Indonesian Science Education Research
(ISER)
Available online https://jurnal.unimed.ac.id/2012/index.php/iser
ISSN Online: 2715-4653

DEVELOPMENT OF STEM EXPERIMENT VIDEO FOR SCIENCE LEARNING: A MOVABLE CHANDELIER

Hayatul Qorryati, Arief Muttaqiin*
Department of Science Education, Universitas Negeri Padang

*muttaqiin.a@fmipa.unp.ac.id

Accepted: June 13th, 2023. Published: July 31th, 2023

Abstract

This research aimed to produce a valid and practical experimental Video Movable Chandelier on Energy Matters in Living Systems (VMC). This experimental video is equipped with STEM elements and several critical thinking questions. The method used in this research is the development of the Plomp model, which consists of three stages, namely preliminary research, prototyping stage, and assessment phase. This research is limited to two stages which up to the stage of prototype formation. The instrument used was a questionnaire in the form of validity sheets and practicality sheets. The video validity test was carried out by three science education lecturers from FMIPA UNP, while the video practicality test was carried out by a science teacher from SMPN 15 Padang. The results of the validity test of the experimental video showed an average Kappa moment (k) value of 0.92 which was included in the very high category, while the results of the practicality test at the one to one evaluation and small group evaluation stages of the experimental video showed an average Kappa Moment value (k) of 0.90 and 0.94 with very high category as well. With the VMC it can help teachers carry out practicums on Energy Material in Living Systems both at school and at home as additional learning media and train students' abilities to think critically.

Keywords: Science Experiment Video, STEM, *Critical Thinking*, Energy in the Life System.

Introduction

For the development of a country, education is a very important pillar. Indonesia must improve and improve the quality of education, not only seek education that can only be accessed by every citizen. Determining the quality of human resources that have a reciprocal relationship with the civilization of Indonesian citizens in the future is one way to improve the quality of education in Indonesia (Arifa & Prayitno, 2019). In the 21st century, quality human resources are urgently needed in all respects (Mardhiyah et al., 2021).

21st century learning is defined as learning that imparts 21st century skills to students, namely 4C skills which consist of: Communication, Collaboration, Critical thinking and problem solving, Creativity and innovation. Learning requires that students have intelligence in solving a problem which is one of the characteristics of 21st century learning (Aji, 2019). Therefore, it is necessary to apply learning that leads to critical thinking skills so that students' abilities are encouraged to find a way out of a problem.

Natural Science Education (IPA) is knowledge obtained through observation, data collection in experiments, and conclusions in order to obtain an explanation regarding a phenomenon (Indriati, 2012). In science learning activities, students must be given the opportunity to develop their abilities, one of which is by thinking critically. Critical thinking is very important to be applied in making decisions when faced with several choices for students. Therefore, the learning process needs to be carried out and chosen properly and correctly, namely by using the help of learning media. Learning media are all things that can be used to provide information on learning activities so that they can stimulate students' interest and attention in learning (Arsyad, 2007). In addition to learning media, the application of STEM (Science, Technology, Engineering, and Mathematics) in the learning process can also develop students' abilities. STEM was formed to develop various 21st century skills that can be used in all areas of daily needs, one of which is critical thinking (Buckner & Boyd, 2015). The application of STEM learning makes students more able to find solutions to a problem in the real world if it is applied in a good way and designed in the right learning.

Critical thinking is the ability to make decisions on problems faced by thinking rationally (Firdaus et al., 2019). Students must have the ability to think critically in a structured, full of curiosity, be able to analyze problems, think independently, use logic as a basis for thinking, use logic as a basis for thinking, and dare to make decisions and stick to the steps set. (Karim & Normaya, 2015). To apply the potential for critical thinking, students also need a high interest in learning.

Based on observations made of science teachers at SMP N 15 Padang, information can be found that the school uses the 2013 curriculum (K-13). In science learning activities in the material Energy in Living Systems, the teacher uses lecture, discussion, and practicum methods. The concept of teaching and learning implemented in schools is not fully effective because there is still a lack of students' understanding of the concept of Energy in Living Systems which results in students not being able to get used to critical thinking skills optimally.

The results of other observations are that during learning activities, teachers use learning media such as books, PPT, and videos. Video learning media that have been used include videos explaining natural science material but learning media such as science experiment videos that can familiarize students' critical thinking skills have never been used in the learning process. In 21st century learning students are required to think critically, but the media to support 21st century learning still needs to be enriched/updated. Therefore, a science experiment video is really needed, especially on the material Energy in Living Systems as an additional medium when practicums are carried out in schools. Learning to use video media is very practical to use because it can be reviewed anywhere and anytime. In addition, video-based learning media is effectively used in learning activities independently or in groups by students (Daryanto, 2016).

The development of the Movable Chandelier experimental video on Energy Matters in Living Systems equipped with a STEM approach and several critical thinking questions (hereinafter referred to as VMC) was carried out as an effort to overcome existing problems. By using this VMC, it is hoped that it will be easier for students to understand the concepts in the material presented in Energy in Living Systems. Then, with the VMC it can help students to learn independently at home and can train their ability to think critically.

Research Method

In this study, the type of research used is development research. Development research is research that forms a product by researching, designing, manufacturing, and testing its validity (Sugiyono, 2013). For the development model used in this study, namely the development of the Plomp model. The development of the Plomp model was chosen because at each step its activities can be adapted to the flexible characteristics of the research (Rochmad, 2012). There are three steps to developing the Plomp model, including the preliminary research stage, the prototyping stage, and the assessment phase. This research is limited to two stages, namely until the prototype formation stage.

The initial investigation phase was carried out with several analyzes including needs analysis, curriculum analysis, student analysis, and concept analysis. At the prototyping stage, a design is carried out based on formative evaluation (done repeatedly) according to Tessmer. The video validity test was carried out by experts, namely three science education lecturers at FMIPA UNP, while the video practicality test was carried out by science teachers at SMPN 15 Padang. The form of the instrument used at the initial investigation stage and the prototype formation stage is in the form of a questionnaire. The data obtained is then processed on the score obtained using the following Kappa Cohen formula.

$$Moment\ Kappa\ (k) = \frac{P_O - P_e}{1 - P_e}$$

Information:
K = Kappa moment that shows the validity and practicality of the product
Po = Proportion implemented
Pe = Unrealized proportion

After processing the results of the kappa moment obtained, then the average kappa moment is calculated and the values in the validity and practicality categories are interpreted based on the kappa moment presented in Table 1 below.

Table 1 Validity and Practicality Categories Based on Moment Kappa (k)

Intervals	Category
0,81-1,00	Very high
0,61-0,80	High
0,40-0,60	Moderate
0,21-0,40	Low
0,01-0,20	Very low
0,00	Invalid/ impractical

(Boslaugh & Watters, 2008)

Result and Discussion

This research uses the type of development research that generate a Movable Chandelier experimental video equipped with a STEM approach and several critical thinking questions, hereinafter referred to as VMC. The development model used is the Plomp model, which consists of three stages, namely the preliminary research stage, the prototyping stage, and the assessment phase (Plomp & Nienke, 2013). This research is limited to two stages, namely until the prototype formation stage.

Preliminary Research Stage

In the initial investigation stage several analyzes were carried out needed in developing the VMC, namely needs analysis, curriculum analysis, student analysis, and concept analysis. Needs analysis is carried out through observation and interviews to find out the difficulties or obstacles encountered by teachers and students when carrying out practical activities on learning Energy in Living Systems.

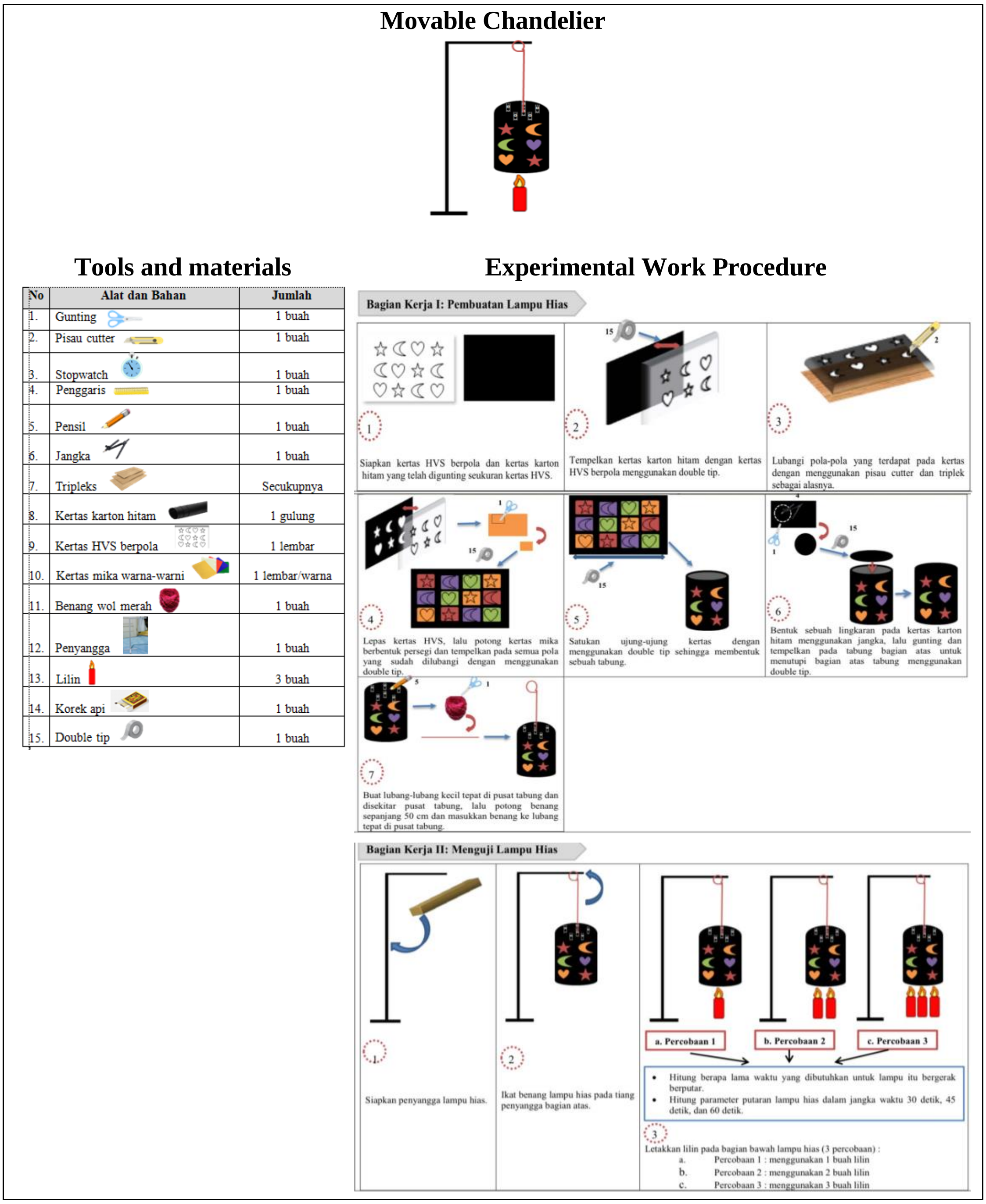
Based on the results of an interview with one of the science subject teachers, problems were found at school, namely in science learning activities in the material Energy in Living Systems, the teacher used lecture, discussion, and practicum methods. The concept of teaching and learning implemented in schools is not fully effective because there is still a lack of students' understanding of the concept of Energy in Living Systems which results in students not being able to get used to critical thinking skills optimally. To overcome this, teachers must be prepared to make updates in using appropriate learning methods (Febriani, 2017). In addition, during the learning process, the teacher uses learning media such as books, PPT, and videos. Video learning media that have been used include videos explaining natural science material, but learning media such as science experiment videos that can familiarize students' critical thinking skills have never been used in the learning process.

Curriculum analysis is carried out by discussing the curriculum used in schools, Basic Competencies (KD), Core Competencies (KI), indicators, materials, and learning process activities in class to achieve learning goals. The material on Energy in Living Systems is found in the Science syllabus for Class VII Curriculum 2013 in KD 3.5 and 4.5.

Student analysis was carried out by giving questionnaires to 13 students to seek information on VMC needs. Based on the data obtained, there are students who experience difficulties in understanding the concepts of Energy in Living Systems which result in not being optimal in familiarizing students' critical thinking skills. In addition, video learning media has been used in the learning process such as videos explaining natural science material, but learning media such as science experimental videos that can familiarize students' critical thinking skills have never been used in the learning process.

Concept analysis is carried out so that it can be used as a reference in the development of VMC. The results of the concept analysis are choosing three materials to be discussed in the VMC including the concept of energy, forms of energy, and changes in forms of energy. The success of students learning science can be seen from well-organized learning materials, which results in the learning process also going well (Widiantono, 2017).

Based on the results of the analysis above, developing video-based learning media can be used as a way out to overcome the problems encountered by students. The video developed is in the form of a Movable Chandelier experimental video contained in the material Energy in Living Systems, especially the material Changes in Forms of Energy which can be seen in Figure 1. In the developed VMC, there are elements of STEM (Science, Technology, Engineering, Mathematics) whose distribution can be seen in Table 2. In addition, the video that was developed also contained several students' critical thinking questions. Critical thinking indicators that are used when making several critical thinking questions are indicators according to Ennis (2011) which can be seen in Table 3.



No	Alat dan Bahan	Jumlah
1.	Gunting	1 buah
2.	Pisau cutter	1 buah
3.	Stopwatch	1 buah
4.	Penggaris	1 buah
5.	Pensil	1 buah
6.	Jangka	1 buah
7.	Tripleks	Secukupnya
8.	Kertas karton hitam	1 gulung
9.	Kertas HVS berpola	1 lembar
10.	Kertas mika warna-warni	1 lembar/warna
11.	Benang wol merah	1 buah
12.	Penyangga	1 buah
13.	Lilin	3 buah
14.	Korek api	1 buah
15.	Double tip	1 buah

Figure 1. Work Procedure for the Movable Chandelier Experiment

Table 2. Elements of STEM

No.	Elements of STEM	Application to Video
1.	*Science*	• The Movable Chandelier Experiment is an application of Energy material in Class VII Life Systems Semester 1 • Movable Chandelier utilizes heat energy from candles to move decorative lights.
2.	*Technology*	• Using search engines to find literature. • Watch videos from youtube. • Using the camera for video production.

No.	Elements of STEM	Application to Video
3.	*Engineering*	• Designing the manufacture of decorative lights. • Testing decorative lights.
4.	*Mathematics*	• Count how long it takes for the lamp to move around. • Calculating decorative lamp rotation parameters in 30 seconds, 45 seconds, and 60 seconds.

Table 3. Examples of Questions with Critical Thinking Aspects Ennis (2011)

No.	Aspects of Critical Thinking	Pertanyaan Berpikir Kritis
1.	*Basic Support*	Does the position between the decorative lamp and the candle affect the speed at which the decorative lamp starts to rotate?
2.	*Advanced Clarification*	Why does the number of candles used in decorative lights affect the time when the lights start rotating?
3.	*Strategy And Tactics*	If we use white paper to make the decorative lights, will the result be the same as using black paper?

Prototyping Stage

The next stage in developing a VMC is the establishment of a prototyping stage. Prototype formation is carried out based on formative evaluation (done repeatedly) (Tessmer, 1993). The results of each prototype at this stage are described as follows:

Prototyping Stage I

After carrying out the initial investigation at the Preliminary Research stage, it will produce Prototype I, namely in the form of a VMC. This video was made using the Adobe Premier Pro editing application. In the video there are several components contained in it, namely: video opening, STEM elements, experimental objectives, introductory material, tools and materials, sketches of work procedures, experimental activities, tables of observations, answers to questions, conclusions, and closing. Examples of video component displays can be referred to in Figure 2 and Figure 3.

Figure 2. Display of Experimental Activities

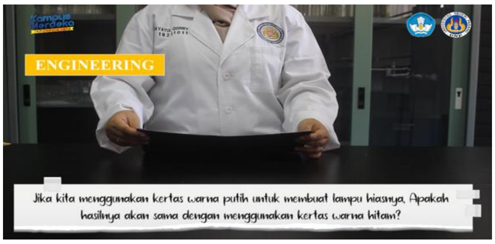


Figure 3. Display of Critical Thinking Questions

Prototyping Stage II

After prototype I is produced, a self-evaluation will then be carried out to produce prototype II. The activity carried out is to re-check the components that must be in the VMC by using a checklist. There are 8 aspects that must be in the video, namely clarity of material or message conveyed (material clarity), stand alone, familiar with users (user friendly), representation of content, visualization with media, can be used classically or individually, aspects of critical thinking, and STEM. Based on its own evaluation, the results obtained were that prototype I already had all the aspects that must be in the video, but there were slight revisions such as typos, dubbing sound that did not match the question, and an untidy layout. The revised results of the evaluation phase itself produced prototype II.

Prototyping Stage III

After producing prototype II, an expert review was then carried out to test the validity of the developed science experiment videos. If there is a revision on prototype II, it will produce prototype III. Prototype II was validated by three validators, namely the Science Education lecturer at FMIPA UNP. The results of data analysis from the video validity test for all aspects can be referred to in Figure 4.

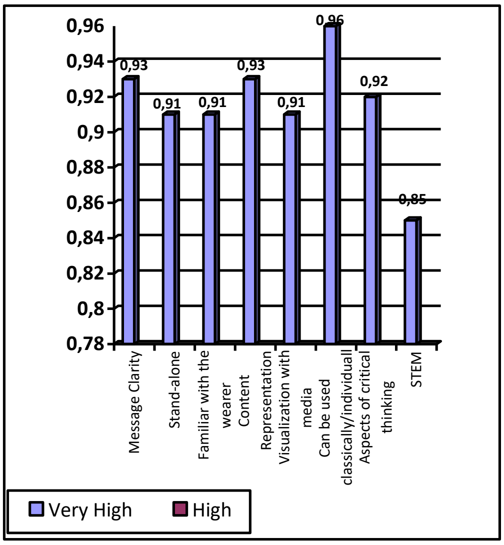


Figure 4. Accumulation of Validity Test Values at the Expert Review Stage

The validator's assessment of the material clarity aspect has an average kappa moment of 0.93, which means it has a very high category. This shows that the video developed has very high clarity, both in terms of sound, articulation, provided text, and instructions for carrying out the experiment. Learning material is easier for students to understand when using simple language (Jailani, 2018).

The validator's assessment of the stand-alone aspect has an average kappa moment of 0.91, which means it has a very high category. This shows that the developed VMC can be used without assistance from other learning media because it includes introductory material, work procedures, and critical thinking questions so that students can more easily carry out their experiments. Learning video media presents learning messages such as concepts, principles, or procedures to help students understand a material (Riyana, 2007).

The validator's assessment of the user friendly aspect has an average kappa moment of 0.91, which means it has a very high category. This shows that the developed VMC uses words that are in line with students' understanding and communicative language. Good learning media is able to stimulate the mind and encourage the learning process, such as media that is easily understood and used by students (Ekayani, 2017).

The validator's assessment of the aspect of content representation has an average kappa moment of 0.93, which means it has a very high category. The aspect of content representation that is assessed is material that is in line with the learning objectives that have been formulated, the sequence of delivery of material is logical and sequential, and the material presented in the video is appropriate and relevant to the learning needs of students. To build the integrity of the concept at the level of students' thinking, there must be compatibility between the material and KD, indicators, and learning objectives that can affect the information conveyed (Widyastuti et al., 2021).

The validator's assessment of the visualization aspect with media has an average kappa moment of 0.91 with a very high category. This shows that the developed VMC is attractive, educating, and stimulates students to think critically. Animations displayed in videos can also add interest and clarity to video content and have good video quality with high resolution. The development of learning videos must look at the attractiveness aspect of designing a video to increase students' interest in the learning process (Mutia et al., 2017).

The validator's assessment of aspects that can be used classically or individually has an average kappa moment of 0.96 with a very high category. This shows that the developed VMC can be used jointly by students in the classroom with the help of projectors and loudspeakers. The developed VMC can also be used individually by students using cellphones. As a learning medium, video is effectively used for the learning process either independently or in groups (Daryanto, 2016).

The validator's assessment of the critical thinking aspect has an average kappa moment of 0.92 with a very high category.

This shows that the critical thinking questions contained in the video have been made based on indicators of critical thinking skills according to Ennis. Critical thinking questions are given when the experimental activity is in progress. it aims to train students' ability to think critically. In order to be able to compete in the world of work, students need to be trained to think critically (Ritonga & Zulkarnain, 2021).

The validator's assessment of the STEM aspect has an average kappa moment of 0.85, which means it has a very high category. This shows that the VMC developed already has a STEM approach consisting of science, technology, engineering, and mathematics components. The STEM aspects in the video are expected to develop students' critical thinking skills and foster an understanding of interdisciplinary relationships in STEM. The application of STEM elements in videos can develop problem-solving skills that occur in real life (Ritonga & Zulkarnain, 2021).

The average kappa moment (k) obtained from the validity test that has been obtained from the three validators for the science experiment videos developed is 0.92 with a very high category. The results of the validity test that was carried out on three validators obtained input and suggestions for revision actions. The results of this revision will produce prototype III. After prototype III, it will then proceed to the practicality test stage.

Prototyping Stage IV

After producing prototype III, a one-to-one evaluation was then carried out to test the practicality of the developed VMC. Three science teachers at SMPN 15 Padang contributed to this test. The results of data analysis from one-to-one evaluation for the video practicality test can be seen in Figure 5.

The ease of use component of the VMC in the one-to-one evaluation obtained an average kappa moment of 0.92, which means it has a very high category. This explains that the VMC that has been developed is in line with the provisions, namely the narrator's voice is heard clearly and the articulation is clear, the contents of the material presented as a whole are easily understood by students, the VMC instructions are easy to understand, the language used in the video is communicative, the video can be used over and over again and can be used anywhere. Improving student learning outcomes can be referred to the use of learning media that can be played repeatedly which affects student learning activities (Deputra, 2017). However, on the aspect of ease of use of VMC, suggestions for revision actions were obtained.

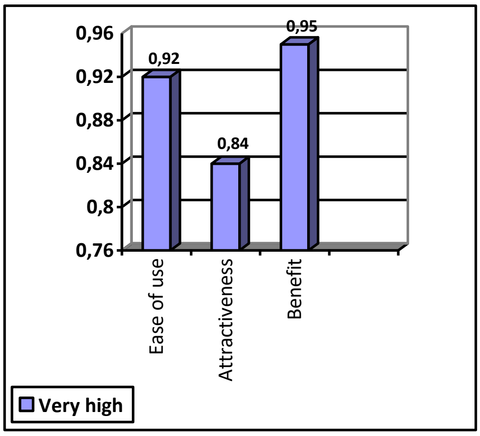


Figure 5. Accumulated Practicality Test Values in the One to One Evaluation Stage

The attractiveness aspect of VMC in the one-to-one evaluation obtained an average kappa moment of 0.84, which means it has a very high category. This explains that the VMC that has been developed is presented in an attractive way and the animation that is displayed is relevant to the material. To be able to influence student learning outcomes so that students become interested in participating in the learning process, they must observe how the learning messages are formed as attractive as possible (Febriani, 2017).

The VMC benefit aspect in the one-to-one evaluation obtained an average kappa moment of 0.95, which means it has a very high category. This explains that the VMC that has been developed is useful for students in understanding the concept of energy in living systems. The potential of students who are low in understanding concepts can be overcome by using learning video media (Sudiarta & Sadra, 2016). The videos developed are also useful for increasing the enthusiasm and curiosity of students and making learning activities fun. Learning by using video media can provide a pleasant atmosphere and keep students' attention focused on videos that contain information about learning material (Supryadi et al., 2013).

Based on the practicality test at the one-to-one evaluation stage, the average for all aspects was 0.90 with a very high category. At this one-on-one evaluation stage, suggestions are obtained that revision action will be carried out. The revised result of prototype III will produce Prototype IV.

Prototyping Stage V

After prototype IV was produced, a small group evaluation was then carried out to carry out a practicality test of the developed VMC. Small group evaluation (small group evaluation) is carried out by the science teacher in small groups of 5 people. The results of data analysis from small group evaluations for video practicality tests can be seen in Figure 6.

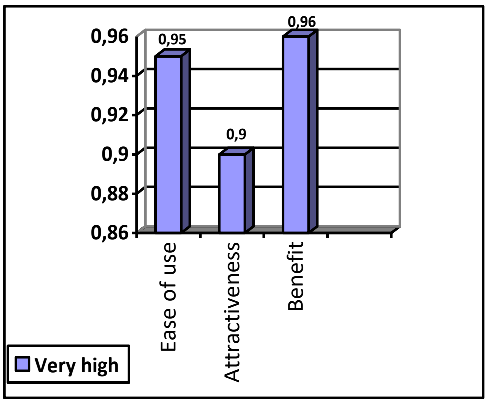


Figure 6. Accumulation of Practicality Test Values in the Small Group Evaluation Stage

Based on the practicality test at the small group evaluation stage, the average for all aspects was 0.94 with a very high category. The aspect of ease of use has an average kappa moment (k) of 0.95, which means it has a very high category. The attractiveness aspect has an average kappa moment (k) of 0.90 with a very high category. And, the benefit aspect has an average kappa moment (k) of 0.96, which means it has a very high category. At this small group evaluation stage, suggestions were obtained that revision action would be carried out. The revised result of prototype IV will produce Prototype V.

Conclusion

After the VMC has been developed, it can be concluded that the VMC validated by experts has an average kappa moment (k) with a very high level of validity. The practicality of VMC was tested on science teachers through two stages, namely the one to one evaluation and small group evaluation stages, which had an average kappa moment (k) with a very high practicality level category. The existence of VMC results in being able to assist teachers in carrying out practicums on Energy Materials in Living Systems both at school and at home as additional learning media and training students' abilities to think critically.

Reference

Aji, M. Q. W. (2019). Mengembangkan Kecakapan Abad 21 Mahasiswa Melalui Model Pembelajaran Inkuiri. *Teknodika*, *17* (2), 70. https://doi.org/10. 20961 /teknodika. v17i2.35281

Arifa, F. N., & Prayitno, U. S. (2019). Peningkatan Kualitas Pendidikan: Program Pendidikan Profesi Guru Prajabatan dalam Pemenuhan Kebutuhan Guru Profesional di Indonesia. *Aspirasi: Jurnal Masalah-Masalah Sosial*, *10*(1), 1–17.https://doi.org/10.46807/aspirasi.v 1 0i1.1229

Arsyad, A. (2007). *Media Pembelajaran*. Jakarta: PT Raja Grafindo Persada.

Boslaugh, S., & Watters, P. A. (2008). *Statistics in A Mutshell, A Desktop Quick Reference*. Beijing, “Cambridge Famham, Koln, Sebastopol, Taipe. Tokyo O” Reilly.

Buckner, T., & Boyd, B. (2015). *STEM Leadership: How do I create a STEM culture in my school?*. VA: ASCD.

Daryanto. (2016). *Media Pembelajaran Edisi 2 Revisi*. Yogyakarta: Gava Media.

Deputra, F. Y. (2017). Pengaruh Penggunaan Animasi Macromedia Flash Berbasis Ispring Suite Terhadap Aktivitas Dan Hasil Belajar Ipa Kelas VIII di SMPN 1 Kotagajah pada Materi Sistem Pencernaan. *BIOEDUKASI (Jurnal Pendidikan Biologi)*, *8*(2), 134. https://doi.org/10.24127/bioedukasi.v8i2.1070

Ekayani, P. (2017). Pentingnya Penggunaan Media Pembelajaran Untuk Meningkatkan Prestasi Belajar Siswa. *Jurnal Fakultas Ilmu Pendidikan Ganesha Singaraja*, 2(1), 1–16.

Ennis, R. H. (2011). The Nature of Critical Thinking : An Outline of Evaluating Mastery and Dispositions and Abilities. *Informal Logic*, 6(2), 1-8.

Febriani, C. (2017). Pengaruh Media Video terhadap Motivasi Belajar dan Hasil Belajar Kognitif Pembelajaran IPA Kelas V Sekolah Dasar. *Jurnal Prima Edukasia*, *5*(1), 11–21. https://doi.org/10.21831/jpe.v5i1.8461

Firdaus, A., Nisa, L. C., & Nadhifah, N. (2019). Kemampuan Berpikir Kritis Siswa pada Materi Barisan dan Deret Berdasarkan Gaya Berpikir. *Kreano, Jurnal Matematika Kreatif-Inovatif*, *10*(1), 68–77. https://doi.org/10.15294/kreano.v10i1.17822

Indriati, D. (2012). Meningkatkan Hasil Belajar IPA Konsep Cahaya Melalui Pembelajaran Science-Edutainment Berbantuan Media Animasi. *Jurnal Pendidikan IPA Indonesia*, *1*(2), 192–197. https://doi.org/10.15294/jpii.v1i2.2138

Jailani, M. S. (2018). Perkembangan Bahasa Anak dan Implikasinya dalam Pembelajaran. *Innovatio: Journal for religious-Innovation studies*, 18(1). https://doi.org/10.30631/innovatio.v18i1.36

Karim, K., & Normaya, N. (2015). Kemampuan Berpikir Kritis Siswa dalam Pembelajaran dalam Pembelajaran Matematika dengan Menggunakan Model Jucama di Sekolah Menengah Pertama. *EDU-MAT: Jurnal Pendidikan Matematika*, *3*(1). https://doi.org/10.20527/edumat.v3i1.634

Mardhiyah, R. H., Aldriani, S. N. F., Chitta, F., & Zulfikar, M. R. (2021). Pentingnya Keterampilan Belajar di Abad 21 sebagai Tuntutan dalam Pengembangan Sumber Daya Manusia. *Lectura: Jurnal Pendidikan*, 12(1). https://doi.org/10.31849/lectura.v12i1.5813

Martin, T. (1993). *Planning and Conducting Formative Evaluations: Improving The Quality of Education and Training*. London: Kogan Page.

Mutia, R., Adlim, A., & Halim, A. (2017). Pengembangan Video Pembelajaran Ipa Pada Materi Pencemaran Dan Kerusakan Lingkungan. *Jurnal Pendidikan Sains Indonesia*, *5*(2), 108–114. https://doi.org/10.24815/jpsi. v5i2.9825

Plomp, Tjeerd dan Nienke Nieveen. (2013). *"Educational Design Research : An Introduction", dalam An Introduction to Educational Research.* Enschede, Netherland : National Institue for Curriculum Development.

Ritonga, S., & Zulkarnain, Z. (2021). Penerapan Pendekatan STEM untuk Meningkatkan Keterampilan Berpikir Kritis Peserta Didik. *Jurnal Studi Guru Dan Pembelajaran*, *4*(1), 75–81. https://doi.org/10.30605/jsgp.4.1.2021519

Riyana, C. (2007). *Pedoman Pengembangan Media Video*. Jakarta: P3AI UPI.

Rochmad. (2012). Desain Model Pengembangan Perangkat Pembelajaran Matematika. *Kreano: Jurnal Matematika Kreatif-Inovatif, 3*(1), 59–72. https://doi.org/10.15294/kreano.v3i1.2613

Sudiarta, I. G. P. & Sadra I. P. 2016. Pengaruh Model Blended Learning berbantuan Video Animasi tehadap Kemampuan Pemecahan Masalah dan Pemahaman Konsep Siswa. *Jurnal Pendidikan dan Pengajaran*, 49 (2): 48-58. https://doi.org/10.23887/jppundiksha.v49i2.9009

Sugiyono. (2013). *Metode Penelitian Pendidikan : Pendekatan Kuantitatif, Kualitatif, dan R&D.* Bandung: Alfabeta.

Supryadi, P. E., Jampel, I. N., & Riastini, P. N. (2013). Penerapan Media Video Pembelajaran sebagai Aplikasi Pendekatan Contekstual Teaching Learning untuk Meningkatkan Hasil Belajar IPA Siswa Kelas V. *Mimbar PGSD Undiksha*, *1*(1), 1–10. https://doi.org/10.23887/jjpgsd.v1i1.1492

Widiantono, N. (2017). Penerapan Model Pembelajaran Interaktif untuk Meningkatkan Aktivitas dan Hasil Belajar IPA Siswa Kelas 5 SD. *Scholaria: Jurnal Pendidikan Dan Kebudayaan*, *7*(3), 199. https://doi.org/10.24246/j.scholaria.2017.v7.i3.p199-213

Widyastuti, N., Riswandi., & Helmy Fitriawan. (2021). Pengembangan video pembelajaran berbasis advance organizer pada materi ikatan kimia. *Cakrawala: Jurnal pendidikan*, 15(1), 54-63.https://doi.org/10.24905/cakrawala.v15i1.11