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Innovation of Digital-Based Instructional Design and Virtual Reality on Geography Subject for 10th Grade High School

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ABSTRAK

Setelah berlalu pandemi COVID-19, pemerintah Indonesia mengeluarkan regulasi yang mendorong pemulihan sektor pendidikan seperti pedoman penerapan kurikulum dalam rangka pemulihan pembelajaran. Namun, hal inilah yang menjadi masalah, guru kesulitan dalam menyesuaikan dan mengembangkan rancanganan pembelajaran akibat berubah-ubahnya kurikulum yang digunakan. Berdasarkan pada permasalahan tersebut, penelitian ini bertujuan untuk mengembangkan rancangan pembelajaran berbasis digital yang sekaligus mengembangkan dan memanfaatkan media pembelajaran virtual reality pada materi sistem tata surya. Penelitian ini merupakan jenis penelitian pengembangan (R&D) dengan menggunakan model ASSURE yang melibatkan ahli media, ahli materi dan ahli instructional design sebagai subjek penelitian. Teknik pengumpulan data yang digunakan ialah pemberian intrumen angket tertutup. Teknik analisis data yang menggunakan pendekatan analisis deskriptif kuantitatif persentase. Hasil analisis data menujukan bahwa 3 orang ahli media memberikan skor rata-rata 3,42, 3 orang ahli materi memberikan skor rata-rata 3,61 dan 3 orang ahli instructional design memberikan skor 3,31. Disimpulkan bahwa rancangan pembelajaran dan media virtual reality dinyatakan valid dan layak untuk digunakan. Rancangan pembelajaran dan media virtual reality dapat digunakan dalam pembelajaran Geografi Kelas X SMA.

ABSTRACT

After the COVID-19 pandemic passed, the Indonesian government issued regulations encouraging the recovery of the education sector, such as guidelines for implementing the curriculum in the context of learning recovery. However, this is the problem, and teachers need help adjusting and developing learning plans due to the changes in the curriculum used. Based on these problems, this study aims to develop a digital-based learning design that simultaneously develops and utilizes virtual reality learning media on solar system material. This development research (R&D) type uses the ASSURE model involving media experts, material experts, and instructional design experts as research subjects. The data collection technique used was the provision of a closed questionnaire instrument. Data analysis technique using a percentage quantitative descriptive analysis approach. The results of the data analysis showed that three media experts gave an average score of 3.42, 3 material experts gave an average score of 3.61, and 3 instructional design experts gave a score of 3.31. It was concluded that the learning design and virtual reality media were declared valid and feasible. Learning designs and virtual reality media can be used for Class X SMA in Geography learning.

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1. INTRODUCTION

Since the entry of the COVID-19 pandemic into Indonesia in early March 2020, it has resulted in major changes in various sectors, including in the education sector (Laksana, 2020; Lee, 2020; Winarni et al., 2021). Along with the slowing down of the spread of positive COVID-19 cases, Indonesia managed to get out of the COVID-19 pandemic crisis on May 17, 2022, which was marked by a national regulation of removing masks outdoors. In line with this, the government of the Republic of Indonesia has also accelerated the national economic recovery program (PEN) in various sectors that had been paralyzed due to the COVID-19 pandemic, including the education (Indrawati, 2020; Olivia et al., 2020; Sugiarto, 2020). One of the regulations of the Government of Indonesia through the Ministry of Education, Culture, Research, and Technology is to issue "Guidelines for Implementing Curriculum in the Context of Learning Recovery". The purpose of this regulation is to accelerate the process of learning recovery at various levels of education in Indonesia through a curriculum implementation approach (Indrawati, 2020; Nugraha, 2022).

The arrangement of "Guidelines for Implementing Curriculum in the Context of Learning Recovery" provides flexibility in choosing the curriculum at each educational institution (Rosmana et al., 2022). Among

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these choices are the 2013 Curriculum (K13), the Emergency Curriculum, and the Independent Curriculum. The freedom to choose this curriculum is based on the freedom of each educational institution to determine the curriculum that is most suitable and relevant to the conditions of the educational institution (Jojor & Sihotang, 2022). Although the decision is optional, the Ministry indicated that starting the new school year 2022/2023, there will be an acceleration of the implementation of the Independent Curriculum and a change in the level of implementation (Yose Indarta et al., 2022; Rahayu et al., 2022). The Merdeka curriculum is specifically designed to provide flexibility for educational institutions to create an operational curriculum for contextual educational institutions that adapts to the learning needs of students in each educational institution (Sopiansyah et al., 2022). The Merdeka curriculum focuses on actual content and character building of Pancasila student profiles (Safitri et In addition, the Independent Curriculum also instructs the creation of a Teaching Module (MA), a complete version of the Learning Implementation Plan (RPP). It aims to produce a more comprehensive and measurable learning design. The five main components contained in MA are learning objectives, learning steps, assessment plans at the beginning and end, and the learning media used (Fahrurrozi et al., 2021; Syafi'i, 2021). MA must be able to contain learning outcomes and efforts to achieve Pancasila student profiles. The combination of the Independent Curriculum and MA can be an option to accelerate the national education recovery process (Nugraha, 2022).

Although various policies such as the Kurikulum Merdeka, freedom to choose a curriculum, operational curriculum of educational institutions, and many others are predicted to accelerate the recovery process of Indonesian education, it turns out that this is not always as expected. Many education experts state that government regulations in the field of education do not focus on accelerating learning loss because the content used is too heavy and the choice of subjects is large (Aisyah et al., 2022; Mabsutsah & Yushardi, 2022; Sasmita & Darmansya, 2020). The presence of the new regulation actually creates new problems because the adjustment and implementation process take a long time, which actually slows down the recovery of education. Substantively, subjects experienced disruption of continuity due to the pressure of change. Indirectly, the curriculum in Indonesia consists of three curricula, namely Curriculum 2013 (K13), Emergency Curriculum, and the *Kurikulum Merdeka* (Y. Indarta et al., 2022; Rofiq & Arifin, 2021; Wardoyo et al., 2020; Wulandari, 2020). The dissynchronization that occurs has resulted in the length of the education recovery process in Indonesia because the adjustments made by teachers have experienced problems due to changes made so quickly and differently. This is what is felt by teachers and educational personnel in Indonesia.

The problems that occur in every educational institution show that teachers and educators have minimal knowledge and experience in producing digital-based instructional designs and increasing the profile of Pancasila students (Sasmita & Darmansyah, 2022). In addition, teachers experience difficulties in implementing the new curriculum with a student centered learning approach due to the low competence of teachers. This causes failures in designing instructional design as instructed by the *Kurikulum Merdeka* (Firdaus et al., 2022; Rahayu et al., 2022). Although various regulations that have been issued by the Indonesian government have had a positive impact on the recovery of Indonesian education after the COVID-19 pandemic, it turns out that this is not balanced with the readiness and competence of teachers in implementing these regulations. Teachers feel culture shock due to the large demands in every regulation launched by the government, such as an the *Kurikulum Merdeka*, the Mo*dul Ajar* (MA), projects to strengthen the profile of Pancasila, and many more. This does not show a significant increase. In fact, there is a decrease due to the COVID-19 pandemic (Dalimunthe et al., 2021; Indrawati, 2020). The Ministry of Education and Culture of the Republic of Indonesia released data showing that 53.55% of teachers find it difficult to manage distance learning and 48% have difficulty adapting to all the changes in the education system. Teachers are not optimal in designing instructional design in accordance with the *Kurikulum Merdeka*, which has serious consequences for student learning outcomes (Ramadhan et al., 2022). The low learning outcomes of students are caused by the decline in their cognitive ability. This problem is triggered by the non-optimal learning design contained in the *Modul Ajar* (MA). The problems that occur become serious problems because they have an impact on the competence and learning outcomes of students. This happens in the subject of Geography in 10th grade of high school (Chaniago et al., 2022).

Based on the explanation of the problem of instructional design in the *Modul Ajar* (MA) that is in accordance with the *Kurikulum Merdeka*, it is not optimal, especially in the learning content of the solar system in the Geography subject of 10th grade of high school after the COVID-19 pandemic. It is necessary to conduct research related to these problems. This research focuses on producing an instructional design in the form of a digital media-based *Modul Ajar* (MA) that can answer the problem of non-optimal instructional design. The digital learning media used to support the instructional design is virtual reality, which is created in conjunction with the instructional design. Much recent research related to the general use of VR in learning, such as the use of VR in interactive learning, shows an increase in complex skills in students (Khoerniawan et al., 2018; Mills & Brown, 2022; Solmaz & Van Gerven, 2022). It is stated that VR can be used to improve student learning outcomes by facilitating the process of extraneous cognitive load, making it easier to stimulate students' high-order thinking abilities (Meyer et al., 2019; Zulherman et al., 2021). However, virtual reality is a specific

learning media for certain learning content, so VR cannot be used for other irrelevant learning. The virtual reality that exists and circulates on the internet has not yet been specifically targeted at 10th grade high school students. Therefore, it is necessary to produce virtual reality as a learning media that specifically contains the learning content of the solar system in geography subjects for 10th grade high school.

Intructional design is a learning process design that is produced specifically for learning in an educational institution (Azimi & Fazelian, 2013; Kristiawan et al., 2017; Sweller, 2021). Instructional design cannot be immediately used by other levels and educational institutions because of its special and differentiating characteristics in the learning process. Learning plans can only be adapted and adopted by other educational institutions (Salim Nahdi & Cahyaningsih, 2018; Wikanengsih et al., 2015). The *Kurikulum Merdeka* provides specialization in instructional design so that the product of instructional design cannot be taken from other places (Aisyah et al., 2022; Baharuddin, 2021; Evy Ramadina, 2021). This distinguishes the instructional design in the subject of geography, particularly in the solar system learning content of 10th grade high school, from the others. There is no such instructional design in accordance with the *Kurikulum Merdeka* which produces *Modul Ajar*. Therefore, it is necessary to produce a specific instructional design on the learning content of the solar system in the Geography subject of 10th grade high school.

This research aims to produce a virtual reality learning media that specifically contains learning content for the solar system in geography subjects for the 10th grade of high school. The virtual reality learning media is utilized in the development of instructional designs that are specifically designed in accordance with the Kurikulum Merdeka in the form of Modul Ajar. The specificity of this research is a novelty value in this research. The existence of this specificity makes the learning process directed specifically at the intended learning objectives as contained in the Kurikulum Merdeka. In addition, this research answers the teacher's problems related to difficulties in designing the learning process. This is the value of novelty in this research.

2. METHOD

This research is a type of development research (R & D) project that creates learning media and instructional designs for geography subjects in 10th grade high school. The development model used is the ASSURE Model, which is very relevant in the development of instructional design (Bajracharya, 2019). The ASSURE model consists of (1) Analyze Learners, (2) State Objectives, (3) Select Media & Contents, (4) Utilize Media & Contents, (5) Require Learner Participation, and (6) Evaluate & Revise.

The first stage of the ASSURE model is to analyze students. The analysis process was carried out directly in several high schools in the social studies department in the city of Kediri. The goal is to find out their learning styles, mastery of technology, and interest in digital-based learning. The second stage is the determination of learning objectives. The third and fourth stages are the selection and use of media and learning contents. The media used in this learning design is virtual reality. Virtual reality is generated together with producing an instructional design with the aim that the media used is in accordance with the instructional design. the purpose of combining both of them is Learning media functions in providing 360-degree visualization to students regarding the virtual environment of the solar system learning content. The fifth stage of the ASSURE model is the determination of students. Students in 10th grades through high school majoring in Social Sciences and those pursuing a Geography specialization are eligible to participate in this learning plan. The last stage of this model is evaluation and revision. The evaluation process is carried out by experts using the expert judgment method. The expert is also the subject of this research.

Research subjects in this research is learning media experts, learning content experts, and instructional design experts. The research subject is tasked with providing an assessment of the level of validity of the instructional design (Fernández-Gómez et al., 2020). The data collection technique for the results of the instructional design validity test is to use a closed questionnaire instrument made using the Lee and Owen model approach (Lee & Owens, 2004). The questionnaires included a questionnaire to test the validity of learning media experts, a questionnaire to test the validity of a learning content expert, a questionnaire to test the validity of an expert and an instructional design. The grid of questionnaires used in this research showed in Table 1, Table 2, and Table 3.

Table 1. Tabel of The Grid of Learning Media Validation Questionnaire for Learning Content Experts

Indicators	Number of Question
Learning objectives are clearly stated to be studied by students	1
The learning content is in accordance with the Learning Objectives (TP) and Indicators of Achievement of Learning Objectives (IKTP)	2
Learning content is arranged according to a logical thinking sequence	3

Indicators	Number of Question
There are references used in the description of learning contents	4
There is an emphasis or highlight on an important part in the description of the learning contents	5
There are examples that are relevant to the learning content	6
The use of terms in learning contents is appropriate and correct	7
The use of words in the text and narration is correct	8
According to the *Ejaan Yang Disempurnakan* (writing rules in Indonesian)	9
The use of language does not cause multiple interpretations	10

(Lee & Owens, 2004)

Table 2. Tabel of The Grid of Learning Media Validation Questionnaire for Learning Media Experts

Indicators	Number of Question
The theme design for the learning media looks interesting	1
There is the use of multimedia elements	2
The display of the theme design on the media is integrated and continuous	3
The display on the learning media is simple and not confusing	4
Display layout on consistent learning media	5
There is navigation in the learning media	6
The selected or used video is interesting	7
High definition video quality	8
The narrator's voice on the learning media sounds clear and clean	9
The use of audio effects on learning media is appropriate and not distracting	10
The use of music in the learning media is relevant and unobtrusive	11
The use of video in learning media is appropriate and relevant to learning	12
The videos displayed are of high quality and clear	13
The duration of the video is just right, not too long or too short	14
The use of style, type, and color of text on learning media is appropriate and legible	15
Placement of text on the learning media is appropriate and does not obstruct other objects	16
Animation and special effects on the learning media can catch the attention of students	17
Animation and special effects in the learning media support the achievement of learning objectives	18
The use of animation and special effects in the learning media is not	19

(Lee & Owens, 2004)

Table 3. Tabel of The Grid of Instructional Design Validation Questionnaire for Instructional Design Experts

Indicators	Number of Question
Instructional design begins with recalling the previous learning content	1
Learning objectives are introduced in learning activities	2
Effective use of verbal language in instructional design	3
There is the use of examples and demonstrations in the instructional design	4
Students will learn more easily if the learning activities use concepts and language that are easy to understand	5
The design of learning activities is made systematic and continuous	6
The instruction is clearly presented in the instructional design	7
The presentation related to the minimum standard of achievement is clear and meaningful	8
There is a measurable evaluation	9
There is real-time feedback for students	10
The instructional design is presented to increase student motivation	11
The instructional design is relevant to real life	12

(Lee & Owens, 2004)

The closed questionnaire has four optional answer choices on a Likert scale consisting of 1) Strongly Agree, 2) Agree, 3) Disagree and 4) Strongly Disagree. The processing and analysis of the data from the validity test questionnaire was conducted through a descriptive quantitative percentage analysis approach by Arikunto

formula (Arikunto, 2013). The results of calculations using the Arikunto formula are then matched with the table of eligibility criteria showed in Table 4.

Table 4. Tabel of Criteria for Validity Level of Learning Media

Category	Percentace	Qualification	Desctiption
A	81%-100%	Valid	Decent
B	61%-80%	Quite Valid	Decent
C	41%-60%	Less Valid	Not Decent
D	<40%	Invalid	Not Decent

(Arikunto, 2013)

In addition to using a percentage descriptive analysis approach, instructional media and instructional designs were analyzed using a comparative descriptive analysis approach. The aim is to compare the results of the three experts in each field in testing instructional media and instructional designs. The formula used is the content validity formula by Aiken (Yusoff, 2019). Referring to this approach, the learning media and instructional design can be declared valid if the test results $T_c > T_t$. This proves that there is a common perception among experts in determining the validity of instructional media and instructional designs.

3. RESULT AND DISCUSSION

Result

Referring to the development model used, namely the ASSURE model, the results of the early stages of this research are the learners' characteristics. The characteristics analysis conducted on the research subjects were students from several 10th grade high schools in Kediri city. The results of the analysis of the learners' characteristics showed in Table 5.

Table 5. Tabel of Learner Characteristics

Category	Description
Level	10th grade of several high school in Kediri city
Number of Students	146 students
Age	±16 years old
Cognitive Development	The level of thinking is at the level of formal operational and logical thinking
Learning Style	• 63% of students have visual learning style, • 12% of students have auditory learning style, • 21% of students have kinesthetic learning style.
Digital Technology Using Ability	100% of students have personal smartphone and proficient in using the internet
Response to Interactive Digital Learning Media	• 71.43% of students need digital learning media to help with learning, • 82.14% of student interested to try interactive-digital learning media in learning, • 78.57% student interested about virtual reality.

After analyzing the learners' characteristics, the next step is to determine the learning objectives and content. Learning objectives and content have been included in the *Kurikulum Merdeka*. The learning objectives and content for the solar system in the geography subject for 10th grade high school showed in Table 6.

Table 6. Tabel of Learning Objectives and Content

Category	Description
Learning Objective (*Tujuan Pembelajaran*)	Analyzing the dynamics of planet Earth as a living space
Indicators of Achievement of Learning Objectives (*Indikator Ketercapaian Tujuan Pembelajaran*)	1. Students are able to analyze the spatial environment in the appropriate solar system learning content after using the Virtual Reality learning media properly. 2. Students are able to characterize learning contents for the planets

Category	Description
	that make up the solar system after using Virtual Reality learning media properly.
Learning Content	1. The theory of the formation of the solar system 2. The concept of the solar system 3. The planets that make up the solar system

Referring to the overall initial data, a learning media design is made to be used later in the instructional design. The design of the resulting virtual reality learning media showed in Table 7.

Table 7. Tabel of Design of Learning Media

Category	Description
Media Type	Learning media based on virtual reality with digital environment panoramic 360° or borderless
Purpose	Producing a digital learning medium containing solar system learning content for the 10th grade of high school that is effective in achieving learning objectives .
Format	*Borderless* mp4
Interaktivitas	Students can explore the virtual environment by directing VR glasses to see their surroundings.
Tools	Adobe After Effect, Adobe Premier Pro, 360 Meta Data

The virtual reality learning media was tested using an expert judgment approach. The results of this is testing of experts using an expert judgment approach. The experts are divided into three categories, namely learning media experts, learning content experts, and instructional design experts. Each expert consists of 3 experts, so that the total number of experts is 9. Each expert is given a closed measurement instrument with an optional number using a rating scale with a scale of 4. Tests related to the validity of the media aspect of learning media for learning media experts were given to 3 experts. Each expert is given the same instrument with the aim of obtaining comparative results. The results of testing by learning media experts using a descriptive quantitative percentage approach showed in Table 8.

Table 8. Tabel of Learning Media Validity Test Results by Learning Media Experts

Expert Name	Score	Percentace	Category	Desctiption
Learning Media Expert 1	3.47	86.84%	4	Valid
Learning Media Expert 2	3.42	85.53%	4	Valid
Learning Media Expert 3	3.37	84.21%	4	Valid

The results of the test using a descriptive quantitative percentage of the Arikunto formula showed that 3 learning media experts stated that they were valid on the media aspect of learning media. The results were compared using a comparative quantitative descriptive approach from the Aiken formula. The results of the comparative test on the results of 3 learning media experts showed V_c 1.00, which was the same as V_t. This means that the Virtual Reality learning media is declared valid with a good predicate on the overall media aspect by 3 learning media experts. The next test is the learning content contained in the learning media. The learning media validity test related to content was carried out by learning content experts. The number of learning content experts who tested the content was 3 experts, each of whom was given the same instrument. The results of media validity testing by learning content experts using a descriptive quantitative percentage approach showed in Table 9.

Table 9. Tabel of Learning Media Validity Test Results by Learning Content Experts

Expert Name	Score	Percentace	Category	Desctiption
Learning Content Expert 1	3.73	93.18%	4	Valid
Learning Content Expert 2	3.64	90.91%	4	Valid
Learning Content Expert 3	3.45	86.36%	4	Valid

The results of the test using a descriptive quantitative percentage of the Arikunto formula showed that 3 learning content experts stated that the learning content was valid in the learning media. These results were compared using a comparative quantitative descriptive approach to the Aiken formula. The comparative test

results show that V_c 1.00 is the same as V_t. This means that the learning content on the Virtual Reality learning media is declared valid with a good predicate as a whole by 3 material experts.

After the virtual reality learning media is declared valid by the learning media experts and learning content experts, the next step is to produce an instructional design that uses the virtual reality learning media. Instructional design refers to the procedure for making instructional designs called *Modul Ajar* (MA) in accordance with the provisions of the Indonesia *Kurikulum Merdeka*. The instructional design must be tested for validity using an expert judgment approach.The instructional design is tested by an instructional design expert who is an educational practitioner. The number of instructional design experts is three people, each given the same instrument. The results of testing the level of validity of the learning design using a descriptive quantitative analysis approach showed in Table 10.

Table 10. Tabel of Instructional Design Validity Test Results by Instructional Design Experts

Expert Name	Score	Percentace	Category	Desctiption
Learning Content Expert 1	3.00	75.00%	3	Valid
Learning Content Expert 2	3.25	81.25%	4	Valid
Learning Content Expert 3	3.67	91.67%	4	Valid

The results of the test using descriptive quantitative percentages in the Arikunto formula show that 2 instructional design experts state that they are valid and 1 instructional design expert states that they are quite valid in instructional design. These results were compared using a descriptive quantitative approach to the percentage of the Aiken formula. The results of the comparative test on the results of 3 instructional design experts showed V_c 0.89, which means it is lower than V_t, but the difference is only 0.11. This means that the developed instructional design is declared valid as a whole by 3 media experts with a passable predicate.

Based on the tests conducted by 9 experts who were divided into 3 expert groups, namely learning media experts, learning content experts, and instructional design experts, it showed that each field of expertise was declared valid both individually through a descriptive quantitative approach to percentages and comparatively through a comparative quantitative descriptive approach. So it can be concluded that the virtual reality media used in designing digital-based instructional designs in the subject of Geography in 10th grade of high school is declared valid and feasible for use in the implementation of the *Kurikulum Merdeka*.

Discussion

The problem of teachers in producing instructional designs in accordance with the *Kurikulum Merdeka* is a new problem in learning (Chaniago et al., 2022; Manalu et al., 2022; Sasmita & Darmansyah, 2022). This is what happened to the learning content of the solar system in the subject of Geography, grade 10th high school. High school teachers, especially in the City of Kediri, have difficulty producing appropriate instructional designs because of the complexity contained in the *Kurikulum Merdeka* (Bangkara et al., 2022). Referring to these problems, it is necessary to produce virtual reality learning media used in instructional design in the learning content of the solar system for the subject of Geography in 10th grade high school, which aims to solve problems in designing instructional designs that are in accordance with the needs of the *Kurikulum Merdeka*. Virtual reality, as the initial output of this research, has good potential in the Geography learning process. The use of virtual reality in geography learning is an appropriate form of utilizing digital media (Prisille & Ellerbrake, 2020; Wu et al., 2021; Yu et al., 2021).

The resulting learning media must be tested for its validity level (Rahayuningsih, 2020; Roemintoyo & Budiarto, 2021; Udayani et al., 2021; Wulandari et al., 2020). Testing the level of validity on learning media related to media aspects and content aspect which were validated by 3 learning media experts and 3 learning content experts. Validity of media aspect test showed valid and appropriate predicates (Table 8). The test results are compared using a comparative descriptive analysis approach, which shows that virtual reality learning media is valid and feasible. And for validity of content aspect test showed valid and feasible in loading solar system learning content without reducing the main essence of the content (Table 9). The results of the validity test by the learning content experts were compared using a comparative descriptive approach, showing that the virtual reality learning media was able to contain the solar system learning content with valid and feasible predicates. After that, produces an instructional design output, the *Modul Ajar* (MA) in accordance with the provisions of the *Kurikulum Merdeka*. Instructional design testing was carried out by instructional design experts and obtained valid and appropriate predicates (Table 10). The instructional design test results were re-examined using a comparative descriptive approach, and the results were found to be quite valid and feasible. The validity of a media shows that the media is suitable for use in learning (Fahmi et al., 2021; Filivani & Agung, 2021; Hariyani et al., 2021).

The results of this research indicate that the virtual reality learning media is able to contain virtual reality learning content and is in accordance with the aspects of the good learning media. The potential of virtual reality is what makes this learning media very suitable in the media aspect and suitable for use in digital-based instructional designs (Aji et al., 2020; Khairudin et al., 2019; Kitchen, 2020; Yu et al., 2021). This is reinforced by various other researchs shown the suitability of virtual reality learning media in loading solar system learning content in geography subjects (Zikky et al., 2018). Through the 360º Panoramic View approach, virtual reality is able to visualize the learning content of the solar system (Borman et al., 2018). The instructional design in accordance with the *Kurikulum Merdeka* is a *Modul Ajar* (MA) with a high level of complexity (Suryaman, 2020). So, combining these three things is a solution that can answer the problem of the need for innovative digital-based instructional designs that are in accordance with the *Kurikulum Merdeka*.

This research focuses on the solar system learning content for grade 10th high school, which refers to the rules in the Indonesian *Kurikulum Merdeka*. Thus, this research cannot be used at other levels of education, both in general and in particular. This is a limitation of this research. However, this research can be a scientific contribution related to the use of virtual reality in learning and the design of instructional design that refers to the *Kurikulum Merdeka*. There is no other research that shows results in the form of instructional designs in accordance with the Kurikulum Merdeka than previous research. Other research only focuses on the use of virtual reality in learning, which shows good significance (Alrehaili & Al Osman, 2019; Khairudin et al., 2019; Stojšić et al., 2016). Another recent research focused on how successful the presence and interaction between virtual reality and learners (Ozdemir & Ozturk, 2022; Saputro & Setyawan, 2020). Although research related to the use of virtual reality in Geography has been popular since 2001 (Fisher & Unwin, 2021). However, there is no research that focuses on the use of virtual reality in instructional design that refers to the Indonesian curriculum, namely the Kurikulum Merdeka. So that this research becomes the starting point of scientific contributions to the design of instructional design using Kurikulum Merdeka. Thus, it is hoped that in the future, similar research will be carried out on different learning content according to the characteristics of learning content and students in order to enrich scientific contributions in the field of instructional design.

4. CONCLUSION

The problems that have been described are related to the demands of a *Kurikulum Merdeka* in designing an instructional design is the *Modul Ajar* (MA) which becomes a problem for teachers, especially in the learning content of the solar system in the subject of Geography, 10th grade of high school. The result of this research is to produce output in the form of virtual reality learning media that is used in instructional design on solar system learning materials that can answer the above problems. This study shows that virtual reality and the instructional design made are declared valid and feasible to be used in the learning process in the subject of geography in the 10th grade of high school.

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