



Enhancement of Students' Learning Outcomes through Virtual Reality based on Case-Based Learning in Social Studies

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ABSTRACT

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Purpose The study aimed to determine the effectiveness of using virtual reality based on case-based learning in social studies to improve learning outcomes in junior high school students. **Methodology** The simple random sampling technique using the Slovin formula was used to identify 80 students of SMPN 30 Grade VII in the 2022/2023 school year in Koja, North Jakarta, Indonesia. The experimental research method with a one-group pretest-posttest was utilized to conduct this research. In addition, the researcher used the paired sample t-test to test the hypothesis and the Kolmogorov-Smirnov t-test to test normality in this study.

Findings The results of the independent samples test showed that the significance value with 2-tailed was $0.000 < 0.05$; then, as the basis for decision-making in the independent sample T-test, it was concluded that H_0 was rejected, and H_a accepted. Thus, there was a significant difference between the average student learning outcomes in the experimental and control groups. **Implications to Research and Practice** This research provides an innovation and alternative solutions to overcome misconceptions that occur in learning, especially in social studies subjects, so that the substance and essence of social studies Education can be realized through a case approach that is factual and contextual to the lives of students and also provides classroom learning innovations that are up to date and interesting by technological developments in the era of the industrial revolution 4.0.

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Introduction

Social Science is one of the compulsory subjects that must be taken by students at the Junior High School level, where the curriculum has undergone many changes, and the material content contained in it also contains many concepts. Social Science is no longer normative; the curriculum comprises many concepts from various interrelated social science network. Learning can occur in networks where each interacts to revive the network until, finally, the network can contribute to each individual involved (Siemens, 2014). Social Sciences is also one part of formal environmental education that integrates several concepts of social science disciplines, humanities, science and even various issues and social life problems. This makes the characteristics of social studies learning different from other monolithic disciplines. Social studies integrate multiple social science disciplines such as sociology, history, geography, economics, politics, law, and culture. Social Studies is one of the educational programs at the school level with a strategic and essential mission: to form, train and develop students to become citizens of society, nation, and state with comprehensive knowledge, understanding, and skills (civic competence). Skills developed in social include critical thinking skills, problem-solving, and decision making (decision-making) to live the life of modern society and the state of life of the global community (NCSS, 2017).

Based on the characteristics of social studies, to meet the achievement of learning in the classroom, it is necessary to implement social studies learning that is effective and meaningful learning. Social studies learning is not just teaching what is right and what is wrong; more than that, social studies education instils habits (habituation) about which things are good so that students become aware (cognitive) about what is right and wrong, able to feel (affective) good value and used to do it (psychomotor). Good social studies learning must involve not only aspects of "good knowledge (moral knowing), but also "feeling good or loving good (moral feeling), and good behaviour (ethical action) by integrating the use of relevant technology as a 21st-century learning needs.

Based on the results of preliminary research conducted at the State Junior High School 30 Koja, North Jakarta, Indonesia, as seen in Table 1, it can be displayed that social studies learning outcomes are still relatively low, especially for class VII students.

Table 1.

Learning Outcomes of Students in Class VII of SMPN 30 Jakarta 2021/2022 academic year

Class	Rate	Amount	Criteria	Grate Completion
VII A	≥75	20	Complete	63%
	<75	12	Incomplete	
VII B	≥75	19	Complete	59%
	<75	13	Incomplete	
VII C	≥75	21	Complete	67%
	<75	12	Incomplete	
VII D	≥75	20	Complete	63%
	<75	12	Incomplete	
VII E	≥75	18	Complete	56%
	<75	14	Incomplete	
VII F	≥75	22	Complete	69%
	<75	10	Incomplete	

Table 1 presents that social studies learning outcomes were still low; this can be seen from the acquisition of student scores with the Minimum Completion Criteria that has been set at 75 for each class still ranging from 50% to 70% of learning completeness and has not reached a percentage of 80% of class completeness, so there are still many students who have social studies learning outcomes below the Minimum Completion Criteria.

The low student learning outcomes must undoubtedly be a concern for teachers to find alternative solutions so that the learning carried out can be successful, which in turn is in line with student learning outcomes to be optimal. The low student learning outcomes are caused, among others, by the learning media applied by the teacher, which still needs to be appropriate with the characteristics of students and social studies subjects.

Eventually, a survey was conducted for students, especially class VII students of SMP Negeri 30 Koja North Jakarta, Indonesia, to reinforce the preliminary research results, as shown in Table 2.

Table 2.

Student Response to the Social Studies Learning Process at SMP Negeri 30 Koja Jakarta

Indicators	Response/Answer (%)			Number of Students
	Yes	No	Neutral	
Interest in the method/model used	16%	57%	27%	30
Interest in the learning media used	23%	50%	27%	30
Contextualized learning with daily life	23%	61%	16%	30
Enthusiastic in following the learning	30%	43%	27%	30
Encourages cooperation and critical thinking	30%	33%	37%	30
Encourage problem/case solving	25%	47	26	30

Based on the data in Table 2, it is known that there is a tendency for students to lack and still need more interest in the learning methods or models carried out by the teacher. In addition, the teacher also needs to relate learning material to everyday life so that learning is deemed less contextualized with students' conditions. Furthermore, students are less enthusiastic about participating in learning in class, and social studies learning does not encourage cooperation, critical thinking, and problem-solving. Conditions like this can make learning less exciting and boring so that student interest in education could be higher, affecting the meaningfulness of learning and student learning outcomes.

Problem Statement

The underlying problem is that many teachers base the wrong assumptions in teaching social studies. The results of interviews with social studies teachers in the region of Jakarta, Indonesia, in the preliminary research, revealed that teachers thought social studies is a

cognitive subject, which contains knowledge that can be transferred as a whole from the teacher's head to the head of students with textbook oriented pattern by asking students to read a lot and memorize the contents of the book. Teachers also revealed that social studies subjects are abstract in nature, which makes it difficult to deliver the material to be relevant and become concrete or contextual to students' daily lives. In addition, teachers also revealed that they need help to use learning media that is appropriate to the context of the material and in line with the development of digital technology as it is today.

These findings are also reinforced by the results of interviews with students, where, in general, students revealed that the tendency of learning carried out by teachers is more to ask them to read books and do assignments in the form of questions to answer or discuss, teachers also tend to use less learning media that is fun to attract and motivate student interest, which of course will make students quickly bored in participating in classroom learning. The study also found that teachers find it difficult when they have to teach abstract learning materials to be contextualized with students' daily lives. As a result, the teacher felt leading well, but students needed to learn optimally. In addition, such a learning pattern caused learning social studies to be "arid", and because learning was done as rote learning, memorized (cognitive) alone, the essence of social studies learning objectives were not well conveyed. This issue is increasingly complex, considering the material.

Social studies at the junior high school level is a comprehensive and abstract subject, finding the right solution so that the substance and essence of social studies learning can be realized as expected. Therefore, to be able to discover effective and meaningful learning, a teacher must master a variety of methods, strategies, and learning media that are packaged to provide student learning experiences. How the teacher packages the learning experience dramatically influences the meaningfulness of the experience for students. Learning experiences that show more links between conceptual elements make the learning process more effective. The conceptual links learned with the relevant side of the field of study will form a scheme (concept) so that students will gain wholeness and roundness of knowledge. The acquisition of wholeness, wisdom, and a rounded view of life and the natural world can only be reflected through integrated and contextual learning.

This study premised that, in order to be able to carry out contextual learning in line with the development of technology and information in social studies learning, it is necessary to take suitable approaches and learning strategies of the use of learning media. This will support the achievement of social studies goals, namely as a subject that equips students to be able to think critically, solve problems and make decisions. Interpreting the era of the Industrial Revolution 4.0, which is an era of digital transformation, learning activities are expected to reduce the application of the lecture method to transfer knowledge and increase the proportion of knowledge-constructing activities by students using innovative learning media, such as virtual learning and case study methods (Seol et al., 2023).

Virtual reality technology helps users feel a three-dimensional (3D) atmosphere that seems natural. This technology is specifically designed so that humans can feel various visual experiences in real life. It can be a learning tool that allows students to enter a three-dimensional environment to activate their' interactive learning experience. It can actively

involve learners in learning by reacting dynamically to students' movements and behaviour (Chen, Grierson, & Norman, 2015; Christou, 2010). In addition to integrating technology in Education (in this case, virtual reality), it also requires an approach and method of learning that is by the characteristics and objectives of social studies itself. It is necessary to renew learning by packaging and integrating social studies learning in technology because technological developments have encouraged social science teachers to modernize pedagogy and practice by using technology in the learning carried out (NCSS, 2017). Using new technologies like Virtual Reality for learning can boost motivation compared to conventional learning materials (Akçayır et al., 2016). In other studies Parong and Mayer (2018), stated that students were more motivated and interested in the learning material when learning in a virtual learning environment when compared to other learning methods.

Furthermore, constructivist-oriented case-based learning is expected to encourage students to be able to solve problems and construct their knowledge. The case-based learning is a student-centred learning approach that involves students actively discussing specific and factual situations or problems (Kaddoura, 2011). The case-based learning model can use authentic issues in everyday life that are open to solve and can develop various thinking skills, independent learning, analysis, sensitivity to problems, practice problem solving, and evaluation problems in analyzing and critical thinking (Thistlethwaite et al., 2012). The learning process is seen as giving meaning by students to their experiences, while the teaching process not only directs students to be able to build their knowledge but also participates with students to form new knowledge in students, make meaning, seek clarity and be critical of things that have been learned. Case-based learning can also provide opportunities for an active process where students build their knowledge by utilizing various learning resources, allowing them to actively collaborate with friends to engage with concepts, ideals and principles. More important is how students can solve problems associated with knowledge obtained from the surrounding environment and then build this knowledge into expertise according to the student's thinking.

Based on this, it is necessary to examine the model of virtual reality in case-based social studies learning to improve learning outcomes at the junior high school level because virtual reality is the transmission of information and material that is factual, contextual, and up to date to clarify the material provided to students in classroom learning.

Literature Review

Several studies exist that have discussed the learning experiences of students. For instance, Edinyang (2016) states that the importance of social learning theory in social studies learning is related to the ability of learners to absorb the behaviour shown in their environment by paying attention to several socialization agents and absorbing the behaviour displayed. Likewise, other studies (Freina & Ott, 2015; Radianti et al., 2020) have realized that teachers can apply social learning theory to achieve the goals and objectives of social science disciplines and that virtual reality as a digital medium is increasingly used in education in addition to conventional learning methods such as textbooks. Virtual reality implemented in learning can attract students' interest and feel the atmosphere in the classroom during offline learning. The novelty of virtual reality technology can also bring excitement and fun to the learning environment (Maas & Hughes, 2020; Merchant et al., 2014; Radianti et al., 2020).

Some previous research results show that using virtual reality in learning can increase student motivation (Makransky, Wismer, & Mayer, 2019). Virtual reality can create an immersive simulation that allows users to interact while feeling like they are in an environment in the virtual world Jensen and Konradsen (2018). reviewed the use of immersive virtual reality technology specifically for the acquisition of skills focusing on immersion and presence and found that virtual reality helps train cognitive skills related to spatial and visual knowledge, visual scanning, observational skills, psychomotor skills involving head movements, and effective control of emotional responses in stressful or difficult situations. In addition, learners can also interact strongly with the material and experience an immersive sensory experience (Kozhevnikov, Gurlitt, & Kozhevnikov, 2013; Parong & Mayer, 2018; Wu, Yu, & Gu, 2020). Radianti et al. (2020) also found that virtual reality can be an appropriate tool to improve procedural, practical, and declarative knowledge in higher Education, Webster (2016) compared students who learned with virtual reality and showed higher learning scores on the posttest for learning performance. This finding aligns with other studies, which also found that learning by using virtual reality can improve learning outcomes (Alhalabi, 2016; Meyer, Omdahl, & Makransky, 2019; Passig, Tzuriel, & Eshel-Kedmi, 2016).

Furthermore, the application of case-based learning in learning can improve scientific reasoning skills that are consistent. Case-based education allows students to apply prior knowledge while building deep understanding (Masko, Thorndson, & Borysewicz, 2020). Students felt that case-based learning effectively improved their information literacy and critical thinking skills, covering many learning outcomes and competencies. Applying case-based knowledge in education can also enhance scientific reasoning skills and is consistent (Yao et al., 2023). Case-based learning includes knowledge of similar context experiences and theoretical information (Bhardwaj et al., 2015). Case-based education is considered appropriate for social learning, having social studies subjects that contain social problems that occur in real life of everyday students so that students will be accustomed to critical thinking and problem-solving efforts from various issues faced.

Case-based collaborative learning model and case-based classroom activities have become a trend in education in American schools. This learning can improve content mastery and encourage student engagement (Zeng et al., 2017). Case-based learning can build artificial experiences with the practice of challenging situations and critical thinking in small groups by evaluating cases positively as a new inspiring method (Takala & Wickman, 2019). Case-based learning bridges theoretical study and practice, as knowledge comprises similar context experiences and academic information (Bhardwaj et al., 2015). Case-based learning can use authentic problems in daily life that are open to solve and can develop various thinking skills, independent knowledge, analysis, sensitivity to issues, practice problem solving, and evaluation problems in analyzing and critical thinking (Hong & Yu, 2017; Thistlethwaite et al., 2012).

Case-based learning makes cases effective and the best way to structure and facilitate learning experiences, improves student learning performance and promotes interaction among members as well as optimizing student interaction and engaging students in active learning (Chen & Kuo, 2019; Frankl et al., 2017; Maslen & Hayes, 2020). Case-based learning can also enhance study skills, analytical and problem-solving skills in groups with self-directed learning abilities, and interactive student-centered, where real-life situations are used as cases to promote active learning and instill analytical and reasoning skills (Pathak, Dixit, & Mukherjee, 2016). Masko et al. (2020) shows an advantage of using case-based

learning, where case-based learning allows students to apply prior knowledge while building deep understanding. Case-based learning effectively improves their information literacy and critical thinking skills, covering many learning outcomes and competencies.

Applying case-based learning can also improve scientific reasoning skills, which is consistent with the learning process and can improve students' practical skills and critical thinking potential compared to the classical method (Qi et al., 2018). Nkhoma et al. (2017) shows that the case-based learning teaching method can positively impact higher-order thinking, which has a positive influence on practical evaluation knowledge, which will result in a positive effect on knowledge improvement. In addition to increasing students' knowledge, case-based learning can improve students' curiosity and motivation based on real social cases to connect theoretical knowledge with real-world applications (Chankong & Maneetien, 2018). Innovation in learning is undoubtedly needed in implementing learning to the development and challenges of the 21st century, including social studies learning. The virtual reality model in case-based social studies learning is one of the alternatives to realizing effective learning. In this model, students solve authentic problems in everyday life that are open to solving, and students can learn independently and develop various thinking skills, analysis, critical and evaluative, and solving cases or problems.

Methodology

- *Research Design*

This study adopted a quantitative research design that conducted several data distribution tests like the normality test and Kolmogorov-Smirnov test and performed the experimental method of pretest-posttest invention to test the effectiveness of the resulting product. The data was collected through Research and Development methods, mainly using the ADDIE model to develop virtual reality in social studies. Table 1 presents the pattern of one group pretest-posttest research design.

Table 3.

Experimental Research Design

Groups	Pretest	Treatment	Posttest
Experiments	O ₁	X	O ₂

Description:

O₁: Pretest (initial test)

O₂: Posttest (final test)

X: Virtual reality in social studies

- *Research Sample*

A simple random sampling with the Slovin formula was adopted to identify 80 students of SMPN 30 grade VII in the 2022/2023 school year in Koja, North Jakarta, Indonesia. This study used an experimental research method with a one-group pretest-posttest. In addition, the researcher used the paired sample t-test to test the hypothesis and the Kolmogorov-Smirnov t-test to test normality in this study.

- *Research Instrument and Procedure*

In addition to a questionnaire for students, semi-structured interviews with grade seven teachers of SMPN 30 Koja, North Jakarta, Indonesia, were also used to collect data. This study also used Pretest and posttest instruments related to student learning outcomes in case-based social studies learning. The pretest measurement was conducted before the treatment; the researcher provided therapy in virtual reality-based social studies learning. After the experimental treatment, the posttest was given to the experimental group. The pretest results were compared with the posttest results of the experimental group after treatment. The comparison between the pretest and posttest of the experimental group shows the effect of virtual reality-based case-based social studies learning treatment on learning outcomes. The grids of pretest and posttest statements about student learning outcomes in case-based social studies learning can be seen in Tables 4 and 5.

Table 4.

Table of Pretest Instruments of Virtual Reality in Case-Based Social Studies Learning

Sub Theme	Case	Total
Connectivity between spaces	Cannot analyze Jakarta's public transportation	2
Indonesia's Natural Conditions	We cannot analyze flooding in the capital city of Jakarta.	3
Population Dynamics	Cannot detect population density in Jakarta and surrounding areas	2
Changes due to interactions between spaces	Cannot examine environmental pollution in urban forests	1
Sustainable development	Cannot analyze natural to artificial land use change	2
Community empowerment	Cannot outline waste management issues	1
Social and cultural life issues	Cannot examine social conflict	3
Scarcity and human needs	Cannot analyze lack in fulfilling needs	3
Community economic activities	Cannot detect lifestyle changes	2
The role of science and technology in economic activities	Cannot examine digital crime	1

Table 5.

Table of Posttest Instruments Virtual Reality in Case-Based Social Studies Learning

Sub Theme	Case	Total
Connectivity between spaces	Canto analyzes Jakarta's public transportation	2
Indonesia's Natural Conditions	Can analyze flooding in the capital city of Jakarta.	3
Population Dynamics	Can detect population density in Jakarta and surrounding areas	2
Changes due to interactions between spaces	Can examining environmental pollution in urban forests	1
Sustainable development	Can analyze natural to manufactured land use change	2
Community empowerment	Can outline waste management issues	1
Social and cultural life issues	Can examine social conflict	3
Scarcity and human needs	Can analyze lack in fulfilling needs	3
Community economic activities	Can detecting lifestyle changes	2
The role of science and technology in economic activities	Can examining digital crime	1

Tables 6, 7, and 8 show the validation instruments from material, media, and linguist experts to test the media's feasibility at this study's trial stage.

Table 6.

Material Validation Instrument Table

Aspects	Total (%)
Suitability of material to learning outcomes	91.43
Accuracy of the material with the scope of the material	88.57
Material accuracy	90.00
Recency of material	82.86
Relevancy of instructional materials	85.71
Encourage critical thinking	82.86
Encourage case/problem solving	85.71
Average	86.73

Table 6 shows that the assessment of the material expert review, virtual reality in case-based social studies learning is excellent. This is shown from the percentage of the average score, which is 86.73% and is included in the category "very feasible" when adjusted to the Likert Scale and categorized as "very feasible" when modified to the Likert scale.

Table 7.

Media Validation Instrument Table

Aspects	Total (%)
Media display	91.43
Media Accuracy	88.57
Ease of media	85.71
Interactive media	88.57
Visualization of media	91.43
Media hearing	82.86
Immersion of media	85.71
Average	87,75

Table 7 shows that the assessment of the Media Expert review is perfect. Virtual reality in case-based social studies learning is excellent. The percentage of the average score demonstrates this is 87.75% and is included in the category "very feasible" when adjusted to the Likert scale.

Table 8.

Linguist Validation Instrument Table

Aspects	Total (%)
Straightforward	85,00
Communicative	80.00
Dialogic and interactive	95.00
Appropriateness to learners	85.00
Conformity to language rules	90.00
Average	88,89

Table 8 shows that the assessment of the linguist expert review of virtual reality in case-based social studies learning is excellent. This is shown from the percentage of the average score, which is 88.89% and is included in the category "very feasible" when adjusted to the Likert scale and categorized as "very feasible" when modified to the Likert scale.

Data measurement analysis technique was used to determine material, media, and language experts' responses using a Likert scale with the questionnaire score category, as shown in Table 9.

Table 9.

Validation Score-Category Material, Media, And Linguist Experts

Scoring Scale	Alternative Answer
5	Very good
4	Well
3	Pretty good
2	Not Good
1	Not very good

The feasibility test of virtual reality in case-based social studies learning is analyzed with a percentage rating scale. The validation criteria used in the validity research of virtual reality in case-based social studies Education are presented in Table 10.

Table 10.

Media Eligibility Criteria Based on The Rating Scale

Percentage of Scoring Result	Eligibility criteria
86% - 100%	Very Worthy
51% - 85%	Worthy
26% - 50%	Less Worthy
0% - 25%	Not feasible

Results

Virtual reality in case-based social studies learning makes it easier for students to understand information by increasing students' comprehension, analytical power and memory, with quick and broad access to social characters integrated into social studies lessons by generating an authentic 3D atmosphere, making users (junior high school students) feel like they are in the real world even though the simulation in front of them is virtual. Students are invited to understand and explore various social cases and issues through a series of information from virtual reality in case-based social studies learning that generates students' interest, attraction, and active participation.

Teachers need to analyze the material to select relevant learning materials that can be packaged in virtual reality media. Teachers can use virtual reality as learning media to make it easier for students to understand complex and difficult-to-reach learning materials better. Learning using virtual reality media can provide students with immersive and fun learning experiences and align with technological developments. The scope or scope of the material developed adapts to the characteristics of social studies, namely the integration (integrated) of social sciences by the scope of material contained in junior high school social

studies learning materials, especially class VII. Virtual reality media is developed using Unity software to create videos through immersion, android applications, and Canva supported by hardware: laptops, android phones, and virtual reality-box smartphones (virtual reality glasses) to get an immersive/virtual learning experience.

The data normality test was carried out to measure the distribution's normality so that the statistical selection can be carried out appropriately. The normality test in this study used the Kolmogorov-Smirnov test with the following test criteria: If the significance value (sig) > 0.05, it is stated that the data is normally distributed, or H0 is accepted, and H1 is rejected; If the significance value (sig) < 0.05, it is stated that the data is not normally distributed or H1 is accepted, and H0 is rejected.

Table 11.

Normality Test Result

Test of Normality			
	Statistic	Kolmogorov-Smirnov	Sig.
Pretest	0.087	df 80	0.200
Posttest	0.094	80	0.079

Based on the analysis results in the one-sample Kolmogorov-Smirnov Test Output in Table 11, it can be indicated that the significance value (sig) is greater than the $\alpha = 0.05$ value, namely $0.200 > 0.05$ for the pretest value and $0.079 > 0.05$ for the posttest value. Therefore, based on the predetermined test criteria, H0 is accepted, meaning the pretest and posttest data are normally distributed.

In this study, students were given pretest and posttest questions using test instruments in multiple-choice questions following the material studied as many as 20 questions. A data normality test was also carried out to measure whether the data obtained had a normal or abnormal distribution so that statistical selection could be done appropriately.

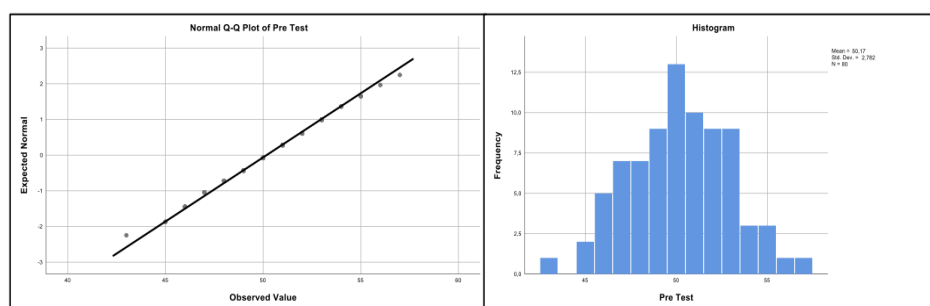


Figure 2. Normal Distribution of The Pretest

Based on the Q-Q Plot graph in Figure 2, we can see that the distribution of points is around and close to the diagonal line, as well as the characteristics of the diagram, which is shaped like a bell and does not deviate to the right or left; this shows that the pretest data is normally distributed.

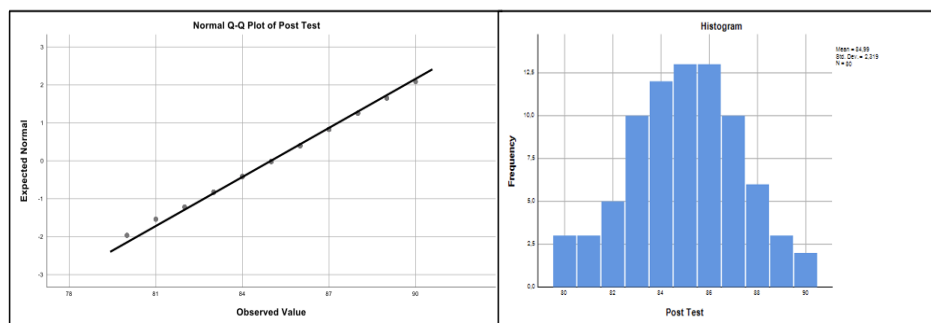


Figure 3. Normal Distribution of The Posttest

The posttest results are shown on the Q-Q Plot graph in Figure 3, where the distribution of points is around and close to the diagonal line, as well as the characteristics of the diagram, which is shaped like a bell and does not deviate from the right or left. This indicates that the posttest data is normally distributed.

Furthermore, a homogeneity test was carried out to determine the variance of the data population whether between two or more groups of data have the same or different variants and use the following testing rules shown in (Table 12 and Figure 4): If the significance value (sig) > 0.05, then the data distribution is said to be the same (homogeneous) or H0 accepted H1 rejected; If the significance value (sig) < 0.05, then the data distribution is not homogeneous, or H1 is accepted and H0 rejected.

Table 12.

Homogeneity Test Results of Pretest and Posttest

		Test of Homogeneity of Variance			
		Levene Statistic	df1	df2	Sig.
Pretest and Posttest	Based on Mean	2.422	1	158	0.122
	Based on Median	2.176	1	158	0.142
	Based on the Median and with adjusted df	2.176	1	152.58	0.142
	Based on trimmed mean	2.434	1	158	0.121

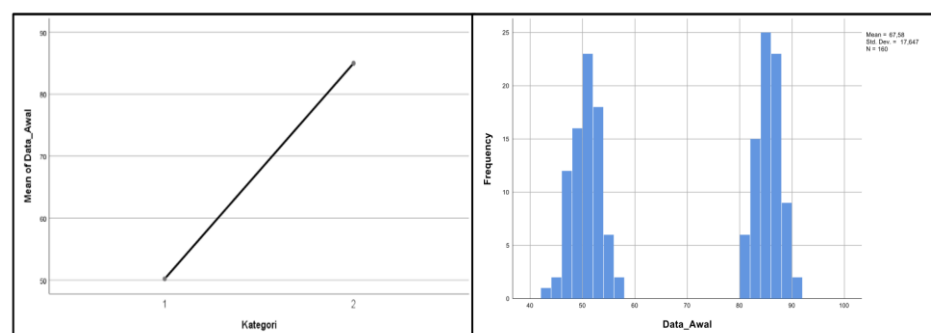


Figure 4. Graphs And Histograms of Pretest and Posttest Homogeneity Tests

Based on the analysis results in the Test of Homogeneity of Variances Output shown in Table 12 and Figure 4, the significance value (sig) is greater than the $\alpha = 0.05$ value, $0.122 > 0.05$. Therefore, based on the predetermined test criteria, it is obtained that H0 is accepted, which means that the data distribution is homogeneous.

Hypothesis testing was conducted using the Paired t-test test to determine whether there is a significant difference between students' pretest learning outcomes before using virtual reality in case-based social studies learning and students' posttest learning outcomes after using virtual reality in case-based social studies learning. The Paired t-test test was conducted using the test criteria as follows: If the significance value (sig) > 0.05 or count $<$ table, it can be told that there is no difference in the average pretest learning outcomes with posttest learning outcomes or H0 is accepted, and H1 is rejected; If the significance value (sig) < 0.05 or t count $>$ t table, it can be said that there is a difference in the average pretest learning outcomes with posttest learning outcomes, or H1 is accepted, and H0 is rejected.

Table 13.

Paired Samples Statistics

		Paired Samples Statistics			
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pretest	50.18	80	2.782	0.311
	Posttest	84.99	80	2.319	0.259

Table 13 presents the results of the paired samples statistics which is a summary of the descriptive statistics of the two samples studied: the pretest and posttest learning outcomes for students. In the output table, it is known that the number of respondents used as research samples is 80 students. In addition, the Pretest's average value (mean) was 50.18, and the average value of the posttest was 84.99. So descriptively, there is an average difference in learning outcomes between the pretest and posttest learning outcomes on virtual reality in case-based social studies learning.

Table 14.

Independent Samples Test

		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	Pretest-Posttest	-34.813	3.202	0.358	-35.525	-34.100	-97.230	79	0.000

Based on the table of independent samples test results in Table 14, a significance value of $0.000 < 0.05$ and a negative t count of -97.230 is obtained, which can be positive because the average pretest learning outcomes are lower than posttest learning outcomes. So that the t counted of $97.230 >$ t table 1.990, based on the predetermined testing criteria, it is known that H1 is accepted and H0 is rejected, which means that there is a difference in the average pretest learning outcomes before the use of virtual reality in case-based social studies learning with posttest learning outcomes after using virtual reality in case-based social studies learning.

After knowing the average difference between pretest learning outcomes before using virtual reality in case-based social studies learning and posttest after using virtual reality in case-based social studies learning, proceed to test the N-Gain value. This N-Gain test is to determine the effectiveness of the use of virtual reality in case-based social studies learning. The categorization of the N-Gain value can be determined based on the N-Gain value or the N-Gain value in per cent. Table 15 and Table 16 present the criteria and interpretation of the N-Gain value.

Table 15.

N-Gain Score Criteria

Score Gain	Criterion
$g > 0,7$	High
$0,3 < g < 0,7$	Medium
$g < 0,3$	Low

Table 16.

Effectiveness Of N-Gain Categories

Percentage (%)	Interpretation
<40	Ineffective
40-55	Less Effective
56-75	Quite Effective
> 76	Effective

Table 17.

N-Gain Results

	Descriptive Statistics				
	N	Minimum	Maximum	Mean	Std. Deviation
NGain score	80	0.59	0.79	0.6983	0.04614
NGain %	80	59.09	78.72	69.8323	4.61362
Valid N	80				

Table 17 presents the N-Gain score showing as 0.69 which is in the medium criteria. Meanwhile, when viewed from the percentage, the acquisition of N-Gain is 69%, which means it is effectively included in the interpretation category. In other words, virtual reality in case-based social studies learning improves students' learning outcomes.

Discussion

Virtual reality media is a computer-based technology that combines particular input and output devices so that users (in this case, junior high school students) can interact deeply with virtual environments as if they were in the real world. Virtual reality media is a powerful technology to solve real-world problems today; it is a technology to ignite users to relate to or feel an event in a computer-operated area (computer-simulated environment). This study made evident that the model of virtual reality media in case-based social studies learning is one of the alternatives to realize effective learning where students use authentic problems in everyday life that are open to solving, and students can

learn independently and be able to develop various thinking, analysis, critical and evaluative skills and problem-solving.

This finding is similar to the study that virtual reality can promote students' academic achievement (Villena-Taranilla et al., 2022). Virtual reality can assist learning activities through highly realistic 3D visualization to manipulate objects virtually, which are similar to the real world, having quality in excellent classification. This is also in line with Sureephong et al. (2023) which revealed that implementing virtual reality in class can improve student learning outcomes. Virtual reality as advanced technology creates virtual immersion in a digital environment. It allows users to dip themselves into an interactive three-dimensional world where many sensory and psychological experiences are engaged. In addition, virtual reality videos as asynchronous e-learning supplements positively affect student cognitive learning outcomes (Ylipulli et al., 2023). Virtual reality with a virtual simulation mode is required to improve students' grasp of the topic. Students' competencies gained via virtual reality in learning include increased inventive thinking skills, problem-solving ability, critical thinking practice, and empathy. Students can repeat studying the content individually (asynchronously) with virtual reality video technology, influencing their more profound understanding.

Papanastasiou et al. (2019) discussed a few pedagogical advantages such as increasing engagement level, promoting self-directed learning, enabling multi-sensory learning, improving spatial ability, confidence and fun, promoting student-centred technology, combining virtual and real objects in a natural environment and reducing cognitive load. Another study, Scavarelli, Arya, and Teather (2021) explored virtual and augmented reality in social learning spaces, such as classrooms and museums, while extending the concept of relevant social interactions in more reality-based and immersive social media frameworks. The conclusions drawn are that virtual reality media positively affects student learning outcomes; when virtual reality is compared with other educational practices, it is seen that virtual reality can improve the learning process (Villena-Taranilla et al., 2022). Several variables, such as level of immersion, length of intervention, and knowledge domain, influence the impact of virtual reality on learning outcomes.

Virtual reality can compensate for the lack of authentic touch (e.g. in situations of social isolation), especially those involving social relationships (Gallace & Girondini, 2022). Virtual reality is a pedagogical tool for various fields of study to encourage engagement. It benefits medical, engineering, language, and social learning, providing an opportunity to gain hands-on experience in the environment. In addition, it helps students engage in the presented virtual environment, experience a sense of presence in it, and enhance their learning experience. Therefore, this review finds virtual reality an essential pedagogical tool to strengthen students' experiential learning (Mayer & Schwemmle, 2023). It can offer a potentially exciting environment for teaching students. The faculty plans to use the metaverse as a dual workspace and classroom for student participants (Qiu, Isusi-Fagoaga, & García-Aracil, 2023). The application of virtual reality technology in creating digital media art helps enrich the means of art creation and improve the quality of the art creation process (Gong, 2021).

In other disciplines, virtual reality can complement traditional skills training and be part of treatment for people with schizophrenia (Oliveira, Simões de Almeida, & Marques, 2021). In healthcare, virtual reality applications in neurosurgery target neurosurgeons mainly in the

areas of training (76.8%) and Education (21%) and target patients and focus on the use of virtual reality for therapy (Vayssiere et al., 2022). Virtual reality can also explore the usability of learning 3D modelling in a virtual reality environment (VRE) (Huang & Lee, 2022). Virtual reality 3D modelling is likely an essential development in industrial design, particularly in product design decisions and designer communication in a synchronous virtual modelling environment. A study showed that the virtual reality group performed significantly better after training. With good VR simulation, satisfaction was substantially higher in the VR group compared to the control group (Birrenbach et al., 2021).

The findings of this study echo in many previous studies. For instance, Tran and Herzig (2023) assert that using circle share discussion activity, case-based learning affects students' argumentation skills as students' argumentation skills are critical in the learning process to make learning effective. Case-based learning can improve experimental skills and make students more confident (Ma & Zhou, 2022). Case-based learning can develop a 3D lab system that supports semi-automated experiment generation, assessment, and instant knowledge-based conversation. Case-based Education improves students' academic. Case-based learning can enhance critical thinking and confidence. Case-based Education in security management practice can motivate students to have essential discussions, draw on relevant experiences, encourage questioning of accepted practices, and create a dialogue between theory and practice (Fromke, Jordan, & Awan, 2022). Case-based learning is an innovative pedagogical instrument. Case-based learning can empower teachers and students to work together efficiently and effectively.

Case-based learning is also well received and considered adequate for students' better understanding of classroom material and encourages more medical schools to explore incorporating case-based knowledge in the curriculum. Students using the case-based learning approach demonstrated adequate conversational English, so it can be used to foster primary school students' ability to learn and use vocabulary in sentence contexts. Case-based learning in first-year medical students is a pedagogical method that uses clinical cases to reinforce learning topics, where students receive case-based learning and integrate this learning style into the preclinical curriculum without completely replacing didactic-based learning (Dai et al., 2020).

Conclusion and Recommendations

This research provides an innovation and alternative solution to overcome misconceptions that occur in learning, especially in social studies subjects, so that the substance and essence of social studies learning can be realized through a case approach that is factual and contextual to student life and also provides learning innovations in the classroom that are up to date and interesting by technological developments in the era of the industrial revolution 4.0. The model of virtual reality media in case-based social studies learning makes it easier for students to understand information by increasing students' comprehension, analytical power and memory, with quick and broad access to social characters integrated into social studies lessons by evoking an authentic 3D atmosphere, thus making users (junior high school students) feel like they are in the real world even though the simulation in front of them is virtual, and can further increase the effectiveness and efficiency of the learning process.

In this study, students were invited to understand and explore various things about cases and social issues through a series of information from virtual reality-based social studies learning that generates student interest, attraction and active participation. The case-based learning approach provided students with practical and efficient learning through content analysis of complex cases based on experience and knowledge gained to solve authentic instances so that the cognitive abilities and creativity of students become more honed and innovative in finding alternative final solutions and wise solutions to every social case in society. The model of virtual reality media in case-based social studies learning helped convey information through case-based learning that is authentic, contextual, accurate and raised from social issues and daily life regarding social studies materials. Social studies learning outcomes in students can increase because it is integrated into social studies learning as a learning resource assisted by virtual reality information technology for the needs of students as learners for information about social problems that can be accessed easily without time limits, up to date, stimulating student interest, engaging, and fun.

Improved learning outcomes in the model of virtual reality media in case based on social studies learning in junior high school will make students independent, creative, interested and motivated and are in a learning environment that is deliberately created for effective and meaningful learning (meaningful learning) which in turn will encourage the achievement of social studies learning objectives in developing critical thinking skills, problem-solving and decision making, which is relevant to 21st-century competencies. Although learning with virtual reality has advantages and benefits, there are some challenges in developing virtual reality-based learning, especially at the school level, including the readiness of teachers to use virtual reality, the long time needed in packaging educational virtual reality content, and the need to consider health aspects if using virtual reality for too long.

Virtual reality integrated into social studies learning in junior high school is helpful to convey information through case-based learning that is authentic, contextual, accurate and raised from social issues and daily life regarding social studies materials. Social studies learning outcomes in students can increase because it is integrated into social studies learning as a learning resource assisted by virtual reality information technology for the needs of students as learners of information about social issues that can be accessed easily without time limits, up to date, stimulating student interest, engaging, and fun. The use of virtual reality in case-based social studies learning in junior high school will make students independent, creative, interested and motivated in a learning environment that is deliberately created for effective and meaningful learning, which in turn is expected to encourage the achievement of social studies learning objectives in developing critical thinking skills, problem-solving and decision making, which are relevant to 21st-century competencies.

This study encountered a few limitations including (i) learning social studies using virtual reality requires "costs" that are not cheap; this is because virtual reality technology, including smartphones and other supporting devices, can be an obstacle in adopting virtual reality in the educational environment, especially in schools with limited budgets; (ii) learning social studies using virtual reality requires quality virtual reality content, which requires technical skills in creating accurate and realistic 3D environments and

sound interactions, so it requires a lot of time and energy in developing it; (iii) learning social studies using virtual reality with a case-based learning approach has limited material coverage. This is because the cases used in case-based learning may only cover some of the curriculum or topics to be learned. This can be a problem if important material is missed or if students need to gain a thorough understanding of the broader topic in its development; and (iv) virtual reality uses smartphones with an Android system, which cannot be used on smartphones with an IOS system.

It is recommended that virtual reality should be adopted in the world of education and learning, considering that virtual reality is increasingly becoming a technology trend that is widely developed. In addition to using virtual reality in education, further research is needed in health and tourism in the use of virtual reality for a long time. In learning by using virtual reality, it is necessary to select realistic cases; besides, it is necessary to enrich the content by presenting learning cases in a more in-depth way by providing additional elements in the form of improved graphics, audio, and even haptic experiences.

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