EDUHUMANIORA: Jurnal Pendidikan Dasar

Journal homepage: https://ejournal.upi.edu/index.php/eduhumaniora/

Development of Construct 3-Based Education Game STEM Pedia SiAr for Learning Science Material of Water Cycle in Grade V Elementary School

*Eva Fauziyah[1] *, Eliya Rochmah[2], Erna Labudsari[3]*

[1,2,3] Fakultas Keguruan dan Ilmu Pendidikan, Universitas Muhammadiyah Cirebon, Indonesian

*Correspondence: E-mail: evafauziyah21@gmail.com

ABSTRACT

The rapid development of technology in the 21st century has an impact on the field of education. One of them requires teachers to continue to innovate and create learning media. In the learning process, there are still many teachers who have not used digital media or are integrated with technology, thus affecting students' understanding of the concept of science in the water cycle material. This research purpose is to develop science educational game learning media, namely STEM Pedia SiAr based on Construct 3. This research uses a method of Research and development model from Borg and Gall. The results of this research are: 1) This research produces education game learning media products for grade V elementary school that focus on science material of water cycle using Construct 3 software; 2) The results of the media expert test get an average score of 94.90% with very decent criteria. While the results of the material expert test get an average score of 98.07% with very feasible criteria.

ARTICLE INFO

Article History:
Submitted/Received 10 Jun 2023
First Revised 11 Sep 2023
Accepted 24 Nov 2023
First Available online 03 Jan 2024
Publication Date 03 Jan 2024

Keyword:
Application,
Elementary school,
Learning motivation,
Quizziz application.

1. INTRODUCTION

The progress of the times has had a huge impact on all areas of human life, including the field of education. In this 21st century, education is sought to be able to form a learning system designed to balance the progress of the times with the aim that students have 21st-century skills known as 4C skills, namely creativity, critical thinking, collaboration, and communication. 21st century skills are one of the needs of individuals in the era of technological and information advances (Septikasari, R., & Frasandy, 2018).

The development of 4C skills can be through a learning process, one of which is in Natural Science subjects. Science learning focuses on the research process because science learning can improve students' thinking processes to understand natural phenomena (Rosnaeni, 2021). It can be understood that the science learning process prioritizes research and problem-solving. The results of the PISA in 2018 stated that Indonesia was ranked 73rd out of 78 countries that took the test with an average score of 483 (Masfufah & Afriansyah, 2021).

Improving 4C skills and science literacy can also be done through the application of learning with a STEM (science technology, engineering, and mathematics) approach (Triana et al., 2020). This STEM approach combines four disciplines to support students' problem-solving skills and knowledge. The STEM approach is also in line with the 21st century learning process which places students as the center of learning or also called the student center. The STEM approach focused by researchers in science learning that will be used as research is on science, engineering, and technology. According to Permanasari (2016), the application of science is found in many technological products. Some findings suggest that science learning in the context of technology and design can improve science literacy. STEM learning is one of the alternatives that can be chosen in scientific learning that can build a generation that is ready to face the challenges of the 21st century (Novianti et al., 2023).

In education, technology has an important role in supporting the learning process. In line with what Rosyad said in Muhsin (2022), science without technology has no fruit, and technology without science has no root. Therefore, to support the improvement of students' science literacy, one of them can be done by making or developing technology products, such as learning media. Teachers have a strategic role to improve student achievement through the learning process (Rochmah et al., 2018). Teachers must have the skills to use communication tools or means available at school and not rule out the possibility of these communication tools or tools developing according to the demands of the times. More and more varieties of learning media are emerging in the era of increasingly sophisticated technology (Diwi, 2023). Technology has changed the teaching and learning process from a conventional to a learning process that is integrated with technology (Rochmah et al., 2018). This requires teachers to be able to utilize technology and choose the media used in classroom learning.

Based on the results of observations made by researchers at SDSI Al Farabi, the implementation of the learning process of science concepts, has not been carried out optimally on several science process skills, one of which is predicting and measuring/trying. In addition, some classes still do not use learning media that are integrated with technology optimally. So teachers tend to convey information orally with the lecture method. This can be done as an effort to develop the potential of elementary school students in the era of digital disruption, namely through the

DOI: https://doi.org/10.17509/xxxxx
p- ISSN 2085-1243 e- ISSN 2579-5457

introduction of technology and the use of appropriate information technology media in classroom learning so that students not only have to master science but also master technology (Labudasari & Rochmah, 2022). Learning technology grows and develops to solve learning problems or facilitate learning activities (Ismail, 2020).

Based on these problems, researchers want to develop learning media products in the form of educational games through a STEM approach made using Construct 3. This is because students at the elementary level need concrete media and are fun in understanding the material (Suda, 2016). Concrete and fun media will support better learning (Falahudin, 2014). Researchers hope to be an alternative problem-solving in the learning process in the classroom.

The purpose of this study is to produce a science learning media called STEM Pedia SiAr based on construct 3, as well as to determine the feasibility of game products and to determine the response of teachers and students to learning media. The benefit of this research is that it is a solution or alternative to the use of learning media by teachers, to create interesting, effective, and fun learning in learning.

2. METHODS

This research uses a method of Research and development model from Borg and Gall. The steps to develop Borg & Gall are research and information collecting, planning, development of the product, validation / preliminary field testing, main product revision, main field testing, revision, field trial, revision, and dissemination (Sugiono, 2017). This research method is limited to the limited trial stage. The steps are (1) Research and data collection in the form of student observation related to science learning and learning media, (2) Planning in the form of needs analysis needed in the development of learning media such as some software and hardware to be used, (3) Product development in the form of making game-based learning media starting from the preparation of media design and collection of necessary assets, (4) validation / preliminary field testing in the form of testing experts who are experts in their fields, namely related media experts and material experts, (5) main product revision in the form of improvements or refinements from the results of testing by experts, and (6) main field testing in the form of limited implementation of educational game learning media for elementary school students. Research stages are described in **Figure 1**.

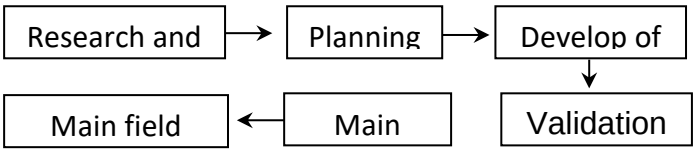


Figure 1. Research stages

DOI: https://doi.org/10.17509/eh.v15i1.47299
p- ISSN 2085-1243 e- ISSN 2579-5457

2.1. Research and information collecting

The first stage is a needs analysis in the development of learning media according to student characteristics, then conducting a literature review, and analyzing what are the problems, so there needs to be the development of new learning media that can be used as media in learning. The data collection used is through observation.

2.2 Planning

The preparation of research plans that will be carried out in the development of educational game learning media includes the collection of tools and materials that will be used in developing learning media, making shells, designing, and preparing materials.

2.3 Develop product

This stage creates an initial framework of models, flowcharts, and tools needed in the development of educational game learning media, such as making initial designs, model frameworks, game storyboard flows, and data collection tools used namely validation sheets and questionnaires needed to collect assessment data from experts. The use case diagram is shown in **Figure 2** below.

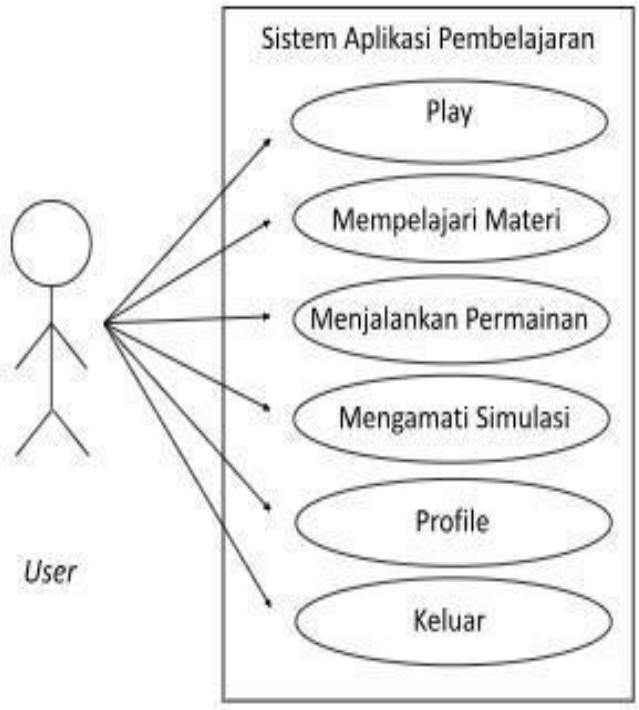


Figure 2. Use case diagram

This learning media displays 4 buttons on the initial menu, namely button play, instructions, profiles, and information. The play button is useful for users to enter the main learning menu. Where users can choose 3 main menus, namely the material, game, and project menus. If the user selects the material menu section, then the system will bring up the Water Cycle learning material. Likewise, the other menus will bring the user to the selected option. The designed activity diagram is shown in **Figure 3**.

DOI: https://doi.org/10.17509/xxxxx
p- ISSN 2085-1243 e- ISSN 2579-5457

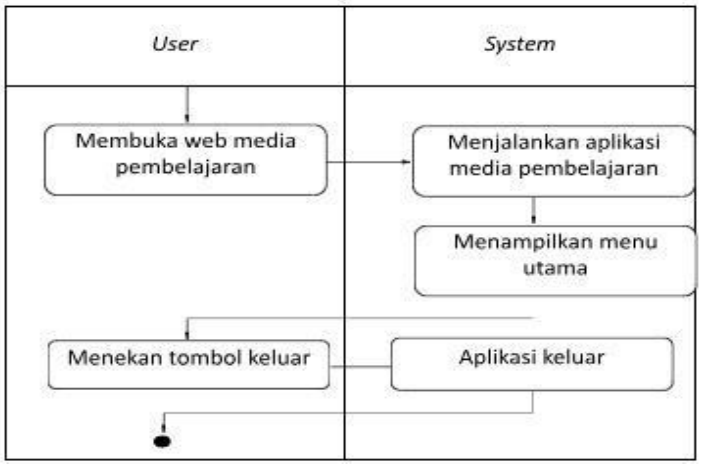


Figure 3. Activity diagram

The activity diagram on the start page is that the user will open and run the learning media of the STEM Pedia SiAr educational game on the web that has been provided, then the system will display the initial menu display. When the user selects the play menu, the user can select the menu including materials, games, and projects. Furthermore, if the user presses the back button, the system will redirect back to the previous menu.

2.4. Validation / Preliminary field testing

Perform product validation by experts who are experts in their fields. The test was conducted by 6 validators consisting of 3 media expert validators, namely 2 lecturers of the University of Muhammadiyah Cirebon and 1 teacher, and 3 material expert validators, namely 2 lecturers of the University of Muhammadiyah Cirebon and 1 teacher. Testing is carried out by providing an assessment of the learning media that has been made in the form of questionnaires and then analyzed. This is done to determine the feasibility of the developed product.

The data collection technique used in this study was using questionnaires. The research instruments used were product feasibility questionnaire sheets (media experts and material experts) and user response questionnaire sheets (teachers and students). The data analysis technique used in this study is using qualitative and quantitative data analysis. Analysis of product feasibility data is used to determine the feasibility of media and material from experts using the Likert scale. The **Table 1** following are product feasibility assessment guidelines.

Table 1. Assessment guidelines

Score	Assessment
4	Very good
3	Good
2	Enough
1	Less

(Source: Iklimah, 2017)

The data obtained from the questionnaire is then calculated using the Sugiyono formula (Ngatmanto, 2022), below.

DOI: https://doi.org/10.17509/eh.v15i1.47299
p- ISSN 2085-1243 e- ISSN 2579-5457

$$Persentase\ kelayakan\ (\%) = \frac{skor\ yang\ diperoleh}{skor\ kriteria}\ x\ 100\%$$

Criteria score the following **Table 2** is the percentage of eligibility criteria for learning media.

Table 2. Eligibility criteria

Persentase	Criteria
81% - 100%	Very Eligible
61% - 80%	Eligible
41% - 60%	Decent Enough
21% - 40%	Less Eligible
0% - 20%	Not Feasible

(Source: Ngatmanto, 2022)

2.5. Main product revision

The revision of the main product is carried out based on the results of validation from experts. This step aims to improve, or refine the initial validation/field test results based on suggested validation results.

2.6. Main field testing

Product trials are limited to one group of students. The number of respondents used was 22 respondents. The quantitative data from the respondents produced is then processed and results will be obtained related to the participants' responses.

3. RESULTS AND DISCUSSION

3.1. Product Development

The resulting product development is an educational game learning media application called STEM Pedia SiAr, which was developed using Construct 3 software. The development of this learning media product is developed by the process and stages of development through a series of validations from material experts and media experts to obtain product feasibility data and as a reference for product revision. The development of learning media made by researchers is an educational game development that focuses on the scope of education aimed at improving students' abilities, providing motivation and interest in learning students in learning materials. Wibawanto (2018) said an educational game is a game that contains learning material and is intended to improve students' ability to learn the material so that students get new experiences such as feelings of pleasure which in the end is that the learning material delivered can be received easily by students. Based on this theory, the results show that students are very interested in a game. This is what the author uses to make an educational game for learning. So that this interest causes a sense of fun, motivation, and enthusiasm for learning students in carrying out learning using the learning media of the Pedia SiAr STEM educational game developed by researchers.

The learning media developed by researchers focuses on science subjects with the main material being about the water cycle for class V elementary school which is technology-based. As stated by Muhsin (2022) "*Science without technology has no fruit, technology without science has no root*". The use of technology in learning, especially in science learning can support fun and fun learning activities. Based on the theory, the results show that students have an interest in technology. So that when the STEM Pedia SiAr learning media is implemented, students are very enthusiastic about participating in learning. This learning

DOI: https://doi.org/10.17509/xxxxx
p- ISSN 2085-1243 e- ISSN 2579-5457

media is presented by combining material, audio, video, and projects tailored to student's learning styles, be it visual, auditory, or kinesthetic. In this application, there are 3 main menus, namely the material, game, and project menus. It aims to facilitate students in learning and understanding material about the water cycle.

The result of the program created through Construct 3 is shown below.

Figure 4 shows the initial menu display on Pedia SiAr's STEM learning media. Inside there are play buttons, hint buttons, profile buttons, information buttons, music buttons, and exit buttons.

Figure 4. Start Menu Display

Figure 5 is the display of the profile menu. It contains information about the developer's name, email, agency, and social media of the product creator.

Figure 5. Profile view

Figure 6 is what the application instructions menu looks like. Inside there is information on the steps to use the application and also button information used in the application.

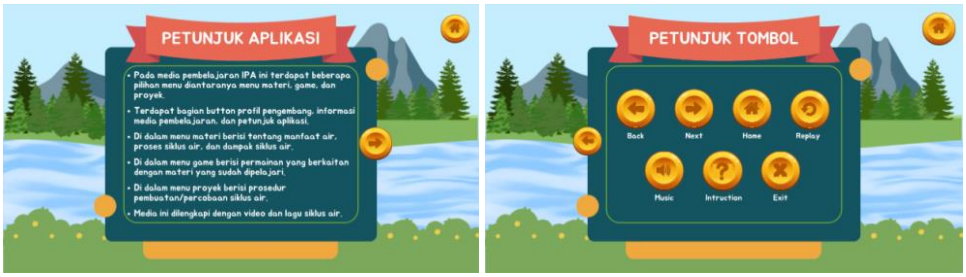


Figure 6. Application Guide Display

Figure 7 shows the game information menu. It contains information about the name of the game, the type of game, the software maker, and a brief description of the application.

DOI: https://doi.org/10.17509/eh.v15i1.47299
p- ISSN 2085-1243 e- ISSN 2579-5457

Figure 7. Game Information Display

Figure 8 is the main menu display. Inside there are menu options that can be selected by the user to play the application. Among them, there is a menu of materials, games, and projects. The material menu is used by users to learn or gain knowledge about the water cycle. While on the game menu, users can play games related to the material. And finally, there is the project menu, which is a menu that contains experiments and the final project in studying this material. On the main menu display, there are also basic competencies and objectives.

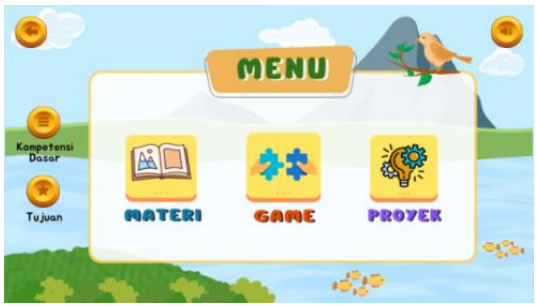


Figure 8. Main Menu Display

Figure 9 is the material menu display and material display. In it, there is a selection of materials that can be studied by users, namely the water cycle, water fungi, and the impact of the water cycle. There are also water cycle videos and songs to support users in understanding the material further. In the material display, it contains an explanation of materials related to the water cycle.

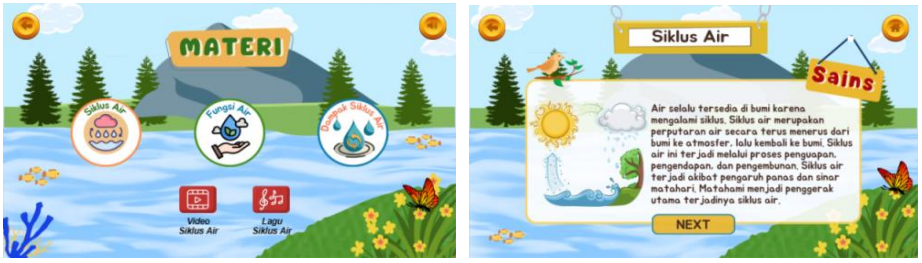


Figure 9. Material Menu Display

Figure 10 shows what the game hint menu looks like. It contains information on how to use each game available.

DOI: https://doi.org/10.17509/xxxxx
p- ISSN 2085-1243 e- ISSN 2579-5457

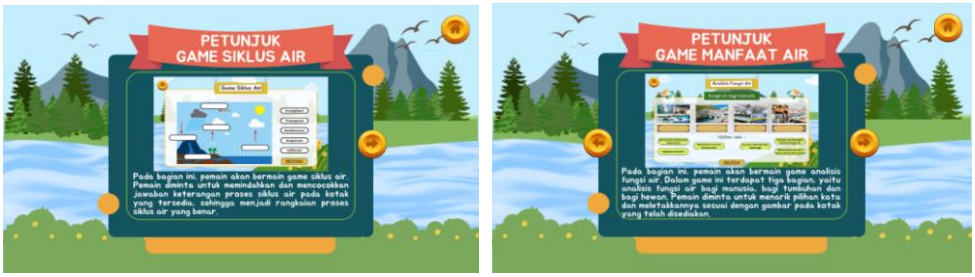
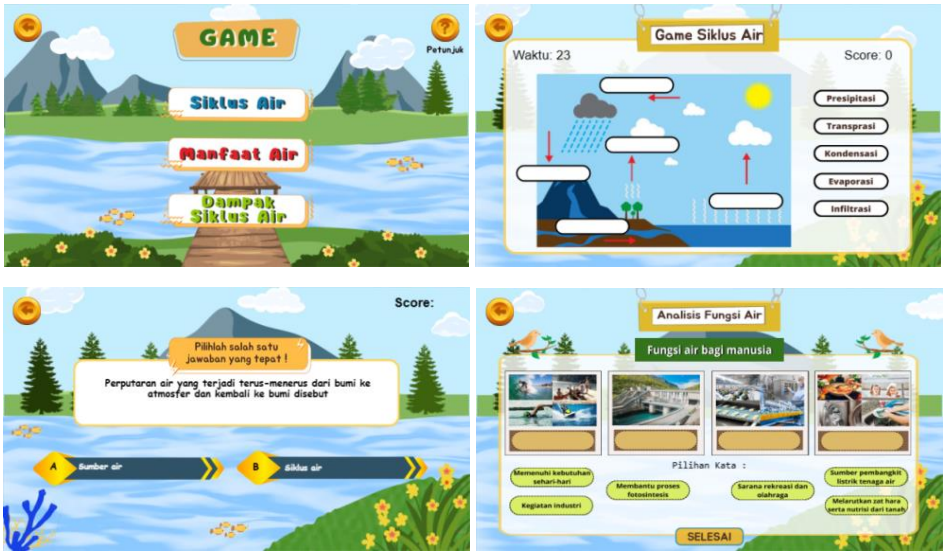


Figure 10. Game Hints Menu Display

Figure 11 shows what the game menu looks like. Inside there are 3 games that can be played by users, namely water cycle games, water function games, and water cycle impact games.



3.2. Product Eligibility

The validity test of material experts and media experts aims to determine the feasibility of the media created. The following are the results of the questionnaire assessment from 3 media expert validators in **Tabel 3**.

Table 3. Media Expert Assessment Results

Assessment	Aspek				Percentage	Criteria
	Efficiency	Display	Technical Quality	Software		
Media Expert 1	12	29	11	14	91,66%	Very Eligible
Media Expert 2	12	31	12	16	98,61%	Very Eligible
Media Expert 3	12	28	12	16	94,44%	Very Eligible
Total	**36**	**88**	**35**	**46**	**94,90%**	**Very Eligible**

Table 3 above shows the results of the media expert assessment consisting of aspects of efficiency, appearance, technical quality, and software. Based on the results of obtaining assessments from media experts, the percentage is 94.90% and with very feasible criteria with the assessment "Worthy of use with revisions", namely adding buttons, improving questions, and adding intros or introductions, and providing comments, learning media can

DOI: https://doi.org/10.17509/eh.v15i1.47299
p- ISSN 2085-1243 e- ISSN 2579-5457

be used in science learning in grade 5. Meanwhile, the results of the material expert assessment are in **Table 4**.

Table 4. Material Expert Assessment Results

Penilaian	Learning Aspects	Content Aspect	Percentage	Criteria
Material Expert 1	23	28	98,07%	Very Eligible
Material Expert 2	23	27	96,15%	Very Eligible
Material Expert 3	24	28	100%	Very Eligible
Jumlah	**70**	**83**	**98,07%**	**Very Eligible**

Table 4 above shows the results of the expert assessment of the material consisting of learning aspects and content aspects. Based on the results of obtaining assessments from material experts, a percentage of 98.07% was obtained, including very feasible criteria with the assessment "Worthy of use with revisions", namely the addition of degree elements to learning objectives, and by providing comments so far is good.

Based on the results of feasibility testing from media experts and material experts, the results are by previous research conducted by Ramansyah (2016) that the learning process using educational game learning media can create active and fun learning, and can help students understand learning. Saputro et al., (2018) said that the learning media of the construct 2-based educational game platform affects the understanding of concepts and student learning outcomes. In line with this, Permanasari (2016) said that STEM-based learning is one of the potential alternatives for building 21st-century skills. Through the use of digital media, it can also apply digital literacy. Rochmah et al., (2022) added that digital literacy is one of the competencies obtained to compile knowledge and collect information obtained from various sources of information.

4. CONCLUSION

Based on the results of research conducted by researchers, it can be concluded that this development produces application products, namely learning media under the name STEM Pedia SiAr. This learning media aims to develop learning media that is integrated with technology so that it can help increase students' understanding of the concept of water cycle science. The developed media obtained an assessment from media experts with a percentage of 94.90% included in the very feasible criteria. The score obtained from material experts with a percentage of 98.07% is included in the very decent category. Therefore, the learning media of this STEM Pedia SiAr educational game is very feasible to be used in the science learning process in grade 5 as a supporting learning media in grade V. From the results of the research that has been done, researchers hope that this STEM Pedia SiAr learning media can help teachers and students in the implementation of learning and teaching. The researcher also suggested that further researchers be able to develop other technology-based learning media so that they can be used as learning resources, digital literacy, and inspiration to make more varied innovations.

5. REFERENCES

Diwi, M. A. (2023). Pentingnya Media Teknologi Dalam Komunikasi Pada Era Revolusi Industri 4.0. *Pentingnya Ilmu Komunikasi Pada Era 4.0: Bunga Rampai*, 100.

Falahudin, I. (2014). Pemanfaatan media dalam pembelajaran. *Jurnal Lingkar Widyaiswara*,

DOI: https://doi.org/10.17509/xxxxx
p- ISSN 2085-1243 e- ISSN 2579-5457

1(4), 104-117.

Iklimah, M. (2017). Pengembangan Media Pembelajaran Interaktif Dengan Menggunakan Software Construct 2 Pada Mata Pelajaran Elektronika Dasar Di Smk Negeri 1 Sidoarjo. *Jurnal Pendidikan Teknik Elektro*, *7*(1), 57–63.

Ismail, I. (2020). *Teknologi Pembelajaran Sebagai Media Pembelajaran*. Cendekia Publisher.

Labudasari, E., & Rochmah, E. (2022). *Pendampingan Penyusunan Media Pembelajaran Daring Berbasis Digital Bagi Kkg Gugus 3 Kecamatan Harjamukti Kota Cirebon*. 9–15.

Masfufah, R., & Afriansyah, E. A. (2021). Analisis Kemampuan Literasi Matematis Siswa melalui Soal PISA. *10*, 291–300.

Muhsin, M. A. (2022). Korelasi Sains Dan Teknologi Dalam Studi Islam. *Risalah*, *8*(2).

Ngatmanto. (2022). Pengembangan Media Pembelajaran Berbasis Game Edukasi Dengan Construct 2 Materi Operasi Bilangan Pecahan Untuk Kelas 6 SD.

Novianti, B. A., Nitiasih, P. K., & Riastini, P. N. (2023). Study Of STEM-Based Learning Against 4C Skills (Critical, Creative, Communication, and Collaboration) In Science. *Jurnal Ilmiah Profesi Pendidikan*, *8*(3), 1917-1921.

Permanasari, A. (2016). STEM education: Inovasi dalam pembelajaran sains. *Seminar Nasional Pendidikan Sains "Peningkatan Kualitas Pembelajaran Sains dan Kompetensi Guru Melalui Penelitian & Pengembangan dalam Menghadapi Tantangan Abad-21" Surakarta, 22 Oktober 2016*, 23–34.

Ramansyah, W. (2016). Pengembangan Education Game (Edugame) Berbasis Android Pada Mata Pelajaran Bahasa Inggris untuk Peserta Didik Sekolah Dasar. *Edutic - Scientific Journal of Informatics Education*, *2*(1), 1–9.

Rochmah, E., Abdulmajid, N. W., Cirebon, U. M., Pendidikan, U., & Kampus, I. (2018). *Membangun virtual classroom melalui social learning networks (SLNS) 1*.

Rochmah, E., Labudasari, E., & Hastuti, S. S. (2022). Development of Digital-Based Covid-19 Mitigation Media (Misimicotin) for Elementary Schools. *EduHumaniora | Jurnal Pendidikan Dasar Kampus Cibiru*, *14*(1), 103–112.

Rosnaeni, R. (2021). Karakteristik dan asesmen pembelajaran abad 21. *Jurnal Basicedu*, *5*(5), 4341–4350.

Septikasari, R., & Frasandy, R. N. (2018). Keterampilan 4C abad 21 dalam pembelajaran pendidikan dasar. *Tarbiyah Al-Awlad: Jurnal Kependidikan Islam Tingkat Dasar*, *8*(2), 107-117.

Saputro, T., Kriswandani, K., & Ratu, N. (2018). Pengembangan media pembelajaran mengunakan aplikasi construct 2 pada materi aljabar kelas VII. *JTAM | Jurnal Teori dan Aplikasi Matematika*, *2*(1).

Sugiono. (2017). *Metode penelitian & pengembangan research and development* (S. Suryandari (ed.)). Alfabeta.

Suda, I. K. (2016). Pentingnya media dalam meningkatkan kualitas pembelajaran siswa di

DOI: https://doi.org/10.17509/eh.v15i1.47299
p- ISSN 2085-1243 e- ISSN 2579-5457

sekolah dasar. *Universitas Hindu Indonesia*, *1*(1), 1-10.

Triana, D., Anggraito, Y. U., & Ridlo, S. (2020). Effectiveness of environmental change learning tools based on STEM-PjBL towards 4C skills of students. *Journal of Innovative Science Education*, *9*(2), 181-187.

Wibawanto, Wandah. & Nugrahani, R. (2018). Desain antarmuka (User Interface). *Game Edukasi*. *XII*(2).

DOI: https://doi.org/10.17509/xxxxx
p- ISSN 2085-1243 e- ISSN 2579-5457