



ANALYSIS OF STUDENTS' RESPONSES ON GENETICS LEARNING INTEGRATED WITH THE LILIAN CULTURAL VALUES OF MOLOKU KIE RAHA SULTANATE SOCIETY

ANALISIS RESPON MAHASISWA TERHADAP PEMBELAJARAN GENETIKA TERINTEGRASI
NILAI-NILAI BUDAYA LILIAN MASYARAKAT KESULTANAN
MOLOKU KIE RAHA

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Abstract	Article Information
<p><i>Students' understanding of genetic concepts generally varies; some students are able to understand the basic concepts well, but many still have difficulties. This survey was conducted to determine students' responses after completing the Basic Genetics course, which integrated the local wisdom values of the Lilian culture of the Moloku Kie Raha Sultanate. The respondents of this study were third- and fifth-semester students enrolled in the Basic Genetics course, Biology Education Study Program, FKIP, Khairun University. Data collection was carried out using a Likert scale questionnaire to determine student responses to the learning that had been implemented. The results showed positive responses from students regarding learning with practical methods integrated with Lilian cultural values, which can increase student interest and involvement, with 54.9% stating strongly agree, 37.1% agree, 12.9% neutral, while disagree and strongly disagree obtained a score of 0%. These results indicate that the learning that has been implemented has significant implications for students, by increasing their involvement and understanding of genetic concepts.</i></p>	<p>Keywords: local wisdom; lilian; Moloku Kie Raha; genetics learning</p>
<p>Pemahaman mahasiswa terhadap konsep genetika umumnya masih bervariasi, sebagian mahasiswa mampu memahami konsep dasar dengan baik, tetapi masih banyak yang masih mengalami kesulitan. Penelitian survey ini dilakukan untuk mengetahui respon mahasiswa setelah mengikuti pembelajaran pada matakuliah Genetika Dasar terintegrasi nilai-nilai kearifan lokal budaya Lilian masyarakat Kesultanan Moloku Kie Raha. Responden dari penelitian ini adalah mahasiswa semester III maupun semester V yang program matakuliah Genetika Dasar, Program Studi Pendidikan Biologi, FKIP Universitas Khairun. Pengambilan data penelitian dilakukan menggunakan angket berskala Likert untuk mengetahui resepon mahasiswa terkait pembelajaran yang telah dilaksanakan. Hasil penelitian menunjukkan respon positif dari mahasiswa terkait pembelajaran dengan metode praktikum terintegrasi nilai-nilai budaya Lilian yang dapat meningkatkan minat dan keterlibatan mahasiswa, dengan nilai 54,9% yang menyatakan sangat setuju, 37,1% setuju, netral sebanyak 12,9%; sedangkan tidak setuju, dan sangat tidak setuju diperoleh nilai 0%. Hasil tersebut menunjukkan bahwa pembelajaran yang telah dilaksanakan memberikan implikasi yang signifikan bagi peserta didik, dengan meningkatkan keterlibatan dan pemahaman mereka tentang konsep genetika.</p>	<p>Kata kunci: kearifan lokal; lilian; Moloku Kie Raha; pembelajaran genetika</p> <p>Manuscript received : 10/09/2025 Revised : 20/10/2025 Accepted : 29/10/2025 Published : 31/10/2025</p>

A. INTRODUCTION

Genetics is a fundamental branch of science that is very important in the development of knowledge and technology in the field of biology. However, understanding genetic material remains a challenge for students, even after undergoing the learning process (Roini & Sundari, 2019). Based on observations in the Biology Education Study Program at Khairun University, it was found that students are not yet able to optimally reconstruct their understanding after attending lectures. One of the causes is that the learning process is considered less engaging, making the material easy to forget. A similar discovery was also reported by Roini (2013), which states that after participating in genetics learning at the high school level, most students fail to reconstruct the concepts they have learned. The other research shows that students and university students often have difficulty understanding genetic concepts such as chromosomes, DNA, RNA, cell division, and inheritance of traits, mainly due to unfamiliar terms and complex concepts (Fitriana & Et.al, 2021). Although inquiry-based approaches can enhance understanding, knowledge decline still occurs over time, especially for memorized information (Duncan et al., 2018). Mechanistic understanding is considered more enduring and important in explaining the relationship between genes and traits (Haskel-Ittah & Yarden, 2018). In addition, common conceptual errors occur, especially in the use of Punnett squares and understanding Mendel's laws, due to a lack of understanding of the meiosis process (Sari, D. P., 2019; Awang Kanak, 2016).

Genetics material that students find difficult includes crosses or matings related to the concept of Mendel's Laws. Based on observations in previous learning, it has been found that students often struggle to write the parental genotypes, determine the number of gamete types produced from the parental genotype, determine the phenotypic and genotypic ratios in the first generation (F1) and subsequent generations (F2, and so on), as well as create simulations of a cross. Students still find it difficult to understand Mendelian genetics due to complex problems, technical terms, mathematical elements, and a high level of abstraction (F. Awang Kanak et al., 2016; Kılıç, 2016).

Learning in the genetics course should be well-designed so that the material is easier to understand and learning motivation is also increased. The learning is designed so that students do not get bored and do not feel like they are studying. Learning that combines visual and verbal elements in a balanced way can help understand complex concepts (Mayer, 2009). Learning motivation increases when students perceive studying as an enjoyable and meaningful experience (Deci & Ryan, 2000), in line with an experience-based approach that emphasizes active engagement in the learning process (Kolb, 1984). Based on these various opinions, it can be interpreted that learning through practical methods can be chosen as an option to enhance students' activeness and motivation. In addition to practical work, discussion effectively increases learning motivation because it encourages active participation, critical thinking, and positive social interaction. This method also helps students build conceptual understanding collaboratively and strengthens cognitive engagement (Kerlinger & Lee, 2020).

This practicum method based on local wisdom is a method that utilizes local wisdom in the region, particularly in North Maluku, as a medium in the learning process. One example of local wisdom found in the Moloku Kie Raha Sultanate used as material in learning is the Lilian tradition. The local wisdom from the Lilian culture of the Moloku Kie Raha community is the value of mutual cooperation, which is a characteristic of the community in performing Lilian. Based on the results of interviews conducted by the researcher with several customary figures

representing the four major Sultanates within the Moloku Kie Raha area, as well as various supporting sources (Doa, 2008; Garwan., 2020; Ummah, 2019) it is concluded that the Lian culture, often referred to as Lilian, is a form of mutual cooperation in the Ternate community and, in general, in the society of the Sultanate of Moloku Kie Raha. The Lilian culture in North Maluku is a community practice of working together to complete and ensure the success of a task that is important to an individual or the community.

The integration of the gotong royong culture in practical work encourages collective engagement, which positively impacts motivation and learning outcomes. Collaboration within groups not only enhances soft skills such as communication and problem-solving but also strengthens commitment, social interaction, and a deeper understanding of the material, especially in a cooperative lab environment (Sanz-Angulo et al., 2025; Lorente et al., 2024; Jördens et al., 2024). Mutual assistance in practical work increases member participation, speeds up completion, and strengthens effective teamwork in accordance with the principles of cooperative learning, which emphasize shared responsibility and team cohesion (Wikipedia, 2023). This active involvement also improves the efficiency and quality of the practical results.

Based on the thoughts that have been presented, it is necessary to understand the students' responses after participating in lectures using a practicum method integrated with the values of local wisdom from the Lilian culture of the Moloku Kie Raha Sultanate community.

B. METHOD

This research was conducted in the Basic Genetics course during the even semester of the 2024-2025 academic year in the Biology Education study program, Faculty of Teacher Training and Education, Khairun University, from February to April 2025. The respondents of this study were third-semester students in class A, and fifth-semester students in classes VA and VB, who were enrolled in the Basic Genetics course, Biology Education Study Program, FKIP Khairun University. The total number of respondents who completed the questionnaire was 22, consisting of 13 third-semester students and 9 fifth-semester students. The lecture material presented in this study is the topic of a single-trait cross (*monohybrid*) conducted over 3 meetings. The first meeting was conducted with direct learning to provide guidance regarding the practical work to be carried out in the next meeting. The second meeting was conducted using a practical method with a Student Practical Activity Sheet (LKM) integrated with Lilian's cultural values, while the third meeting was held using a discussion method to review the results of the practical work. The study was conducted using a Likert-scale questionnaire distributed to students after the third learning session via *Google Form*. The research data were analyzed using percentage formulas to measure the proportion and distribution of variables quantitatively, thereby facilitating the interpretation of the research results (Sugiyono, 2019; Creswell & Creswell, 2018; Kerlinger & Lee, 2020).

Quantitative analysis is used to process data obtained in the form of percentages. Each score obtained is converted into a percentage using the following formula:

$$P = \frac{\sum x}{\sum x_i} \times 100\%$$

Description:

P = perscentage

$\sum x$ = number of answer scores per item

$\sum x_i$ = total maximum score per item

100% = constant

To calculate the overall percentage of assessment aspects, the following formula is used:

$$P = \frac{\sum p}{n}$$

Description:

$\sum p$ = the overall percentage of assessment aspects

N = number of components

The results of the data analysis were then interpreted and concluded based on the assessment qualification criteria obtained.

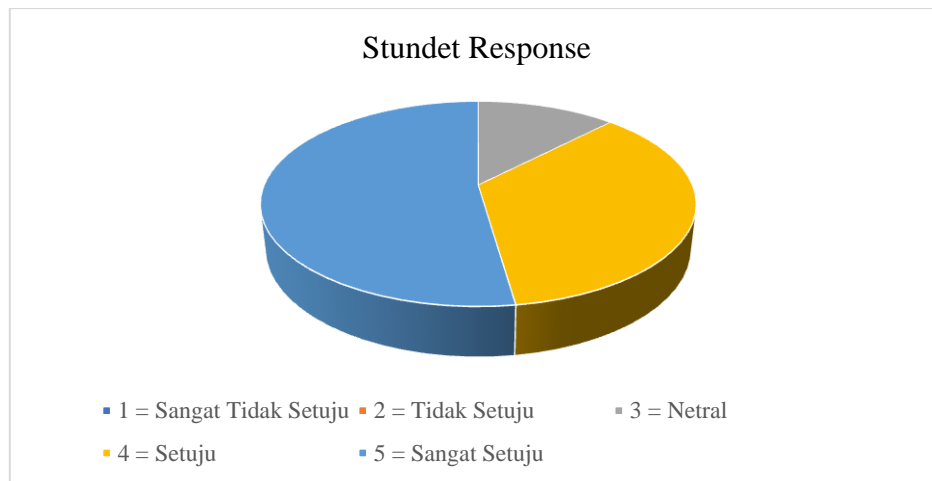
Table 1. Percentage of Respondent Data

Value	Category
81-100	Strongly agree
61-80	Agree
41-60	Neutral
21-40	Disagree
0-21	Strongly disagree

C. RESULTS AND DISCUSSION

Result

Research data on students' responses to learning genetics integrated with Lilian cultural values of the Kesultanan Moloku Kie Raha community from all aspects studied obtained the following averages: strongly agree 54.9%; agree 37.1%; neutral 12.9%; while disagree and strongly disagree received a score of 0%. These response data can be seen in Figure 1 below.



Gambar 1. Students' Response to Genetics Learning Integrated with Lilian's Cultural Values

The student response data shown in Figure 1 illustrates how students react to genetics learning that integrates Lilian's cultural values. The high positive response indicates that the integration of cultural values in genetics learning can enhance students' interest and engagement. This suggests that a learning approach that incorporates cultural aspects can make the material more relevant and meaningful to students, thereby encouraging motivation and deeper

understanding of genetic concepts. The complete research data are presented according to assessment aspects as shown in Table 1 below.

Tabel 1. Interpretasi Setiap Aspek Respon Mahasiswa

No.	Aspect	% The answer “Agree” (4) + “Disagree” (5)	Interpretation
1	Learning is interesting and fun	95.30%	Very positive, the majority feel that learning is enjoyable.
2	The material is easier to understand	81.40%	Positive response, although 23.8% are still neutral.
3	Student engagement in learning has increased	100%	Very positive, participation has increased.
4	Feeling happy and joyful with friends until class time is over	95.20%	Enhancing a pleasant sense of togetherness.
5	Learning activities in a relaxed yet serious atmosphere	100%	All respondents felt comfortable and focused.
6	Students are encouraged to ask questions/discuss	85.60%	Most people feel active in discussions.
7	Increasing interest in learning genetics	100%	Demonstrates the success of a cultural approach.
8	Enough time	61.90%	Tends to be positive, but 42.9% are still neutral — this needs evaluation.
9	The LKM steps are easy to understand	90.60%	LKM is quite effective.
10	Tools and materials are easily obtained	100%	The practicum is easily accessible.
11	Lilian's cultural LKM increases activities	100%	Very effective in increasing engagement.
12	First experience	81.00%	A new experience that is quite enjoyable.
13	Enhancing the spirit of mutual cooperation	95.30%	Learning supports the values of mutual cooperation.
14	Recommendation of this method moving forward	85.70%	The majority of students want this method to be continued.

Based on the data in Table 1, it is known that in all aspects studied, there were no data showing “*Strongly Disagree*” or “*Disagree*”. This can be interpreted that the learning conducted using the practicum method, which refers to LKM integrated with Lilian cultural values, is favored by students because it brings up the local wisdom values of the Lilian culture from the Moloku Kie Raha Sultanate community, which is part of daily culture and familiar to students, especially those from North Maluku. In addition, the learning carried out reflects a positive attitude and strong acceptance from the students. However, a small portion of respondents chose the “Neutral” category, indicating that there is a group that does not yet have a definite view or remains neutral towards the learning conducted. Overall, based on the research data, it can be understood that the majority of respondents tend to support or approve of the topic being studied.

Based on Table 1, it is known that the applied learning method received a very positive response from the respondents, in this case, the students. More than 80% of respondents gave positive feedback on almost all assessed aspects, indicating good acceptance of the method. However, there are several aspects that require further attention, such as the time allocated for

practical sessions or studying, where 42.9% of respondents chose a neutral answer, indicating the need for improvement in time management. In addition, the aspect of ease of understanding the material and the first learning experience that integrates cultural values also recorded a neutral response rate of 23.8%, which indicates the need for more intensive initial guidance to support the learning process.

Discussion

Data analysis shows that students responded positively to genetics learning integrated with Lilian cultural values. This method not only makes learning more interesting and easier to understand, but also enhances active participation, learning interest, sense of togetherness, and cooperative attitude. Five points can be presented based on the research findings, namely:

a. Increasing Engagement and Concept Understanding

Integrating local cultural values into genetics learning can create a more meaningful and relevant learning context for students. By linking abstract genetic concepts with cultural values familiar to students, the learning process becomes more concrete and easier to understand, in line with the principles of constructivist learning that emphasize building knowledge based on prior experiences (L.S., 1978; Drits-Esser et al., 2021). Research data shows that 100% of respondents agreed that this method enhances students' cognitive, affective, and psychomotor engagement, making them more active in thinking, discussing, and exploring through contextual lab activities. In addition, the 'relaxed but serious' learning atmosphere also received entirely positive responses, creating a comfortable learning environment while remaining focused on achieving competencies, which is important for encouraging students' courage to participate (Ojo & Ige, 2021). A similar positive response was observed in the aspect of increased interest in learning genetics material, indicating that cultural integration not only clarifies the material but also fosters students' intrinsic motivation and curiosity (Gericke & McEwen, 2025). Thus, culture-based genetics learning effectively enhances understanding, active engagement, a conducive atmosphere, and learning interest, while also bridging modern science with students' local cultural identity.

b. Inclusive and Contextual Learning

The integration of Lilian's local cultural values into genetics learning creates an inclusive and contextual learning environment. This approach makes the material feel more relevant as it is connected to values and experiences close to students' lives. This aligns with the theory of Culturally Relevant Teaching (Ladson-Billings, 1995), Culture-based learning not only transfers knowledge but also builds identity, social awareness, and a sense of ownership of knowledge.

The research results show a 100% positive response regarding the aspect of a comfortable classroom atmosphere as well as an increase in learning activities through values such as mutual cooperation and togetherness. These values encourage more active interaction, strengthen social skills, and make abstract genetic material, such as monohybrid crosses, easier to understand (Ogbu & Simons, 1998). This approach reinforces the principles of inclusive and multicultural education, and is relevant to be applied in culturally rich regions such as eastern Indonesia, particularly in North Maluku.

c. Cooperative as the Basis of Social Skills in Mutual Assistance

Collaboration based on cooperative learning that emphasizes positive interdependence, namely the balance between individual responsibility and group cooperation, has been proven to strengthen social interaction and teamwork in small group settings (Theobald, R., 2017;

Gillies, 2016). This approach supports students' ability to communicate and collaborate effectively (Bećirović, 2023).

The integration of local cultural values such as mutual cooperation and egalitarian togetherness also enriches collaborative learning by strengthening the sense of ownership and joint participation in a meaningful context (Gillies, 2014; Legette et al., 2021). An approach based on local culture also provides a classroom atmosphere that is emotionally comfortable or a safe space, which is essential for social inclusion and successful learning interactions, in line with the principles of Culturally Relevant Teaching (Legette et al., 2021).

d. Challenges in Time Management and Initial Mentoring

Although the learning method received a positive response from the majority of students, the limited lab time remains a concern, with 42.9% of respondents choosing a neutral answer, indicating potential time pressure that could affect learning effectiveness (Beck et al., 2025; Cavanagh, M., 2022). Limited time also affects emotionally and cognitively, such as stress, fatigue, and lack of deep reflection, which is worsened by the tendency to procrastinate (Student Syndrome, 2025). In addition, the low understanding of the material and cultural values indicates the need for early support, including Lilian's cultural orientation, time management training, as well as academic guidance that has been proven to enhance students' self-efficacy and engagement (Paunonen, S. V., 2007). Therefore, strategies such as realistic planning of practicum duration, training in time management skills, and intensive mentoring at the beginning of activities become important to maintain the effectiveness of learning (Beck et al., 2025).

e. Educational Implications for the Local Context

The integration of local cultural values, such as the values in Lilian culture, presents a holistic ethnopedagogical approach in genetics learning. This strategy not only strengthens the cognitive aspects but also the affective and cultural dimensions of students. By relating abstract material, such as monohybrid crosses, to familiar cultural experiences, students can more easily understand the concepts in depth. The learning environment also becomes more inclusive and emotionally supportive through the values of mutual cooperation and togetherness (Duit, R., 2022; Ladson-Billings, 1995; Gay, 2018; Ojo & Ige, 2021; Ojo & Ige, 2021).

In addition to promoting understanding, this approach also builds the cultural identity of students as academic individuals as well as members of their cultural community. It fosters pride in students' origins and strengthens their sense of belonging. In holistic education, success is not solely determined by academic achievements, but also by the emotional and cultural connections students have with the learning process (Forbes, 2016). Thus, the profound insight found is that the integration of local culture is the key to creating meaningful and contextual learning.

Based on the previous discussion, it is important to examine from the aspects of Ethno-STEM and Modern Ethnopedagogy. This article emphasizes the importance of an ethno-STEM and ethnopedagogy approach in science education (biology, particularly genetics) that integrates elements of science, technology, and local wisdom. This approach is effective in enhancing students' critical thinking skills, creativity, and cultural awareness (Sari et al., 2023). Furthermore, systematic studies in primary education show that indigenous learning-based education strengthens inclusive practices, encourages active community participation, and preserves cultural authenticity in the learning process (Widiyanto & Prasetyo, 2022). Innovative learning modules that integrate ethnopedagogy, such as in chemistry subjects, have been

successfully developed by adopting local values, thereby creating opportunities for application in various other fields of science (Putri & Rahman, 2021).

This approach aligns with the value of mutual cooperation as a collective attitude that prioritizes collaboration and solidarity in achieving shared goals. Mutual cooperation not only strengthens social bonds within the community but also supports inclusive and participatory learning, as emphasized in ethnopedagogy that integrates local cultural values in the context of education (Kusmana, 2019). Thus, integrating the value of mutual cooperation in the ethno-STEM approach not only enriches the learning process but also fosters students' social awareness and collective responsibility in the development of contextual and meaningful scientific knowledge.

D. CONCLUSION

Based on the research results, the Student Worksheet (LKM) developed received positive responses from students according to the questionnaires provided. The learning approach that integrates Lilian cultural values from the Moloku Kie Raha Sultanate successfully increased learning interest, active engagement, and social dynamics among students. The integration of local culture in the learning process also significantly strengthens student participation and activity. With slight adjustments in timing and the addition of a deeper cultural orientation, this method has great potential to be further developed systematically and to be evaluated for its impact on students' conceptual understanding and character in the long term. Therefore, this method is feasible to implement and is recommended to enrich the learning experience in future meetings.

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