



Developing Interactive Multimedia with The Instructional Games Model for Water Cycle Materials for Fifth Graders

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Abstract

The research purpose was to develop and determine feasibility of interactive multimedia instructional game model. The research method used *R&D* with *4D* stages. The research was conducted grade V in SD NEGERI 3 Batudaa Kabupaten Gorontalo Provinsi Gorontalo. The result was average score of 91% from media design experts was very feasible criteria, the material experts obtained an average of 85% was very feasible criteria and the practitioner experts obtained an average of 98% was very feasible criteria. Based on this, the interactive multimedia *instructional games* model was suitable for use for grade V in water cycle concept.

Keywords

Instructional games model, interactive multimedia

Abstrak

Tujuan penelitian adalah untuk mengembangkan dan menentukan kelayakan model permainan pembelajaran multimedia interaktif. Metode penelitian menggunakan R&D dengan tahapan 4D. Penelitian dilakukan di kelas V di SD NEGERI 3 Batudaa Kabupaten Gorontalo Provinsi Gorontalo. Hasil rata-rata skor 91% dari ahli desain media diperoleh kriteria sangat layak, ahli materi memperoleh rata-rata 85% kriteria sangat layak dan ahli praktisi memperoleh rata-rata 98% kriteria sangat layak. Berdasarkan hal tersebut, model permainan pembelajaran multimedia interaktif ini cocok digunakan untuk siswa kelas V pada konsep siklus air.

Kata Kunci

Model instructional games, multimedia interaktif

Introduction

The current development of science and technology demands teachers to be more creative in the classroom learning process. Ample applications useful in the learning process also give opportunities to teachers. They can choose applications which are congenial to school conditions, class conditions, student development conditions, and suitability to materials. Within the applications, there is interactive multimedia technology which integrates several media to overcome learning process issues, including misconceptions in understanding science learning concepts, and augment student learning outcomes, especially in science learning materials. Students can also be more active in learning activities if using interactive multimedia. It will elevate their learning outcomes, in terms of either cognitive, affective, or psychomotor aspects. Some advantages of interactive multimedia are (1) teaching-learning activities develop to be more interactive and communicative, (2) teachers are required to and can be creative and innovative, (3) students are more motivated in teaching-learning activities, (4) materials can be delivered more clearly, and (5) students learning independence is more honed (Munir, 2012). Additionally, (Kusumawati, 2021) argues that interactive multimedia can (1) deliver learning materials more clearly, (2) enhance student competencies, (3) motivate students, and (4) allow students to self-determine materials to learn using navigating buttons. Interactive multimedia hence positively affects student learning motivation (Brečka, 2016).

Data from an initial observation of fifth graders at SD Negeri 3 Batudaa in September 2021 showed abstract science learning materials. For example, there was a lack of the use of interactive multimedia-based technology-based learning media, bringing about less attractive science learning, specifically water cycle materials for students. The learning cycle was around paying attention to teachers who would write the materials on a board, deliver the materials, and instruct students to do exercises from the exercise book. The materials, which were only

delivered using a lecturing method and non-modern technology-based media, made students less interested and allegedly experience difficulties in understanding them. In addition, teachers merely transferred materials from learning books to students, lowering student learning activity and boring students. It also brought on poor implications for student learning outcomes. Learning media at present, therefore, should not use simple instruments only but also specific applications as they grow more modern. It will develop student learning interests.

Learning science materials using interactive multimedia-based media thus is expected to enhance student learning outcomes, especially in science learning materials. Interactive multimedia enables users to interact. Used in learning activities, they can escalate efficiency and motivation. They can also facilitate active learning and experimental learning and heighten consistency. Besides, they help teachers to hold student-centered learning. Previous research proves that applying interactive multimedia can have a significant and effective impact on the classroom learning process (Kahfi, 2021).

Interactive multimedia has some models. We use one of them in this research, i.e., instructional games. The instructional games model uses interactive multimedia with a computer-based system to provide a learning atmosphere or facility which can improve student competencies. The model does not imitate a real-life object but defines its characteristics to students (Kurniawati, 2018)

Many researchers have carried out development research on interactive multimedia at different education levels with different learning materials. Among the researchers are (Octaria, 2017), (Sintya. Y., 2020), and (Dwiranata, 2019). We offer a dissimilarity in this research, namely in terms of the education level, materials, research area, and results. Our research, entitled Developing Interactive Multimedia with the Instructional Games Model for Water Cycle Materials for Fifth Graders, is different from previous research, particularly in terms of materials and the research area.

Method

The research area was SD Negeri 3 Batudaa, Gorontalo District, Gorontalo Province. The method was research and development using the 4D model (Sugiyono, 2018). And yet, we solely adopted three out of four stages from the 4D model, i.e., Define, Design, and Develop, because of time constraints. The developed interactive multimedia in this research were interactive multimedia with the instructional games model containing water cycle materials for fifth graders. Five experts were engaged: (1) media experts, Dr. Rustam Husain, S.Ag., M.Pd., and Dr. Candra Cuga, M.Pd., (2) material experts, Rifda Mardian Arif, M.Pd. and Dr. Irvin N. Arifin, S.Pd., M.Pd., and (3) a practitioner expert, Arianti D. Datau, S.Pd., to ensure the product validity.

Data were analyzed for their validity levels after the validation process. Data should fulfill either “Irreliable”, “Reliable”, or “Very Reliable” criteria in line with the determined percentage. We also provide comment sections to be filled out by validators in reasonable agreement with the evaluation conducted. We executed a revision after acquiring suggestions or recommendations from expert validators. The developed interactive multimedia with the instructional games model could be tested after being revised. Figure 1 demonstrates our research stages.

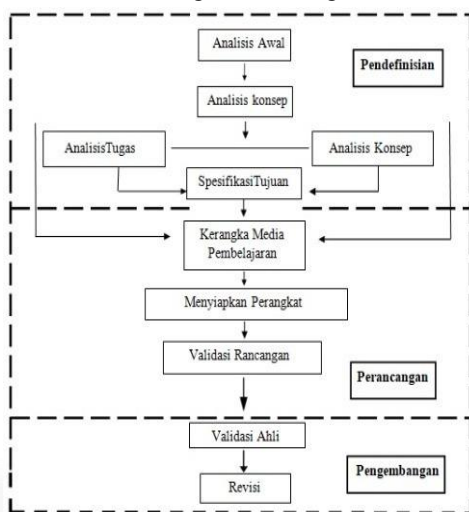


Figure 1. Research Design

Results and Discussion

Results

1. Define

The define stage was performed to identify or determine the problems we noticed from the observation. Steps undertaken in this stage covered (1) student need analysis, (2) student task analysis, and (3) goal specification.

2. Design Stage

We prepared several devices, i.e., interactive multimedia with the instructional-games model, in this stage. We used Adobe Animate CC 2018 to design the interactive multimedia. The application helped us design the media, images, animations, and appearances, including the background color of the interactive multimedia with the instructional games model.

This stage brought on the initial design of instructional games model-based interactive multimedia learning media. A validity test by experts was carried out after we implemented the conceptual design of the instructional games-based interactive multimedia. The initial designs of the instructional games-based interactive multimedia for science subject materials, especially water cycle, for fifth graders, comprised (1) the initial appearance of the interactive multimedia, (2) the main menu, (3) basic competencies, (5) the material menu, (6) the evaluation menu, and (7) the profile menu.

3. Develop

This stage was the end stage of this research. Validators, either material or media design experts, conducted a validity test of the instructional games model-based interactive multimedia. Each validator evaluated the developed interactive multimedia.

Validation by media experts was executed to evaluate the media we developed. The media design validators were Dr. Rustam Husain, S.Ag., M.Pd. and Dr. Candra Cuga, M.Pd. as the comparing validator. The results of the media design validation are exhibited in table 1.

Table 1
 The Results of Media Design Validation

No.	Assessed Indicator	Acquired Score	
		Media Expert	Comparing Media Expert
1	Layout design	7	7
2	Test/typography	11	9
3	Image	11	11
4	Animation	8	8
5	Audio	8	5
6	Video	8	8
7	Packaging	4	4
Total		57	52
Percentage		95%	87%
Mean Percentage		91%	

Validation by material experts was performed to evaluate the interactive multimedia we developed. The evaluation targets were curriculum content, users, materials, and test items in the interactive multimedia. The material expert validators were Rifda Mardian Arif, M.Pd. and Dr. Irvin N. Arifin, S.Pd., M.Pd. as the comparing material expert validator. The results of the material expert validator are indicated in table 2.

Table 2
 The Results of Material Expert Validators

No.	Assessed Indicators	Acquired Score	
		Material Expert	Comparing Material Expert
1	Curriculum content	10	11
2	User	14	14
3	Introductory lesson	7	8
4	Core	26	31
5	Test item	18	21
Total		75	85
Percentage		78%	88%
Mean Percentage		85%	

The practitioner validation was undertaken to evaluate the media we developed. The validator carrying out the practitioner validation was the fifth-grade homeroom teacher, Arianti D. Datau, S.Pd. The practitioner validation results are pointed out in Table 3.

Table 3
Practitioner Validation Results

No.	Assessed Indicator	Acquired Score
1	Layout design	8
2	Test/typography	12
3	Image	11
4	Animation	8
5	Audio	8
6	Video	8
7	Packaging	4
Total		59
Percentage		98.3%

The validation was conducted by some experts, namely media design experts, material experts, and a practitioner expert on the instructional games model-based interactive multimedia. The validation results based on the media design experts' evaluation categorized the multimedia as "very reliable". The validation results grounded on the material experts' evaluation categorized the multimedia as "reliable". Table 4 contains a more detailed explanation.

Table 4
The Recapitulated Results of Experts Validation

No.	Validator	Score	Validation Results	
			Percentage	Category
1	Media experts	54.5	91%	Very reliable
2	Material experts	83	85%	Reliable
3	Practitioner expert	59	98.3%	Very reliable

Experts' comments and suggestions were considered references for developing final products to engender quality interactive multimedia. Table 5 presents the comments and suggestions given to the instructional games model-based interactive multimedia.

Table 5
Comments or Suggestions from Media Expert Designs

No.	Comment or Suggestion	Revision
1	Place the topic images by keeping pace with the discussed topic.	Fixing the position of the images in each topic on pace with the discussed topic.
2	Provide an award/certificate at the end of the evaluation.	Providing an award/certificate at the end of the evaluation.
3	Make the writings attractive and suitable for children ages.	Making the writings provided attractive and suitable for children ages.
4	Consider the audio selection.	Selecting suitable audio for elementary school students.

Table 6
Comments or Suggestions from Material Experts

No.	Comments or Suggestions	Revision
1	LTP indicators are not yet included in the application	Including LTP in the application
2	KD must be complete with Skill 4	Completing KD with Skill 4
3	Give numbers to materials presented	Giving numbers to materials presented
4	Provide exemplary images in each material	Providing exemplary images in each material
5	Exercises must represent HOTS, at least C4-C6	Making the exercise represent HOTS, at least C4-C6
6	Pay attention to student preparedness before delivering materials	Improving the core activity section in the media



Table 7

Comments or Suggestions from the Practitioner Expert

No.	Comment or Suggestion	Revision
1	Add images to each material	Adding images to each material

Discussion

We developed these media using the R&D method with the 4D model, consisting of define, design, develop, and disseminate stages (Sugiyono, Metode Penelitian Kuantitatif, Kualitatif dan R&D, 2020). However, we only carried out to the develop stage. The research products were instructional games model-based interactive multimedia for water cycle materials for fifth graders.

Development research on interactive multimed had been conducted by other researchers who focused on different education levels or learning materials. Among the researchers were (Octaria, 2017), (Sintya. Y., 2020), and (Dwiranata, 2019). Other researcher concerned about the use of multimedia in learning were (Gunawan, 2015), (Ilmiani, 2020), and (Meirza, 2019). Their research addressed multimedia implementation in learning, increases in student learning outcomes, increases in student learning activities, and solutions to materials which were difficult to understand. It was executed at several education levels and focused on different learning materials. This research offered some differences from the research process and results of the previous ones. The differences encompassed the target education level, materials, and interactive multimedia focusing on instructional games.

Developing Interactive Multimedia with The Instructional Games Model for Water Cycle Materials for Fifth Graders

We performed a student need analysis to identify classroom issues and interviewed the fifth-grade homeroom teacher in the define stage. A task analysis was then undertaken following the student need analysis. The task analysis aimed to observe the learning process to acquire a description of the developed product design. This analysis made researchers efficiently design interactive multimedia with the instructional games model for water cycle materials for fifth graders. We carried out a goal specification analysis after completing the task analysis. The goal specification analysis aimed to identify the reliability of interactive multimedia with the instructional games model. The reliability analysis was conducted pursuant to expert validation results. The validation aimed to identify if the developed media were reliable and could be tested in an elementary school.

The design stage was the second stage we executed in this development research. The objective of this design stage was to design interactive multimedia. Nevertheless, the media generated in this stage were temporary. That was, they were not the final products of the developed media. The media were made using Adobe Animate CC 2018. The application was selected as it could be used to design HTML animations, animation advertisement media, animation videos, learning media, web-version games, and others.

The media design process took three months to complete. The target materials in this design stage were science ones, especially water cycle materials for fifth graders. They were packed in the form of interactive multimedia with the instructional games model. The target materials covered the definition of the water cycle, types of water cycle, water cycle processes, human activity effects on water, and the uses of water for living creatures. Two basic competencies (KD) used were KD 3.8. Analyzing the water cycle and its impacts on phenomena on the Earth and creatures' sustainability and KD 4.8. Making a work of the water cycle scheme predicated on information from a range of sources.

The Reliability of the Developed Interactive Multimedia with the Instructional Games Model for Water Cycle Materials for Fifth Graders

The develop stage was the final stage of this research. Experts validation and comments on the initial media design generated from the design stage were used to develop our interactive multimedia. The developed interactive multimedia focused on water cycle materials for fifth graders. The validation was carried out by media design experts, who were Dr. Rustam Husain, M.Pd. and Dr. Candra Cuga, M.Pd. as the comparing media expert validator; material experts, who were Rifda Mardian Arif, S.Pd., M.Pd. and Dr. Irfin N. Arifin, M.Pd. as the comparing material expert, and a practitioner expert, who was Ariyanti D. Datau, S.Pd.

Dr. Rustam I. Husain, M.Pd. conducted media design validation on March 22nd, 2022. The results demonstrated that the developed interactive multimedia was very reliable. He gave several comments and suggestions, e.g., "Place the topic images by keeping pace with the discussed topic", "Provide an award/certificate

in the end of the evaluation”, and “Make the writings attractive and suitable for children ages”. Those suggestions were used to revise the interactive multimedia, and the results had been confirmed by the media design experts. The comparing media expert, Dr. Candra Cuga, M.Pd. also executed validation on the developed interactive multimedia and gave a very-reliable criterion. He gave several inputs related to the appropriateness of audio or background selection and the selection of texts or typography which could attract students when using the multimedia.

In addition to validation by media design experts, it was also conducted by material experts. Rifda Mardian Arif, S.Pd., M.Pd. undertook the validation on March 22nd, 2022. The results categorized the developed interactive multimedia as reliable. Notwithstanding the category, there were some suggestions or comments the material expert delivered: “LTP indicators were not yet included in the application”, “KD had to be complete with Skill 4”, “Give numbers to the material presentation”, “Provide exemplary images in each material”, and “Exercises should represent HOTS, at least C4-C6”. The suggestions or comments were used to revise the interactive multimedia, and the revised version had been confirmed by the material expert. Dr. Irvin N. Arifin, S.Pd., M.Pd., as the comparing material expert, also carried out validation. He categorized the interactive multimedia as very reliable with an input, i.e., “Pay attention to student preparedness before delivering materials”.

Another validation was carried out by the practitioner expert, Ariyanti D. Datau, S.Pd., on March 28th, 2022. The validation results categorized the interactive multimedia as very reliable. She gave a suggestion to add images to each material. We revised our multimedia products based on it, and the result had been confirmed by the practitioner expert.

We revised our products grounded on the given suggestions or comments. The revised interactive multimedia included several additional menus, e.g., an apperception which became the opening of the material delivery session. There was also a certificate feature which would give an award to students who could complete the evaluation exercise.

The developed interactive multimedia focused on water cycle materials for fifth graders. Materials included covered the definition, uses, processes, and types of water cycle. On the grounds of the validation results, the developed interactive multimedia acquired scores of 57 (95%) and 52 (87%) from the media design expert and the comparing media expert, respectively, giving off a mean percentage of 91%. The percentage exhibited that the interactive multimedia had a very reliable criterion. Furthermore, the material design expert and the comparing material design expert gave scores of 75 (78%) and 88 (88), inducing a mean percentage of 85%. The percentage indicated that our interactive multimedia had a reliable criterion. Finally, the practitioner expert gave the interactive multimedia we developed a score of 59%, hence the percentage was 98.3%, categorizing the multimedia as very reliable.

The scores given by experts pointed out that our instructional games model-based interactive multimedia for water cycle materials for fifth graders were very reliable and reliable to use in elementary schools, particularly for the fifth grade. We improved our multimedia products on the grounds of suggestions delivered by experts, either media design experts, material experts, or practitioners, and all experts confirmed the revised products.

Conclusion

1. We developed instructional-games-based interactive multimedia for water cycle materials for fifth graders in the define and design stages. We analyzed data from the selected school and interviewed the fifth-grade homeroom teacher in those stages. We also executed a student need analysis and produced the interactive multimedia. The developed interactive multimedia products contained the materials, uses, and types of water cycle packaged in the form of interactive multimedia attractive for students to learn. We also provided an evaluation, i.e., a multiple-choice exercise, students had to answer. The results would be automatically presented through our interactive multimedia.
2. The develop stage was performed to identify the reliability of the interactive multimedia we designed to be validated by experts. The media design expert and the comparing one gave a score of 54.5, hence the percentage was 91%, categorizing the multimedia as very reliable. The material expert and the comparing one gave a score of 83, hence the percentage was 85%, categorizing the multimedia as reliable. Finally, the practitioner expert and the comparing one gave a score of 59, hence the percentage was 98%, categorizing the multimedia as very



reliable. The scores, therefore, showed that this instructional-games-based interactive multimedia for water cycle materials for fifth graders was reliable.

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