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Development of Hologram Media Based on Problem Based Learning Ability Think Critical Symbiosis Material Class III At SDN Sidomulyo 01

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***Abstract*—**This research is motivated by the lack of varied learning media. The aim of the research is to improve critical thinking skills through the development of Hologram Media with the Problem Based Learning model. The research method uses Research and Development (R&D), the development model uses ADDIE which consists of five stages: analysis, design, development, implementation and evaluation. The research subjects were media, language and material expert validators, teachers, and 15 class III students. Data collection techniques include observation, questionnaires and documentation. Data analysis uses qualitative and quantitative methods. Hologram media was validated by 89.7% of media experts, 89.4% of material experts and 97.5% of language experts in the "very appropriate" category. The teacher's practicality test obtained 90%, while student responses showed 91% in the small group and 94% in the large group "very practical". The effectiveness test of the results of the t-test analysis proved a significant difference between before and after treatment, showing an increase from 56.33% to 89.67%. Furthermore, the N-Gain test for 15 students received an average score of 80% in the "Effective" category. So it can be said that Hologram Media Based on Problem Based Learning is effective in improving critical thinking skills.

Keywords— Hologram Media, Problem Based Learning , Thinking Critical.

INTRODUCTION

Development technology very fast communication and information This naturally give very big benefits in life man . (Ratminingsih , 2020) to put forward that with development technology in education moment This , educators and participants educate can with fast search and find various information about knowledge knowledge via the internet. Various field life always utilise technology For help overcome every The problems it faces are also very technological influential for aspect man especially in the field of Education. Science knowledge and technology (IPTEK) is developing with fast and complex in the era of globalization . The role of science and technology is increasingly wide make every institution education compete in increase quality education .

Education is foundation main or beginning in development national . One of the part education is learning moment This teacher is required capable make activity real learning can make student own knowledge Good in a way theory and practice . According to Djamaluddin (2014) education is business For develop and grow potential self Good physical and also appropriate

spiritual with environment . In terms of this , educator must find or create atmosphere learning that is fun and also easy student For understand , interpret , and relate material the lessons he learned .

21st century learning is transition learning through implementation curriculum to guide school For switch to approach learning teacher centered to student centered (Daryanto, 2017) . Skills 21st century needs in learning that is skills think critical thinking, collaboration , communication , and creativity or normal called with 4C. Skills 21st century promotes learning lifelong lifelong learning that enables student For adapt become more responsive to change around they (Lapek, 2018) .

Learning in the current era This experience Lots development from various side , thing the not escape Because existence change the applicable curriculum . In Indonesia, implementing curriculum independence . According to Fatirul , (2022) stated about curriculum independent namely implementation system learning that emphasizes formation character participant educate so form the assessment that occurred was also not only limited to academic , but more emphasize How characteristics participant educate each other.

Facts on the ground prove Lots problems that occur in the field such as , learning Still book - centered packages and LKS, with method monotonous lectures . Media limitations , both concrete and also ICT based , making student passive , bored , and lacking interested Study . Use of teaching media can help achievement success Study (Putri, 2017) . Teachers play a role as center learning , not facilitator . Although including school mover , facility still minimal, such as absence of LCD projector , loudspeaker sound , and science laboratories , which inhibit science lab . Learning process not enough effective and not activate students , things This make student difficult For understand material and tend to will bored in Study activity (Rostikawati , 2016) .

Educator must have creativity tall For designing supportive media learning and appropriate with development of science and technology. Availability facilities and infrastructure at school it is also mandatory in accordance standard . According to Isma, (2023) state lack of access to infrastructure adequate education , gap in quality and relevance curriculum with demands of the times, challenges in recruit , train , and improve competence of the workforce teachers , and obstacle in apply learning distance far into the digital age, everything impact on quality and equality education . Overcoming boredom and boredom student In the learning process , teachers should using learning media or learning models so that the learning process walk with effective (Utami, 2019) .

Learning model Lots its uses start from planning learning and planning curriculum until design ingredients learning , including multimedia programs . Learning models functioning as guidelines for designers learning and teachers in plan as well as carry out activity learning . According to Yuspiani , (2024) stated learning model approach innovative is very important in increase readiness student face challenges in the future , and can give more opportunities big for student For Study in accordance with speed and style Study students , so that make it more inclusive . According to Ahmad, (2020) appropriate learning model in overcome the problem that occurred is a learning model based on problem .

The Problem Based Learning (PBL) model is a learning model Where participant educate sued For think critical and creative every finish problem contextual (Anwar, 2019) . The purpose of method learning This done For make student more active and capable Study in a way independent with various the task given For hone ability students . (Shoimin , 2014) Learning model innovative as done This naturally have obstacle in implementation that is not in accordance with what was planned . Various innovation method learning This take action continue from demands from development increasingly advanced technology advanced in the world of education (Nurdyansyah , 2016). Development technology the influence method or learning model integrated into 21st century education where learning student - centered in finish problem .

The Problem Based Learning (PBL) model is a learning model Where participant educate dig a information related current material studied with his knowledge Alone in to develop ability think level high . The syntax of the PBL learning model is (1) orienting student related problems faced ; (2) organizing participant educate in Study with to form group ; (3) Guiding investigation in group ; (4) presenting results ; (5) Analyze results (Pratiwi, 2020) . Therefore that , ability think critical be one of reject measuring For evaluate whether PBL learning can influence results Study students . According to Muchrib (2018) , one of the The advantages of the PBL model are: can practice ability participant educate For think critical and developing interest in the learning process . This learning make participant educate can Study independent from given problem . Designed problem can build return understanding participant educate on knowledge that has been got previously .

Ability think critical is activity understand , formulate problem , collect , analyze information with method be careful , right and wrong easy accept opinion , clarify necessary and unnecessary information required so that the conclusion drawn from the process can accountable (Yuniar , 2022) . Ability think critical covering clarification basis , foundation decision , conclusion , clarification continue , ability estimating and combining . In thinking critical there is a number of indicator inside it namely capable analyze argumentation , able ask , able answer question , able solve problem , able make conclusions and be able to evaluate / assess overall (Arjudin , 2022) .

Table 1.1 Critical Thinking Indicators

Indicator	Description Indicator
Analyze Argumentation	1. Students Respond and Question A Assumptions 2. Students Collect Keywords From Problems As Information More Carry on .
Able to Ask	1. Participant educate analyze information in a way objective and accurate

	2. Participant educate to question quality information Supporter
Able to Answer Questions	1. Participant educate formulate possible alternative answers 2. Participant educate give information via pick list decision
Able to Solve Problem	1. Participant educate look for information what 's still there need added 2. Participant educate give a reason for think that That is correct answer or Accurate Solution
Able to draw conclusions and be able to evaluate / assess Overall	1. Participant educate give evaluation best with quality decisions 2. Participant educate give evidence leading to a conclusion

Critical thinking and problem solving are one of the skills need grown develop on participants educate . Skills This Already to obtain confession as the main skill For success in live , work as well as learning in the 21st century (Roudlo , 2020). Meanwhile, meaning think critical according to (Sari, 2022) is thinking logical reflective For justify What should done and believed . Critical thinking is intended in research This namely the process for help participant educate can create appropriate ideas, concepts and conclusions so that you can act with Good in face a problem (Maesaroh , 2021).

Implementation PBL learning also influences the teaching materials used . Merger method learning This also utilizes teaching media based on electronic and face to face face . So in general tid ak direct , method learning in a way combination This also combines media or teaching materials used (Cronje, 2020) . Utilization of learning media based on technology has a big influence improvement mastery in understand various material (Sufiyanto , 2022) . Various teaching media , namely in the form of learning videos , multimedia, educational games, e-modules and others .

Instructional Media is all something teachers use for help convey materials and building understanding students for learning more effective and efficient . Hologram learning media is means included to in modern media. According to Hasyim, (2019) holograms are notes from interference positive that comes from from wave laser light and has excess keep what information is in it load objects three dimension (3D). Hologram is A technology that can display a picture , view , or scene in form three visible (3D) dimensions as if picture the go out from A flat place (Nabila, 2024) . According to Muasyaroh , (2022) stated Like other media , hologram media requires device hardware and devices soft use display A hologram image . Hologram media requires help from device soft in the form of a cellphone. From the statement above can it is concluded that hologram media is A tools that can utilized as tool For convey material learning with use help 3D objects so that seen real .

Science subjects at school base aiming For introduce students on the concept base knowledge knowledge nature and help they develop understanding beginning about phenomenon nature that exists around . Indra, (2021) explains that science is developed science based on phenomenon nature and method scientific involving phenomenon biological and non- biological . Mastery the lack of science concepts , resulting in the value he obtained low . Based on Exposure on resulting in the process of knowledge transfer knowledge not enough maximum , the result student No understand matter what is said by the teacher. So that will affect the results learning and achievement students who are declining . According to Gumilar , (2023) stated Lots elementary school students think science learning as scary learning , no interesting , boring and difficult . As a educator must can create how to make learning This can accepted with good by students , no There is Again perception If science learning is boring learning will but changed become eye fun lesson .

A number of research has also been researching development of hologram learning media based on Problem Based Learning for increase ability think critical participant educate . In line with study (Sari, 2015) , that multimedia creation based on problem will increase ability student For think critical . In addition research conducted by Wati, (2021) stated that use of the Problem Based Learning model in learning will create student class III more active and atmosphere fun learning . This is also in accordance with study Aditya, (2023) which shows use of learning media This influential positive to conceptualization student to eye difficult science lesson . Students more involved and motivated For Study Because Mica Hologram 3D's ability to make Topic abstract become more concrete . In addition , it is strengthened by research conducted by (Jannah et al., 2020) that the PBL Model with AudioVisual Media Support Regarding the Learning Outcomes of the Beautiful Theme Diversity My Country Effective , as well as study Insani et al (2021) developed device learning mathematics based on Science, Technology , Engineering and Mathematics (STEM) for increase ability think critical student .

Hologram media brings impact positive in learning with increase activity and interest students . Different from the previous model which only use mica shaped pyramid , research This develop a box- shaped hologram for produce light more clear . This media PBL based , featuring Syntax learning , and applied in science learning about symbiosis , so that student more easy understand draft in a way concrete and enjoy an innovative and fun learning process .

From the description above , researcher lift title " Development of Hologram Media Based on Problem Based Learning for Ability Think Critical On Symbiosis Material Grade III at SDN Sidomulyo 01".

METHOD

Research methods used that is Research and Development (R&D) with the ADDIE model. According to Maydiantoro , (2021) said that Research and Development is method study For develop and test products that will be will developed in the world. According to (Cahyadi, 2019) The ADDIE model consists of into five steps , namely : (1) analysis (analyze) , namely analysis done use results from instrument interview , (2) design that is gather various reference For content , select color , choose font types , designing media, to choose application Supporter For develop media, (3) development that is after develop media prototype , then done validation media expert , expert materials and experts Language For evaluate eligibility and quality Contents loaded content in the media, (4) implementation , namely do implementation of media to teachers, after That done to participant educate , and (5) evaluation , namely acquisition results Study cognitive and achievement indicator think critical indicates that this media effective in increase ability participant educate in increase ability think critical they . Following chart from ADDIE development model procedures .

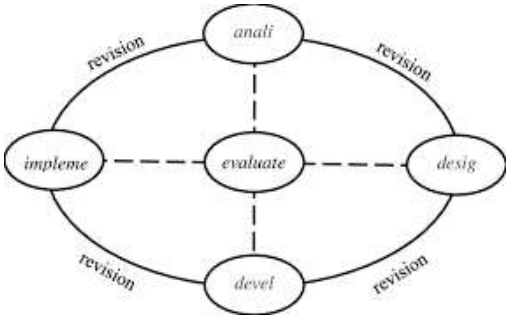

Figure 1.1 ADDIE Development Model (Cahyadi, 2019)

Data collection techniques in study This covers observation , interview , documentation , sheet validation products , as well as questionnaire for teachers and students . Data analysis was carried out use method qualitative and quantitative .

Qualitative data analysis techniques is technique analysis data in the form of results that describe or in the form of words and sentences submitted by the validator with criticism and suggestions about hologram media that researchers develop . Whereas quantitative data analysis is the process of analyzing data in the form of the numbers obtained from results percentage answer hologram media questionnaire in science learning with processed use technique statistics For answer question study or test hypothesis

Hologram Media Feasibility Data Analysis Based on Problem Based Learning known with through data analysis from validation lecturer media expert , expert material , language expert . According to Andrew, (2019) Questionnaire response student own rule giving score For count feasibility , practicality , effectiveness that is Score 4 Strongly Agree , Score 3 Agree , Score 2 Less Agree , Score 1 Disagree .

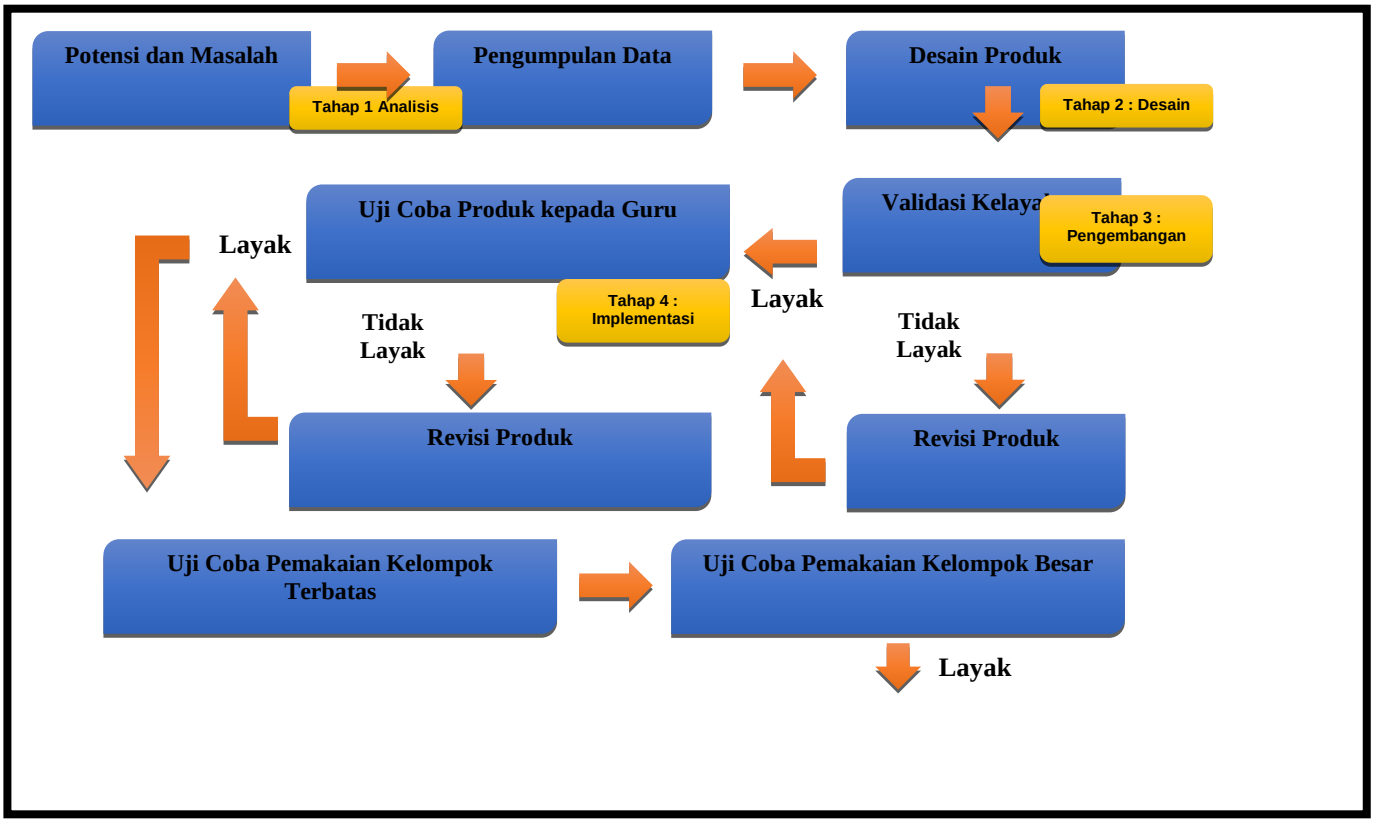

Figure 1.2 Implementation flow study

Questionnaire sheet This given to media expert , expert material , expert teacher and student language For given evaluation product in the form of hologram- based media problem based learning . Aspects and indicators developed in accordance with need For evaluation .

Table 1.2 Instrument Grid Validation of Media Experts, Material Experts and Language Experts

Aspect	Indicator	Assessment Aspects
Media	Alignment with learning objectives	Alignment with learning objectives Conformity in learning activities Compliance with learning assessment Suitability to student needs
	Feedback and Adaptation	Students' ability to respond to material The material meets the needs of students
	Motivation	The ability of learning objects to develop students' learning motivation
	Design	The correctness of writing text on the media Compliance of layout settings and 3D image objects The suitability of color combinations and compositions in the media as a whole Conformity of color display on media background Color display conformity Appropriateness of image placement on media
	Usability	Ease of media operation
	Accessibility	Ease of access for students with the devices used
Material	Accuracy of media content with competencies to be achieved	Hologram media appearance Suitability of holograms to purpose Hologram conformity to achievement indicators Study
	Completeness of materials	Completeness of materials and objectives achieved Completeness of video sections with the material to be achieved.
	Material breakdown	Presentation of material can provide learning assistance Presentation of material can be additional knowledge for students Presentation of material can attract students' interest
	Quality of motivation	Presentation of material makes students pay attention The presentation of the material fosters curiosity. Feeling happy
	Student learning interest	Interest Student involvement Student attention
Language	Compliance with development participant educate	Compliance Language with level development think participant educate Suitability language with development social participant educate
	Communicative	Teaching materials presented with interesting , easy language understood , and not give rise to multiple interpretations Compliance illustration with substance message
	Dialogic and interactive	Ability Motivate participant educate For respond message Encouragement think critical of participants educate
	Straightforward	Accuracy structure sentence

		Standardization terms (terms used in accordance with the Big Indonesian Dictionary)
	Coherence and sequence flow of thought	The collapse between sentence in One paragraph with relatedness Contents Integrity meaning in chapter / sub chapter / paragraph
	Compliance with Correct Indonesian Language Rules	Grammatical Correctness Accuracy spelling

Modification from source : Wulandari, (2021)

Table 1.3 Grid of Practical Instruments for Teachers and Students

Aspect	Indicator	Aspect Evaluation
Teacher	Harmony with objective learning	Compliance of TP, CP, and indicators achievement Flow Compliance with objective learning Compliance Contents material with indicator Clarity objective learning
	Coverage material	Media suitability with material Compliance illustration with material
	Accuracy material	Accuracy the material presented in learning media Clarity the material presented in learning media
	Compliance between rules correct Indonesian language	Compliance use of the word with Enhanced Spelling (EYD) Standardization language and terms used Effectiveness sentences used Convenience understand language used (not meaningful double)
	Compliance Language development participant educate	Compliance Language with level development think student Compliance Language with level development emotional student
	Motivation	Learning media capabilities in Motivate participant educate
	Design	Convenience media operation Legibility the material presented Visual conformity of 3D images Compliance combination and composition color Compliance appearance color *background* Compliance appearance 3D color
Student	View of teaching materials	Attractive design Clear 3D objects
	Material	The material presented is easy to understand
	Activity	Active in learning Don't feel bored while following the learning process
	Student attention	Student Concentration in Learning
	Attraction	Desire to study other materials with similar media
	Convenience	Ease of using hologram media Ease of understanding material in hologram media

Modification from source : Wulandari, (2021)

Analysis The feasibility of hologram media based on Problem-Based Learning is assessed from each aspect with standard certain . Media is considered worthy if you pass the lecturer test expert through questionnaire provided . Eligibility counted with formula : P = (Amount) Score achieved / Total score highest) × 100%. Hologram Media Based on Problem Based Learning is stated worthy If the presentation exceeding 70% (Noviana , 2021).

Analysis The practicality of hologram media based on Problem-Based Learning is seen from practicality of teachers and students . Practicality student measured through questionnaire response , analyzed with count percentage response positive use formula : P = (Amount) response students per aspect / Total total response) × 100%. Criteria practicality : 76%-100% (Very Practical), 51%-75% (Practical), 26%-50% (Quite Practical) Practical), 0%-25% (Not Practical) (Sahida, 2018) .

Analysis The effectiveness of hologram media based on Problem-Based Learning was carried out researcher to student with total 15 students . Product researcher it is said effective if fulfil mark completeness Study student in using hologram media

based on Problem-Based Learning is shown through acquisition score question pre test and post test . Here formula method count results acquisition score average student score do question that is :

The t-test is testing This done functioning For know existence the average difference between , two identical samples but done different treatment , but with condition data distribution is classified as normal (Setianingsih & Nelmiawati , 2020). Determination criteria reception or rejection , Ha or Ho at the level 5% significance : a) If t count > t table , then Ho is rejected , Ha is accepted or it is said significant , meaning in a way partial independent variable (X) has an effect significant to the dependent variable (Y), then hypothesis accepted . b) If t count < t table , then Ho is accepted and Ha is rejected , then it is said No significant , meaning in a way partial variable independent (X) influential No significant to variable dependent (Y) then hypothesis rejected .

Normalized–Gain Test, Stages furthermore namely perform the Gain normalization test (N-Gain) with objective can categorize level effectiveness use formula as following : Based on adapted formula from Husein, (2015) Calculation of Normalized Gain (N-Gain) using formula : N-Gain = (Posttest Score - Pretest Score) / (Ideal Score - Pretest Score), N-Gain Criteria : g < 0.3 (low), 0.3 ≤ g ≤ 0.7 (moderate), g > 0.7 (high). The effectiveness of hologram media based on Problem-Based Learning is categorized as following : <50 (no effective), 50-70 (less effective), 70-80 (effective), 85-100 (very effective).Finally, complete content and organizational editing before formatting. Please take note of the following items when proofreading spelling and grammar:

RESULTS AND DISCUSSION

RESULTS

Stage analysis , At the stage analysis , observation learning show a number of problems , such as learning book - centered packages and LKS with method monotonous lectures . Media limitations , both concrete and also ICT based , making student passive and less interested . Teachers play a role as center learning , not facilitator . Although school including mover , facility still minimal, such as No the presence of LCD projector , loudspeaker sound , and science laboratories , which inhibit practical work science . At the stage this , activity interview done to teachers and students class III SDN Sidomulyo 01 with objective For strengthen analysis problem .

Stage design at stage Hologram Media Design Based *Problem Based Learning* customized with results analysis . Stage First media design includes making design in accordance material part body plant class IV. The process begins with develop types of images and videos symbiosis , such as mutualism (buffalo and birds) starlings), commensalism (sharks and remora fish), and parasitism (mosquitoes and humans). Content made with Adobe Premiere, using background black and effect move . Hologram box created from coated duplex paper cardboard with mica acrylic in the middle , and decorated picture funny . In addition , the second hologram shaped pyramid backwards from plastic mica .

Figure 1.3 Design for making Hologram Media using Adobe Premiere, and Display of Hologram Box and Pyramid media based on PBL

Stage second , researchers compile instrument research that will be used For assess the media developed . Research instruments covering questionnaire validation , media expert , expert material , expert language . Stage development , stage This is stage advanced with to concretize all the concept that has been designed at the design stage . Next Hologram Media Based on Problem Based Learning Validated by Lecturers validator expert namely media expert , expert materials and experts language . From the results validation show that results obtained from media expert 89.7% category "very worthy ", expert material 89.4% category "very worthy ", expert language 97.5% category “very decent ”.

Table 1.4 Expert Validation Test Data

Validation	Lecturer Name	Institution of Origin	Presentation	Category
Media Expert	Dr.S ,M.Pd	PGRI University of Kanjuruhan Malang	89.7%	Very Worth It
Subject Matter Expert	Dr. CS, M.Pd	PGRI University of Kanjuruhan Malang	89.4%	Very Worth It
Linguist	Dr. R, M.Hum	PGRI University of Kanjuruhan Malang	97.5%	Very Worth It

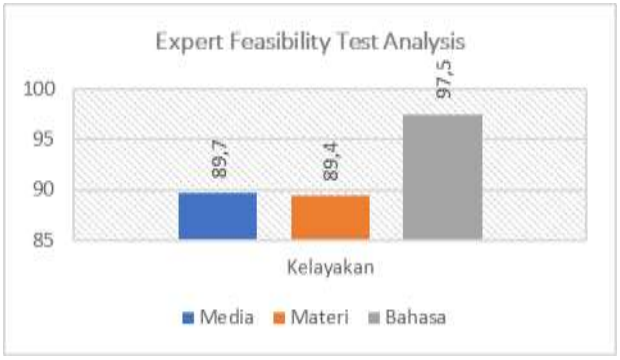

Figure 1.4 Feasibility results

Stage implementation , stage implementation This done with teacher practicality test , student test group small totaling 7 students , and the test on students group big totaling 15 students class III at SDN Sidomulyo 01 as subject study .

The questionnaire that has been given to teachers and students requested For filled in in accordance with instruction filling . The results of the practicality test by the teacher obtained an average percentage of by 90% with “Very Practical ” category . Assessment results response students on trial field limited to group small get percentage 9 1 % with “Very Practical ” category , in the group big get percentage 9.4 % with “Very Practical ” category .

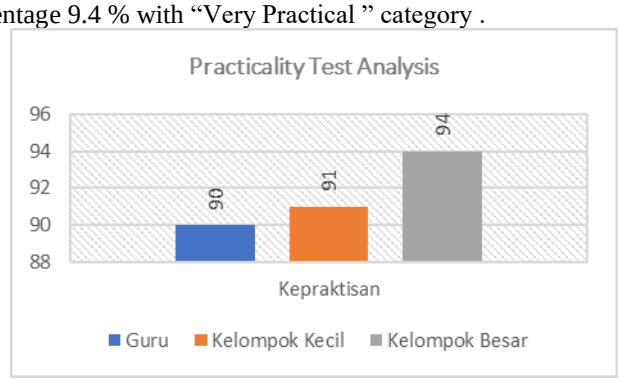

Figure 1.5 Practical results

Stage Evaluation , Assessment results question evaluation with score the value that has been obtained participant educate done with trial method by 15 students Class III at SDN Sidomulyo 01 which aims to For know the effectiveness of Hologram Media Based on Problem Based Learning used during the learning process .

Stage First , Research This using the paired t-test (Paired t-Test) to test whether there is significant difference between mark before (Pre) and after (Post) treatment . Use The purpose of the paired sample T test hypothesis test is as comparator the difference between the two means of two paired samples and having influence to normal data classification . Here This is t-test hypothesis results research that has been done : Ho: no There is significant influence between pre-test (before using Hologram Media Based on Problem Based Learning) and post-test (after Hologram Media Based on Problem Based Learning) on improvement ability think critical students . Ha: there is significant influence between pre-test (before using Hologram Media Based on Problem Based Learning) and post-test (after using Hologram Media Based on Problem Based Learning) towards improvement ability think critical student . Determination criteria reception or rejection of Ha or Ho at the level 5% significance : 1) if sig < 0.05, then Ha is accepted , 2) if sig > 0.05, then Ho is accepted .

Tabel 1.5 Paired Samples Statistics

Pair	Mean	N	Std. Deviation	Std. Error Mean
Pretest	56.33	15	18.75	4.84
Posttest	89.67	15	9.43	2.43

Tabel 1.6 Uji t Skala Besar

Paired Samples Test

	Paired Differences				t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference			

					Lower	Upper			
Pair	Pretest – Posttest	-34.33	12.04	2.64	-38.84	-27.83	-12.99	14	.000

From table 4.17. it is obtained mark significant obtained is 0.000, the value significance 0.000 < 0.05, then Ha is accepted , indicating the group data big There is significant influence between pre-test pre-test (before using Hologram Media Based on Problem Based Learning) and post-test (after using Hologram Media Based on Problem Based Learning) towards improvement ability think critical student .

From the results of the statistical test , it was obtained t-Stat value = -12.99 with degrees freedom (df) = 14. The p-value obtained for a two-tailed test is 0.0000000034 , which is far more small from 0.05. This is show that there is very significant difference between mark before and after treatment .

In conclusion , the results analysis This prove that there is real and significant difference between condition before and after treatment . Improvement the average value from 56.33 to 89.67. The average increase of 33.33 from the Pretest Data to the Posttest Data , indicates that the treatment given succeed increase results in a way significant .

Stage second namely the N-Gain Test, based on pretest and posttest results , used N-Gain test for know whether ability think critical student experience improvement . In class III there are 15 students finish pretest and posttest questions . N-gain test was conducted with use information from pretest and posttest scores students . Results of the N-gain test of ability think critical shown in the table following .

Table 1.7 N-Gain Test Data

No	Student Name	Mark		N – Gain Formula		N – gain Score	Criteria
		Post test	Pre-test	Post – Pre test questions	Ideal score (100) – Pre – test		
1	KAB	100	85	15	15	1	Tall
2	HQA	100	85	15	15	1	Tall
3	NCAD	95	70	25	30	0,83	Tinggi
4	NEOV	95	60	35	40	0,87	Tinggi
5	AA	95	55	40	45	0,88	Tinggi
6	ENZ	95	50	45	50	0,90	Tinggi
7	FII	95	55	40	45	0,88	Tinggi
8	ARA	95	60	35	40	0,87	Tinggi
9	MF	90	55	35	45	0,77	Tinggi
10	AFY	90	65	25	35	0,71	Tinggi
11	IHUU	90	60	30	40	0,75	High
12	TWH	85	50	35	50	0.70	High
13	DRPA	80	45	35	55	0.63	Medium
14	MAH	70	30	40	70	0.57	Medium
15	AMI	70	20	50	80	0.62	Medium
TOTAL		845	1345	500	655	12.0	
AVERAGE		56.3	89.6	33.3	43.6	0.8	Effective

Table 1.8 N-Gain Test Results

Respondents	Total
Overall N-Gain value	12.03
Average N-Gain Value	0.802
Average N-Gain Value in percent	80%
Criteria	Effective

Based on the table above, the average N-Gain score of critical thinking skills for 15 students is 80% with the category "Effective". So it can be said that Hologram Media Based on Problem Based Learning is effective in improving critical thinking skills .

DISCUSSION

Knowledge knowledge and technology develop with fast and complex in the era of globalization (Ratminingsih , 2020) stated that with development technology in education moment This , educators and participants educate can with fast search and

find various information about knowledge knowledge via the internet. Education is foundation main or beginning in development national . One of the part education is learning moment This teacher is required capable make activity real learning can make student own knowledge Good in a way theory and practice . Learning in the current era This experience Lots development from various side , thing the not escape Because existence change the applicable curriculum .

Facts on the ground prove Lots problems that occur in the field such as , learning Still book - centered packages and LKS, with method monotonous lectures . Media limitations , both concrete and also ICT based , making student passive , bored , and lacking interested learning . Teachers play a role as center learning , not facilitator . Although including school mover , facility still minimal, such as absence of LCD projector , loudspeaker sound , and science laboratories , which inhibit science practicum . Learning process not enough effective and not activate students , things This make student difficult For understand material and tend to will bored in Study activity (Rostikawati , 2016). So one of them The method can done with using learning media and active learning models as well as in accordance with Merdeka curriculum . Learning model Lots its uses start from planning learning and planning curriculum until design ingredients learning , including multimedia programs. According to Ahmad, (2020) appropriate learning model in overcome the problem that occurred is a learning model based on problem .

The Problem Based Learning (PBL) model is a learning model Where participant educate sued For think critical and creative every finish problem contextual (Anwar & Jurotun , 2019). The purpose of method learning This done For make student more active and capable Study in a way independent with various the task given For hone ability students . The advantages of the PBL model are: can practice ability participant educate For think critical and developing interest in the learning process .

Hologram media brings impact positive in learning with increase activity and interest students . Different from the previous model which only use mica shaped pyramid , research This develop a box- shaped hologram for produce light more clear . This media PBL based , featuring Syntax learning , and applied in science learning about symbiosis , so that student more easy understand draft in a way concrete and enjoy an innovative and fun learning process .

This learning make participant educate can Study independent from given problem . Designed problem can build return understanding participant educate on knowledge that has been got previously . Ability think critical is activity understand , formulate problem , collect , analyze information with method be careful , right and wrong easy accept opinion , clarify necessary and unnecessary information required so that the conclusion drawn from the process can accountable (Yuniar et al., 2022). In the study This ability think critical student can increase due to researcher implementing PBL -based hologram media . In the Problem Based Learning model there are a number of Syntax in it , in study This very influential syntax namely in the syntax 3rd guide investigation in group . Students do teacher - guided observations / investigations . Investigation This done with observing hologram media.

CONCLUSION AND SUGGESTIONS

CONCLUSION

In the research development This is a product that was developed in the form of Hologram Media Based on Problem Based Learning using a development model ADDIE which includes Analysis (analysis), Design (design) , Development (development) , Implementation (implementation) and Evaluation (evaluation) . Based on Validity test results Hologram Media products based on Problem Based Learning are validated by three validator expert , consisting of from validation media expert , expert materials and experts Language to obtain “Very Eligible” category . Next results The practicality of Hologram Media Based on Problem Based Learning tested by teachers, responses students in groups small and group big get “Very Practical ” category . results This t-test analysis prove that there is real and significant difference between condition before and after treatment . Improvement the average value from 56.33 to 89.67. The average increase of 33.33 from Data 1 to Data 2, indicates that the treatment given succeed increase results in a way significant . In addition The results of the N-Gain effectiveness test were obtained “ Effective ” criteria . The results of the study This can made into a reference for other research in do study similar developments , as well as follow up with effectiveness test .

SUGGESTIONS

Based on conclusion development Hologram Media Based on Problem Based Learning , then researcher provide suggestions for teachers , namely as alternatives that can utilized For development of learning process teaching at school base said , at the same time add learning media new fun for participant for students . product This can used student as an interactive learning medium in a way independent in class or at home . For other researchers this media can used reference as well as expected can develop product more creative , fun and exciting so you can increase quality learning for participant educate

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