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The Effectiveness of Developing Android-Based IPA Learning Devices to Improve Students 21st Century Skills

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Abstract: ***This research was motivated by the scientific literacy skills of PGSD UNIROW students which were still not optimal, because students have not been able to find learning resources to guide learning activities. In era of the industrial revolution 4.0, it is hoped that students will be involved in the learning process which will make them ready to compete in the global world. In general, students use Android to find learning resources from internet with low accuracy. This research uses a 4-D design: define, design, develop, and disseminate. The purpose of this research are testing effectiveness of developing android-based IPA learning devices to improve students 21st century skills. The research subjects were PGSD UNIROW students who took the Science Concept course in 2019/2020 academic year. Data analysis technique used is descriptive statistical percentage. From the test results and data analysis showed that the average critical thinking skills assessment results were 3.15; the assessment of creativity skills 3.23; the assessment of collaborative skills are 3.28 and the assessment of communication skills are 3.15, so it can be concluded that the learning devices for the Android-based Science Concept are effective in increasing student 21st century skills.***

Keywords: Learning devices, science concepts, android, 21st century skills

1. Introduction

The background of this research is that the science literacy abilities of PGSD UNIROW students are still not optimal, because students have not been able to find learning resources as guides in experiments or learning activities. Important in 21st century skills besides literacy skills, there are also other abilities such as creative thinking, collaborative and communicative abilities. In addition, in the 21st century according [8], the education sector in Indonesia adopts three 21st century education concepts including 21stCentury Skills [20], scientific approach [2] and authentic assessment [21]. In their implementation of education in Indonesia, the three concepts are integrated into the 2013 curriculum.

In this 21stcentury, critical thinking skills are important to prepare students for the era of the industrial revolution 4.0. Learning based on 21st century skills not only enhances cognitive abilities, but creative thinking process skills.

The ability of scientific literacy is related to the abilities of creativity, critical thinking, communication, and collaboration which are often called 21stcentury skills [4]. The ability of 21stcentury skills must not only be possessed by students, but teachers must also have these skills in order to create quality learning. Teachers must have abilities that can teach students to be ready to face the 21stcentury through skills called 21stcentury skills. Through 21stcentury skills, teachers are able to compete and have competence, so that they can foster systematic, logical, and critical ways of thinking and reasoning. All of this will have an impact on the learning designed and the desired abilities of students. To produce teachers who have good 21stcentury skills, it can be formed before the teacher is directly involved in teaching or is called a prospective teacher / student.

Now, learning will occur optimally if the learning process is assisted by learning media. Media is used for learning purposes and can be used to channel teacher-student communication, so that it can be said to be a learning medium [3].

Optimal material delivery requires suitable media. That media is a means of channeling messages from teachers to students so that it can stimulate thoughts, and interest in student performance to participate in learning activities [14].

Learning media is also a methodology or instrument made for learning activities in order to improve the educational skills of students, in accordance with the established curriculum. Traditionally, the teacher is functioning as a source of knowledge and the media will be used by the teacher for transmission of knowledge to the students. But the media can immediately impose any information on students because it is modern technology. Currently, the role of the teacher is more significant to become a director of knowledge, who plans, selects and develops instructional media effectively according to the content of the lesson [1].

Based on the results of research [22], the use of learning resources in scientific literacy-based practicum instructions is not optimal, students still have difficulty obtaining theoretical foundations in experiments / learning. So that the role of learning resources through digital media is very appropriate to be used as an alternative to overcome the limitations of learning resources experienced by students.

Technology is growing, one of which is information technology. Information technology is one of the motivations for educators to be able to use it as an innovative learning media and learning resource [5]. Media and learning resources have several uses, namely clarifying messages so that they are not too verbal; overcome the limitations of space, time, energy and sensory power, generate passion for learning, more direct interaction with learning resources; allows for independent study according to their visual, auditory and kinesthetic talents and abilities; giving the same stimulation, equalizing experiences and causing the same perception [17].

With the development of technology can affect the world of education which is marked by the existence of interactive learning media. Interactive learning media is a concept of making media with the help of technology where components such as images, text, animation, and video are combined into one to be presented interactively[10]. Mayer [11] also said that multimedia or media technology as a presentation of material using words and images. Learning media using computer-based media (Adobe Flash) or android combined with Kahoot evaluation. The main advantage of this learning media is its ability to take advantage of all computer capabilities which can then be applied to android applications.

Research on android application development has also been conducted [6]. In this study, the results show that through the use of Android applications it is very effective in increasing interest, student learning outcomes, and critical thinking skills.

Media and learning resources require means of implementing them, especially media and learning resources that use technology. Facilities that support technology-based learning can use an android application via mobile phones. The android application according to can have a big impact in education which includes an increase in the need to always be connected and learn in many places with unlimited time [15]. In line with that, states that a class that is equipped with the right tools and technology and facilitates the growing need for knowledge is a characteristic of smart education [18].

The use of technology in Android-based learning is one of the learning alternatives that is in accordance with the current era of technological development in facing the era of the industrial revolution 4.0. In line with that, according to states that one of the media can stimulate students' attention and interest in learning using Android so as to improve student literacy skills [13]. So that students will easily understand the material presented. Because understanding is an important aspect of learning, with understanding, learning will be more meaningful [12]. Learning occurs through meaning and understanding [1]. So that without understanding, students become lazy to learn, and make the learning process meaningless. Understanding is also the basic ability of everyone. The learning process cannot run optimally if students cannot think creatively without understanding the concepts they are learning. Android-based learning referred to in research is cooperative learning supported by supporting facilities in the form of android applications that can help student understanding.

Based on the analysis of the initial abilities of PGSD UNIROW students in 2019, the results are still low. The results of the research [16] show that the average ability to think critically of students shows an average result of less than 30%, communicative skills less than 50%, collaborative skills and creative thinking less than 45%. Based on this description, the development of Android-based learning devices to build students' 21stcentury skills was chosen because it can prepare students for the future with skills needed at that time and have never been developed in the PGSD Unirow Study Program. The ability of 21stcentury skills is much needed in learning which includes creativity, critical thinking, innovative, communicative, and collaborative as well as honing character. UNIROW's flagship research is the development of science and technology towards an advanced and characterful Indonesia. Based on the achievements of UNIROW's strategic plan and research map, research on the development of RaJaKoIBrAnd (an Android-based science learning device) to build students' 21stcentury skills can support the achievements of the strategic plan and the Unirow research map.

From the above background, researchers here will examine the level of effectiveness of the development of RaJaKoIBrAnd (an Android-based science learning device) to build the 21stcentury skills of PGSD FKIP UNIROW Tuban PGSD students taking semester I courses in primary science concept in SD.

2. Method

This type of research is research and development with a 4D model design by Thiagarajan, et al. (1974) namely: define, design, develop, and disseminate [19]. This research was conducted on the first semester students of the PGSD FKIP UnirowTuban study program who took the Science Concept course in elementary school in the 2019/2020 academic year.

The data analysis technique in this research is to use descriptive statistical analysis of percentages and then interpreted according to valid, practical and effective criteria. The calculations used are as follows:

- $\sum$ is the number of assessments for four meetings obtained by the formula:

$$\sum = \frac{\sum_{i=1}^{n} x_i}{n}$$

Where,
$\sum_{i=1}^{n} x_i$ = average number of observer ratings
n = number of observers.

- The average score is the sum of the observers' assessments during the four meetings obtained by the formula:

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

Where,
$\sum_{i=1}^{n} x_i$ = number of observer ratings
n = number of observers.

- Y The average for each category during the teaching and learning activities is obtained from the formula:

$$Y = \frac{\sum_{i=1}^{n} X_i}{n}$$

Where
$\sum_{i=1}^{n} Y_i$: The average number of scores
n : many assessments

- Reliability using the formula:

$$Reliabilitas = (\frac{A}{A+D})x100\%$$

Where
A : Agrement
D : Disagreement

- Average reliability is obtained by the formula:

$$Rata - rata\ Reliabilitas = \frac{\sum_{i=1}^{n} R_i}{n}$$

Where
R : Reliability
n : many meetings.

3. Result and Discussion

In a study entitled The Effectiveness of the Development of RaJaKoIBrAnd (Android-based Natural Science Concept Learning Tool) to improve the students 21st century skills. This study uses a 4D research design with 4 stages, namely define, design, develop, and disseminate. The complete research results are as follows:

3.1 Definition (Define)

The definition stage is carried out in five steps, namely front-end analysis, student analysis, task analysis, concept analysis and formulation of learning objectives.

a) Front-end analysis
According to regarding the front end analysis at the define stage, namely knowing the basic problems faced by lecturers to improve student learning achievement, then looking for better alternative solutions [19]. This activity is carried out by looking for related Learning devices that have been circulating. If these tools or alternatives do not exist, it is necessary to develop the desired Learning devices.

Based on the theoretical study conducted, the characteristics of teachers in transforming themselves in the digital era in the 21st century are very important. The use of technology in learning is very important in facilitating students in quality learning [9]. To be able to realize this quality learning, it is necessary to strengthen the role of the teacher as a facilitator, motivator, and inspiration. In addition to the role of teachers, teachers must also have abilities that can teach students to be ready to face the 21st century through 21st century skills called 21st century skills. 21st century skills make teachers able to compete and have competence so that they can foster systematic, logical, and critical ways of thinking and reasoning. All of this will have an impact on the designed learning and the desired abilities of students according to the 21st century skills. To produce teachers who have good 21st century skills, it can be formed before the teacher is directly involved in teaching or is called a prospective teacher / student.

Based on interviews conducted at the Head of Study Program and lecturers, the Learning devices developed in the PGSD UNIROW study program are still limited to paper-based development and have not involved technological assistance, especially Android applications. Science and technology which is increasingly developing and competition in an increasingly challenging global world, requires the next generation of nations who have complete and highly competitive competence known as 21st century skills.

The development of Android-based Learning devices to build students' 21st century skills was chosen because it has never been developed in the PGSD UNIROW Study Program and can prepare students to face the future with the skills needed at that time.

b) Student Analysis (Learner Analysis)
According to regarding the analysis of students at the define stage, namely examining student characteristics in accordance with the design and development of learning devices [19]. The results of the study are used as a consideration for developing Learning devices. Based on the documentation data of the PGSD UNIROW study program, students of PGSD UnirowTuban generally come from schools in the Tuban, Bojonegoro, Lamongan and Rembang areas. Most of the students come from private SMA / MA and private SMK and a small proportion come from public SMA / MA and public SMK. The percentage of PGSD students at Unirow can be seen in Figure 1.

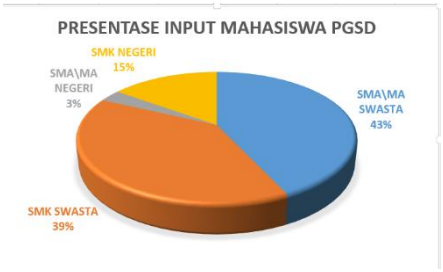

Figure 2: Percentage of PGSD Student Input

Based on these results, the input of many PGSD students comes from private schools and vocational schools. In addition, the SMA / MA majors they take are mostly social studies majors. So that this can affect the initial ability of students with the concept of science which is still low.

The ability of students 'natural science concepts is still low as well as the background of the ability of scientific literacy and also the ability of students' 21st century skills. The results of the students 'initial scientific literacy abilities in 2016. The recapitulation of the results of the analysis of students' answers related to their initial scientific literacy abilities concluded that most of the 2016 Unirow PGSD study program students tended to have low scientific literacy skills, which was less than 50% for each indicator. This can be seen from the results of the correct answers which show a very small percentage. Furthermore, students' initial 21st century skills also still showed low results. This result is shown by the average ability to think critically of students, showing an average result of less than 30%, communicative ability less than 50%,

Apart from being based on their educational background and initial knowledge ability of students, based on interview data with students, it was found that most of the students had an average economic level from middle to lower class families. Some are from among the teachers. However, most students have parents who work as farmers, fishermen or private companies. This factor affects student infrastructure in learning.

Students who should have textbooks or reference books because most of them are from the middle to lower class, it becomes a cliché problem faced by lecturers to hold textbooks and reference books with learning resources that can be accessed by students online or electrically so they don't have to buy valuable books expensive. Through the facilities from the campus that provide free wifi in every place on campus and the habits of students who often use cellphones as a means of communication, direct them to be able to access material via each student's cellphone via Android. This may occur because every student as a whole already has an Android cellphone and besides that,

c) Task (Task Analysis)

Task analysis aims to identify the main skills studied by the researcher and analyze them into a set of additional skills that may be needed [19]. This analysis ensures a thorough review of the assignments in the learning material. In this task analysis is carried out to identify the 21st century skills that students must acquire in learning, then analyze them into the sub-skills of students' 21st century skills including critical, creative, collaborative and communicative attitudes as follows:

1) Critical thinking aspects include interpretation, analysis, evaluation (determining the basis for making conclusions) and inference.
2) Creative aspects include Fluency, flexibility, and novelty.
3) Collaboration aspects include group collaboration, collaboration between groups, synergy, empathy, respecting different perspectives, and adaptation to responsible roles.
4) The communicative aspects include clear speech / language (not double meaning), speaking assertively, not being convoluted, polite in communicating and behaving, body gestures in accordance with the subject matter and situation conditions, the flow of systematic idea delivery (from global to specific things) and communicative (using language that is easy to understand)

Task analysis ensures the overall coverage of the tasks contained in learning. So that in the task analysis, the researcher must arrange tasks that must be done by students which include learning outcomes (CP), namely 'understanding basic science concepts and theories, to get to know nature and its contents, natural phenomena and natural phenomena and to be skilled. Apply the concept of science critically and creatively in every science teaching in low and high grades collaboratively and communicatively '.

d) Concept analysis

Regarding concept analysis, namely identifying the main concepts to be taught, arranging them in a hierarchical form, and detailing individual concepts into critical and irrelevant things [19]. Concept analysis is needed to identify declarative or procedural knowledge in the material to be developed. Concept analysis is an important step to fulfill the principles in concept building on the materials used as a means of achieving basic competencies and competency standards.

Concept analysis is needed to identify the main concepts to be conveyed. In supporting this concept analysis, the analysis carried out is a basic competency analysis which aims to determine the competency achievement indicators (GPA) of each meeting in learning science concepts in elementary schools. Competency achievement indicators (GPA) for each meeting in learning science concepts in elementary schools which include:

e) Formulation of Learning Objectives (Specifying Instructional Objectives)

States that the formulation of learning objectives is useful for summarizing the results of task analysis and concept analysis into specific goals [19]. The details of specific learning objectives form the basis for the preparation of tests and the design of learning devices. Then integrated into the learning device material that will be used by researchers.

The final step in the define stage is formulating goals. The objectives are derived from indicators which are also derived from the CPI. Learning objectives that must be achieved by students are through learning activities using a cooperative learning model that requires students to observe (read) problems, write down solutions and present the results in front of the class so that students can describe the concepts of quantity and units, analyze the concept of material, light, body structure humans, food ingredients needed by the human body and the human food digestive system, as well as applying the concepts of static electricity, dynamic electricity, and motion so that students can develop critical thinking skills, communicate, collaborate, be creative in enhancing 21st century skills.

3.2 Design

Thiagarajan divides the design stage into four activities, namely: constructing criterion referenced test, media selection, format selection, initial design [19]. Activities carried out at this stage are:

a) Compiling a test of 21st century skills, as the first action to determine students 'initial 21st century skills, and observing students' collaborative and communicative abilities according to the task analysis at the definition stage.
b) Choosing learning media that is in accordance with the material and student characteristics.
c) The choice of learning device format and learning presentation form is adjusted to the learning media used. The choice of learning device format includes choosing the format for designing learning content and resources. The learning device format used was adopted from Glencoe Mc-Graw-Hill, New York which would later be adapted to the KKNI curriculum. In the design stage, the researcher has made an initial draft product (draft 1) a prototype or product design consisting of a Learning

Implementation Plan (RPP), e-books, Student Worksheets (LKM) and evaluation tools. Writing this initial draft is a presentation of applied learning that is using cooperative learning. The learning media used are varied in multi-media according to the learning materials and characteristics of Unirow PGSD students.

3.3 Development

Thiagarajan divides the development stage into two activities, namely: expert appraisal and developmental testing [19]. Expert appraisal is a technique for validating or assessing the feasibility of a product design. In this activity, evaluation is carried out by experts in their fields. The suggestions given are used to improve the material and learning designs that have been compiled. Developmental testing is the activity of testing product designs on the real target subject. At the time of this trial, response data, reactions or comments were sought from the target users of the RaJaKoIBrAnd development (Android-based Natural Science Concept Learning Tool). The trial results are used to improve the product. After the product has been repaired, it is then tested again to obtain effective results.

In the context of the development of RaJaKoIBrAnd (Android-Based Natural Science Learning Tool Kit), development activities are carried out in the following steps:

a) Validation of learning devices

Validation of the implementation of learning by experts. Validated matters include observation / assessment of management learning, observation/assessment of learning implementation, expert (expert) perceptions about the implementation of learning, and expert (expert) perceptions about the effectiveness of learning. The team of experts involved in the validation process consisted of media and learning technology experts (Dr. DjokoApriono, M.Pd. and Dr. Sumadi, M.Pd.), experts in the field of study in the same subject (Dr. Marita J, M .Pd. And Ir. HernikPujiastutik), language experts (Dr. MohMu'minin, M.Pd.) and involved lecturers who were teaching the Science Elementary School Science Concept course (IfaSeftia, M.Pd.). Based on the results of expert validation, there is a possibility that the product design still needs to be repaired / revised according to the validator's suggestion. The validations that are assessed include:

1) Content Validation

The results of the content validation are obtained in Table 1.

Table 1: Validation of Data by Material Experts

Aspects of assessment	The average score obtained
Supporting theory	3.53
Syntax	3.8
Social System	3.4
The principle of management reaction	3.7
Support system	3.7
Instructional impact and Accompaniment impact	3.8
Implementation and learning / lectures	3.67
Learning environment and assignment management	3.6
Evaluation	3.5
Average Aspect of assessment	3.63

Based on the content validation results that have been assessed by the validator, the learning device is declared valid with a result of 3.63.

2) Validate constructs

The results of construct validation are as follows:

Table 2: Validation of Data by Experts Learning Construction

Aspects of assessment	The average score obtained
Model components	3.6
Supporting theory	3.9
Syntax	3.53
Social System	3.75
The principle of management reaction	3.9
Support system	3.5
Instructional impact and impact Companion	3.6
Implementation of learning	3.58
Learning environment and assignment Management	3.72
Evaluation	3.7
Average Aspect of assessment	3.68

Based on the results of construction validation that have been assessed by the validator, the learning device is declared valid with a result of 3.68.

3) RPP validation

The results of the RPP validation are as follows:

Table 3: Validation of Data by RPP Experts

Aspects of assessment	The average score obtained
Performance criteria	3.67
Contents served	3.78
Language	3.67
Time	3.4
The serving method	3.89
Closing	3.9
Average Aspect of assessment	3.72

Based on the results of the validation of the lesson plans that have been assessed by the validator, the lesson plans are declared valid with a result of 3.72.

4) Textbook Validation (E-book)

The results of the textbook validation (e-book) are as follows:

Table 4: Validation of Data by Textbook Experts

Aspects of assessment	The average score obtained
Sub Concept Organization	3.82
Descriptions according to the steps of learning Android Based Cooperative	3.63
Activity	3.93
Closing	3.7
Average Aspect of assessment	3.77

Based on the results of the validation of teaching materials (E-book) which has been assessed by the validator, the teaching materials (E-book) is declared valid with a result of 3.77.

5) Teacher Book Validation

Aspects of assessment the average score obtained:

Table 5: Validation of Data by Teacher Book Experts

Aspects of assessment	The average score obtained
Preliminary	3.53
Material representation	3.67
Learning / lecturing	3.74
Closing	3,6
Average Aspect of assessment	3.64

Based on the results of the validation of the teacher's book that has been assessed by the validator, the teacher's book learning device is declared valid with a result of 3.64.

6) MFI Validation

Table 6: Data Validation by MFI Experts

Aspects of assessment	The average score obtained
MFI organization	3.8
Procedure	3.72
Questions / problems	3.86
Average Aspect of assessment	3.79

Based on the results of the LKS validation that had been assessed by the validator, the lesson plan learning device was declared valid with a result of 3.79.

7) Validation of Evaluation Tools

Table 7: Validation of Data by Evaluation Tool Experts

Aspects of assessment	The average score obtained
Theory	3.5
Construction	3.6
Language	3.4
Average Aspect of assessment	3.5

Based on the results of the validation of the evaluation tools that have been assessed by the validator, the evaluation tool learning devices are declared valid with a result of 3.5.

b) Revision 1

Based on the results of the validation of draft 1 Learning devices by the validator, revisions were made. This revision by the researcher is referred to as revision 1, while the results of the revision of draft 1 are referred to as draft 2 of the Learning devices. Revisions are made according to the results of the validation and the input / suggestions of the validator are writing errors, layout presentation design suggestions, material content, terms used, steps for learning activities in the lesson plan, LKM questions and cover design.

c) Simulation

In this step, the researcher simulates certain lesson plans within a small scope of presenting learning materials (lesson plans, e-books, LKM and evaluation tools) using the media and cooperative learning steps that have been designed. Simulations are carried out on two lesson plans, namely RPP-1 to RPP-2 complete with e-book material, LKM and related evaluation tools. Simulations are carried out by model lecturers, students, observers, partner lecturers and the research team. During the simulation, observations were made using instruments for observing the activities of lecturers and students, learning management instruments, learning implementation instruments, and 21stcentury skill assessment instruments.

The simulation results show that draft 2 of the Learning devices and research instruments can be used well, although there are some minor revisions to the steps of learning activities in the lesson plan according to the allocation of learning time, writing errors on the remaining devices, improving implementation instructions on the activity instruments lecturers and students, as well as improvements to the 21st century skill assessment instrument.

d) Revision 2

Based on the simulation results of the two lesson plans, a small revision was made to the Learning devices and research instruments, namely the components of the lecturer and student activities, the steps for learning activities in the lesson plans were adjusted to the allocation of learning time, writing errors on the remaining devices, improving the implementation instructions on lecturer and student activity instruments, as well as improvements to the 21th century skill assessment instrument. This revised learning tool is hereinafter referred to as draft 3.

e) Trial 1

Trial I was carried out on draft 3 of the revised learning devices and was observed by the observer using a revised research instrument. Trial 1 was conducted in 4 meetings using four lesson plans, namely RPP-1 to RPP-4.

f) Trial analysis 1

1) The results of the analysis of trial 1 obtained the following data:

Table 8: Tabulation of Data on Learning Management Observation Validation

Aspects of assessment	The average score Obtained
Introduction	3.67
Brownsing / Related Material Discovery	3.5
Communication / Communication	3.5
Problem Solving And Presentation	3.8
Presentation of Summary (Summary)	3.5
Question and Response Phase (Closing)	3.67
Time Management	3
Observation of Classroom Atmosphere	3.5
Average Aspect of assessment	3.52

Based on the results of the validation of the results of observations/assessments of management learning that have been assessed by the validator and declared valid with a result of 3.52.

2) Validation of Results of Observation / Assessment of Learning Implementation

Table 9: Tabulation of Data on Learning Implementation

Aspects of assessment	The average score obtained
Syntax	3.67
Social system	3.38
Principles of Reaction and Management	3.7
Average Aspect of Rating	3.58

Based on the results of the validation of the learning implementation results that have been assessed by the validator and declared valid with a result of 3.58.

3) Validation of Expert Perception About Learning Implementation

Table 10: Tabulation of Data on Validation Expert Perceptions about Learning Implementation

Aspects of assessment	The average score obtained
Syntax	3.75
Social system	3.25
Principles of Reaction and Management	3.6
Average Aspect of Rating	3.53

Based on the results of the validation of expert perceptions (experts) about the implementation of learning that has been assessed by the validator and declared valid with a result of 3.53.

4) Validation of Expert Perception (Expert) about Learning Effectiveness

Table 11: Tabulation Data of Expert Perception Validation Results about Learning Effectiveness Data

Assessment Aspects	The average score obtained
Student Learning Outcomes	3.25
Student and Lecturer Activities	3.4
Lecturer Ability to Manage Learning	3.5
Student and Lecturer Response to Components and Learning Process	3.2
Average Aspect of Rating	3.53

Based on the results of the validation of the results of the validation of expert perceptions about the effectiveness of learning that has been assessed by the validator and declared valid with a result of 3.38.

5) Reliability of Lecturer and Student Activity Instruments in Cooperative Learning Based on the King Koi Brand.

Table 12: Tabulation of data on Instrument Reliability Results for Lecturer and Student Activities in Cooperative Learning Based on the King Koi Brand

Meeting	Reliability	
	Lecturer Activities	Student Activities
1	86	80.5
2	90	86
3	90	92.5
4	94	93
Average	90	88

The reliability of the instrument for observing the activities of lecturers and students in learning during the 1st trial was classified as high and there was an increase in each meeting.

6) Critical Thinking Aspects

Table 13: Tabulation ofData the Assessment Results for Critical Thinking Aspects

Aspects of assessment	The average score Obtained
Interpretation	2.97
Analysis	3.09
Evaluation	3.24
Inference	3.17

Based on the results of the critical thinking aspect, it is stated to have a good category and high reliability.

7) Aspects of Creative Thinking
Aspects of assessment the average score obtained:

Table 14: Tabulation of Data on Assessment of Creative Thinking Aspects

Aspects of assessment	The average score Obtained
Fluency	3.14
Flexibility	3.02
Novelty	3.35

Based on the results of the creative thinking aspect, it is stated to have a good category and high reliability (92.36).

8) Collaborative Aspect

Table 15: Tabulation of Data on Collaborative Aspect Assessment

Aspects of assessment	The average score obtained
Group collaboration	3
Cooperation between groups	3
Synergy	3
Empathy	3
Appreciate different perspectives	3
Adaptation in roles of responsibility	3

Based on the results of the collaborative thinking aspect, it is stated to have a good category and high reliability (92.01)

9) Communicative Aspects

Table 16: Tabulation of Data the Assessment Results for Critical Thinking Aspects

Aspects of assessment	The average score obtained
clear speech / language	3
speak firmly, and not be circumspect	3
polite in communicating and behaving	3
body gestures according to the material discussion and situation conditions	3
flow of systematic ideas	3
Communicative	3

Based on the results of the communicative thinking aspect, it is stated to have a good category and high reliability (88.19).

g) Revision 3

Based on the results of trial 1 on the four lesson plans, a small revision was made to the Learning devices and research instruments, namely the student activity components, writing errors on existing devices and improvements to the 21th century skill assessment

instrument. This revised learning tool is hereinafter referred to as draft 4.

Furthermore, to determine the effectiveness of the Raja Koi Brand learning device, it can be seen from the data used in the effectiveness analysis consisting of: the results of the assessment of critical thinking skills, the results of the assessment of creativity skills, the results of the assessment of collaborative skills and the results of the assessment of communication skills. The following data and analysis were obtained during the trial phase on twelve students which can be seen more clearly in Figure 2:

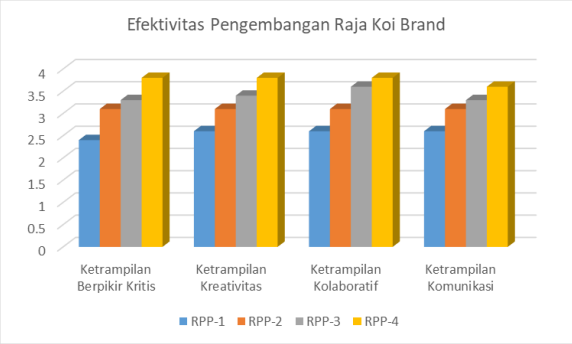

Figure 2: Data Tabulation Diagram of the Effectiveness of Raja Koi Brand Learning devices

From Figure 2, it can be seen that there is an increase in each meeting. So that the average of each aspect of the assessment is obtained, namely, the average results of the assessment of critical thinking skills are 3.15; the average results of the assessment of creativity skills 3.23; The average collaborative skills assessment result is 3.28 and the average communication skills assessment result is 3.15. Then the average result of the assessment from these four aspects is 3.2 and then interpreted into the following table:

Table 17: Interpretation of Effectiveness Data

Average score (%)	Criteria
1 - 1.59	Ineffective
1.6 - 2.19	Less effective
2,2 - 2,79	Effective enough
2.8 - 3.39	Effective
3,4 – 4	Very effective

Source: [7]

Based on the interpretation of the effectiveness data used to determine the effectiveness of the Raja Koi Brand learning device, it is known that the average result of the assessment of the four aspects is 3.2 so it can be concluded that the Raja Koi Brand learning tool is said to be effective in improving students' 21th century skills.

4. Conclusion

Based on the data on the effectiveness of the research results and the results of the data analysis trials used, the Raja Koi Brand learning device was said to be effective in improving students' 21th century skills with an average of all aspects, namely 3.2. This research has not yet reached the stage of deployment. Therefore, the author suggests readers who are interested in this problem that further research includes the dissemination stage and method addition.

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