JESE 2 (2) (2022)

Journal of Environmental and Science Education

http://journal.unnes.ac.id/sju/index.php/jese

Development of Website-based Virtual Science Learning to Train Students' Critical Thinking Skills

Sinta Putrianingtyas[1], Novi Ratna Dewi[1*], Resti Adriyani[2]
[1]Science Education Program, Faculty Mathematics and Natural Sciences, Universitas Negeri Semarang, Indonesia
[2]Educational Development, Hiroshima University, Japan

DOI: https://doi.org/10.15294/jese.v2i2.53956

Article Info

Received 20 January 2022
Accepted 11 August 2022
Published 26 September 2022

Keywords:
Critical Thinking Skills, Virtual Science Learning Website

*Corresponding author:
Novi Ratna Dewi
Universitas Negeri Semarang
E-mail: noviratnadewi@mail.unnes.ac.id

Abstract

The main concept in education in the 21st century revolution 4.0 is a process or learning with the support of information technology. The 2013 curriculum is designed to develop the 21st century skills of students. One of them is critical thinking skills. Based on government policies issued by the Ministry of Education and Culture (Kemendikbud) Directorate of Higher Education No. 1 of 2020 which states that the learning process is carried out boldly (online). This is because to respond to the COVID-19 pandemic that has occurred throughout the world, none other than Indonesia. The LMS referred to in the research is the development of a website-based Virtual Science Learning or "VISEL" to train critical thinking skills. This study aims to develop an e-learning system called VISEL (Virtual Science Learning) based on a website that can be used to train students' critical thinking skills. The development procedure is carried out with reference to the development of a 4D model. The research data obtained were in the form of product validation score data, questionnaire readability data, and response questionnaire data. The results showed that after going through the product validation process, the material expert obtained an average percentage of 97%% with valid criteria. Product validation by media experts obtained an average percentage of 96% with valid criteria. The average readability questionnaire obtained 88.57% and was included in the very good category. The average payment from VISEL's response obtained an average of 95.46% and was included in the very good category.

p-ISSN 2797-0175
e-ISSN 2775-2518

INTRODUCTION

The life of the 21st century has an educational role that is very important in preparing the next generation who have the skills to learn, innovate, use technology and information media as well as skills to survive (Mayasari et al., 2016). The implementation of the education system in Indonesia in the 21st century underwent many revolutions, one of which was revolution 4.0. Facing this revolution must be prepared, because it requires educators and students to be able to master and utilize ICT capabilities. The main concept in industrial revolution 4.0 education is a learning process or activity with the support of information technology (Rusman, 2016). The 4.0 revolution in innovation is a core concept facing the challenges of the labor market and global (Palazzeschi et al., 2018). One of the technologies that can affect the educational process is internet technology.

Internet technology can be used in teaching and learning activities, which can be said to be a change from conventional to modern methods (Khusniyah and Hakim, 2019:21). This utilization is carried out in the learning process which makes it a different learning process from previous learning, namely the implementation of the 2013 curriculum (student-center learning). Kuo et al. (2014) revealed that online learning is in line with the characteristics of 2013 learning. Government policies issued by the Ministry of Education and Culture (Kemendikbud) Directorate of Higher Education no. 1 of 2020 which states that the learning process is carried out online because it is to respond to the COVID-19 pandemic which has occurred throughout the world.

According to research by Firman & Sari (2020) it is stated that in online learning, students are more comfortable to ask questions and express opinions in forums that are held online. Moore, Dikson-Deane, & Galyen (2011) define online learning as learning that uses the internet network with accessibility, connectivity, flexibility, and the ability to generate various types of learning interactions.

The online learning process so far has been implemented through various mobile devices as well as various LMS (Learning Management Systems), such as Google Classroom, Edmodo, and Schhology (Gikas & Grant, 2013; Enriquez, 2014; Sicat, 2015; Iftakhar, 2016). LMS according to Prasojo & Rianto (2011) says that LMS is a platform for creating and managing learning activities. The Regulation of the Minister of Education and Culture Number 81A of 2017 concerning the implementation of the 2013 Curriculum also confirms that the learning process is carried out interactively, inspiring, fun, and students can be involved in the learning process. In addition, the 2013 curriculum recommends applying aspects of critical thinking skills to learning.

One of the lessons that can train critical thinking skills is Natural Sciences. The Ministry of National Education (2011) states that science is related to efforts to understand natural phenomena systematically, so that science is not only the mastery of knowledge in the form of facts, concepts, and principles, but also a process of discovery. Curriculum 2013 is designed to develop 21st century skills of students in particular. critical thinking skills. The implementation of science learning is currently done online, so there are no space and time limitations in its implementation. In fact, in the implementation of online learning (online) is not optimal to train one of the 21st century skills, namely critical thinking skills. Susilo, et al (2012), stated that learning science does not make students accustomed to practicing to actively think critically. Therefore, in this case it is necessary to prepare that science learning that should be done is learning that can make students literate in science and technology, think comprehensively and be able to think critically and creatively in solving various problems (Depdiknas, 2011). One solution to support the implementation of online science learning is a learning that can train critical thinking skills, one of which is the use of e-learning.

Based on the results of observations made during the pandemic at SMP N 2 Pekalongan, especially class VIIID in science subjects, there were problems found during online learning. This study focuses on three problems, namely First, the learning interest of students when online learning is less than optimal, this is because some students do not pay attention when giving instructions that are conveyed through the WhatsApp group or Google Classroom, only a few students respond. Second, there is still a lack of use of e-learning in learning to support the online learning process, this can be seen that 30 students out of 35 students are not optimal in learning to use e-learning in the learning process, as they assume that in learning science it is only in the form of materials and questions. many of which are abstract so they feel bored in online learning. Third, in science learning, students' critical

thinking skills have not been seen. This is supported by the data from the needs analysis through google form that as many as 38% (16 students out of 35 students). These results can be used as a benchmark that the critical thinking skills of SMP N 2 Pekalongan students are still relatively low. It is indicated by these results that only 16 students can grow their critical thinking skills supported by the given learning process and the mid-semester assessment results in odd semesters. Indicators of critical thinking skills that have not been seen include the ability of students to solve practice questions and problems that are still less visible, it is still difficult to formulate problems in the given worksheet, check the truth of a statement that has been studied in detail, report the results of observations, and draw conclusions. The results of the needs analysis show that there are still many indicators of critical thinking skills for students of class VIIID SMP N 2 Pekalongan have not been seen.

Based on these results, a solution is needed that can support the success of an active, creative, economical and communicative online learning process for students, especially science learning and to be able to encourage students to learn independently (self learning) and train students to think critically in solving problems. both concretely and abstractly. Development of website-based Virtual Science Learning or can be called VISEL.VISEL developed is a website-based Virtual Science Learning. The resulting product output is able to support the science learning process, as well as creating science learning that is effective, efficient, creative, economical, interactive and able to train critical thinking skills. This product is supported by facilities such as discussion activities in forums, chats, and two-way communication through the facilities available in Virtual Science Learning (VISEL) in the form of video conferencing.

METHOD

The research subjects were students of SMP Negeri 2 Pekalongan class VIII D as many as 35 students of Class VIII D as the experimental class and class VIII E as the control class. The sampling technique in this research is purposive sampling, namely the technique of determining the sample with certain considerations.

The type of research used is development research. The development model chosen in this study is the 4D model, namely Define, Design, Develop, and Disseminate which was developed by Thiagarajan, Semmel, 1974. The stages in this research only include Define, Design, Develop. The data collection methods in this study were as follows: (1) The observation method used to determine the learning process in the classroom, (2) The questionnaires or questionnaires used in this study were: (1) the material expert and media expert validation questionnaire, used in design validation stage to test product validity; (2) the legibility questionnaire used in analyzing the characteristics at the time of product testing. (3) Student Response Questionnaire on Virtual Science Learning (VISEL) products. Analysis of the data in this study are: (1) The validity test used is the Validity index or Aiken V (2) Readability Questionnaire and Response Questionnaire with descriptive percentage analysis

RESULTS AND DISCUSSION

This research is a website-based Virtual Science Learning (VISEL) development research to train students' critical thinking skills. This research was conducted at SMP N 2 Pekalongan during the Odd semester of the 2021/2022 Academic Year. The subjects of this study were students of class 8D at the product trial stage as many as 35 students. This research is focused on the material of the Human Digestive System. The research procedure for developing VISEL based on this website uses 4D (four D models) including: define stage, design stage, and develop stage. In the definition stage, the data obtained are: (a) analysis of science learning while online, (b) platforms that can support distance learning, (c) characteristics of students, (d) determining KD and indicators, (e) compiling materials and (f) determine learning objectives. In the design phase, data were obtained: (a) determining and designing the platform to be developed, (b) designing or designing learning content, (c) approaches, and learning resources, and (d) integrating content or content with indicators of critical thinking skills. The development stage (develop) obtained data: (a) VISEL Platform (Virtual Science Learning), (b) validation from validator, (c) VISEL characteristics developed with data obtained from Expert Validation Questionnaire and Readability Questionnaire, and (d) data the results of the use of students' responses. A website-based VISEL has been developed and has been validated. VISEL comes with instructions for use for learning. VISEL can be accessed via

http://lms.devlabs.space/login with any device, whether smartphone, computer, and laptop and can be accessed in various browsers (google chrome, mozilla firefox, opera and so on). Instructions for using VISEL (Virtual Science Learning) can be seen in Figure 1.

Figure 1. Instructions for Accessing VISEL

The VISEL display that appears when opened via the link above can be seen in Figure 2.

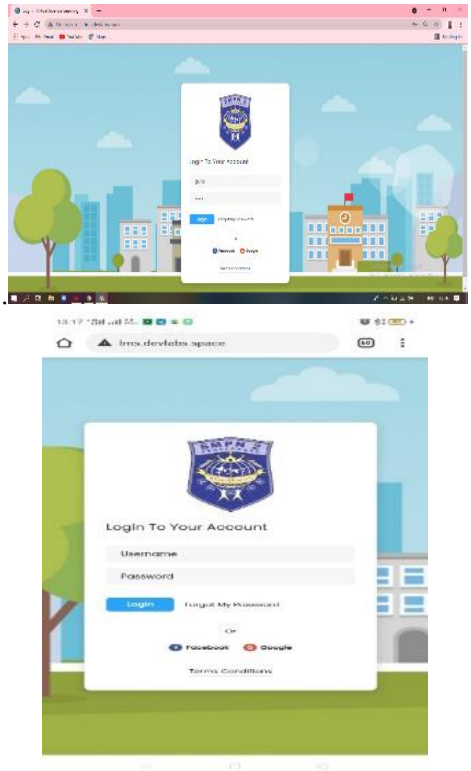

Figure 2. view of the VISEL login.

Figure 2 shows the initial view of the VISEL login which can be accessed via smartphones and laptops. Login menu consisting of username and password. The display is packaged attractively with a combination of backgrounds and is identical to the logo of SMP N 2 Pekalongan. After successfully logging in, the home menu appears for each account. The view of the homepage can be seen in the following Figure 3

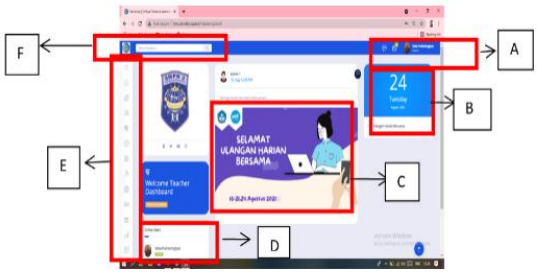

Figure 3. is the VISEL homepage display.

The display on the homepage is equipped with several menus.

VISEL Validity

The development of website-based VISEL (Virtual Science Learning) to train critical thinking skills was also carried out based on the assessment of expert validators, both material experts and media experts, each validator of material experts totaling 5 (1 lecturer and 4 science teachers), while media experts amounting to 5 (1 Lecturer and 4 ICT teachers).

Website-based VISEL validity data to train critical thinking skills were obtained at the development stage. The website-based VISEL system was validated by five material expert validators and five media expert validators. The results of the assessment by the validator are used to determine the validity of the VISEL product. The results of the validity of the VISEL system are shown in Table 1 and Table 2.

Tabel 1. VISEL validation data by Material Expert

No.	Indicator	Achievement (%)	Criteria
1.	Presentation in accordance with KD and learning indicators on the Human Digestive System material	100,00	Valid
2.	Accuracy with learning indicators	100,00	Valid
3.	Clarity of material	100,00	Valid

	delivery		
4.	The suitability of the material with the theories and concepts in the Human Digestive System material	100,00	Valid
5.	The subject matter and questions are formulated clearly, concisely and firmly	100,00	Valid
6.	The suitability of learning on VISEL (Virtual Science Learning) with critical thinking indicators	100,00	Valid
7.	Encouraging students to use critical thinking knowledge and skills	100,00	Valid
8.	Interactive (Interaktif)	93,00	Valid
9.	Idependency (kemandirian)	87,00	Valid
10.	Accsesbility (Aksesbilitas)	100,00	Valid
11.	Enrichment (Pengayaan)	93,00	Valid
12.	Website Based	100,00	Valid
13.	Practice critical thinking skills	100,00	Valid

The data shown in table 1 is about the details of the VISEL validity assessment by material experts. The average obtained is 97% and is included in the valid category. Each aspect obtained valid criteria. VISEL was also validated by five media experts each.

The material validators agree that the website-based VISEL is very valid. The average material validation achievement is 97%. The results of the validation of material experts can be seen in table 1. The material validators agree that the VISEL product is suitable for use. Judging from the presentation of VISEL in accordance with KD and learning indicators on the Human Digestive System material. This is evidenced by the validator's assessment of 100.00% with valid criteria. VISEL can support distance learning, in line with the opinion of Setiawati et al (2019) which states that in supporting distance learning, facilities can be accessed anytime, anywhere, without direct physical contact. This is also supported by the regulation of the Ministry of Education and Culture No. 1 of 2020 where learning is carried out online in the face of the corona virus pandemic. The accuracy of the learning indicators and the clarity of the delivery of the material in VISEL are in accordance with the material. This is indicated by the results of the validator's assessment of 100.00% with valid criteria. Santyasa (2017) which states that in order to achieve learning objectives, the presentation of material is delivered in a systematic, sequential, interesting and clear manner so that it can motivate learning success. The suitability of the material with the theory and concept of the digestive system material obtained a validator rating of 100.00% with valid criteria. This is indicated by the presentation of the material provided for the digestive system in accordance with the theories and concepts. In line with Pratama et al (2016) stated that the presentation of material in a lesson should be in accordance with theories and concepts so as not to cause misconceptions of science. Also supported by Asyahri and Silvia (2021) stated that in order to avoid misconceptions in students, teaching materials are needed, accurate sources of information that can remediate misconceptions.

The subject matter and questions are formulated in a clear, concise, and firm manner. This is evidenced by the validator's assessment of 100.00% with valid criteria. The presentation of the material is made in several formats, including: power point, images, videos, pdf, hyperlinks. This is done because it aims so that students can process information from various sources and achieve learning indicators and indicators of critical thinking skills in the realms of c3 to c6. The goal is to include indicators of critical thinking skills so that students can use their knowledge and skills in processing information. This is in line with Iskandarwassid and Dadang Sunendar (2011) that the preparation of materials and questions must be formulated clearly in accordance with learning needs and can dance for students to learn. Supported by Widodo and Jasmadi (2013) stated that a good learning device is a device or tool that contains material, methods, boundaries, evaluations that are designed in a clear, systematic manner and are expected to achieve the expected goals.

The VISEL developed can encourage students to use their knowledge and critical thinking skills. This is evidenced by the validator's assessment of 100.00% with valid criteria. This is indicated by learning activities through discussion by displaying pictures, communicating via chat. These activities can train students' knowledge and skills to think critically. In line with Warda (2011) states that someone who thinks critically has a special character that can be clarified by looking at how someone reacts to a situation, problem or argument. John and Ika (2019) agreed that critical thinking can encourage students to think at a higher level than usual, not only remembering but being able to solve problems.

VISEL system is presented interactively. This is evidenced by the assessment of the validator obtaining 93.00% with valid criteria. The value of VISEL interactivity can be demonstrated by the participation of students who participate in the discussion and the availability of the VISEL feature. This is in line with Allen (2017) that learning interactivity can be created through four components, namely context, challenges, activities and feedback. The four components can be run by activating features that support asynchronous communication in VISEL including forums, study materials, online exams, home work, live, marks. Supported by Dian and Sungkono (2017) explained that the high level of learning interactivity can be seen from the attractiveness of the learning process. The attractiveness of learning can be realized through attractive presentation of material, challenging learning activities, media that stimulate interest and curiosity, supporting facilities and infrastructure. The process of developing a Website-based VISEL can be used in learning. This can be proven by the presence of several features available. Can be seen in table 4.1.

VISEL development has independence in supporting learning, which means it is centered in providing time, place, and teaching materials provided. This is evidenced in the assessment of the validator obtaining 87.00% with valid criteria. The developed VISEL is able to become one of the LMS that can support distance learning, because by its nature it is also related to bringing up student learning independence. This is shown in the activities of discussing in the forum, studying the teaching materials provided, working on the available evaluations. Here VISEL is able to provide opportunities for students to be in control of their learning activities, meaning that students are given the freedom to decide when to start, when to finish, and which part of a learning resource they want to learn first. If they have difficulty, they can repeat until they feel able. Students can also communicate with the teacher at certain times. Hakim (2018) stated that independence is more effective. This is in line with the Presidential Regulation of the Republic of Indonesia No. 87 of 2017 concerning strengthening character education which states that in order to create a cultured nation, through strengthening religious characters, being honest, tolerant, disciplined, working hard, creative, independent, democratic, curiosity, national spirit, love for the homeland, respect for achievements communicative, peace-loving, likes to read, cares about the environment, cares about social, and is responsible. Also supported by Suhendri (2011); Purwaningsih and Herwin (2020) which states that the nature of independence is a very important character to be instilled, because of the learning activities carried out by students without depending on others to achieve understanding.

The developed VISEL has accessibility properties which means it can be accessed very easily. This is evidenced by the acquisition of a validator assessment of 100.00%. Accessing VISEL can be accessed by any device, not limited by time, place and distance, the availability of learning resources (text, audio, video) can be connected easily in the developed VISEL (Virtual Science Learning). This is in line with Gikas & Grant (2013) which states that the implementation of online learning requires the support of device assistance, which can be used to access information anytime and anywhere. Supported by Bell et al. (2017); Arzayeva, et al (2015) that online learning allows interaction via the web even though they are far apart and in different places. Accessibility is a person's comfort level to achieve goals related to communication behavior (Sapri, Saleh & Maksum, 2009).

VISEL also has enrichment properties, which means that learning activities are presented in more varied and interactive ways, such as the use of video streaming, animation, simulation applications, and so on. This is evidenced by the acquisition of an assessment from the validator of 93.00%. Presentation in VISEL is equipped with various objects that match the material. The appearance of learning activities is presented more attractively and interactively, such as the availability of more varied, interesting and communicative E-LKPD. E-LKPD that can be connected to

YouTube videos, so that in this case it is intended that students can obtain and process information from various learning sources. Furthermore, the presentation of teaching materials is designed to be varied, brief, clear, and easy to understand. The creation of these teaching materials is assisted by the Canva application. The design of teaching materials is also adapted to the material and characteristics of students. In addition, other teaching materials are also presented in the form of learning videos that are in accordance with the material. Daryanto (2013) says that a learning activity that is presented in a varied, interesting, and interactive way can create effective learning, encouraging students to be more enthusiastic in learning activities. Supported by Rusman (2013) confirms that the use of interactive and interesting methods, strategies, teaching materials or learning facilities can help create more varied learning, where by utilizing technology now it will be easier for a teacher to convey information to students.

VISEL, which was developed based on a website, means that it can be used on all types of devices such as computers, tablets, smartphones. This is indicated by the validator's assessment of 100.00%. The development of website-based e-learning aims to be able to automatically respond to user preferences on the size of the device layout or device screen resolution (Putra, 2017). These adjustments can be in the form of font size, image size and other components without having to make adjustments to its scripting capabilities. Supported by Melani's research (2019) that website development is very beneficial because it can be accessed through any device including cellphones, making it easier to access anytime and anywhere. In addition, that the website system can increase motivation and learning quality (Kusumaningrum, 2016).

VISEL is equipped with activities that are able to train critical thinking skills, such as discussing, seeking information, analyzing, and concluding the available problems. This is evidenced by the validator's assessment of 100.00%. In line with the 21st century learning, that thinking skills are very important to be trained, if a person is trained continuously then a person's personality can be formed who can solve problems properly, and correctly according to the theory or concept. B.C Judge (2013) emphasized that the 2013 curriculum is very possible for critical thinking learning, because in learning they are required to analyze an idea about an idea and present well-organized arguments. Through e-learning the learning process is expected to develop students' critical thinking skills. (Sari, Supandi, & Ariyanto, 2020).

Tabel 2. Data validasi VISEL *(Virtual Science Learning)* oleh Ahli Media

No.	Indicator	Achievement (%)	criteria
1.	VISEL (Virtual Science Learning) system quality and displayed menu	100,00	Valid
2.	Display design presented	93,00	Valid
3.	The quality of images, videos, and animations displayed	100,00	Valid
4.	Matching colors, layouts, and menus served	93,00	Valid
5.	VISEL (Virtual Science Learning) system packaging that is creative, interactive, effective, efficient, can provide student learning motivation	93,00	Valid
6.	Grammatical accuracy according to EBI rules	87,00	Valid
7.	The sentences used are easy to understand (communicative), and standard	100,00	Valid

8.	The VISEL (Virtual Science Learning) system was developed based on a website, so it can be accessed easily with any browser, practical, and not limited by space and time	100,00	Valid

The average validity of VISEL (Virtual Science Learning) by media experts is 96% and is included in the valid category. Each indicator obtains valid criteria to be used.

Media validators agree that the website-based VISEL to train students' critical thinking skills is very valid. The average achievement of VISEL media validation is 95.84%. The assessment includes presentation, content design, language and accessibility. The percentage of each expert's assessment of the results of media validation achievements can be seen in table 2.

The results of the first assessment on VISEL Presentation obtained 100.00% with valid criteria. This assessment is an assessment of the quality of the VISEL (Virtual Science Learning) system and the menus displayed. VISEL (Virtual Science Learning) system presentation and menus are displayed in an attractive, flexible, user friendly way. In addition, the assessment of the display design presented obtained an assessment from the validator of 93.00% with valid criteria. The selection of text colors, backgrounds and other components is attractive and compatible with the VISEL (Virtual Science Learning) system developed. The VISEL presentation assessment aims to make the product developed to motivate students in learning. This is in accordance with Tilbury (2013) which states that flexibility will provide opportunities for students to choose the learning process according to their needs. Supported by Steinberg (1989) who stated that the more students who can control their learning environment, the greater their learning motivation. The selection of creative, innovative, attractive designs is done so that the learning carried out is more colorful and gives the impression of experience to the learner (Zuhri et al., 2020).

The achievement of learning objectives is determined by several things including the media, the learning process, and the selected teaching materials. The media validator provides VISEL with an assessment of the content design assessment provided. The assessment is obtained by 100% with valid criteria. It is proven that the developed VISEL includes pictures, videos, animations that are clearly in accordance with the learning materials and learning objectives. In addition to these contents, there is an assessment of the suitability of colors, layouts, and menus presented. The results of the assessment from the media validator obtained 93.00% with valid criteria. Both assessments are in line with Kurniasari (2020) which states that the presentation of content and the selection of colors, layouts, and menus served have a contribution to achieving learning objectives. Supported by Hikmah (2020) that learning activities must also be designed according to the content of the material, have evaluation materials, according to needs, and can attract the attention of students.

The Language Assessment in VISEL consists of grammatical accuracy in accordance with EBI rules and the sentences used. The results of the media validator's assessment respectively obtained a percentage of 87% and 100.00%. Language is one thing that has an important urgency to be considered in the development of e-learning. This is because it can determine the ease of understanding of students in understanding the delivery delivered by the teacher (Setiawan & Sa'dijah, 2017). this is in accordance with the linguistic aspects referred to in this study, namely 1) The sentence structure is clear and precise; 2) Using standard terms; 3) The grammar used is in accordance with the EBI rules; 4) The sentence used is effective; 5) The sentences used are easy to understand; 6) The language used is the standard language.

VISEL Readability

Readability questionnaire at the product trial stage after the instrument was validated and revised. The results of the readability questionnaire on VISEL (Virtual Science Learning) are presented in Table 3.

Table 3. VISEL (Virtual Science Learning) readability questionnaire data based on Website

No.	Indicator	Achievement	Criteria

		(%)	
1.	The presentation of VISEL (Virtual Science Learning) is clear, interesting so that it encourages me to study hard	86,42	Good
2.	Presentation of material and questions is short, precise, clear and easy to understand	80,71	Good
3.	The content presented in VISEL (Virtual Science Learning) is sequential and interesting	86,42	Very Good
4.	VISEL (Virtual Science Learning) system packaging that is creative, interactive, effective, efficient, can provide learning motivation	90,71	Very Good
5.	The language used in VISEL (Virtual Science Learning) is easy for students to understand	84,28	Very Good
6.	The use of the VISEL (Virtual Science Learning) system can be used effectively, efficiently, interactively, and practically so that it is not limited by space and time for independent study	95,71	Very Good
7.	The VISEL (Virtual Science Learning) e-learning system can be easily accessed using any device, be it smartphones, computers, laptops and so on.	95,71	Very Good

The data shown in Table 3 is about the details of the VISEL readability assessment. Each indicator gets very good criteria, except for indicator number two it gets good criteria. The average obtained is 88.57% with very good criteria. The Big Indonesian Dictionary defines characteristics as the characteristics possessed by an object. The product developed in this research is a Virtual Science Learning system. Experts have expressed opinions about the characteristics of virtual learning. This study refers to the characteristics of Rusman (2013), namely interactive (interactivity), independence (independence), accessibility (accessibility), learning resources are more easily accessible via the internet; enrichment This opinion becomes a reference in this study to determine the indicators of product characteristics that are developed so that the product is suitable for use and right on target. The indicators for the characteristics of VISEL (Virtual Science Learning) are as follows: (1) Conformity of content with KI, KD, and GPA, (2) VISEL packaging that is creative, interactive, and can motivate learning, (3) Website-based, (4) Training Skills critical thinking, (5) Accuracy of

materials and questions with indicators of critical thinking skills, (6) Use of language (7) Ease of access.

Website-based VISEL is a platform that supports distance learning that can be accessed anywhere, anytime without any physical contact between each other, thus supporting Ministry of Education and Culture Regulation No. 1 of 2020 in dealing with the corona pandemic. VISEL comes with instructions for use for learning. VISEL can be accessed via http://lms.devlabs.space/login with any device and can be accessed in various browsers. VISEL has various menus that can support learning activities. Can be seen in Figure 3.

The developed VISEL has characteristics. The Big Indonesian Dictionary explains that a characteristic is a special trait that fits a certain description. The characteristics of website-based VISEL are (1) Conformity of content with KI, KD, and GPA, (2) VISEL packaging that is creative, interactive, and can motivate learning, (3) Website-based, (4) Train critical thinking skills, (5) Accuracy of materials and questions with indicators of critical thinking skills, (6) Ease of access.

Characteristic 1 is Conformity of content with KI, KD, and GPA. The material validators agree that VISEL is in accordance with KI, KD, GPA on the focused material. This is evidenced by the website-based VISEL obtaining an assessment achievement of 100.00% from material validators with valid criteria. The validator's assessment is supported by the average student assessment achievement of 83.57% with very good criteria. This is in line with Prasetyo et al. (2019); Arsyad (2013) which states that learning activities must be in accordance with the competencies and learning objectives. Website-based VISEL is equipped with forum activities, home work, live and online exams. Forum activities are used as a communication feature in discussing learning. Homework contains assignments, live is a feature used for video conference discussions, and online exam is an online test feature provided such as daily assessments, PTS, and PAS. The material in VISEL is focused on the material of the human digestive system with four meetings.

Characteristic 2 is VISEL Packaging which is creative, interactive, and can motivate learning. This is evidenced by the website-based VISEL obtaining an assessment achievement of 100.00% from media validators with valid criteria. The validator's assessment is supported by the average student assessment achievement of 88.57% with very good criteria. The selection of creative, innovative, attractive designs is done so that the learning carried out is more colorful and gives the impression of experience to the learner (Zuhri et al., 2020). Dwiningsih (2016) states that the provision of creative, interactive designs can motivate and develop skills and improve student learning achievement. Supported by Mustofa (2019) in his research, learning using e-learning that is designed to be attractive can strengthen students' learning motivation so that students feel comfortable and interested in learning. VISEL display is presented creatively and attractively with the selection of fonts, colors, images/illustrations that match the material. VISEL display can be seen in Figure 2. and 3 and table 3.

Characteristic 4 is to train critical thinking skills. Table 4.3 shows that the developed VISEL can train critical thinking skills by showing an average percentage gain of 100%. The developed VISEL is equipped with activities that can train critical thinking skills. Such as discussions, synchronous and asynchronous communication through chat, forums, and so on. Critical thinking skills are skills to perform various analyses, assessments, evaluations, reconstructions, and decision-making that lead to rational action (King, 2010). The VISEL platform with its features is used optimally, and integrates interactive learning videos, interesting teaching materials, interactive E-LKPD, and evaluation questions that can train critical thinking skills. Students see, observe, and respond, do assignments and ask questions that they do not understand. This is supported by Syarif's research (2012) which shows that e-learning is able to improve and train critical thinking skills because students gain the habit of always thinking and processing which information is appropriate and which is not.

Characteristic 5 is the accuracy of the material and questions with indicators of critical thinking skills. This is evidenced by the acquisition of a material validator assessment of 100.00% with valid criteria. The material and questions presented in VISEL refer to the C3 to C6 domains so that they can be integrated with critical thinking skills indicators. Learning process activities using the platform can also train critical thinking skills. Through discussion activities, managing ideas, self-regulating, evaluating, someone has practiced critical thinking skills (Yayuk, 2017).

Characteristic 6 is ease of access. This is evidenced by the acquisition of an assessment

from the media validator of 100.00% with valid criteria. The validator's assessment is supported by an average student assessment achievement of 95.71% with very good criteria. Access to VISEL can be accessed by any device, not limited by time, place and distance, the availability of learning resources (text, audio, video) can connect easily in the developed VISEL (Virtual Science Learning).

VISEL Usage Response

Student response data obtained at the development stage. Student response data obtained after product testing. The product trial was carried out in class VIII D SMP N 2 Pekalongan as many as 35 students. The results of student responses to VISEL can be seen in table 5.

Table 5. Student Response Data to VISEL (Virtual Science Learning)

No.	Statement	Achievements (%)	Criteria
1.	The VISEL system provides content that fits the material that is packaged in an attractive and creative way	97,00	Very Good
2.	VISEL system is easy to use	93,60	Very Good
3.	The features provided are many and easy to access	99,00	Very Good
4.	The VISEL system can encourage a desire to learn	89,29	Very Good
5.	VISEL system is stable and smooth	95,71	Very Good
6.	The VISEL system provides an active learning environment	94,30	Very Good
7.	The VISEL system provides communicative features in providing feedback, such as chat forums	100,00	Very Good
8.	The chat feature makes it easy for 2-way active learning	97,85	Very Good
9.	The VISEL system allows me to study the material I need	94,29	Very Good
10.	VISEL system can be used to convey material well	95,00	Very Good
11.	Interactivity of learning through the VISEL system helps increase enthusiasm for learning	92,10	Very Good
12.	Interactivity of learning through the VISEL system provides a sense of comfort/closeness between students and teachers	95,71	Very Good
13.	Interactivity of learning through the VISEL system provides an understanding of mastery of the material	94,29	Very Good
14.	Interactivity of learning through the VISEL system gives a sense of pleasure/satisfaction /comfort in learning science	96,40	Very Good
15.	The layout provided is easy according to its content and function	100,00	Very Good
16.	The clarity of the font that is easy to read well	88,57	Very Good
17.	VISEL system can be used anytime and anywhere	100,00	Very Good

Response is a form of reaction or response to an object. Based on table 6. shows student response data obtained at the development stage. Student response data obtained after product testing. The product trial was carried out in class VIII D SMP N 2 Pekalongan as many as 35 students. The results of student responses to VISEL can be seen in table 4.6. The average result of achieving student responses to VISEL is 95.46% with very good criteria.

CONCLUSION

Website-based VISEL to train students' critical thinking skills is declared valid for use with a validity score of 97.94 for material

experts and media experts. The characteristics of website-based VISEL are Conformity of content with KI, KD, and GPA,VISEL packaging that is creative, interactive, and can motivate learning, Website-based, Train critical thinking skills, Accuracy of materials and questions with indicators of critical thinking skills, Ease of access. Characteristic data was obtained from a readability questionnaire. Can be seen in table 5. Student responses to the website-based VISEL got very good results as indicated by the results of the student response questionnaire which got an average of 95.46%.

BIBLIOGRAPHY

Alfath, S. N. (2013). *Pengembangan Media Blended Learning Berbasis Web Enhanced Course pada Mata Kuliah Fisika Dasar 2 Jurusan Fisika Unnes* (Doctoral dissertation, Unnes).

Aboagye, E., Yawson, J. A., & Appiah, K. N. (2021). COVID-19 and E-learning: The challenges of students in tertiary institutions. *Social Education Research*, 1-8.28

Anderson, N.R., Potočnik, K., & Zhou, J. (2014). Innovation and Creativity in Organizations: A State-of-the-Science Review, Prospective Commentary, and Guiding Framework. *Journal of Management*

Amiroh. (2012). *Membangun E-Learning Dengan Learning Management System Moodle*. Sidoarjo: Genta Group Production.

Anggraeni, D. M., & Sole, F. B. (2018). E-Learning Moodle, Media Pembelajaran Fisika Abad 21. *Jurnal Penelitian Dan Pengkajian Ilmu Pendidikan: E-Saintika*, *1*(2), 57.

Arikunto, Suharsimi. (2012). *Prosedur Penelitian Suatu Pendekatan Praktik,* Jakarta: Rineka Cipta

Arikunto, Suharsimi. (2015). *Prosedur Penelitian Suatu Pendekatan Praktik*, Jakarta: Rineka Cipta

Apganendaria, H., & Sujatmiko, B. (2019). *Pengembangan Instrumen Tes Online Menggunakan High Order Thinking Skill (Hots) Berbasis Moodle Pada Mata Pelajaran Rancang Bangun Jaringan Di Smk Negeri 1 Surabaya*. *04*, 150–155.

Aqib, Zainal. (2013). *Model-model, Media, dan Strategi Pembelajaran Kontekstual (Inovatif).* Bandung: Yrama Widya.

Azis, A. A. (2015). Pengembangan Media E-Learning Berbasis LMS Moodle pada Matakuliah Anatomi Fisiologi Manusia. *Jurnal Pendidikan Biologi*, *7*(1), 1–8.

Cucus, A., & Aprilinda, Y. (2016). Pengembangan E-Learning Berbasis Multimedia untuk Efektivitas Pembelajaran Jarak Jauh. Explore: *Jurnal Sistem informasi dan telematika (Telekomunikasi, Multimedia dan Informatika)*, 7(2).

Crawford, R., & Jenkins, L. (2017). Blended learning and team teaching: Adapting pedagogy in response to the changing digital tertiary environment. *Australasian Journal of Educational Technology*, *33*(2).

Darmadi, H. (2013). *Metode Penelitian Pendidikan dan Sosial.* Bandung: Alfabet.

Diharjo, R. F., Budijanto, B., & Utomo, D. H. (2017). *Pentingnya Kemampuan Berfikir Kritis Siswa Dalam Paradigma Pembelajaran Konstruktivistik.* In Seminar Nasional Teknologi Pembelajaran dan Pendidikan Dasar 2017 (pp. 445-449).

Efrita, K. A., Bakri, F., & Muliyati, D. (2016). Pengembangan E-learning menggunakan LMS (Learning Management System) untuk mahasiswa pendidikan fisika. *Prosiding Snips*, *July*, 469–474.

Enriquez, M. A. S. (2014). Students ' Perceptions on the Effectiveness of the Use of Edmodo as a Supplementary Tool for Learning. DLSU Research Congress.

Firmadani, F. (2010). Media Pembelajaran Berbasis Teknologi Sebagai Inovasi Pembelajaran Era Revolusi Industri 4.0. *Prosiding Konferensi Pendidikan Nasional*, *ISSN: 2654-8607*, 93–97.

Firman & Sari. (2020). Pembelajaran Online di Tengah Pandemi Covid-19. *Indonesian Journal Of Educational Science (IJES)*, Volume 02 No 02.

Farida, I., & Yuliana, E. (2014). Sikap mahasiswa memanfaatkan teknologi informasi dan komunikasi dalam pembelajaran terbuka dan jarak jauh. *Jurnal Pendidikan Terbuka Dan Jarak Jauh*, *15*(2), 112-121.

Gikas, J., & Grant, M. M. (2013). *Mobile computing devices in higher education: Student perspectives on learning with cellphones, smartphones & social media. Internet and Higher Education.*

Handarini, O. I., & Wulandari, S. S. (2020). Pembelajaran Daring Sebagai Upaya Study From Home (SFH) Selama Pandemi Covid 19. *Jurnal Pendidikan Administrasi Perkantoran (JPAP)*, 8(3), 496-503.

Iftakhar, S. (2016). GOOGLE CLASSROOM: WHAT WORKS AND HOW? *Journal of Education and Social Sciences.*

Khairani, N. A., Rajagukguk, J., & Derlina.

(2020). *Development of Moodle E-Learning Media in Industrial Revolution 4.0 Era*. *384*(Aisteel), 752–758.

Khamidah, K., & Triyono, R. A. (2013). Pengembangan Aplikasi e-Learning Berbasis Web Dengan PHP Dan My SQL Studi Kasus SMPN 1 Arjosari. *IJNS-Indonesian Journal on Networking and Security*, 2(2).

Kuo, et al. (2014). *Interaction, Internet self-efficacy, and self-regulated learning as predictors of student satisfaction in online education courses.* Volume 20, pages 35-50.

Kuo, Y. C., Walker, A. E., Schroder, K. E. E., & Belland, B. R. (2014). Interaction, Internet self-efficacy, and self-regulated learning as predictors of student satisfaction in online education courses. *Internet and Higher Education.*

Kusniyah & Hakim,L. (2019). Efektifitas Pembelajaran Berbasis Daring: Sebuah Bukti pada Pembelajaran Bahasa Inggris. *Jurnal Pemikiran dan Penelitian Pendidikan*, Vol. 17 No.1.

Lukitaningrum, H. (2016). *Pengembangan Media Pembelajaran Berbasis Web pada Materi Basis Data di Sekolah Menengah Kejuruan Kelas XI*. 77.

Lantip, R. P. D., & Diat, R. (2011). *Teknologi Informasi Pendidikan.* Yogyakarta : Gava Media

Ma'rifah, U. (2017). *Pengembangan E-Magazine Berbasis Website Sebagai Media Pembelajaran IPA Biologi Untuk Memberdayakan Kemampuan Berpikir Kritis. (Skripsi).* 1–140.

Muhammad, H., R. Eka Murtinugraha, & Sittati Musalamah. (2020). Pengembangan Media Pembelajaran E-Learning Berbasis Moodle Pada Mata Kuliah Metodologi Penelitian. *Jurnal PenSil*, *9*(1), 54–60.

Munawar, A. (2009). *Pengembangan E-Learning Berbasis Moodle Sebagai Penunjang Perkuliahan Di Jurusan Teknik Elektro Universitas Negeri Semarang*.

Moore, J. L., Dickson-Deane, C., & Galyen, K. (2011). E-Learning, online learning, and distance learning environments: Are they the same? Internet and Higher Education.

Palazzeschi L, Bucci O & Di Fabio A. (2018). *Re-thinking Innovation in Organizations in the Industry 4.0 Scenario: New Challenges in a Primary Prevention Perspective.* Front. Psychol. 9:30. PMC5797748

Papp, KK., Huang, G.C., Clabo, L.L.M., Delva, D., Fischer, M., Konopasek, I., Schwartzsein, R.M., dan Gusic, M., (2014), Milestones of CriticalThinking: A Developmental Model for Medicine and Nursing. *Academic Medicine*, Vol 89, No 5, Hal 715-720.

Prani, A. I. E., Parno, P., & Hidayat, A. (2018). Keterampilan berpikir kritis pada Bounded Inquiry Lab: analisis kuantitatif dan kualitatif. *Momentum: Physics Education Journal*, *2*(1), 29–38.

Prasetyo, H., & Sutopo, W. (2018). Industri 4.0: Telaah Klasifikasi aspek dan arah perkembangan riset. J@ ti Undip: *Jurnal Teknik Industri*, 13(1), 17-26.

Rijal, A., & Sofiarini, A. (2019). Pengembangan E-Learning Mata Kuliah Pembelajaran Matematika Sd Berbasis Aplikasi Moodle Di Pgsd. *Jurnal Basicedu*, *3*(4), 2071–2082.

Rusman, *et al*. (2016). *Pembelajaran berbasisteknologi informasi dan komunikasi, mengembangkan profesionalitas guru*.Jakarta: PT. Raja Grafindo

Ray, S. A., Adisaputera, A., & Pramuniati, I. (2020). The Quality of E-Learning Based on Learning Media Using Moodle LMS on Text of Observation Reports of Grade 10th Students of Vocational School Telkom Shandy Putra Medan. *Britain International of Linguistics Arts and Education (BIoLAE) Journal*, *2*(2), 688-699.

Sampurno, P. J., Maulidiyah, R., & Puspitaningrum, H. Z. (2015). Implementasi Kurikulum 2013: MOODLE (Modular Object Oriented Dynamic Learning Environment) dalam pembelajaran fisika melalui lembar kerja siswa pada materi optik di SMA (Halaman 54 sd 58). *Jurnal Fisika Indonesia*, *19*(56).

Sakti, juanda tri hardika & T. (2016). *Pemesanan berbasis website*. 1–12.

Septyanto, K., Hamid, M. A., & Aribowo, D. (2020). *Pengembangan E-Learning Berbasis Website menggunakan Metode Waterfall*. *5*(1), 89–101.

Setyadi, D., & Qohar, A. (2017). Pengembangan Media Pembelajaran Matematika Berbasis Web Pada Materi Barisan Dan Deret. *Kreano, Jurnal Matematika Kreatif-Inovatif*, *8*(1), 1–7.

Shalatska, H. M., Zotova-Sadylo, O. Y., & Muzyka, I. O. (2020). Moodle course in teaching English language for specific purposes for masters in mechanical engineering. *CEUR Workshop Proceedings*, *2643*, 416–434.

Sicat, A. S. (2015). Enhancing College Students' Proficiency in Business Writing Via Schoology. *International Journal of Education and Research.*

Shih, W. L., & Tsai, C. Y. (2017). Students' perception of a flipped classroom approach to facilitating online project-based learning in marketing research courses. *Australasian Journal of Educational Technology*, *33*(5).

Silin, Y., & Kwok, D. (2017). A study of students' attitudes towards using ICT in a social constructivist environment. *Australasian Journal of Educational Technology*, *33*(5).

Sulistiani, E., & Masrukan, M. (2017). Pentingnya berpikir kritis dalam pembelajaran matematika untuk menghadapi tantangan MEA. In PRISMA, Prosiding Seminar Nasional Matematika (pp. 605-612).

Triyono. (2020). *Pengembangan Instrumen Penilaian Sikap Toleransi pada Pembelajaran PPKn Berbasis Android*.

Widayati, S., Hotimah, N., & Rakhmawati, N. I. S. (2020). Respon Mahasiswa Pada Proses Pembelajaran Mata Kuliah Daring. *Child Education Journa*l, 2(1), 48–52.

Zainul, R., Adri, M., Sriadhi, *et al.* (2020). Development of e-Learning Courses for Subjects about "Learn and Learning" with Moodle-based for Prospective Teacher in Indonesia. *Journal of Physics: Conference Series*, *1594*(1).