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Examines the evaluation of science process skills among first-year students in the biology education department.

Corresponding Author: Anny Fatmawat

RESEARCH ARTICLE

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Abstract: In the quest for effective science education, a central tenet is the emphasis on reconstructing knowledge and experiences. An essential aspect of this reconstruction involves nurturing science process skills, empowering students with problem-solving capabilities. This study meticulously examines the science process skills of first-grade students within the Biology Education Department. Conducted as a descriptive research study, this investigation encompasses the entire first-grade student cohort in the Biology Department during the academic year 2016/2017. The primary goal is to unveil the intricacies of science process skills, providing insights into their application and proficiency in problem-solving. The findings yield valuable insights into both basic and integrated skills. Notably, data measurement emerges as the most accessible facet of basic skills, establishing a robust foundation for students. However, challenges arise in classifying and inferring data, marking them as the most formidable aspects. In the realm of integrated skills, crafting data for investigation is identified as the easiest facet, contrasted with the more challenging tasks of analyzing investigations and identifying variables.

This research offers a comprehensive overview of science process skills, presenting nuanced perspectives in the field of science education. By delving into the specific challenges and successes experienced by first-grade students, this study provides valuable information for refining pedagogical approaches and enhancing the curriculum within the Biology Education Department.

Keywords: Descriptive research study, Student cohort, Intricacies Application, Proficiency

Introduction:

The field of Science goes beyond the simple understanding of facts; it involves the systematic interpretation of physical phenomena through a structured methodology (1). This approach goes beyond acquiring factual knowledge, including the application of gained knowledge and processes that shape individuals' cognitive perspectives. In scientific education, learners are not merely expected to comprehend facts and concepts; they are urged to utilize their knowledge, promoting the development of hypotheses, conducting experiments, and effectively communicating the results of their experiments 2. Written skills, a combination of both process and product, play a

crucial role in this scientific exploration (2).

According to [1], scientific inquiry is based on three fundamental dimensions: scientific products (content, concepts, and knowledge), the scientific process (methodology), and the scientific attitude (characteristics and worldview). In the context of Biology education, an optimal learning environment should foster expertise in all three dimensions, enabling students to not only gain scientific knowledge but also understand the processes and attitudes that define scientific thinking.

According to [1], scientific learning comprises three fundamental dimensions: scientific products (content, concepts, and knowledge), the scientific process (methodology), and the scientific attitude (characteristics and worldview). However, Biology education at secondary and elementary levels often prioritizes the product of science over its processes, which can limit the full potential of scientific education. To unlock the complete benefits of scientific learning, the focus should extend beyond mere factual knowledge and incorporate the vital component of scientific process skills.

Cognitive learning is most effective when it goes beyond rote memorization and involves learners in problem-solving, thereby connecting the acquisition of material knowledge to the development of practical skills. Natural sciences, particularly Biology, necessitate the use of science process skills as an essential component of the scientific method. These skills are demonstrated through biological inquiries or tasks that require the application of one or more process skills.

As per , science process skills are the actions scientists undertake during scientific endeavors. These skills include fundamental activities such as observing, classifying, measuring, inferring, predicting, and communicating. Science process skills demystify the scientific method, providing a roadmap for understanding natural phenomena through processes like observation, conclusion drawing, measurement, and experimentation.

Science process skills are divided into two fundamental types: basic skills and integrated skills. Basic skills include observing, classifying, measuring, inferring, predicting, and communicating, while integrated skills involve variable identification, hypothesis construction, investigation analysis, data tabulation, variable definition, investigation design, and experimentation. The practical application of these skills in laboratory settings enhances the learning experience.

The primary objective of education, especially in science, is behavioral transformation, rather than material mastery. To initiate this change, a paradigm shift in teaching methodologies is essential, with a focus on not only conveying subject matter but also fostering an environment that facilitates transformative learning experiences.

The Biology Education Department is home to students from diverse backgrounds, educational levels, and origins. The first-year cohort for the academic year 2016/2017 consisted of 40 females and 7 males, hailing not only from South Kalimantan but also from other regions. The heterogeneous mix is further compounded by the diverse educational backgrounds of the students, ranging from science-oriented high schools to vocational institutions. Given these complexities, the research question that arises is: “How do the science process skills of first-year students in the Biology Education Department manifest?” The primary objective of this research is to comprehensively measure the science process skills exhibited by first-year students within the Biology Education Department.

Methodology:

The study employed a descriptive research design,

presenting results as an objective account without researcher intervention, specifically focusing on describing the mastery of science process skills. Employing a quantitative approach, the research was carried out at the Biology Education Department, Universitas Lambung Mangkurat, spanning two months from January to March during the academic year 2016/2017. The research participants were students enrolled in the Biology Education Department, and the analytical techniques included scoring each test item, categorizing scores into three groups, and calculating the frequency of each category using a predetermined formula.

$$p = \frac{f}{N} X100\%$$

The data analysis for the research involved using Microsoft Excel. The frequencies (F) were examined to calculate the percentage points (P), which represented the occurrence of specific categories. The total number of frequencies (N) was considered as the overall count in the dataset. This approach facilitated a systematic analysis, ensuring a reliable examination of the research data.

Results and Discussion:

The outcomes of the assessments conducted on students' fundamental science process skills are consolidated in Table 1.

Table I: Percentage of Students' Basic Science Process Skills

The table provides a detailed breakdown of the percentage distribution of students' proficiency in basic science process skills. The findings aim to provide a comprehensive overview of the levels of mastery achieved by students in these essential skills. The subsequent discussion will delve into the implications of these results, shedding light on areas of strength and potential areas for improvement within the context of basic science process skills among the student cohort.

No	SPS	Type	Percentage
1	Observing	Basic	55.68
2	Classifying	Basic	35.23
3	Predicting	Basic	51.14
4	Communicating	Basic	63.64
5	Hypothesizing	Basic	59.09
6	Informing	Basic	28.41
7	Measuring	basic	86.36

Based on the data presented in Table 1, it appears that the most proficient basic science process skill among students is the ability to measure. This skill involves using standard measures or estimations to determine specific dimensions of an object or event, resulting in the generation of quantitative data. As a result, a majority of students achieved the highest scores in this particular skill.

According to the data presented in Table 1, the most proficient basic skill observed among students is the ability to measure. This skill involves using standard measures or estimations to determine specific dimensions of an object or event, resulting in the generation of quantitative data. Conversely, the most challenging basic skills were identified as the abilities to infer and classify. In the process of inference, students engage in formulating assumptions or potential explanations grounded in their observations. The classification skill involves the grouping or ordering of objects or events based on distinctive characteristics or criteria, presenting notable difficulty.

According to the data presented in Table 1, the least proficient basic science process skill among students is observation. It is noteworthy that basic skills, including observation, should ideally be thoroughly mastered by learners from elementary to senior high school levels.

Based on the data presented in Table 1, it appears

that the most proficient basic science process skill among students is the ability to measure. This skill involves using standard measures or estimations to determine specific dimensions of an object or event, resulting in the generation of quantitative data. As a result, a majority of students achieved the highest scores in this particular skill.

Basic science process skills are interdependent, indicating that investigators may manifest and apply more than one of these skills within a singular activity.

The findings from the measurements on integrated science process skills are succinctly outlined in Table 2.

Table II illustrates the percentage distribution of students' integrated science process skills.

No	SPS	Type	Percentage
1	Identifying of Variables	Integrated	19.32
2	Organizing Data in Tables and Graphs	Integrated	88.64
3	Designing investigation	Integrated	50.00
4	Analyzing investigation	Integrated	18.18
5	Defining Variables Operationally	Integrated	21.80

Presented in Table II, it is evident that this study incorporates integrated skills that encompass five sub-skills. Integrated science process skills are immediate capabilities utilized in problem-solving scenarios

Students showed the highest proficiency in organizing data in tables and graphs. They demonstrated competence in presenting and structuring collected data using these graphical representations. On the other hand, the lowest scores were associated with the skills of analysis, investigation, and the identification of variables.

Analyzing investigations involves the statistical interpretation of data, identification of human errors and experimental discrepancies**,** evaluation of hypotheses**,** formulation of conclusions**, and** recommendations**. On the other hand,** identifying variables **requires** determining variable types**,** designating the independent variable manipulated**,** recognizing the dependent variable measured for its response**, and** acknowledging constants as variables that remain unchanged and potential independent variables**.**

It is essential for students to master the entirety of science process skills, considering learning as an adaptive process involving science. The significance of science as a process lies in comprehending concepts such as conducting observations, making
classifications, measuring, predicting, hypothesizi ng, and constructing knowledge. Providing training in science process skills has been shown to enhance students' academic achievements . Learning activities should prioritize experiential learning over an exam-focused approach, moving away from teaching solely to meet testing requirements, often referred to as "teaching for the test" .

Conclusion:

The highest proficiency in basic science process skills was attained in the capacity to measure data, achieving a percentage of 86.36%. Conversely, the least favorable percentages were noted for the skills of inference at 28.42% and classification at 35.23%. In the realm of integrated science process skills, the most proficient aspect was the organization of data in tables and graphs, representing 88.64%. On the contrary, the least proficient aspects were the analysis of investigations at 19.32%, followed by the identification of variables at 18.18%.

For researchers contemplating similar investigations, it is recommended to carefully consider the inherent characteristics of learners when constructing test instruments. Additionally, researchers may delve into additional factors such

as divergent thinking, creative learning, and motivation to enrich the scope and depth of future research endeavors.

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