

The Impact of Physics Co-curricular Activities Based on Makassar Local Wisdom on the Quality of Student's Questions

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ABSTRACT

Integrating local wisdom in co-curricular activities can enrich students' learning experiences and introduce cultural values, although this approach is underutilized. Learning that is relevant to students' daily lives can foster curiosity and encourage higher-quality questions. This study aims to examine the impact of physics co-curricular activities based on local wisdom in Makassar on the quality of students' questions. This study used a pre-experimental design with a comparison of whole groups, consisting of 39 students: 21 who participated in co-curricular activities and 18 who did not. The results showed that students who were involved in physics-based co-curricular activities based on local wisdom achieved a higher average question quality score (26.83) compared to those who were not engaged (23.36). However, the Mann-Whitney U test showed that the difference was not statistically significant ($p > 0.05$). These findings indicate that although co-curricular activities based on local wisdom have potential, their impact on the quality of student questions has not been statistically significant. The conclusion of this study states that physics co-curricular activities based on local wisdom are not substantial enough to have an impact on the quality of students' questions.

Keywords: Physics Co-curricular, Local Wisdom, Makassar Tribe, Quality Questions, Revised Bloom Taxonomy.

1. INTRODUCTION

The ability of learners to ask quality questions is seen as an essential indicator of cognitive development and scientific reasoning in science education. Questions are one of the important stages in the learning process (Sutiani et al., 2021). The ability to ask questions not only shows the cognitive involvement of students, but also becomes the foundation for critical thinking and problem-solving (Almulla, 2023). Questions allow learners to connect theory to practice and evaluate their understanding independently (Ho et al., 2023; Osman Gani et al., 2022). Therefore, encouraging students to actively ask questions is an important part of creating meaningful and student-centered science learning.

High-level questions reflect critical, creative, and reflective thinking skills. These skills are important because physics is closely related to phenomena in everyday life (Maryanti et al., 2021). The application of questioning skills at all levels of education is essential to encourage creativity, an open mindset and the courage to express opinions (Jordania, 2023). Questions that are qualitative in academia have different characteristics compared to

questions at other levels of education (Soysal & Soysal, 2023). So that it can be used as an indicator in measuring students' conceptual understanding and scientific thinking skills.

A number of studies show that most of the students' questions are still at a low cognitive level, limited to factual and memorization aspects (Jaliyah et al., 2022; Salamah & Susiyawati, 2022). The low quality of these questions is generally due to conventional and teacher-centered learning approaches (Hadiyanto et al., 2021). So that students lack space to explore, ask questions and build knowledge independently. This approach also has an impact on students' low critical thinking skills (Hidajat, 2023). The role of teachers, ideally, is not only as an informant, but also as a facilitator who encourages the cognitive and metacognitive development of students (Rivas et al., 2022). Teachers can also use questions to evaluate learning, explore material and provoke student discussion (Al Faraby et al., 2023). Therefore, it is necessary to have a participatory and student-focused learning approach to improve the quality of questions and critical thinking skills.

Social constructivist learning emphasizes that knowledge is constructed through interaction and engagement in sociocultural contexts (Lubbe et al., 2025). In contrast, conventional learning tends to be passive and disconnected from students' real-life experiences. Physics is often perceived as abstract and less relevant to everyday life, posing challenges in creating meaningful learning experiences. Various studies show that few students view physics as difficult to understand (Abraham & Barker, 2023; Kanyesigye et al., 2022; Soeharto & Csapo, 2021). Physics learning behavior is strongly influenced by the difficulty level of the material, such as abstract concepts and the application of formulas, independent effort, and external support from the teacher (Cai et al., 2021). In addition, the initial knowledge of the new material learned also often varies, thus influencing the way they understand the information (Witherby & Carpenter, 2022). The disconnect between the concepts of physics and the reality of learners results in a lack of stimuli to think actively and ask questions. Therefore, it is essential to create a relevant learning environment by associating the subject matter with the social and cultural environment of the learners.

Integrating local wisdom in the learning process is considered one of the practical approaches to overcome this. A culturally rooted local wisdom-based approach helps build identity and encourage inclusivity in knowledge development (Mpuangnan & Ntombela, 2024). Integrating local wisdom can also increase the relevance of the material so that students are more interested and active in the learning process (Budiarti & Harlis, 2020). Learning that incorporates local wisdom is considered effective because it is contextual, meaningful, and centered on students. Educational media based on local culture can also enhance critical thinking skills (Muhammad et al., 2022; Sofyan et al., 2019). Thus, students no longer see science as something foreign but rather as part of the local culture and wisdom they have encountered daily (Suprpto et al., 2021). This strengthens the relationship between physics material and the social reality of students.

Local wisdom plays an important role in responding to cultural changes, as well as being a guideline for life and a reflection of the noble values of society (Munajah et al., 2023). Local wisdom also reflects values, practices, and knowledge that are relevant and meaningful to the local community, so it can be a strong context for building students' engagement and active participation (Brondizio et al., 2021). In learning, teachers are

facilitators who convey the essence of local wisdom and its application in daily life, which is very important and cannot be ignored (Sakti et al., 2024). Teachers who actively integrate local wisdom in innovative teaching methods play an important role in preserving cultural values and creating relevant learning experiences (Asmayawati et al., 2024). When applied appropriately, an approach that integrates local wisdom can be an effective tool to encourage learners to ask questions that are more reflective and relevant to their context. Integrating local wisdom in co-curricular activities positively impacts student learning and engagement (Kelly, 2020; Martawijaya et al., 2025). Exploring local values in co-curricular activities, students understand the concept of physics and are allowed to ask questions, discuss, and reflect on knowledge from their cultural perspective (Lestari et al., 2024). Therefore, conducting a more in-depth study regarding the quality of students' questions is necessary through this approach.

The quality of questions is an important indicator in the learning process that reflects students' understanding of the material being taught. The quality of learners' questions can be assessed using the revised Bloom Taxonomy, which maps cognitive levels from the most basic to the most complex (Lubbe et al., 2025). This taxonomy consists of two dimensions, namely cognitive processes, which include (C1) Remembering, (C2) Understanding, (C3) Applying, (C4) Analyzing, (C5) Evaluating, and (C6) Creating, as well as the dimensions of knowledge: Factual, Conceptual, Procedural, and Metacognitive (Magdalena et al., 2023). The revised Bloom's taxonomy provides a framework for analyzing the quality of learners' questions. More profound questions include more levels in the dimensions of cognitive processes and knowledge, which indicate the ability to think critically, reflectively, and creatively in learning. Through this analysis, teachers can identify the level of quality of the questions asked by students.

The learning approach based on local wisdom has proven effective in increasing students' learning motivation. However, its application is still limited to local content lessons and has not been thoroughly integrated into developing students' reflective thinking skills (Tohri et al., 2022). In 21st-century learning, these skills are an important indicator in evaluating students' cognitive development (El-Haggar et al., 2019). Critical thinking skills are essential in education because they underlie all academic activities through teaching, understanding and testing to support learners' learning (Baharuddin & Naufal, 2023). Integrating local cultural elements in the learning process contributes to developing students' critical thinking skills as part of higher-level thinking skills (Ramdani et al., 2021). On the other hand, this skill requires learners to interpret, analyze, and process information in depth (Azid et al., 2022). The high-level thinking skills of students in Indonesia are still relatively low, so various efforts are needed to develop them (Hikmawati et al., 2024). Therefore, a learning strategy that links local wisdom with developing critical thinking is needed.

Integrating learning with the development of students' understanding and skills can be effectively facilitated through co-curricular activities (Shaharuddin et al., 2018). These activities offer a flexible and contextual environment where students can engage actively in discussions and hands-on experiences that are not always accessible in traditional classroom settings (Sukadari & Huda, 2021). Instructors and institutions must proactively build inclusive communities through learning and co-curricular activities that support interaction, cooperation, and mutual respect for differences (Harry et al., 2024). Students not involved in

extracurricular activities tend to have difficulty adapting to informal learning and the use of technology, so it tends to impact low learning motivation (Hooshangi et al., 2022). In contrast, learners who engage in extracurricular activities gain experiences and skills that are difficult to acquire in traditional classrooms (Richert & Benoit, 2022). Active involvement in activities outside the classroom can improve learners' learning outcomes and retention, while lack of participation can decrease both (Lingo & Chen, 2023; Nouri et al., 2022). Therefore, integrating local wisdom in co-curricular activities can enrich the learning experience, introduce local cultural values, and encourage the development of students' critical thinking skills.

Co-curricular activities based on local wisdom serve as an effective means to enhance the relevance of physics content to their everyday lives. These activities also offer opportunities for students to actively explore local values through experiments and observations of environmental phenomena, which can stimulate their ability to ask reflective questions. However, studies on the integration of Makassar local wisdom into physics co-curricular activities remain scarce. This approach has the potential to bridge culture and science while improving the quality of students' questions. Therefore, it offers a distinct and potentially superior alternative to conventional learning models that overlook students' cultural contexts. This study aims to evaluate the impact of physics co-curricular activities based on Makassar local wisdom on the quality of students' questions, as measured by the Revised Bloom's Taxonomy. The primary focus is to analyze the differences in question quality between students who have participated in these activities and those who have not.

2. METHOD

This study employed a quantitative approach using a pre-experimental design with a whole-group comparison model (Sugiyono, 2013). The research subjects consisted of 39 tenth-grade students from a public high school, who were naturally divided into two groups: 21 students who had participated in physics co-curricular activities and 18 students who had not. A purposive sampling technique was used to ensure the inclusion of students with and without participation in such activities, while an incidental approach was applied due to limited control over student attendance during data collection. Although this method does not ensure full representativeness of the population, it is considered appropriate for comparative studies involving naturally formed groups.

Data were collected using non-test instruments, including a stimulus sheet, an observation sheet, and an assessment rubric. The instruments, developed based on cognitive theory and the Revised Bloom's Taxonomy, were validated by physics education experts. Students observed a demonstrated physical phenomenon and wrote questions individually. Only questions relevant to the measurement concept were selected for analysis. This study uses quantitative and qualitative analysis. Quantitative analysis was used to test the significance of differences in the quality of questions between groups of students who had participated in physics co-curricular activities and those who had not. The Mann-Whitney U test, a non-parametric statistical method, was employed due to the non-normal distribution of the data and the limited sample size. The test was considered appropriate for comparing two independent and unpaired groups—students involved in co-curricular activities and those who were not.

Qualitative analysis was conducted by classifying students' questions based on the Revised Bloom's Taxonomy, which includes two dimensions: cognitive processes (C1–remembering, C2–understanding, C3–applying, C4–analyzing, C5–evaluating, and C6–creating) and types of knowledge (factual, conceptual, procedural, and metacognitive). The quality of students' questions was then categorized into two levels: low and high. Questions classified as C1 to C3 were considered low-level, while those categorized as C4 to C6 were considered high-level. The classification served to assess the level of students' cognitive skills. The analysis results were interpreted to identify the influence of local wisdom-based physics co-curricular activities on the quality of the questions posed by students.

3. RESULTS AND DISCUSSION

The learning process is carried out by conducting demonstrations related to physical phenomena that encourage students to formulate solutions and questions. This study aims to determine the difference in the quality of students' questions based on their involvement in physics co-curricular activities based on Makassar's local wisdom.

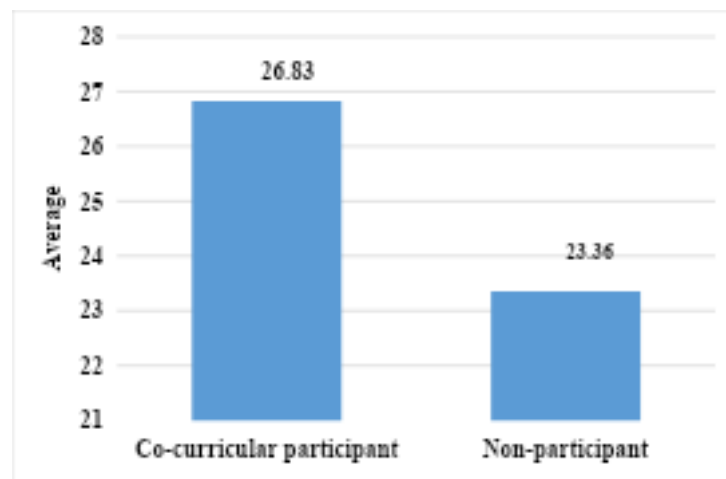


Figure 1. The Average Score Based on Participation Students

Figure 1 shows an increase in the average score of the quality of students' questions based on participation in physics co-curricular activities based on Makassar's local wisdom. The average score increased from 23.36 in the group that had never participated in the physics co-curricular activity to 26.83 in the group that had participated. Co-curricular activities allow students to directly observe physical phenomena in the context of local culture to deepen their understanding of concepts and stimulate the emergence of more critical and reflective questions. Participation in extracurricular activities can promote a better understanding of the knowledge they learn than those who are not engaged (El-Haggag et al., 2019). Such engagement helps students relate their learning to real-life experiences, enhancing understanding.

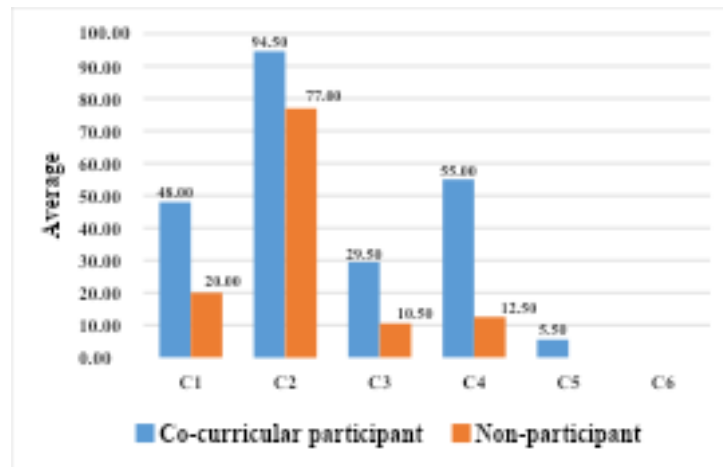


Figure 2. The Average Score of Question Quality Based on The Dimensions of Cognitive Processes

Figure 2 shows the difference in the quality of students' questions based on cognitive processes between the two groups, namely the group that has and those who have not participated in physics co-curricular activities. Students who engage in physics co-curricular activities tend to ask questions at a higher cognitive level, particularly on C4 (Analyzing) and C5 (Evaluating). On the other hand, students who had never participated in the activity produced more questions at the low cognitive level, namely C1 (Remembering) and C2 (Comprehending). At the C3 level (Applying), no noticeable differences were found between the two groups, and no students were asked questions on C6 (Create). This shows that the quality of questions at a high cognitive level needs to be practiced systematically so that students are accustomed to thinking critically, reflectively, and creatively in understanding physics concepts. These findings show that involvement in physics co-curricular activities based on Makassar's local wisdom can encourage students to think higher (Ramdani et al., 2021). This is evident from the increasing number of questions at the C4 and C5 levels, which reflect students' critical and reflective thinking skills. In contrast, those who have not participated in these activities tend to remain at lower cognitive levels, namely C1 and C2 (Sukadari & Huda, 2021). These findings underscore the need to implement more contextual and interactive learning strategies that align with students' cultural backgrounds and everyday experiences.

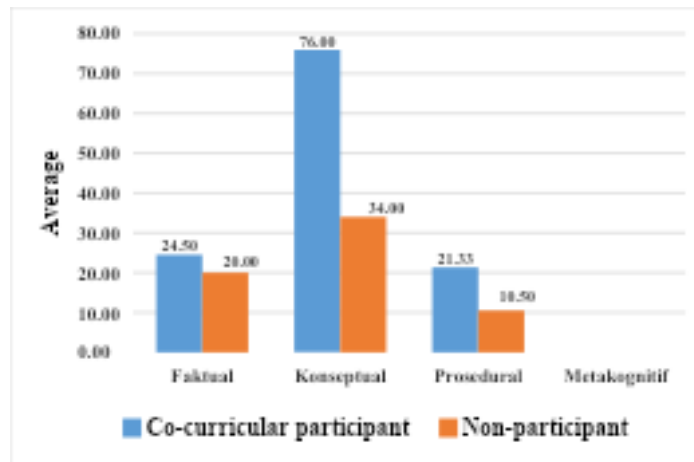


Figure 3. The Average Score of Question Quality Based on The Knowledge Dimension

Figure 3 shows an improvement in the quality of students' questions based on the dimension of knowledge. Students who have participated in physics co-curricular activities show higher achievements in the three dimensions of knowledge than those who have never participated. The most noticeable improvement occurred in the conceptual dimension, followed by the factual and procedural dimensions. This indicates that physics co-curricular activities positively impact students' understanding of concepts and knowledge application. In metacognitive knowledge, no questions were found among students from both groups, which shows the need for a learning approach that encourages reflection and awareness of students' thinking. Therefore, co-curricular activities are critical in improving the quality of students' questions.

The initial analysis involved a normality test to determine the distribution of data from both student groups.

Table 1. Shapiro-Wilk Normality Test

Group	Kolmogorov-Smirnov			Shapiro-Wilk		
	statistic	df	sig	statistic	df	sig
Co-curricular participant	.237	21	.003	.727	21	.001
Non-participant	.148	18	.200	.915	18	.106

Table 1 shows that the group of students who participated in co-curricular activities had significance values below 0.05, indicating a non-normal data distribution. In contrast, the group that had never attended showed values above 0.05, indicating normal distribution. Since one group did not meet the normality assumption, the overall data was considered not normally distributed. Therefore, the Mann-Whitney U test was used to examine differences

in the quality of questions between students who participated in co-curricular activities based on Makassar local wisdom and those who did not.

Table 2. Mann-Whitney U T Test

	Value
Mann-Whitney U	166.000
Z	-0.650
Asymp. Sig. (2-tailed)	0.516

The results of data analysis based on Table 2 showed that the significance value (Asymp. Sig. 2-tailed) of $0.516 > 0.05$ showed that there was no significant difference between the quality of questions of students who had participated in co-curricular activities and those who had never participated in them. Although the average quality of questions of students who had participated in co-curricular activities (26.83) was higher than those who had never participated (23.36), this difference was not statistically significant. This indicates that involvement in physics-based co-curricular activities based on local wisdom has not significantly improved the overall quality of questions.

Several factors that explain the impact of co-curricular activities have not been seen significantly on the quality of students' questions, namely: (1) the number of samples is too small, (2) the time gap between the implementation of physics co-curricular activities and the measurement of the quality of questions is relatively long so that the impact of the learning experience obtained from these activities tends to fade in the student's thinking process, and (3) the implementation of co-curricular activities has not been consistently integrated into classroom learning so that students do not get optimal knowledge reinforcement or transfer from co-curricular experiences to formal academic contexts.

The average increase in the group that had participated in co-curricular activities indicated that a local wisdom-based approach could impact the quality of students' questions because it encouraged more contextual and meaningful learning. Activities associating physics concepts with daily life and local culture can foster students' curiosity. Integrating local wisdom in co-curricular activities supports the strengthening of character values and opens up opportunities for meaningful and contextual science learning (Martawijaya et al., 2025). Therefore, it suggests that local wisdom is not only culturally relevant but also pedagogically effective.

4. CONCLUSION

The research findings indicate that, descriptively, local wisdom-based physics co-curricular activities show potential to enhance the quality of students' questions. However, the statistical analysis revealed no significant difference. This study suggests that physics co-curricular activities rooted in local wisdom do not have a statistically significant impact on the quality of students' questions. Therefore, it is advisable to conduct further

research involving larger samples or more robust intervention frameworks to investigate the potential impact further.

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