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Mastery of generic science skills in biology learning in high school level students

Penguasaan keterampilan generik sains pada pembelajaran biologi pada peserta didik tingkat SMA

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Abstract
Generic skills are part of learning skills that are applied to new and different situations, especially to certain principles of the learning process. Students' abilities improved due to changes in the process. Biology has complex concepts and problems that students must learn. Apart from that, many biological objects cannot be observed directly and are abstract. This research aims to analyze the mastery of generic science skills based on students' gender and class level so that the research results can be implemented in Biology learning. This research is descriptive research which uses a qualitative research method by taking data samples from questionnaires distributed to class XI and class X by taking samples in one class totaling 176 students. The sample is based on disproportionate stratified random sampling. It is known that the number of respondents who filled out the questionnaire based on class level was 76 people in class X and class Research shows that there is no difference in students' mastery of GSS based on gender, this can be seen from testing with Asymp scores. Sig. (2-tailed) of 0.199. Apart from that, there is no difference in KGS mastery based on class level, this is reflected in Asymp. Sig. (2-tailed) of 0.187, this indicates that generic science skills have the potential to be mastered before biology learning is carried out.

Keywords: generic science skills; biology learning; gender; grade level

Abstrak. *Keterampilan generik merupakan bagian dari kecakapan pembelajaran yang diaplikasikan pada situasi baru dan berbeda terutama pada prinsip tertentu proses pembelajaran. Kemampuan peserta didik berkembang lantaran adanya perubahan proses tersebut. Biologi memiliki konsep dan permasalahan kompleks yang harus dipelajari oleh peserta didik. Selain itu banyak objek Biologi yang tidak dapat diamati secara langsung, bersifat abstrak. Penelitian ini bertujuan menganalisis pengusaan Keterampilan generic sains berdasarkan jenis kelamin maupun tingkatan kelas peserta didik sehingga hasil penelitian dapat diimplementasikan dalam pembelajaran Biologi. Penelitian ini merupakan penelitian deskriptif yang digunakan adalah metode penelitian kualitatif dengan mengambil sampel data hasil angket yang disebarkan ke kelas XI maupun kelas X dengan mengambil sampel dalam satu kelas yang berjumlah 176 peserta didik. Sample didasarkan melalui disproportionate stratified random sampling diketahui jumlah responden yang mengisi angket berdasarkan jenjang kelas 76 orang kelas X dan kelas XI berjumlah 100 orang, sedangkan proporsi pengisian data oleh laki-laki sebanyak 40 orang sedangkan perempuan 136 peserta didik. Penelitian menunjukkan bahwa tidak terdapat perbedaan penguasaan KGS pada peserta didik didasarkan pada jenis kelamin hal ini terlihat dari pengujian dengan nilai Asymp. Sig. (2-tailed) sebesar 0.199 selain itu tidak terdapat perbedaan penguasaan KGS didasarkan pada jenjang kelas hal ini tercermin dari Asymp. Sig. (2-tailed) sebesar 0.187 hal ini mengindikasikan bahwa keteramapilan generic sains berpotensi untuk dikuasai terlebih dahulu sebelum dilaksanakan pembelajaran biologi. Kata kunci: keterampilan generik sains; pembelajaran biologi; jenis kelamin; jenjang kelas.*

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INTRODUCTION

Developing the potential of students to become knowledgeable, capable and creative humans is important, including the concept of biology which is one of the fields of Natural Sciences (IPA). Biology learning contributes to learning development, especially the science process, such as learning activities such as demonstrations and practicums (Utami et al., 2021).

Generic Skills are one of the primary skills for improving the quality of Human Resources in the 21st century. Generic Science Skills include direct observation, indirect observation, awareness of magnitude scales, symbolic language, logical framework, logical inference, the law of cause and effect, mathematical modelling, and building concepts. KGS is part of learning skills applied to new and different situations, especially certain principles (Muspiroh, 2012; Putra et al., 2022). Generic science skills combine natural components in science with process skills (Wahyuningsih et al., 2019).

Generic Science Skills are one of the skills that need to be developed in students in the field of science. Basically, in the world of education, Generic Skills have been adopted, especially in science; this can be seen from the learning process, which uses learning models to improve KGS (Taofiq et al., 2018); apart from that, the use of modules helps improve KGS (Safitri et al., 2022; Septiani & Sumarni, 2015). Mastery of generic science skills has a strong connection with students' scientific attitudes (Martiningsih et al., 2018), so it is hoped that mastering generic science skills will help internalize students' scientific attitudes during Biology learning. Science process skills refer to what scientists do when they learn and investigate. Science teaches how to understand phenomena such as observing, inferring, measuring and experimenting (Utami et al., 2017).

Generic science skills can be taught through classroom learning, and this can be improved through the use of LKPD, which contains generic competencies in science learning (Sarita & Kurniawati, 2020); apart from that, the use of specific learning models such as Search, Solve, Create and Share (SSCS) can improve generic science skills (Mursyidah et al., 2019), so that generic science skills can be taught to students.

Based on the research results, it is known that the mastery of generic science skills has a different percentage. Many of the students are in the high category in class X students. However, it cannot be ignored that some students are still in the low category (Abidin & Utami, 2023), and the mastery of KGS has not been maximized, especially in classes at certain levels. The things that focus on mastering KGS, such as lesson materials, are presented in five indicators of generic science skills: direct observation, logical inference, cause-effect relationships, mathematical modelling, and symbolic language (Sarita & Kurniawati, 2020). Biology subjects, part of science lessons, are concepts for studying various scientific problems. A scientific activity, for example, understanding concepts, consists of several generic competencies. Different scientific activities can contain the same generic competencies. Hence, this research aims to analyze the influence of gender and grade level on the mastery of generic science skills in high school students.

RESEARCH METHOD

This descriptive research uses questions based on generic science skills in biological material. This research analyses students' mastery of generic science skills based on gender and grade level. This research was taken from a population that provides an overview of the generic science skills of state high school students in biology subjects. The study was conducted on SMA Negeri 1 Daha Utara students at classes X and XI science levels. The sample is based on disproportionate stratified random sampling, a technique carried out in a non-homogeneous and excessive population. Based on this, it is known that the number of respondents who filled out the questionnaire based on class level was 76 in class X and 100 in class XI.

The instrument used as a data collection tool in this research is a questionnaire with aspects and indicators in Table 1. The stages in data collection include (1) creating a research design and compiling research instruments, (2) fill in the questionnaire with the indicators assigned to students, and (3) analyze the data. Data were analyzed using the Mann-Whitney test to analyze mastery of generic science skills based on class level and student gender. The research hypothesis is as follows:

(a) Hypothesis 1

Ha there are differences in mastery of generic science skills based on grade level

Ho there is no difference in mastery of generic science skills based on grade level

(b) Hypothesis 2
Ha there are differences in mastery of generic science skills based on gender
Ho there is no difference in mastery of generic science skills based on gender

Table 1 Aspect and Indicators of Science Generic Skills Questionnaire

No.	Aspect	Indicator
1.	Indirect observation	1. Using measuring instruments as sensory aids in observing natural experiments/phenomena 2. Collect facts from experiments on natural phenomena 3. Look for differences and similarities
2.	Awareness of magnitude	1. Be aware of natural objects and high sensitivity to numerical scales as microscopic or macroscopic scale quantities/measures
3.	Symbolic language	1. Explain symbols, symbols and terms 2. Explain the quantitative meaning of units and magnitudes of equations 3. Using mathematical rules to solve natural problems/phenomena 4. Read a graph/diagram, table
4.	The basic logical framework of natural law	1. Look for logical relationships between two rules
5.	Logical inference	1. Understand the rules 2. Argue based on rules 3. Explain the problem based on the rules 4. Draw conclusions from a phenomenon based on previous rules/laws
6.	The law of cause and effect	1. State the relationship between two or more variables in a certain natural phenomenon 2. Estimate the causes of natural phenomena
7.	Mathematical modeling	1. Reveal phenomena/problems in the form of sketch images/graphs 2. Revealing phenomena in formulaic form 3. Proposing alternative solutions to the problem
8.	Building concept	1. Adding new concepts

RESULTS AND DISCUSSION

Mean rank data on the influence of class level on mastery of generic science skills on generic science skills can be seen in Table 2. This data is supported by statistical tests using the Mann-Whitney test on the influence of class level on mastery of generic science skills in Table 3.

Table 2 Mean Rank Influence of Class Level on Mastery of Generic Science Skills

KGS	Grade	N	Mean Rank	Sum of Ranks
	10	76	94.20	7159.00
	11	100	84.17	8417.00
	Total	176		

Table 3 Statistical Test of the Effect of Class Level on Mastery of Generic Science Skills

z	Test Statistic	KGS
	Man-whitney U	3367.000
	Wilcoxon W	18417.000
	Z	-1.320
	Asymp. Sig. (2-tailed)	0.187

Based on student class level data, it is known that the mean rank for class 10 has better mastery compared to class 11. The statistical test table shows that Asymp. Sig. (2-tailed) of 0.187. This indicates that there is no influence of class level on KGS mastery. Based on student class level data, it is known that the amount of data for men and women is different, so based on the results of the mean rank for the female gender, the mean rank is better when compared to the male gender. Next, testing is carried out in Table 4 on the influence of gender on mastery of generic science skills. There is no difference in the results of generic science skills based on female type, and this Asymp data proves this. Sig. (2-tailed) of 0.199, this demonstrates that it is greater than 0.05 (see Table 5).

Table 4 Mean Rank of the Effect of Gender on Mastery of Generic Science Skills

KGS	Gender	N	Mean Rank	Sum of Ranks
	Female	136	91.12	12392.00
	Male	40	79.60	3184.00
	Total	176		

Table 5 Statistical Test of the Effect of Gender on Mastery of Generic Science Skills

z	Test Statistic	KGS
	Man-whitney U	2363.000
	Wilcoxon W	3184.000
	Z	-1.283
	Asymp. Sig. (2-tailed)	.199
a. Grouping Variable: jenis kelamin		

Based on the two data above, it is known that there is no relationship between gender and KGS mastery or class level and KGS mastery. Generic science skills are closely related to Biology subjects. This is, of course, because biology is part of science lessons. Generic science skills are concepts for studying various scientific problems. In a scientific activity, for example, the movement of understanding concepts consists of several generic competencies. Different scientific activities may contain the same generic competencies. The characteristic of learning science through generic science skills is providing generic science skills to students to develop thinking skills.

Generic science skills provide opportunities for students to be actively involved in learning so that interaction occurs between skills and concepts, principles and theories that have been discovered or developed. Everyone has the same opportunity to master or have generic abilities, which requires a learning process. Generic science skills invite students to be able to think through science in their lives. KGS is part of Biology learning and does not influence gender. Several studies reveal that scientific attitudes do not influence gender (Fadli, 2019). This finding is relevant to the results of subsequent research, proving that apart from that, there were no differences in learning outcomes between men and women (Saputro et al., 2021). However, the commutational abilities between men and women differ; in the decomposition process, male students read the problem-solving questions several times. They can identify the information, while in the decomposition process, female students read the problem-solving questions while underlining important information (Danindra & Masriyah, 2020).

Apart from that, class level also has no influence on the mastery of generic science skills, but this is contrary to the results of previous research which shows significant differences in the level of students' emotional intelligence from class level so that learning is needed that increases students' emotional intelligence to a higher level (Suharyani et al., 2023) but other research shows no differences in students' academic writing skills based on class level and parents' occupation (Hamzah et al., 2021), this is different from divergent thinking skills which have differences between class levels, this shows that the higher the class level, the more likely it is that the higher the ability to think divergently (Wulandari, F. S., Subali, B., & Suyanto, 2016). Based on the findings, it is known that gender and class level between class and modelling. In the concrete operational stage, students can master generic science skills, namely formulating symbolic language, logical inference, and finding a basic logical framework from natural laws. In the formal

operational stage, students can master generic science skills, namely the law of cause and effect, building concepts, making models, and finding logical inferences. This implies that getting generic science skills can be done in stages according to the students' backgrounds.

CONCLUSION

Based on research that has been carried out, it is known that grade level does not have a significant effect on mastery of generic science skills. This can be seen from the statistical test table showing that Asymp. Sig. (2-tailed) of 0.187. However, in the ranks score, it is known that class X students have a better rank compared to class XI. Apart from that, based on gender, it is known that gender does not have a significant effect on mastery. This can be seen from the statistical test table showing that Asymp. Sig. (2-tailed) of 0.199. Based on these findings, biology learning in schools already applies generic science skills.

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