

ANALYSIS OF THE PROBLEM-BASED STORY MODEL DEVELOPMENT WITH ICT KAHOOT AND THE EFFECTIVENESS ON STUDENTS' METACOGNITION AWARENESS AND SCIENCE PROCESS SKILLS

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ARTICLE INFO

ABSTRACT

Received:
March, 26th 2022
Revised:
April, 16th 2022
Approved:
April, 18th 2022

This study aims to develop a problem-based story learning model with ICT using the Kahoot interactive quiz that could increase students' metacognition awareness and science process skills which were determined by the validity, practicality, and effectiveness of the learning model. This research was a research development (R&D) 4D Thiagarajan through four stages such as define, design, develop, disseminate. The effectiveness of data collection was done by giving pre-test and post-test questions on metacognition awareness using MAI (Metacognition Awareness Inventory) and questions on students' science process skills by looking at the increase in the average score of normalized gain. The results showed that the learning model was effective for increasing awareness of metacognition, this was based on the average N-Gain in the small group test, large group test, and the dissemination test with an average of 0.62 in the medium category, and on the students' science process skills with an average N-Gain value of 0.61 in the medium category. This model was also declared "valid" by the expert validators and users which was supported by empirical validation results. The practicality of implementing the PBS model had also been tested by observing the teacher's ability in classroom learning, learning responses to the ease with

How to cite:

E-ISSN:

Published by:

Widiet Nurcahyo Ramadhana, Suratno, Yushardi. (2022). Analysis of the Problem-Based Story Model Development with ICT Kahoot and the Effectiveness on Students' Metacognition Awareness and Science Process Skills. Journal Eduvest. Vol (2): 755-766
2775-3727

<https://greenpublisher.id/>

which teachers used the model, and student responses to the learning model applied by the teacher. The final result showed that the problem-based storytelling model developed had met the valid, effective, and practical criteria.

KEYWORDS

Metacognition awareneses, Science procces skill, ICT (kahoot), Problem based story



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INTRODUCTION

Education is currently facing the challenges of the 21st century, where learning transformation is needed so that students are able to master various skills to face the era of global economic competition (Weilenmann, 2014). In an effort to face this challenge, improving the quality of learning must be sought to change the mindset or paradigm of science learning that is from Teacher -centered Learning to Student-centered (Student Centered Learning). This was in line with the researcher who stated that in the learning process students were not required to understand the concept but were also invited to carry out the process of finding (Minasari & Setiadi, 2020). The government had perfected the 2013 curriculum in an effort to give teachers the freedom to be creative in creating an effective learning atmosphere in an effort to produce a generation that was ready to face future challenges by providing education that stimulates HOTS (High Order Thinking Skills) learning and the demands of 21st century learning including critical thinking, collaborative creativity, and communication. But the fact, the majority of education in Indonesia had not been able to meet the learning needs of the 21st century, one of which was due to low student involvement in the learning process (Munir, 2016).

Low student involvement was influenced by low willingness to think about thinking related to students' subconscious. Metacognition played an important role to increase students' interest in learning, metacognition was knowledge and belief about one's cognitive processes and the lack of conscious effort to engage in the process of behaving and thinking about one's own thinking. So that metacognition had a significant influence in shaping students' subconscious in a positive way so as to increase motivation in learning (Cera, Mancini, & Antonietti, 2013). This was supported by facts in the field through a questionnaire distributed to 30 junior high school teachers in the former Besuki residency via google form. The results showed that the biggest obstacle for teachers in increasing student involvement in the process was leading students to problem solving, and low student motivation to be actively involved in the learning process. This was supported by further facts, namely based on the metacognition awareness inventory (MAI) assessment instrument which was distributed to 30 students randomly in the former Besuki residency area where students received an average assessment in the risk category, while for students' science process skills covering 7 domains such as the domain of observation, classifying, predicting, interpreting, formulating hypotheses, planning experiments, and communicating an average score of 54 or in the low category.

Metacognition played an important role in motivating students to be actively involved. Metacognition was knowledge and beliefs about one's cognitive processes and the lack of conscious effort to engage in the process of behaving and thinking about one's own thinking (Kristiani, 2015). Efforts to improve students' science process skills to

formulate problem solving results would be more meaningful when students' metacognitive awareness was developed optimally.

Until this journal was created, there had been several previous studies examining the relationship between metacognitive awareness and science process skills [7, 6, 8, 9]. If previous studies were reviewed, there were facts that proved that metacognitive awareness had a significant influence on process skills and student learning outcomes. Other studies also showed that there was a positive relationship between metacognitive awareness and student learning outcomes. Furthermore, research on the relationship between metacognitive awareness and interest in reading had a positive contribution to student involvement in the learning process (Helendra, Fadilah, & Arsih, 2018). Increased student involvement in the learning process had a positive correlation with process skills (Adiningsih, Karyasa, & Muderawan, 2020).

Based on studies of previous research, there was no researchers who had designed a learning model that specifically examined the relationship between increasing awareness of metacognition through problem-based short stories and science process skills. Therefore, based on this background, the formulation of the problem in this study was:

- a) Was the problem-based story (PBS) learning model developed valid?
- b) Was the problem-based story (PBS) learning model effective for increasing students' awareness of metacognition and science process skills?
- c) Is the problem-based story (PBS) learning model practical to use?

The problem-based story (PBS) development model is a development model based on problem-based learning packaged through short stories and presented through the Kahoot interactive quiz (Harris et al., 2020). The problem-based story (PBS) model guided students to find their own solutions to problems that exist in the community as a result of efforts to examine science-based knowledge through discussion activities. The problem-based story (PBS) learning model has 5 stages such as Problem Society, Science Investigation, Product Analysis, Conclusion and Evaluation. Through the development of a problem-based story (PBS) model students were expected to actively find out for themselves, conduct investigations, hypotheses, make products and product analysis regarding reproductive system materials in plants through a social story-based approach, the results obtained were expected to last long in students' memories (Long term memory), students would not easily forget if the learning was meaningful for students (McQuiggan, Rowe, Lee, & Lester, 2008). The problem-based story (PBS) development model occurred when students had to find out for themselves about the target concept by making products that were arranged in such a way by students to solve a given problem by using the reproductive system material in plants provided so that in this model the teacher was involved in the learning process, teachers and learners were together with students to solve the existing problems.

The application of the problem-based story learning model using the Kahoot interactive quiz media is expected to increase students' interest in being actively involved in problem solving (Kuswando & Ginting, 2021). Students are able to find out their own level of understanding as a result of using the Kahoot interactive quiz media, interactivity through the quizzes presented has an impact on students' focus which makes the class more conducive. The limited time given by the teacher to make the learning process effective makes Kahoot as a solution in carrying out the assessment process through students' laptops or cellphones only. Kahoot technology media is an application in which there are learning features including interactive quizzes, surveys and discussions (Plump & LaRosa, 2017). In its use, Kahoot is free of charge which makes it as its own

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advantage in general use. Another study showed that the use of Kahoot interactive quiz could improve student learning

outcomes. The development of a new model of problem-based story (PBS) must meet the requirements of having 3 criteria such as valid, practical, and effective (Flores, 2018). Thus, development research was needed which expected to meet these criteria that was the development of a problem-based story (PBS) model".

RESEARCH METHOD

This was a research on the development of a problem-based story (PBS) model using the Kahoot interactive quiz. This type of research was the development of learning models based on Thiagarajan's 4-D development model which consisted of define, design, develop, and disseminate as shown in the following figure.

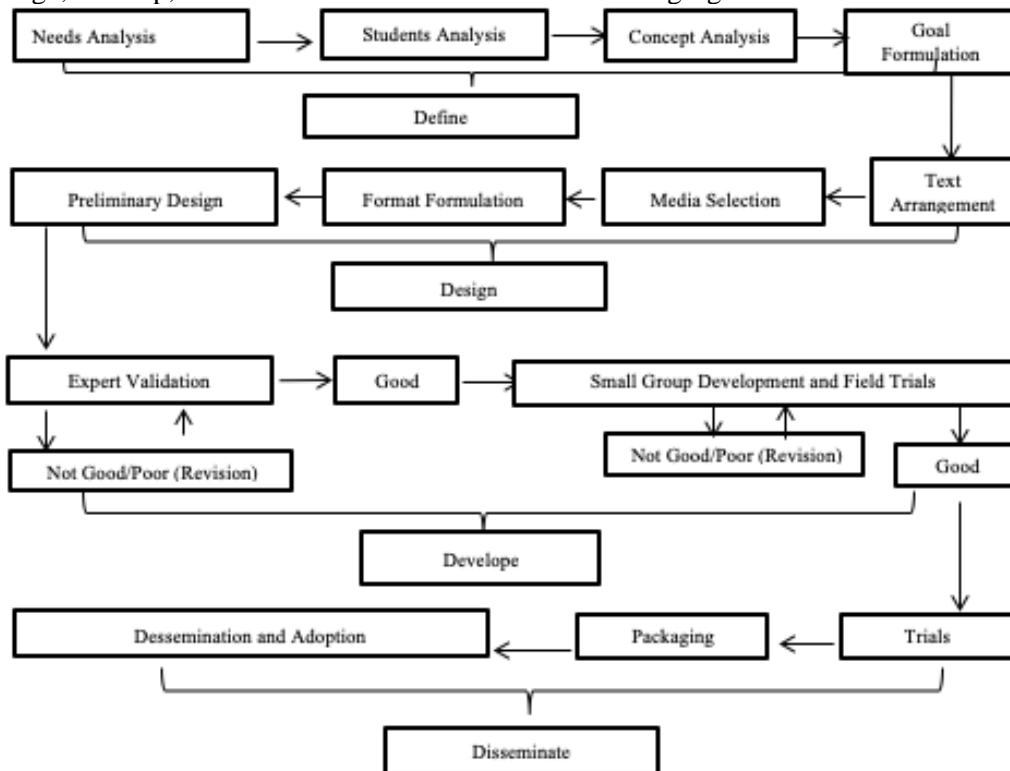


Figure 1. Development model trial design

This study aimed to produce a learning model product and test the product. This development was based on trials which would then be revised to produce products that were valid and feasible to use. The learning model tools used such as lesson plans, syllabus, student worksheets, learning implementation questionnaires, science process skills assessment questionnaires, practicality questionnaires, and student metacognition awareness assessment questionnaires through the Metacognition Awareness Inventory (MAI). Prior to the trial, it was validated by expert validators and user validators both quantitatively and qualitatively.

The research period for the problem-based story (PBS) model using the Kahoot interactive quiz was carried out from September 2021 to October 2021 in the odd semester of the 2021-2022 academic year. The place where the model development was carried out is in the Science Education Postgraduate Study Program, FKIP, Jember University, for the application of the model test was as follows.

- a) The development test was carried out in one of junior high schools in Jember Regency with a small trial of 10 students in two meetings, and a large class trial of 30 students in two meetings.
- b) The dissemination stage would be carried out in 3 junior high schools in the Besuki residency area, such as 30 students in Situbondo, 28 students in Probolinggo, and 30 students in Banyuwangi with 2 meetings each.

The learning model could be said to be feasible if it met the requirements, including validity, practicality, and effectiveness. The operational validity of the problem-based story model using the Kahoot interactive quiz was defined, among others (syntactic, social system, reaction principle, support system, instructional impact and accompaniment impact) which was shown in the results of the assessment of at least 2 experts on the validation sheet at least in the valid category. The validity of the learning model was the average percentage of assessment of the validation indicators carried out by expert validators and users of the problem-based story model consisting of lesson plans, syllabus, science process skills test questions, MAI assessment, and an introductory book to the problem-based story learning model consisting of syntax, support system, reaction system, social system, minimal accompaniment impact on valid category.

The problem-based story development model was categorized as practical, defined as the average score from the results of observation, research on the implementation of the learning model assessed by 2 observers on the observation sheet with at least the assessment in the good category (no score less than 3 in the scale range 4 on each assessed indicator). The learning model was said to be operationally effective, defined as an increase in the average score of students' metacognition results at least in the medium category, students' science process skills at least in the good category, and minimal student feedback in the medium category. The achievement of students' science process skills could be said to increase if there was a change in the observation score before and after learning had a maximum score difference minus the pretest score. Student responses were categorized as good if the percentage score of student assessment results on student response questionnaires, and student learning activities were said to be active if the average score of 2 observers on the learning activity sheet.

The data obtained were then analyzed to answer the validity of the instrument. The measured results are as follows.

- a) The data measured was the result of metacognition obtained by students' scores from the MAI (Metacognitive Awareness Inventory) results.
- b) MAI test results were analysed on a scale of 0-100 and categorized based on the rating scale. Students' answers were analysed in terms of metacognitive abilities with 4 criteria such as "always" with 5 points, "very often" with 4 points, "often" with 3 points, "rarely" with 2 points and "never" with 1 point. Points earned were converted to a scale of 0-100.
- c) The next measured data was science process skills obtained from students' scores in answering science process skills questions.
- d) Data analysis of science process skills was obtained from an observation sheet in the form of a rating scale with 7 categories adapted to statements including observation, classification, predicting, interpreting, formulating hypotheses, planning experiments, and communication.
- e) Analysis of student learning outcomes data using pretest and posttest data on science process skills and students' metacognition awareness would then be analysed using the normalized gain (N-Gain) formula to determine the increase in student learning outcomes.

- f) Analysis of the data from the observation of the implementation of learning in the form of quantitative data from the observation of the implementation of learning was then analysed using the following formula:

$$\text{Percentage of Implementation} : \frac{\text{Number of "Yes" Answers}}{\text{Number of All Aspects}} \times 10$$

RESULT AND DISCUSSION

The results of the research on the problem-based story (PBS) using the Kahoot interactive quiz learning development model were as follows.

- a) The average validity score of the model guidebook had a score of 91.59 in the very valid category so that the model guidebook could be used in research. The characteristics of the learning model development guide could be seen in Figure 1 below.

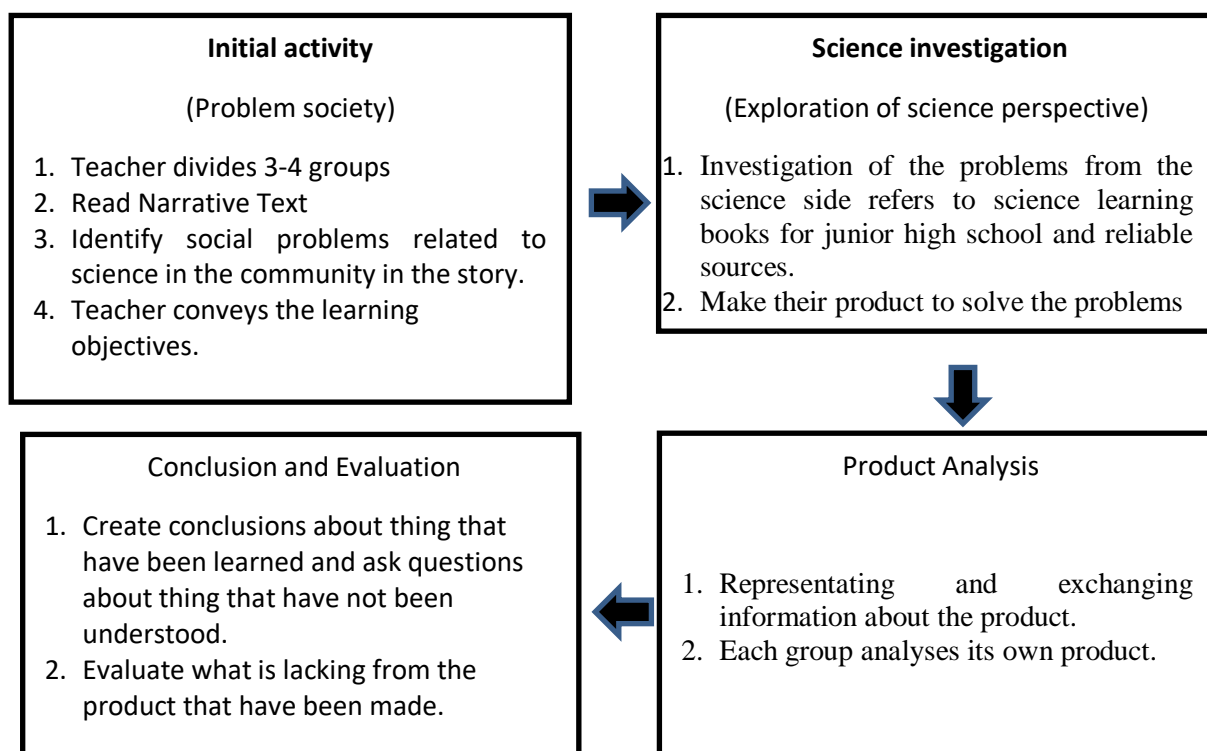


Figure 1. Characteristics of Problem-based Story (PBS) Development Model

- a) Further validation of the syllabus assessed by 3 validators. The average percentage score of the syllabus as a whole is 92.18, which meant the syllabus instrument was in the very valid category and could be used in the learning process.
- b) The results of the average total percentage of the overall RPP validation showed a score of 96.35 or in the very valid category and ready to be used in learning.
- c) The average total percentage score was 93.51 or in the very valid category so that the pre-test and post-test questions were feasible to be used in learning. For the assessment of the science process skills instrument sheet, it could be seen in table 3.5 below.
- d) The overall average of validation was at a score of 91.89 or in the very valid

category, it indicated that the science process skills instrument was suitable for use

in learning. The results of validation were not only quantitative data but also qualitative data, that was in the form of input and suggestions from expert validators such as summarizing the title and making it more interesting, more specific learning objectives, and improving assessment aspects.

- e) The results of the observation validation of the implementation of the learning model were 99.51% or in the very valid category. So that the learning implementation observation sheet could be used to obtain data during the learning process.
- f) The average result of the observation on the implementation of learning in the small group test was 91.04 in the very practical category and the average result of the observation on the implementation of learning in the large group test was 91.34 in the very practical category, and in the dissemination group test it was 91.51 in the very practical category.
- g) The average validation result on the objective aspect was 100%, the coverage aspect was 95.83% and the language aspect was 100%. Overall, the average teacher response questionnaire validation was 97.90% with a very valid category. This showed that the teacher's response questionnaire was ready used.
- h) The average overall teacher response questionnaire to the use of the POSPACE learning model in the small and large group test showed an average score of 89.74 in the very good category.
- i) Average results of student response questionnaire validation in the aspect of objective assessment of 97.91%, coverage aspect of 95.13.75% and language aspect of 100%. The overall average of the results of the validation of the student response questionnaires from the three validators was 97.68% with a very valid category. These results indicated that the student response questionnaire was ready to be used in research.
- j) The results of the validation of students' metacognition awareness inventory (MAI) with 2 aspects contained 6 indicators with an overall average content validation result of 95.77% with a very valid category and the average result of language validation and question writing of 98.43% with a very valid category. This showed that the question of metacognition awareness inventory (MAI) was ready to be used in research.
- k) The results of the average N-Gain scores of pre-test and post-test of students' metacognition awareness at meetings 1 and 3 in the small class test were 0.59 in the medium category. In the large group test, the average N-Gain value is 0.64 in the medium category. Meanwhile, in the dissemination test, the dissemination test 1, 2, and 3 had an average N-gain value of 0.60 in the medium category.
- l) Furthermore, the results of the validation of science process skills. the results of the validation of the scientific process skills instrument at meetings 1 and 3 on indicators, classification, predicting, interpreting, formulating hypotheses, planning experiments, and communication had an overall content validation result of 93.75% in the very valid category and the average language validation and question writing was 89.58% in the very valid category. These results indicated that the science process skills questions were ready to be used.

- m) The results of the average N-Gain scores of pre-test and post-test of students' science process skills in meetings 1 and 3 in the small class test were 0.54 in the medium category. In the large group test, the average N-Gain value is 0.65 in the medium category. Meanwhile, in the dissemination test, the dissemination test 1, 2, and 3 had an average N-gain value of 0.64 in the medium category.

The increase in the average N-Gain score at meetings 1 and 3 in the small, large and dissemination tests could be seen in Figure 2 below.

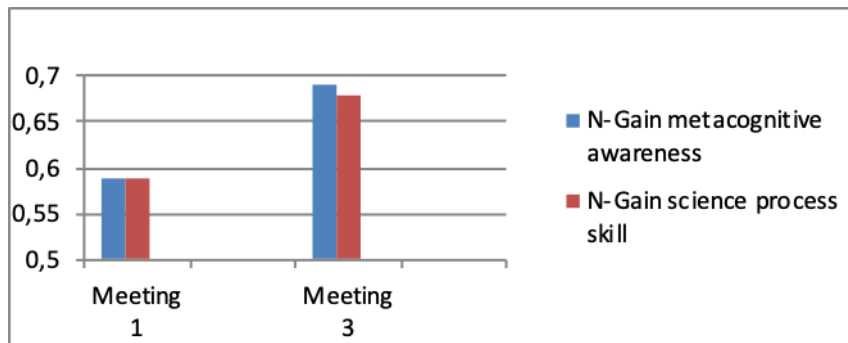


Figure 2. Graph of Increase in the Average N-Gain Score

Graph 2 showed that there was an increase in the average N-Gain score at meetings 1 and 3. This proved that there was a positive correlation between metacognitive awareness towards increasing science process skills and student learning outcomes.

Discussion

The results showed that the problem-based story learning model using the Kahoot interactive quiz had valid, practical, and effective criteria and there was a positive correlation in increasing metacognitive awareness and science process skills and student learning outcomes where it was in accordance with the science learning paradigm which was not only about how students master facts, concepts, and principles, but more than that, science learning should prioritize the discovery process based on observations of the problems obtained (Coil, Wenderoth, Cunningham, & Dirks, 2010). Through the application of the problem-based story model, the increase in metacognitive awareness was shown by the increasing value of the N-Gain pre-test and post-test of students at meetings 1 and 3. Awareness of metacognition about knowledge about cognition was divided into 3 namely declarative knowledge, procedural knowledge, and conditional knowledge. Declarative knowledge was knowledge to know something (what, how, and why) in another sense was knowledge to find out how someone learned it, and what factors influenced its success. In the results of the study, the knowledge about cognition aspect had an N-Gain value of 0.47 at the 1st meeting and 0.63 at the 3rd meeting. This indicated that students at the 3rd meeting had higher cognitive processes about memory than the first meeting.

In the next aspect, namely procedural knowledge, that was the ability of students to list abilities and design strategies as effectively as possible in sorting and categorizing any information they received (Cer, 2019). The results showed that in the procedural knowledge aspect there was an increase in the N-Gain value from 0.51 at the 1st meeting

to 0.65 at the 3rd meeting. This indicated that at the 3rd meeting the students were better prepared in designing their best strategy in obtaining maximum results. This happened because at meeting 1 students did not have experience in sorting information compared to meeting 3. Next was the aspect of conditional knowledge. Conditional knowledge was one's knowledge of knowing when and why to use declarative knowledge and procedural knowledge. Conditional knowledge helped students to change the conditions they wanted in any given lesson assignment. The results showed that there was an increase in the average N-Gain conditional knowledge of meeting 1 by 0.59 to 0.72. This was also supported by the fact that students' ability to improve strategies in processing information as much as possible in improving conditions at meeting 1 becomes more effective at meeting 3.

Moreover, metacognitive awareness regarding regulation of cognition includes planning, information management strategies, and comprehension monitoring. Planning was a series of strategic approaches to processing the allocation of data sources that affected the resulting actions. The results showed that there was an increase in the average N-Gain in the 1st meeting with a score of 0.75 to 0.76 at the 3rd meeting. The increase occurred because at the 3rd meeting the students were more experienced in making better strategies than at the 1st meeting. Next was management strategies, namely students' skills in sequencing strategies used to process information more efficiently, including organizing, describing, and summarizing. The results showed that there was an increase in the average N-Gain score of 0.59 at the 1st meeting, increasing to 0.67 at the 3rd meeting. The experience at the 1st meeting was used by students to improve strategies by processing information more efficiently at the 3rd meeting. The last aspect in metacognitive awareness was comprehension monitoring, namely students' understanding to perform an action. Research proved that there was an increase in the average N-Gain score of 0.64 at meeting 1 to 0.72 at meeting 3. Monitoring accuracy could be seen from how students took measured actions (Barcakanli, 2011). From all aspects of metacognitive awareness, there was an increase in the average N-Gain score of 0.59 at the 1st meeting to 0.69 at the 3rd meeting.

Furthermore, the influence of the model on science process skills. Science process skills were a student's ability to apply scientific methods to obtain and discover their own knowledge (Stender, Schwichow, Zimmerman, & Härtig, 2018). According to another source, students constructed their own process of gaining knowledge through the application of the scientific method. Science skills were divided into several aspects such as observation, classification, predicting, interpreting, formulating hypotheses, planning experiments, and communication. The result of the first science process skills was observation skills. Observation skills were the most basic skills that students must have in studying science. Students were measured based on their ability to use the five senses optimally to make observations which will later become empirical facts.

Based on the results of the study, the students' ability in observation had an average N-Gain value of 0.32 at the 1st meeting, increasing to 0.47 at the 3rd meeting. This happened because students were more trained to use their five senses in observing plants more intensively than meeting 1. The results of other studies proved that observation skills in children must be trained continuously so that students are accustomed to using their senses in making observations. The next skill was classification. After carrying out observations, students first knew the differences, similarities, and grouping objects based on their characteristics and objectives in an effort to make certain parameters to

understand the observed objects. The results showed that there was an increase in the average N-Gain

score of 0.60 at meeting 1 to 0.82 at meeting 3. The ability of students to classify plants based on their reproduction method increased because at meeting 1 students were trained to group plants based on their characteristics. The next skill was predicting. Forecasting was a pattern activity or tendency to make predictions or conjectures. The results showed that there was an increase in students in making prediction patterns with an increase in the average N-Gain score of 0.57 at meeting 1 to 0.64 at meeting 3. The next skill was interpreting. Interpreting was the ability of students to present a data to show a pattern. Research showed that there was an increase in the average N-Gain score of 0.70 at meeting 1 to 0.73 at meeting 3. Furthermore, the skills to formulate hypotheses were the ability of students to propose their assumptions to explain an event or research on the basis of the information collected. The results showed an increase in the average N-Gain score of 0.67 at the 1st meeting, an increase of 0.79 at the 3rd meeting.

The next skill assessed was planning an experiment. The activity of planning an experiment was a process that included determining the tools and materials, objects to be observed, measured, written down and determining the required work steps. The study showed that there was an increase in the average N-Gain score of 0.50 at meeting 1 which was higher than at meeting 3, which was 0.52. This was because the material at meeting 1 of generative reproduction in plants was easier to arrange experiments because materials such as flowers were widely available in schools compared to meeting 3 of material for artificial vegetative reproduction. The last skill assessed was communication. Communication skills were the ability to find out and explain empirical information in the form of diagrams, express ideas or ideas both written and oral. The results showed that there was an increase in the average N-Gain score of 0.69 at meeting 1 to 0.80 at meeting 3. The average results of science process skills in all aspects of skills in the small test, large test and dissemination test at meeting 1 showed that the mean of the pre-test results of the students' science process skills was 46.82 in the poor category and 78.53 in the post-test in the good category, the results of the normalized gain (N-Gain) showed a score of 0.67 in the medium category.

Meanwhile, meeting 3 showed that the average result of the pre-test of students' science process skills was 54.04 in the poor category and in the post-test was 83.71 in the very good category, the results of the normalized gain (N-Gain) with a score of 0.69 or in the medium category. The aspects of student mastery that had been mentioned were to answer the challenges in improving the quality of education in an effort to reach the golden generation of Indonesia in 2045. With the improvement of the 2013 curriculum in an effort to give teachers the freedom to be creative in creating an effective learning atmosphere, this development was the answer to the freedom given by the government in an effort to produce a generation that was ready to face future challenges by providing education that stimulated HOTS (High Order Thinking Skills) learning and the demands of 21st century learning included critical thinking, collaborative creativity, and communication.

CONCLUSION

Based on the results of the research, analysis of data processing and research discussion, it could be concluded that the problem-based story (PBS) learning model using the Kahoot interactive quiz to improve science process skills and students'

metacognition awareness in junior high school science learning was categorized as very valid, this was based on the results of the average overall score of expert validation and user validation were 98.13% so that the learning model was feasible to be used as an alternative learning model for science learning in the classroom. The development of a problem-based story (PBS) learning model to improve science process skills and metacognitive awareness of students in science learning in junior high schools was categorized as very practical, it could be seen based on the average score of learning literacy of 91.29. Student response scores had an overall average value of 89.74 in the very good category.

The problem-based story (PBS) learning model using the Kahoot interactive quiz was a model with a story-based approach to social problems that was occurred in everyday life which students then investigated and made products based on science to solve problems so as to improve science process skills and students' metacognitive awareness in Junior High School science learning. This was based on the average N-Gain in the small group test, large group test, and in the dissemination test with an average of 0.59 in the medium category. However, there were shortcomings where researchers had not linked directly to cognitive, psychomotor, and affective learning outcomes. It was hoped that further researchers would examine and investigate the correlation with cognitive, affective, and psychomotor in order to add insight to teachers in implementing good learning models.

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