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ANALYSIS OF THE QUALITY OF STUDENTS SCIENCE RESEARCH IDEAS THROUGH THE IMPLEMENTATION OF RESEARCH-BASED LEARNING MODELS

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Abstract: Learning that focuses on achieving product mastery is not optimal in facilitating students to create quality research ideas. In this research, we implemented MPBR to analyze the quality of science research ideas from students. To collect research ideas from students, the documentation method is used. Documents as qualitative instruments obtained through this method are assessed based on four criteria. They are suitability to the scope of scientific studies, the presence of research problems, the accuracy of the editorial title formulated from the research problem, and the urgency of the study variables. The data obtained was analyzed quantitatively and qualitatively. The quantitative analysis that we carry out is proportion analysis. The qualitative analysis includes data reduction, visualization, and conclusion. We found that all research ideas are within the scope of scientific studies and are based on research problems. However, only some scientific research ideas have appropriate title formulations, and the variables need to be studied further through the research process. This has implications for the overall quality of research ideas. The quality of research ideas in the outstanding category is 44.06%. The proportion in the good category is 14.68%, and the remainder is in the fair category, with a ratio of 41.26%. The conclusion is that implementing the PBR model effectively trains students to create scientific research ideas based on problems they find in the surrounding environment.

Keywords: *Science Research Ideas, Students, PBR Models, Example Media, Templates, Paper Guidelines*

INTRODUCTION

The distribution of courses in the Merdeka Belajar Kampus Merdeka (MBKM) curriculum [1] and several other previously applicable curricula show that science competency is facilitated through two methods (Crs). Basic Natural Sciences (BNS) and Elementary Science Education are these two Courses. Judging from the CMPK editorial of these two Constitutional Courts, a more significant proportion of science learning is focused on mastering products consisting of facts, concepts, theories, principles, and natural laws. This phenomenon was also observed in the test instruments used during the Mid-Semester Examination (UTS) and Final Semester Examination (UAS). Respectively, UTS and UAS have a proportion of 30% and 50% of the final grades listed on the student's Study Result Card (KHS) [2]. Focusing on aspects of the product itself positively impacts students' mastery of science concepts. The results of the Crs BNS assessment show that student learning outcomes are in a good category, with an average score of 75.83 [3]. The assessment results at the Elementary School Science Education Crs also showed relatively the same results—student learning outcomes. Most of them obtained good and very good categories [4]. Apart from the positive impacts, there are also negative impacts. Student SPS is in the inferior category [5]. This indicates that learning that only focuses on product aspects is ineffective in developing other science aspects.

Efforts to improve learning have been carried out over the last few years. Practice-based education began to be implemented by utilizing the Natural Laboratory as a learning resource. This facility positively impacts the development of students' science process skills [6]. The category is good, with a degree of mastery of 66.20. This value has a grade of B. Students' science learning outcomes regarding the ability of products and SPS also show a positive trend. The category has reached good with a mastery of 70.97 [7]. This value itself has a grade of B+. Even though learning was carried out during the Covid-19 pandemic, based on survey results, students tended to respond negatively for several reasons. These reasons are that interaction with lecturers is not optimal, limited quota fees, and unstable internet connections [8-9]. Therefore, there are recommendations for hybrid learning, combining online and offline education. Online learning includes virtual face-to-face learning using Google Meet, collecting assignments and online discussions using SPADA/Daring Unram, and social media applications using WhatsApp Group [10]. This results from an adaptation of the model recommended by Utomo [11]. Offline learning is carried out in the environment around students as a Natural Laboratory.

Science learning by utilizing the Natural Laboratory as a learning resource has a good impact on the one hand but has shortcomings on the other hand. One is a research idea whose quality still needs to be developed. Many research ideas are proposed by students that do not fall within the scope of science topics. The proportion is 35.14%. Of the number of pictures relevant to science topics, only a few study variables are urgent to proceed to the research stage. The proportion is 10.20% [12]. This means that only a tiny proportion (n%) of all research ideas from students are of good quality. The quality of ideas is one of the keys to research, where the practice-based science learning process is adopted or adapted from the systematic research process. If research ideas are of low quality, it can impact not maximizing science learning, which is more focused on solving problems in everyday life and constructing scientific knowledge through this process [13]. This can also reduce the creation of an epistemic culture where students conduct scientific and authentic investigations [14].

If viewed from learning, the process does not start with problem identification. The research idea depicted in the research title emerged spontaneously. This title then becomes a basis for students to reconstruct their scientific knowledge and apply science learning as practice [15]. In this research, we cover these weaknesses by implementing MPBR. *Tremp* states that the first phase of this model syntax is formulating general questions [16]. In the research context, this first phase is also known as "problem formulation". To get a problem formulation, start first with the problem identification process. From this process, the research title is then formulated. The research we conducted aimed to analyze the quality of students' science research ideas by implementing this learning model. The results can be used as material for lecturers' reflection and evaluation in continuously improving the quality and outcomes of science learning. The results of this research are also helpful in increasing the body of knowledge regarding the effectiveness of MBPR in developing student competence in constructing science research ideas, primarily for PGSD study program students, which nomenclatural include study programs from the non-science group.

RESEARCH METHODS

The research that we have conducted is a type of qualitative descriptive research. The analysis was conducted at the Primary School Teacher Education Study Program at Mataram University. The data source sample consisted of 143 students taking the Elementary School Science Education and Basic Natural Sciences MK program. Data was collected using the documentation method from this number of pieces, and documents extracting research ideas collected via Google Drive links became qualitative data collection instruments [17]. The quality of student research ideas is assessed based on criteria adapted from [12], which consists of 3 criteria. These three criteria are suitability to the scope of science (K-1), editorial accuracy of the research title (K-3), and urgency of the study variables (K-4). In this research, the quality of science research ideas is measured based on these 3 criteria plus the presence or absence of science problems (K-2). K-3 refers to the Mataram University FKIP thesis writing guidelines [18]. The quality of research ideas is interpreted into 5 categories: very high quality, good quality, moderate quality, low quality, and deficient quality. Apart from quality, we added classification factors in this study to obtain a more detailed description of students' science research ideas. This classification is based on the type of study. The types of study here are theoretical research and practical research. The data was then analyzed qualitatively and quantitatively. Qualitative data analysis refers to Miles and Huberman, namely reduction, visualization of data, and conclusion [19]. The quantitative data analysis is proportion analysis.

RESULTS AND DISCUSSION

Quality of Research Ideas based on K-1

The quality of science research ideas was collected from 143 students. Everything is by the scope of scientific studies. This finding shows that student competence has increased compared to previous learning, which was not facilitated using the PBR model. Previously, there were still many (35.14%) whose research ideas did not match science topics [12]. This also shows that the RBL model effectively facilitates students to learn science, especially for the science learning process with a new paradigm, namely practice-based [15]. However, its scope still does not cover all science topics studied at the elementary school (ES) level. The study topics still focus on plant morphology, balance and conservation of natural resources, the human digestive system, ecosystems, and substances/materials in everyday life. This means that only a few topics are included in the content standards and are the minimum competencies that students must master in elementary school [20]. The issues that have not been touched upon through analysis of research ideas from students include the solar system, electrical phenomena, temperature and heat, force and motion, light and optical devices, and various other topics that are relatively more difficult to carry out research with limited competence and financial resources.

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Topics such as the solar system can be said to be a part of science that makes it impossible to carry out research by students from non-science groups such as PGSD. The main factor is the lack of tools to help observe phenomena in the solar system. Some of the latest research related to this topic includes biosignatures in the solar system [21], physical phenomena on exoplanets [22], and material transport on protoplanets [23]. These variables and research subjects will not be able to be carried out by PGSD students and even by physicists whose knowledge is not in that field. For other topics, students can still do it, but they have no idea what problems they need to research regarding these topics. This was driven by the factor that many research ideas were rejected by course lecturers when several students proposed them. Another external factor is that the learning style of many students is still imitative in finding scientific research ideas. This is observed from many research ideas that have similarities. This factor is also why so few topics represent 143 students' science research ideas. Science topics such as animal and plant life cycles, alternative natural resources, movement systems, and adaptations of living creatures can be carried out by students.

Quality of Research Ideas based on K-2

All research ideas proposed by students have problems that form the basis of the research process. Judging from survey results in previous years, the majority of students (46%) had difficulty writing backgrounds [24]. This is compared to other research and thesis writing processes, such as collecting and processing data, examining and revising the thesis, and looking for reference sources. The most significant inhibiting factor is internal factors or oneself. From the aspect of understanding the thesis content and the problem's background, 12% of students admitted that they had difficulty understanding it. This proportion is higher than the number of students with difficulty in the theoretical study section, determining research titles, thesis writing techniques, and other areas. This means that the problems previously discovered can be eliminated through the science learning process facilitated by the RBL model.

According to Tremp, phase one of the PBR model syntax is formulating general questions [16]. In the research context, this phase is compiling a problem formulation. To prepare a quality problem formulation, it is necessary to identify and discover the problem. So, in this phase, students are trained to locate and find problems that exist around students. These findings have been empirically confirmed by previous research results, where the PBR model was influential in developing students' skills in conducting research and writing the results in the form of scientific reports [25]. The results of other research confirm the same data as our findings are a study conducted on prospective teacher students at the Tangerang campus [26]. In the initial learning process, students are facilitated to search for and observe current problems in the field of education. The identified issues are then used to formulate general statements – phase 1 of the RBL model.

Quality of Research Ideas based on K-3

Most students can write research titles with the correct editorial. The number reached 84 students. This number is equivalent to 58.74% of the total students sampled in this study. Fifty-nine students still need time to learn to write research titles with correct editorials. This number is equivalent to 41.26% of the total students sampled in this study (Figure 1). This means that most students can take advantage of the learning facilities provided, and the PBR model is effective for many of these students. Compared with previous research results, the proportion of students who miswrote editorial titles was more significant. Previously, the balance related to this matter was 68.06% [12]. Some inappropriate editorial titles and their shortcomings are presented in Table 1.

Table 1. Sample of research title editorials and the location of the errors

No	Editorial Title Science	Research Error Location
1	Predatory insects in the rice paddy ecosystem in Babakan	There are no study variables
2	The process of filtrating turbid water to become clear using simple ingredients	There are no study variables.
3	Variety of life in the sewer ecosystem in the Royal Madinah housing complex	There are no variables or objects of study.
4	Use of natural ingredients and chemicals to get rid of ants in the house	There are no study variables
5	Enjoyment of coffee with different blend ratios	There are no study variables

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In Table 1, editorial titles 1, 2, 4, and 5 do not include clear study variables. This type is a common mistake made by students when writing research titles. For example, in editorial number 1, it is unclear what aspect of predatory insects will be studied. Is it species richness, diversity, community structure, taxonomy, ecology, or other parts of biology? Or the role of these predatory insects in the rice field ecosystem in Babakan? Likewise with the editorial titles in numbers 2, 4, and 5. Let's look at the various articles resulting from scientific research that have been published in journals or proceedings at national and international levels. The editorial diversity is very high. The author's creation created this to avoid similarities with the editorial titles of previous research, which have been published online. A good research title at least includes study variables and research subjects. Research locations may be added, depending on the research. Some examples include the study variable is genome size in amphibian issues [27], the study variable is diversity and community structure in dragonfly subjects in the Suranadi Nature Tourism Park [28], and the study variables are conservation and community structure in bird subjects in the Nature Tourism Park Mount Tunak [29].

Quality of Research Ideas based on K-4

The quality of research ideas based on this criterion has the most minor proportion. As many as 44.06% of students studied urgent variables, and the majority (55.94%) were not critical. Some research ideas with compulsory variables are related to native plants in the Sesaot forest, which local communities can use as traditional medicines and vegetables, butterflies in conservation areas, and "beautiful" insects in ecological or village-based tourist areas (Ecotourism). Research related to the types of medicinal plants in the Sesaot forest is urgent because (1) traditional medicines are more easily accessible, (2) the prices are relatively more affordable for the community, and (3) the need for inventory and documentation of various types of plants that are useful for treatment [30], likewise for types of wild plants that are useful as vegetables. To get vitamins from vegetables for free, local people around the living area take them from nature. Vegetable plants such as ferns are wild plants that are not planted, and anyone can take them. In addition, this vegetable is free from dangerous chemicals, so there is no risk to health. This encourages widespread public consumption of organic vegetables [31]. Apart from that, Sesaot is also a protected forest area [32], part of the Tahura Nuraksa area. Hence, data on plants as the leading producers in the terrestrial ecosystem is necessary for sustainable conservation efforts.

Conservation efforts in legally protected areas require data regarding plants and herbivore wild animals, which play a significant role in maintaining the stability of the area's ecological processes. These animals, for example, are butterflies and insects in general. On Lombok Island, in particular, studies on this animal are still relatively rare. This impacts the lack of biological and ecological knowledge of these animals. In the last 10 years from 2013 – 2023, there have only been 5 publications related to this animal. Study locations include Suranadi Nature Tourism Park [33], Tahura Nuraksa [34-35], Gunung Tunak Nature Tourism Park [36], and Jeruk Manis Protected Forest [37]. From the aspect of study location, this does not yet cover all conservation areas on Lombok Island. West Lombok district still has Bangko-bangko and Pelangan Nature Tourism Parks [38]. In the north, there is Senaru, which is part of the Mount Rinjani National Park. This does not include ecotourism areas under the forestry and environmental services, such as the Bagek Kembar essential area in Sekotong.

Interpretation of the Quality of Research Ideas

In this research, we found that the quality of most students' science research ideas was very good. The proportion reached a value of 44.06%. The second largest proportion is in the sufficient category, and the quality in the good category is in third place. The poor and very poor categories have a proportion of 0% (Figure 2). This means that students' ability to find research ideas is relatively good. This also shows that implementing the PBR model is effective in science learning, especially in training students to create research ideas based on scientific problems they encounter in everyday life. These data alone confirm that the science learning objectives were achieved. Students not only achieve goals in the knowledge domain, which consists of cognitive and knowledge process dimensions [39], but also in the skills domain which consists of concrete and abstract skills. Other aspects of science – scientific attitudes – such as being highly curious, honest, objective, open-minded, caring, thorough, diligent, brave, and polite [40] can also be achieved indirectly.

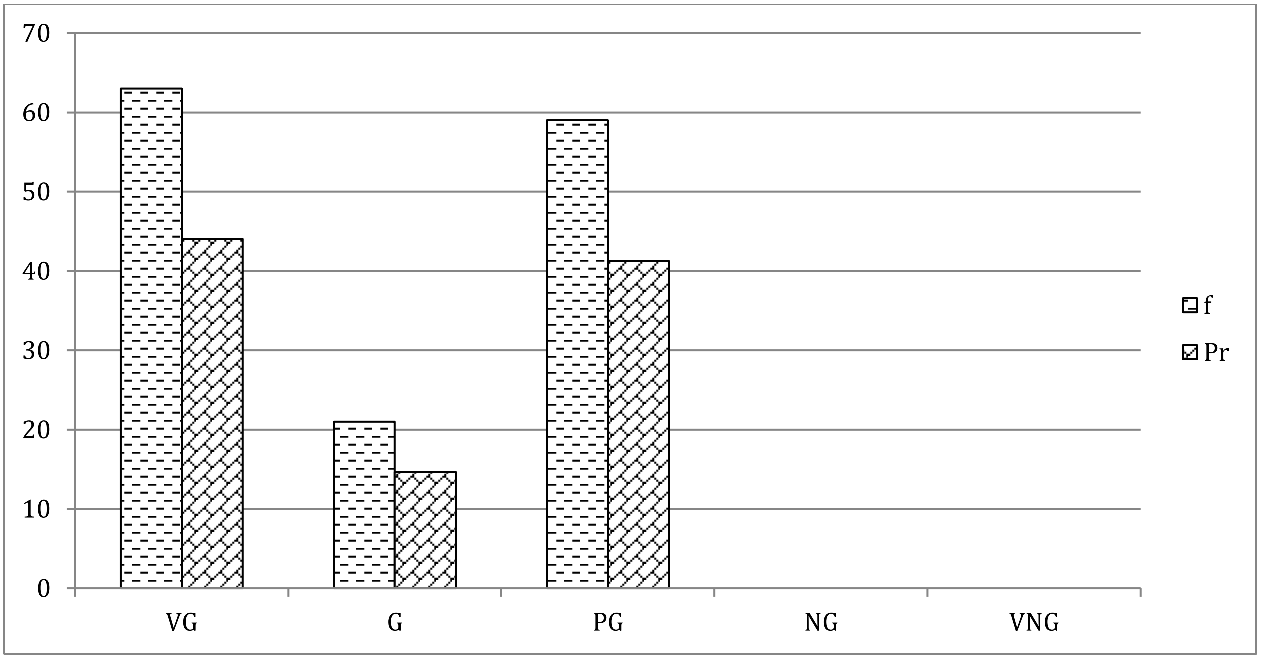

Figure 2. Distribution of the number and proportion of the quality of students' science research ideas

Figure 2 shows that the quality of research ideas in the KB and SB categories is nonexistent. This is because all students have good-quality research ideas for K-1 and K-2. However, several students have the competence to create research ideas in categories B and CB, so some students have poor-quality research ideas in K-3 and K-4 (Figure 2). Most students still need to learn to improve their competence in creating research ideas to meet K-3 and K-4.

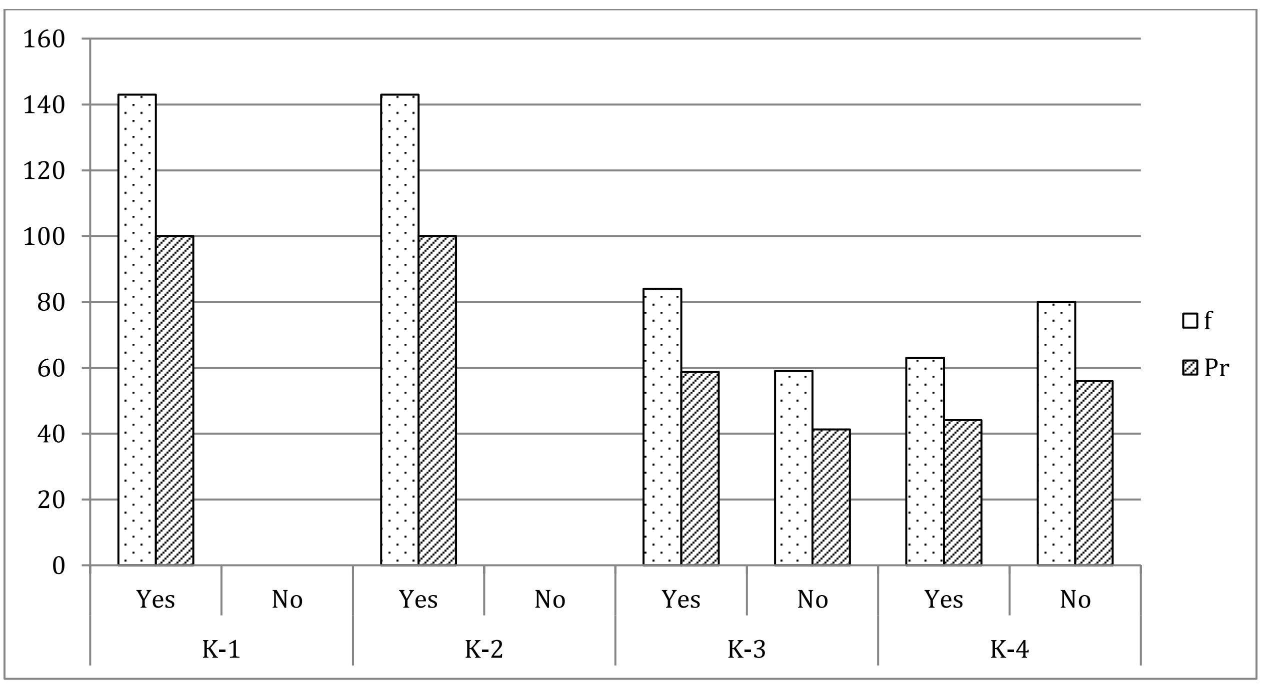

Figure 2. Frequency distribution and proportion of the quality of student research ideas

Students' weaknesses in creating science research ideas, as visualized in Figure 2, require a solution. Based on the independent campus learning curriculum, several compulsory and elective courses provide students with training to develop their skills in conducting research. They are quantitative research

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methods (weight 3 credits), qualitative research methods (importance 3 credits), educational statistics (weight 3 credits), elementary school seminars (2 credits), writing scientific papers (weight 2 credits), and analysis data (2 credits). So there is a total of 15 credits provided by the Study Program [1]. However, students who program elementary science education courses are still in their first year (semester 2), while these courses can be programmed in semesters 4 and above. This is one of the factors causing many students to be unable to create research ideas well, especially for K-3 and K-4. The students taking introductory natural sciences courses are already in their 5th semester (3rd year). They have taken courses in quantitative research methods, qualitative research methods, and educational statistics. So, they have better initial abilities compared to first-year students. In science learning, initial capabilities significantly affect student learning outcomes [41].

Several learning facilities have theoretically been proven to overcome this problem. The first is the implementation of a virtual laboratory. These facilities can provide meaningful learning experiences for students [42]. Another learning facility is a game-based learning model. This model has the advantage that students have good perceptions and are more enthusiastic about learning through research. In addition, learning through games can attract and maintain students' attention during the learning process [43]. Learning carried out by providing direct experience has also proven effective in developing students' skills in conducting research [44]. This is by John Dewey's theory, where learning will be effective if students are facilitated to do something practical [45]. This is also in accordance with the science curriculum, which emphasizes active student involvement in constructing their own science knowledge through direct experience in the field [46-47]. In the PGSD Study Program, learning has been implemented that aligns with the last statement: the environment around students is a Natural Laboratory. This learning resource has been proven effective in developing science process skills [6]. This skill itself is needed in carrying out scientific investigations. Therefore, we recommend this learning resource combined with the RBL model.

CONCLUSION

Implementing the research-based learning model effectively develops students' abilities in creating science research ideas. This is proven by the quality, which ranges from very good to good and quite good categories. There are no students with abilities in the poor categories. However, there are still students who are unable to create scientific research ideas where the ideas are written in the correct research title. Apart from that, most students still have ideas for scientific research with study variables that are not urgent. Based on the results of this study and previous studies, we recommend using research-based learning models combined with natural laboratories as a contextual science learning resource.

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