materials considering the diversity of learning modalities that students have (Musfiqon, 2012).

2 Methods

This research is Research and Development (R&D). According to Asrori (2014), Research and Development (R&D) is developing educational tools through various research methods. In this study, the researcher adopts and modifies the methods proposed by Sugiyono (2009), which the set processes proposed to consist of ten steps in total. The steps include 1) Potency and problem, 2) Research and information collecting, 3) Design product, 4) Design validation, 5) Design revision, 6) Product testing, 7) Product revision, 8) Operational field testing, 9) Final product revision, 10) Mass Production. However, the researcher remodifies the steps proposed by Sugiyono (2009) due to the limited time and cost of the researcher. Moreover, The steps in the development of PowerPoint-based interactive multimedia are outlined in Figure 1.

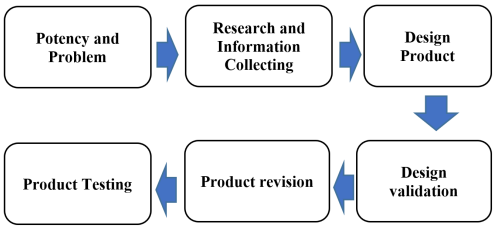


Figure 1 Stages of Research Development according to Sugiono (modification)

The first step is potency and problem. This research is based on the potency and problem gained by the researcher from the observation of the fourth-grade students and direct interview with a fourth-grade teacher of Karangtengah Baru Imogiri Bantul Elementary School. This stage is done to determine the problems teachers and students face.

The second step is research and information collection. The data collection techniques used in this research are interviews and questionnaires, with interviews and observation as the basis of instruments. The interview technique led to direct interviews with the fourth-grade teacher of Karangtengah Baru Imogiri Bantul Elementary School to figure out the obstacles the teacher

faced in delivering mathematics learning in the fourth-grade class faces. On the other hand, the observation technique leads to finding the facts in the field.

The third step is the product design. The development of Power-Point-based interactive multimedia starts with designing the multimedia elements such as materials, background, text, and pictures to become content. Moreover, the existing content is inserted into the desired slides to the layout setting. Additionally, the product is uploaded to an application so that students become easily access it via smartphones.

The fourth step is design validation. Design validation is done by giving assessment questionnaires to media experts, material experts, and classroom teachers. This step is carried out to determine the validity and readiness of the research product developed by the researcher before being tested. The assessment contains data on the quality of interactive multimedia based on PowerPoint, which is qualitative and quantitative data, qualitative data in the form of suggestions submitted through a validator questionnaire. According to Widoyoko (2009), the value given by the experts will later be analyzed and tabulated using a Linkert scale of 1-5 and calculates the average score of the assessment.

The fifth step is product revision. The revision or design improvement stage is carried out to improve or add to the shortcomings and weaknesses of the developed multimedia. These weaknesses are obtained from the assessments and comments provided by experts. Design improvement aims to improve the developed product to be more feasible to be tested.

The last stage is product testing. The trial was conducted on research subjects consisting of 10 fourth-grade students at Karangtengah Baru Imogiri Bantul Elementary School by providing student response questionnaires. The student response questionnaire was used as a student assessment of the developed media.

The research subjects of this study are ten fourth-graders of Karangtengah Baru, Bantul Elementary School, consisted three females and seven males. The researcher would use the research subject as a product trial subject. This research is conducted in Karangtengah Baru, Imogiri Elementary School. Additionally, this research was done from September 2020 to February 2021. This research starts from the interview stage to the product revision stage. The result gained is the final product design of PowerPoint-based interactive multimedia.

The qualitative and quantitative data were obtained from assessments and suggestions in validator and student questionnaires. They asked about the quality of interactive multimedia products based on PowerPoint. According to Widoyoko (2009), Quantitative data analysis was carried out by tabulating the data from expert validation using a 1-5 Linkert scale and then calculating the average score of the assessment. After knowing the average score of the expert's assessment and the assessment of the student questionnaire, the next step is to change the average value of each aspect of the qualitative data in Table 1.

Table 1 Guidelines for changing the average score into qualitative data

Score Range	Criteria
$\overline{x} > 4.2$	Very Good
$3.4 < \overline{x} \leq 4.2$	Good
$2.6 < \overline{x} \leq 3.4$	Enough
$1.8 < \overline{x} \leq 2.6$	Not Good
$\overline{x} \leq 1.8$	Very Not Good

3 Results

The results is PowerPoint-based Interactive Multimedia on the Mathematics Learning of Multiple and Factor Materials in Fourth Grade Elementary School. This research is conducted to determine the validity and practicality of Powerpoint-based Interactive Learning Media. Based on the research procedure, the result could be outlined as follows:

3.1 Potency and problem

The potency and problems in this study are obtained from the interviews conducted at SDN Karangtengah Baru Imogiri, Bantul. Based on the interview results conducted by the researcher at SDN Karangtengah Baru Imogiri Bantul, many students still have difficulty understanding abstract mathematics and many symbols. Additionally, the students do not focus on mathematics learning due to their disinterest in the media used by the teacher. Conversely, the teacher emphasizes that he/she is more dominant in using the conventional method while delivering the materials of multiple factors. This reflects the absence of interactive learning media that supports the delivery of mathematics learning multiples and factors. Additionally, the teacher states that students are not attracted to the learning process.

3.2 Research and information collecting

Research and information collecting is conducted through observation and interviews. This step intends to determine the students' needs on the learning media developed through research and development.

3.3 Design product

Product development design

The product development design is carried out to create a framework of the PowerPoint-based interactive multimedia before the production stage. The product development flow includes competency mapping and framework development.

3.4 Preproduction

The preproduction stage starts with preparing the materials and tools to create PowerPoint-based interactive multimedia. The materials and tools consisted of an adequate computer, material pictures, Microsoft PowerPoint application, ISpring Suite program, and APK builder website.

3.5 Production

The development and manufacture of PowerPoint-based interactive multimedia products are outlined as follows:

Application Installation

In this stage, various applications are installed (Microsoft PowerPoint, ISpring suite, APK builder) on the pc/computer.

3.6 Multimedia design and compilation

The preparation of PowerPoint-based interactive multimedia learning material for grade IV elementary school multiples and factors is adjusted to the fundamental competencies contained in the 2013 curriculum. This media is designed using Microsoft Office PowerPoint. In addition, it is processed by using the iSpring suite application and APK builder. Therefore, it becomes an Android application. This media consists of several parts: the beginning, the content, and the end. The main media menu display could be in Figure 2-9.

Figure 2 Main Menu

The main menu displays options that the students could select. The menus consist of various things related to learning media or learning materials, a profile menu, guide menu, core and primary competencies menu, material menu, quiz menu, and the profiles of learning multimedia developers (the researcher), starting from a brief biography and educational history.

Figure 3 Instructions Menu

The instructions menu contains instructions for using the application. Therefore, it guides the users or students to operate the application rightly.

Figure 4 Material Menu

The initial display of the material menu displays a selection of learning material menus that students could choose. Dalam 2 menu tersebut terdapat materi pembelajaran yang dapat di akses siswa sendiri.

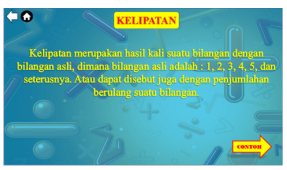
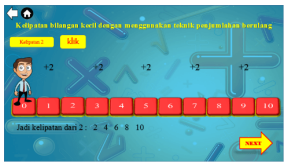


Figure 5 Brief Multi-Material

This display contains a brief explanation of the multiples material, and it aims as an initial introduction to students about the multiple materials.



This section contains animations related to multiple materials. Additionally, it could be operated by students as users. Moreover, by using simple animation, it is hoped that the students would feel at ease in understanding the basic concept of multiples.

Figure 6 Multiple Materials

This display contains a brief explanation of the factors material, and it aims as an initial introduction to students about the factors of materials.

Figure 7 Factors Material

This section contains animations related to factors of material. Additionally, it could be operated by students as users. Moreover, by using simple animation, it is hoped that the students would feel at ease in understanding the basic concept of factors.

Figure 8 Factors Material

The quiz section begins with a quiz opener and continues with a display containing multiple choice questions consisting of multiples and factor questions followed by answer choices that students must do as evaluation material. The students take the quiz one by one and immediately know the results of their work.

Figure 9 Quiz Display

3.7 Product Validation

3.7.1 Material expert validation

Material expert validation consists of three aspects of the assessment. The aspects are the material, display, and motivating quality aspect. These three aspects are assessed using an instrument of a questionnaire. Material expert assessment could be understood in Figure 10.

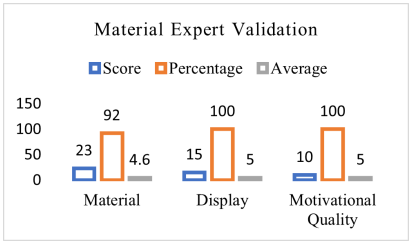


Figure 10 Diagram of material expert validation

The material aspect has obtained 4.6 in the average score and 92% in the percentage. Therefore, this aspect is categorized in the "Very Good" category. The display aspect has gained an average score of 5 and 100% in the percentage. Therefore, this aspect is categorized in the "Very Good" category. The motivational quality aspect has gained an average score of 5 and 100%. Therefore, this aspect is categorized in the "Very Good" category. The total score obtained from material experts is 48, consisting of three assessment aspects. The average material expert assessment is 4.9, and 97% in the percentage. Therefore, it is categorized in the "Very Good" category. To summarise, PowerPoint-based interactive multimedia is categorized as "Very Good" regarding material quality. Therefore, PowerPoint-based interactive multimedia is feasible to apply in the learning process.

3.7.2 Media expert validation

Media expert validation consists of four assessment aspects. The aspects are navigational, language, display aspects, and delivery objectives. Figure 11 is a media expert assessment diagram:

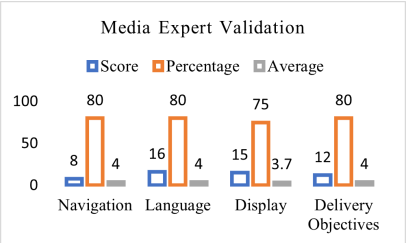


Figure 11 Media expert validation

The navigation aspect has obtained 4 in the average score and 80% in the percentage. Therefore, it is classified as the "Good" category. The language aspect has gained 4 in the average score and 80% in the percentage. Consequently, it is classified as the "Good" category. The display aspect has obtained 3.7 in the average score and 75% in the percentage. Therefore, it is categorized as the "Good" category. The aspect of delivery objectives has gained 4 in the average score and 80% in the percentage. Therefore, it is categorized as the "Good" category. The total score obtained from media experts is 51, consisting of four assessment aspects. The average media expert assessment is 3.9, and 78.7% in the percentage. Therefore, it is classified in the "Very Good" category. To summarise, PowerPoint-based interactive multimedia is categorized as "Very Good" regarding media quality. Therefore, PowerPoint-based interactive multimedia is feasible to apply in the learning process.

3.7.3 Classroom teacher validation

Classroom teacher validation consists of four aspects. The aspects are navigation, language, display aspects, and delivery objectives. The classroom teacher assessments are outlined in Figure 12.

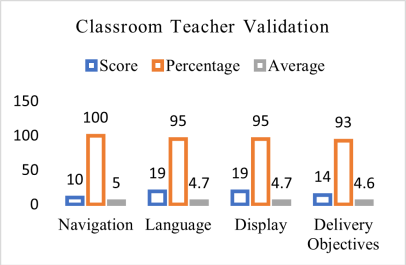


Figure 12 Classroom teacher validation

The navigation aspect has obtained an average score of 5 and 100% in the percentage. Therefore, it is categorized as the "Very Good" category. The language aspect has obtained an average score of 4.7 and 95% in the percentage. Therefore, it is categorized as the "Very Good" category. The display aspect has obtained an average score of 4.7 and 95% in the percentage. Therefore, it is categorized as the "Very Good" category. The aspect of delivery objectives has obtained an average score of 4.6 and 93% in the percentage. Therefore, it is categorized as the "Very Good" category. The total score obtained from media experts is 62, consisting of four assessment aspects. The media expert's average rating is 4.7 and 95.7% the percentage. Therefore, it is categorized as the "Very Good" category.

3.7.4 Product testing

The product testing of PowerPoint-based interactive multimedia products on multiple factors is carried out by delivering a questionnaire to the ten fourth-grade students of Karangtengah Baru, Imogiri Elementary School, and conducted on Tuesday, November 25, 2021. This testing is carried out by asking students to use learning media and providing the statement instrument sheet that consists of ten assessments that students or respondents should fill in. The results show that PowerPoint-based interactive multimedia is included in the "Very Good" category with an average score of 4.7 and a percentage of 94% of 9 questions, and the number of respondents is ten students.

4 Discussion

4.1 Media development

This research is developed through the product planning stage. The stage consists of the potency and problems also data collection. The potency and problems in this study are obtained

from the interviews conducted at SDN Karangtengah Baru Imogiri, Bantul. Based on the interview results conducted by the researcher at SDN Karangtengah Baru Imogiri Bantul, many students still have difficulty understanding abstract mathematics and many symbols. Additionally, the students do not focus on mathematics learning due to their disinterest in the media used by the teacher. On the other side, the teacher emphasizes that in the learning process, the teacher is more dominant in using the conventional method in delivering the materials of multiples and factors due to the absence of interactive learning media that supports the delivery of mathematics learning multiples and factors. In addition, the teacher states that students are not attracted to the learning process. Based on the potency and problems, the researcher needs to develop the PowerPoint learning media operated by fourth-grade students of Karangtengah Baru Imogiri Elementary School. This research is backgrounded by the results of 1) Puspita Ayu Damayanti dan Abdul in 2019. 2) Maria Resti Andriani & wahyudi in 2016. 3) Widya Wijayanti dan Stefanus Christian Relmasira, in 2019. The three studies developed PowerPoint-based interactive media, and both revealed that It could make it easier for students to understand the learning material. This research is strengthened by Sanjaya's (2012) view. Sanjaya (2012) reveals that interactive multimedia is exciting, providing various menu choices that students could use to choose the preferred option and having more variety of material they could understand.

The product development analysis results of this research have been through several stages. The stages consist of product development, preproduction, and production. In the product development stage, the researcher designs the material content and outlines the multiple factors used through a competency map. Furthermore, the researcher creates a multimedia learning framework containing three parts. The parts are namely: opening, content, and closing. In the preproduction stage, the researcher prepares the tools and materials used to create the product. The production stage allows the researcher to arrange the designs selected to be combined and designed in the PowerPoint application. In addition, it is processed by using the iSpring suite application and APK builder. Therefore, it becomes an Android application.

4.2 Media feasibility analysis

The product feasibility analysis is a product feasibility test based on feasibility criteria and product practicality through the material and media experts, teachers, and fourth-grade students at Karangtengah Baru Imogiri Elementary School assessments. The assessment carried out by the validator is guided by the aspects of the existing instrument.

4.3 Material expert product feasibility analysis

The product is tested by material experts based on assessment aspects. The assessments consist of material, appearance, and motivational quality aspects that aim to determine these aspects' shortcomings. In addition, the material test also intends to find errors in the material or content contained in the learning media design. Material expert validators provide input to change the starting point of a multiple of a number, where the multiple of a number starts from its multiple. Material expert validators also give suggestions to improve multimedia sound quality. Based on product validation data from material experts, it is stated that the material made by the researcher is categorized as "Very Good" by obtaining an average score of 4.9 and a percentage of 97%. In conclusion, PowerPoint-based interactive multimedia used in mathematics learning could be excellent in the material.

4.4 Media expert product feasibility analysis

The product is tested by the media experts based on several aspects. The aspects consist of navigation, language, display, and motivational aspects that aim to figure out the shortcomings in these aspects. In addition, the figures given to the students allow students to feel at ease and attract them. Moreover, the media experts provide suggestions and input to revise several material sections. The recommendations are changing image pixels to bigger ones, the uniformizing font used in multimedia, turning off keyboard access, separating the developer menu from the main menu, and providing references. Based on product validation data from media experts, it is stated that the media made by the researcher is categorized as "Very Good" by obtaining an average score of 3.9 and a percentage of 79%. In conclusion, PowerPoint-based interactive multimedia used in mathematics learning could be outstanding in the media.

4.5 Classroom teacher feasibility analysis

The product is tested by the media experts based on several aspects. The aspects consist of navigation, language, display, and motivational aspects that aim to figure out the shortcomings in these aspects. The classroom teacher does not provide suggestions and input regarding the

media and material tested. Based on the materials chosen, the teacher states that the materials are appropriate regarding the essential competencies and indicators. Moreover, the media is categorized as very good. Based on product validation data from material experts, it is stated that the media made by the researcher is categorized as "Very Good" by obtaining an average score of 4.7 and a percentage of 95%. In conclusion, PowerPoint-based interactive multimedia used in mathematics learning could be exquisite in the media.

4.6 Media practical analysis

The product testing is conducted by providing questionnaires to the ten fourth-grade students of Karangtengah Baru Imogiri Elementary School on Tuesday, November 25 2021. Moreover, the students are asked to use PowerPoint-based interactive multimedia learning on multiple factors under direct supervision by the researcher as a multimedia developer. Furthermore, the students are given a statement instrument sheet to assess the multimedia developed by the researcher. This statement consists of nine assessments to fill by students or respondents as the product developed practicality assessments. Based on the product testing of this research is categorized as "Very Good" by obtaining an average score of 4.7 and a percentage of 79% from nine questions, with ten students as respondents. Based on the analysis of validity and practicality above, it is concluded that the product developed is suitable for use in the mathematics learning process. This PowerPoint-based interactive multimedia would make students feel at ease in understanding mathematics learning on multiple factors. This previous statement fits the opinion of Winarko & Zaky (2015). They state that PowerPoint is software used to convey information easily and quickly. Therefore, it would make people feel at ease to understand it.

5 Conclusions and suggestions

This study aims to describe the development of power point-based mathematics learning multimedia and describe PowerPoint-based learning multimedia products in mathematics for fourth-grade elementary school students. Judging from the validity and practicality. Based on the research results, analysis, and discussion, it could be concluded as follows:

First, the development of PowerPoint-based interactive multimedia of mathematics learning multiples and factors materials in the fourth grade of Karangtengah Baru Imogiri Elementary School is learning multimedia designed using the Microsoft Powerpoint program and extracted into the form of an android application. The purpose of developing PowerPoint-based interactive multimedia is to make students feel at ease to understand the learning material presented. This PowerPoint-based interactive multimedia is developed through Research and Development (R&D) using the development stages proposed by Sugiono and have been modified into six stages: 1) Potency and problem, 2) Research and information collecting, 3) Design product, 4) Design validation, 5) Design revision, 6) Product testing.

Second, the feasibility of Powerpoint-based learning multimedia products in mathematics for fourth-grade elementary school students is assessed by material experts, media experts, classroom teachers, and students to get a feasibility assessment that includes the validity and practicality of the product. According to material experts, the feasibility assessment results of PowerPoint-based interactive multimedia of mathematics learning multiples and factors materials in the fourth grade of Karangtengah Baru Imogiri Elementary School are categorized as "Very Good" with an average of 4.9 and a percentage of 97%. The assessment results from media experts are categorized as "Good", with an average of 3.9 and a percentage of 79%. The assessment from the classroom teacher is categorized as "Very Good", with an average of 4.7 and a percentage of 95%. The results of student assessments obtained from filling out questionnaires, Powerpoint-based learning multimedia is categorized as "Very Good" with an average of 4.7 and a percentage of 94%.

In conclusion, the PowerPoint-based interactive multimedia of mathematics learning multiples and factors materials in the fourth grade of Karangtengah Baru Imogiri Elementary School is excellent to apply to mathematics learning material of multiples and factors for fourth-grade Elementary School.

Conflicts of interest

The authors declare that they have no conflict of interest.

References

Andriani, M., & Wahyudi, W. (2016). Development of Interactive Power Point Learning Media through a Scientific Approach to Integrative Thematic Learning for Grade 2 Students of SDN Bergas Kidul 03 Semarang Regency. Scholaria: Journal of Education and Culture, 6(1), 143-157. https://doi.org/10.24246/j.scholaria.2016.v6.i1.p143-157

Asrori, M. A. (2014). Metodologi dan Aplikasi Riset Pendidikan. Jakarta: PT. Bumi Aksara.

Barianos, A. K., Papadakis, A., & Vidakis, N. (2022). Content manager for serious games: Theoretical framework and digital platform. Advances in Mobile Learning Educational Research, 2(1), 251-262. https://doi.org/10.25082/AMLER.2022.01.009

Dahal, N., Manandhar, N., Luitel, L., Luitel, B., Pant, B., & Shrestha, I. (2022). ICT tools for remote teaching and learning mathematics: A proposal for autonomy and engagements. Advances in Mobile Learning Educational Research, 2(1), 289-296. https://doi.org/10.25082/AMLER.2022.01.013

Damayanti, P. A., & Qohar, A. (2019). Pengembangan Media Pembelajaran Matematika Interaktif Berbasis Powerpoint pada Materi Kerucut. Jurnal Matematika Kreative-Inovatif, 10, 119-124. https://doi.org/10.15294/kreano.v10i2.16814

Novitasari, D. (2016). Pengaruh Penggunaan Multimedia Interaktif Terhadap Kemampuan Pemahaman Konsep Matematis Siswa. Jurnal Pendidikan Matematika & Matematika, 2, 10. https://doi.org/10.24853/fbc.2.2.8-18

Fatimah, F. (2009). Fun Math Matematika Asyik Dengan Metode Pemodelan. Bandung: DAR Mizan.

Kalogiannakis, M., & Papadakis, S. (2017). Pre-service kindergarten teachers acceptance of "ScratchJr" as a tool for learning and teaching computational thinking and Science education. In Proceedings of the 12th Conference of the European Science Education Research Association (ESERA), Research, practice and collaboration in science education (pp. 21-25). Dublin: Dublin City University and the University of Limerick.

Grzeszczyk, K. B. (2016). Using Multimedia in The English Language Classroom. Journal-World Scientific News, 132.

Katsaris, I., & Vidakis, N. (2021). Adaptive e-learning systems through learning styles: A review of the literature. Advances in Mobile Learning Educational Research, 1(2), 124-145. https://doi.org/10.25082/AMLER.2021.02.007

Lazarinis, F., Boididis, I., Kozanidis, L., & Kanellopoulos, D. (2022). An adaptable multi-learner serious game for learning cultural heritage. Advances in Mobile Learning Educational Research, 2(1), 201-215. https://doi.org/10.25082/AMLER.2022.01.004

Mamolo, L. A. (2022). Students' evaluation and learning experience on the utilization of Digital Interactive Math Comics (DIMaC) mobile app. Advances in Mobile Learning Educational Research, 2(2), 375-388. https://doi.org/10.25082/AMLER.2022.02.006

Munir, M. (2013). MULTIMEDIA dan Konsep Aplikasi Dalam Pendidikan. Bandung: Alfabeta.

Musfiqon, M.. (2012). Pengembangan Media Belajar Dan Sumber Belajar. Jakarta: Prestasi Pustakakarya.

Papadakis, S. (2020a). Evaluating a game-development approach to teach introductory programming concepts in secondary education. International Journal of Technology Enhanced Learning, 12(2), 127-145. https://doi.org/10.1504/IJTEL.2020.106282

Papadakis, S. (2020b). Tools for evaluating educational apps for young children: a systematic review of the literature. Interactive Technology and Smart Education, 18(1), 18-49.. https://doi.org/10.1108/ITSE-08-2020-0127

Papadakis, S. (2022a). Apps to promote computational thinking concepts and coding skills in children of preschool and pre-primary school age. In Research Anthology on Computational Thinking, Programming, and Robotics in the Classroom (pp. 610-630). IGI Global. https://doi.org/10.4018/978-1-6684-2411-7.ch028

Papadakis, S. (2022b). Apps to Promote Computational Thinking and Coding Skills to Young Age Children: A Pedagogical Challenge for the 21st Century Learners. Educational Process: International Journal, 11(1), 7-13. https://doi.org/10.22521/edupij.2022.111.1

Papadakis, S., & Kalogiannakis, M. (2019). Evaluating a course for teaching introductory programming with Scratch to pre-service kindergarten teachers. International Journal of Technology Enhanced Learning, 11(3), 231-246. https://doi.org/10.1504/IJTEL.2019.100478

Papadakis, S., Trampas, A. M., Barianos, A. K., Kalogiannakis, M., & Vidakis, N. (2020). Evaluating the Learning Process: The "ThimelEdu" Educational Game Case Study. 12th International Conference on Computer Supported Education, 2, 290-298. https://doi.org/10.5220/0009379902900298

Pujiriyanto, P. (2012). Teknologi untuk Pengembangan Media dan Pembelajaran. Yogyakarta: UNY Press.

Rahmansyah, W. (2016). Pengembangan Multimedia Pembelajaran Interaktif. Jurnal Ilmiah Edutic, 3, 3 https://doi.org/10.21107/edutic.v3i1.2558

Rusman, D. (2013). Metodologi Penelitian Kualitatif. Jakarta: Rajawali Pers.

Sanjaya, W. (2012). Strategi Pembelajaran Berorientasi Standar Proses Pendidikan. Jakarta: Kencana.

Sugiono, P. J. A. (2009). Metodologi Penelitian Kualitatif dan R&D. Bandung: Alfabeta.

Sugiono, P. J. A. (2014). Metodologi Penelitian Kualitatif dan R&D. Bandung: Alfabeta.

Sugiono, P. J. A. (2016). Metode Penelitian Kuantitatif Kualitatif dan R&D. Bandung: Alfabeta.

Suhendri, H., & Rahmawati, E.. (2016). Pengembangan Desain Pembelajaran Matematika Siswa Sekolah Dasar Kelas 6. Jurnal Formatif, 6, 186. https://doi.org/10.30998/formatif.v6i3.991

Tsoukala, C. (2021). STEM integrated education and multimodal educational material. Advances in Mobile Learning Educational Research, 1(2), 96-113. https://doi.org/10.25082/AMLER.2021.02.005

Widoyoko, E. P. (2009). Evaluasi Program Pembelajaran (panduan praktis bagi calon pendidik dan calon pendidik). Yogyakarta: Pustaka Pelajar.

Widoyoko, E. P. (2014). Teknik Penyusunan Instrumen Penelitian. Yogyakarta: Pustaka Pelajar.

Wijayanti, W., & Relmasira, S. C. (2019). Pengembangan Media PowerPoint IPA Untuk Siswa Kelas IV SD Negeri Samirono. Jurnal Penelitian dan Pengembangan Pendidikan, 3, 77-83. https://doi.org/10.23887/jppp.v3i2.17381

Winarko, E., & Zaky, A. (2015). Grafik dan Animasi Profesional Powerpoint. Jakarta: Alex Media Komputindo.