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THE IMPACT OF PHYSICS CO-CURRICULAR ACTIVITIES BASED ON MAKASSAR LOCAL WISDOM ON IMPROVING THE PANCASILA STUDENT PROFILE AND LEARNING SATISFACTION

M. A. Martawijaya*[1], E. H. Sujiono[1], A. D. Halim[2], S. W. Tho[2], Mahir[1], P. Palloan[1], V. Zharvan[1]

[1]Physics Department, Makassar State of University, Makassar, Indonesia
[2]Physics Department, Sultan Idris Education University, Malaysia

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ABSTRACT

Pancasila education shapes students' character and national identity. Integrating local wisdom in co-curricular activities strengthens Pancasila values in modern learning. Despite the flexibility of co-curricular activities in reinforcing physics concepts and the Pancasila Student Profile (P3), educators rarely utilize or neglect them entirely. This study aims to improve P3 and learning satisfaction through physics co-curricular activities based on Makassarese local wisdom. This study used a mixed-methods sequential explanatory design. The quantitative method used a pre-experimental design with a one-group pretest-posttest type to measure changes in P3, and the qualitative method used an open questionnaire to measure students' learning satisfaction. This activity integrates the 21st-century learning approach with the practice of *a'bulo sibatang* through physics measurements by 31 high school students. The study showed a significant improvement in students' P3 ($p < 0.05$), with an N-Gain of 48.39% in the low category and 51.61% in the medium category. All students expressed positive learning satisfaction towards the Makassarese local wisdom-based physics co-curricular activities, although some experienced difficulties in certain aspects. This study concludes that co-curricular physics activities based on Makassarese local wisdom effectively improve students' P3 and positive learning satisfaction. In addition, this study also has an impact on preventing the erosion of Makassarese cultural identity and improving students' academic understanding.

Keywords: physics co-curricular activities; local wisdom; *A'Bulo Sibatang*; Pancasila student profile; learning satisfaction

INTRODUCTION

Pancasila education in Indonesia is important in shaping the character and awareness of nationalism in the younger generation (Natalia et al., 2021). Pancasila education that involves the school environment and society can optimize nationalist attitudes and behavior (Yusuf et al., 2019). Pancasila education is the foundation of the education system in Indonesia (Abdulkarim et al., 2020). Indonesians apply Pancasila as the basis for belief in the identity of the Republic of Indonesia in solving social problems (Kusdarini et al., 2020). Students who follow Pancasila education will become intellectuals responsible as citizens in solving social problems because they can apply Pancasila values in their thinking (Sarkadi et al., 2020). Pancasila education integrates emotional and spiritual intelligence competencies into the operational education curriculum (Mudlofir et al., 2021). Pancasila education in Indonesia is currently formulated as a curriculum requirement in the 2013 and Merdeka curricula.

In the 2013 Curriculum, Pancasila education as a curriculum requirement is called Character Education. In recent decades, character

*Correspondence Address
E-mail: martawijayamagus@unm.ac.id

education has become the focus of educational research to improve students' character holistically (Kropfreiter et al., 2024). Character education is fundamental and should be implemented early (Safrilsyah et al., 2024). Another reason is that individuals and educational institutions are increasingly aware that individuals with strong character can only face the challenges that determine our present and future (Dabdoub et al., 2024). However, conventional character education methods no longer engage the 21st-century generation (Suma et al., 2024). The proof is that the value crisis in society has questioned the quality of character education in various educational institutions (Sartika et al., 2024). As a result, the requirements of the 2013 Curriculum regarding character education have undergone a national transformation in the Merdeka Curriculum since 2024.

In the Merdeka Curriculum, Pancasila education is a curriculum requirement called Profil Pelajar Pancasila (P3) or Pancasila Student Profiles. P3 consists of six dimensions: (1) Faith, Devotion to God, and Noble Character; (2) Global Diversity; (3) Mutual Cooperation; (4) Critical Thinking; (5) Independence; (6) Creativity (Ardiansyah et al., 2024; Widiana et al., 2024). P3 is planned as a curriculum achievement to form students with competencies, characters, and behaviors under Pancasila values throughout life (Rifki et al., 2024; Wahyuni et al., 2024; Rusilowati et al., 2024). In learning, enforcing P3 can be improved through the effectiveness of activities focusing on structured opening and closing, better interaction, and the use of 21st-century learning approaches per Pancasila values (Yafie et al., 2024). P3 characterizes the character and skills that must be possessed by Indonesian students rather than the noble values of Pancasila (Sadiah et al., 2024). Although the national education curriculum changes periodically, the requirements of the Merdeka curriculum with indicators in each P3 dimension remain in line with the achievements of 21st-century characters and skills education (Wahyuni et al., 2024).

The dimensions of faith, devotion to God, and noble character with integrity indicators have meanings that align with the character of scientific integrity. Students must understand and improve scientific integrity in scientific activities (Varda et al., 2024). The rapid development of technology has increased the human inability to distinguish between artificial intelligence and human work (Hakam et al., 2024), so scientific integrity must continuously be improved. Compliance with scientific integrity involves norms, ethics, scientific research guidelines, and rules that require transparency, honesty, and accountability (Weber-Mandrin et al., 2024). The dimension of independence with self-regulation indicators has a meaning that aligns with the character of discipline (Kangwa et al., 2024). Self-discipline is important in balancing commitment to work and academic achievement (Erduran Tekin, 2024; Pujianto et al., 2024). Self-discipline is how individuals complete and follow up on commitments and obligations that must be carried out on time (Phillips-Berenstein et al., 2023). The dimension of global diversity, which indicates actively participating in decision-making, aligns with communication. Practical communication lets individuals express their competence clearly and engage in meaningful social interactions (Ngoc, 2024). Communication as a 21st-century skill includes the ability to express opinions effectively through oral, written, or nonverbal communication in various forms and contexts, listen effectively to analyze meaning, including values, attitudes, knowledge, and intentions, and communicate for various purposes, including in group decision-making (Guo & Asmawi, 2024).

The dimension of mutual cooperation with the collaboration indicator has a meaning that aligns with cooperation. One of the biggest challenges in 21st-century education is fostering students' collaboration skills (Demetroulis et al., 2024). Collaboration skills are fundamental and can encourage improving learning outcomes through projects (Wibowo et al., 2024). The dimension of critical thinking with the question-asking skill indicator has a meaning that aligns with critical thinking. Critical thinking skills can be developed through good student interactions through problem-solving (Indah et al., 2024). In 2025, the need for critical thinking skills is predicted to increase to improve the quality of human resources (Hasyim et al., 2024). The characteristics of a critical thinker are being able to analyze relevant and irrelevant information to make a decision (Hastuti et al., 2024). The dimension of creativity has flexible thinking indicators under the indicators of 21st-century creative thinking skills. Creative thinking is an important aspect of learning that has been widely recognized as a solution to solving problems in the 21st century (Amrianto et al., 2024). Creative thinking skills are analyzed using the dimensions of fluency, originality of ideas, flexibility, and elaboration of knowledge (Sigit et al., 2024). However, despite recognizing creative thinking as a key 21st-century skill, its integration into curriculum implementation remains inconsistent, and students often struggle to develop fluency, originality, flexibility, and elaboration in their thinking.

The six P3 dimension indicators that align with 21st-century characters and skills can be achieved through curriculum implementation by applying a 21st-century learning approach. 21st-century learning is a government recommendation that is currently widely used both nationally and globally in order to achieve P3. 21st-century learning integrates the Problem-Based Learning (PBL), Project-Based Learning (PjBL), Inquiry Learning (IL), and Discovery Learning (DL) approaches. The characteristics of PBL begin with presenting a problem to a small group of students, then formulating questions, and finding solutions to the problem (Silva et al., 2024). PBL is oriented toward critical thinking skills, analyzing, and motivating students to solve problems according to reality (Hastuti et al., 2024). PjBL can potentially improve P3 by focusing on technical solutions that combine hands-on and mind-on so that they can be applied to real problems (Wahyudi et al., 2024). PjBL actively engages students in small groups that begin with project goal setting, collaboration, communication, and reflection on the problem (Lee et al., 2024). IL also has the potential to improve students' critical thinking skills (Prayogi et al., 2024). IL consists of confirmatory, structured, guided, and open inquiry, generally identical to investigating and communicating results (Mursali et al., 2024). DL requires students to discover new knowledge by actively applying scientific attitudes in learning (Lestari et al., 2024). Integrating DL activities to focus on real objects can help students develop cognitive skills, such as connecting, generalizing, and hypothesizing (Zare et al., 2024). These four learning approaches are expected to be applied nationally in every subject, including physics in high school.

Physics learning in high school by adapting 21st-century learning can encourage students' engagement in exploration, collaboration, elaboration, and the use of technology. However, implementation in the classroom is less effective because of the minimal time and material that must be completed in one semester. The maximum time for physics learning in high school in the National Curriculum is only 135 minutes per week. Meanwhile, physics has material characteristics that can be designed as problem-based scientific investigations or extended projects. In addition, some students still consider physics difficult and require a relatively long time to understand and apply its concepts. Furthermore, to help students achieve learning objectives related to sustainable living, the learning design should consider the suitability of students' environment and socio-culture (Halim et al., 2024). Therefore, physics learning can be integrated into local wisdom-based physics co-curricular activities.

Co-curricular activities in schools have proven to be an effective platform for improving character values through more practical and contextual learning (Saqib et al., 2018; Zada & Zeb, 2021). Co-curricular activities are curriculum activities that accompany intra-curricular activities or reinforce materials for students in these activities (Murtiyasa & Al-Karomah, 2020). Co-curricular activities are important in instilling character development in students if intra-curricular activities do not have adequate time (Malicdem & Perilla, 2019). Projects through co-curricular activities will help students be more collaborative and participatory in their work (Dlouhy-Nelson & Hanson, 2023). Co-curricular activities can be a good space for educators to promote and instill values of wisdom through local wisdom-based learning activities.

Co-curricular activities in high schools have been implemented through Proyek Penguatan Profil Pelajar Pancasila (P5) or Pancasila Student Profile Enrichment Project with various themes. However, no educator has implemented a local wisdom theme that explores the values of *a'bulo sibatang*, including its connection to physics. Physics is closely associated with training students' scientific process skills, aligning with the skill indicators in P5. However, it is also widely regarded as a complex subject by most students, requiring ample time for proper understanding. Through physics co-curricular activities, P5 can be effectively and integratively developed. Educators generally state that P5 is a new challenge because they must plan and create projects based on specific themes, including local wisdom (Fauziah et al., 2023). The ideal characteristics of students expected in P5 can be enriched with guidance from educators, parents, and the environment through its six dimensions (Saphira, 2022). In reality, co-curricular activities are only carried out by educators and students once a semester rather than being carried out in stages every week and involving various parties. Co-curricular activities should also continue to improve learning materials by integrating 21st-century learning approaches while improving P3 following students' character as a society. Thus, co-curricular activities can be carried out according to their characteristics and definitions, such as enrichment of learning materials outside of class hours by integrating 21st-century learning approaches based on local wisdom.

Local wisdom is one of the characteristics and heritages of Indonesia (Baruadi et al., 2024). Local wisdom is a term consisting of the syllables "wisdom" and "local," which is accepted by someone who is just born in an area that adheres to wisdom in life (Munajah et al., 2023). Local wisdom in Indonesia is a rich heritage of values that have similarities with the values of Pancasila. The potential of local wisdom in Indonesia is an important diversity to be passed on to the younger generation through education to strengthen their identity amidst high global competitiveness (Yaqin et al., 2024). Local wisdom has various forms: local knowledge, local skills, local social processes, local norms, and customs. The term form is the form of artifacts, social activities, and local expression (Jeniver et al., 2024). Local wisdom can be integrated with problem-based learning models to improve students' knowledge (Damopolii et al., 2024). One local wisdom that has been embedded since ancient times in the Makassar community is *a'bulo sibatang. A'bulo sibatang* is still firmly held by Makassar community leaders. The Bugis and Makassar communities still believe in local wisdom expressions as a guide in living, such as *a'bulo sibatang* in Makassar or ma'bulo sipeppa in Bugis.

According to Kulle and Tika (2008), *a'bulo sibatang* means a strong unity and a symbol of the strength of unity. The main values in a*'bulo sibatang* create a strong unity when working together. The character in working in *a'bulo sibatang* is displayed in eight norms (Sumantri, 2006). Assamaturu ri pa'rappungang means agreeing with each other in a group. Lambusu ri panggaukang means being honest with each other. Sipakalabbiri' means respecting each other. Tena sipakasiri' means protecting each other's honor or not embarrassing each other. Siagang baji na kodi pa'mai means being together in joy and sorrow. Tena sisala ri se'rea passala' means not engaging in destructive competition. Tessibaku ri sitinajayya means being generous and giving what is appropriate. The last is sipattojeng ri kuntu tojengnga, which means justifying each other for justice. These eight norms are the basis for physics co-curricular activities in this study.

Based on observations of high school students in areas dominated by Makassar, the values of *a'bulo sibatang* have begun to fade and are not known by most Makassarese students. Most students state the meaning of *a'bulo sibatang* like a textbook and do not know its values. The students' answers clearly illustrate that the local wisdom of *a'bulo sibatang* is concerning. Makassar students generally have experienced a crisis of self-identity related to *a'bulo sibatang*. Self-identity can be substantial if students are actively involved in activities based on local wisdom and can positively influence others and their environment (Qasim et al., 2019). Co-curricular activities based on local wisdom are practical for students and educators to achieve P3 improvement. The theme that is the basis for co-curricular activities is interesting and appropriate if it is under the objectives to improve P3.

The values of *a'bulo sibatang* will continue to grow strong and sustainable if educators continue to bring them to life through activities integrated with 21st-century learning materials and approaches in co-curricular activities. Therefore, this study is designed to address whether physics co-curricular activities based on Makassarese local wisdom are effective in enhancing the Pancasila Student Profile (P3) and providing student learning satisfaction. Thus, this study aims to strengthen P3 and improve students' learning satisfaction through physics co-curricular activities rooted in Makassarese local wisdom. In addition to improving P3, learning satisfaction is also the aim of this study, which is to measure the effectiveness of physics co-curricular activities based on Makassarese local wisdom for students. Learning satisfaction determines the quality of learning (Amini et al., 2024). Engaging learning facilities and tools can create learning satisfaction (Mahmud et al., 2024). An important characteristic that significantly impacts learning satisfaction is the ease and comfort of using something or participating in an activity (Mathew & Pappachan, 2024). Although learning satisfaction is essential in measuring educational success, no research has measured the success of learning based on local wisdom regarding student learning satisfaction. Therefore, learning satisfaction can specifically explain the meaning of P3 improvement after participating in physics co-curricular activities based on Makassarese local wisdom.

METHODS

This study used a mixed-methods sequential explanatory design, as shown in Figure 1 (Mertens, 2010; Sugiyono, 2013). The quantitative method used a pre-experimental design with a one-group pretest-posttest type to measure changes in P3 before and after co-curricular activities. The qualitative method used an open questionnaire to explain quantitative results by exploring satisfaction and difficulties experienced by students in physics co-curricular activities based on Makassarese local wisdom. The study subjects were 31 tenth-grade high school students who used the Merdeka Curriculum. The sample was determined based on a purposive sampling technique, with the criteria that students came from the dominant Makassar tribe, used local wisdom of *a'bulo sibatang* in everyday life, needed P3 improvement according to educators, and was willing to participate in co-curricular activities for 5 weeks. In each co-curricular week, students focus on completing one physics co-curricular activity within approximately 3 to 5 hours, providing more flexible time than intraclass lessons.

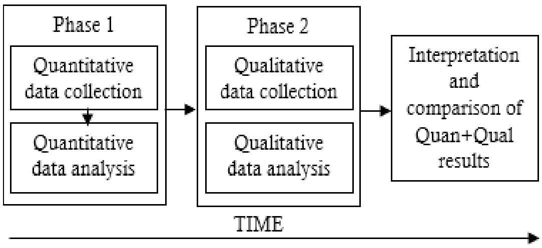

Figure 1. Flowchart of the Stages of Research

The data collection technique of this study used an essay test instrument conducted before (pretest) and after (posttest) co-curricular activities to see changes in P3. The essays used in this study were presented as questions about students' experiences before (pretest) and after (posttest) participating in physics co-curricular activities based on local wisdom. The focus of the questions include (1) how to conduct physics measurements with honesty and scientific accuracy; (2) the patterns of collaboration in group learning; (3) the form of support or contributions provided to peers or within the study group; (4) the quality of questions asked regarding physics phenomena as a reflection of curiosity; (5) the quality of solutions provided to address encountered problems; and (6) the adherence to agreed-upon commitments as an indicator of student discipline. In addition, an open questionnaire in qualitative data collection was intended to convince researchers that the findings from the pretest-posttest assessment occurred significantly as an impact of the Makassarese local wisdom-based physics co-curricular activities. Each student's answer in the open questionnaire determines whether the P3 improvement follows what students experience. The essay instrument consists of 6 items developed based on indicators from the P3 dimension: (1) Faith, Devotion to God, and Noble Character; (2) Global Diversity; (3) Mutual Cooperation; (4) Critical Thinking; (5) Independence; (6) Creativity. This instrument went through a validation test before being used with a Cronbach Alpha value of 0.78, indicating that this instrument has been declared valid by experts. The P3 reinforcement measurement indicators are categorized based on the activities and answers of students on the co-curricular worksheet according to the criteria in Table 1.

Table 1. P3 Dimension Measurement Indicator

P3 Dimension	Indicator	Activity
Faith, Devotion to God, and Noble Character	Scientific Integrity (Weber-Mandrin et al., 2024)	Conducting measurements for reliable data
Global Diversity	Communication (Guo & Asmawi, 2024)	Participating in decision-making
Mutual Cooperation	Collaboration (Amrianto et al., 2024)	Cooperating by accepting, implementing, and taking responsibility for group work
Critical Thinking	Critical Thinking (Hastuti et al., 2024)	Asking questions relevant to the problem
Creativity	Creativity (Fazal et al., 2024)	Thinking in a solution-oriented and flexible manner through logical ideas
Independence	Self-discipline (Phillips-Berenstein et al., 2023)	Submitting assignments correctly and promptly

This study uses quantitative and qualitative analysis. Quantitative analysis is tested using paired t-test and N-Gain or Normalized Gain (Martawijaya et al., 2023)which is character-ized by higher-order thinking skills and the level of misconceptions. The sample in this study was eleventh-grade students in senior high school. Students are exposed to local wisdom-based learning strategies integrating science, technology, engineering, and mathematics through group project assignments. Students are given a pre-Achieve-ment Test (PAT to determine P3 improvement. The paired t-test was analyzed with the pretest-posttest data of students' P3 before and after treatment. The data were analyzed using SPSS version 20 with the following reference: if the t-count is less than 0.05, there is a significant difference in students' P3 before and after treatment (Santoso, 2014).

N-Gain is calculated by taking the difference between the posttest and the pretest scores and dividing it by the difference between the maximum possible and the pretest scores. This N-Gain calculation shows how much improvement has occurred relative to the maximum possible improvement, with N-Gain ranging from 0 to 1. N-Gain close to 1 indicates significant improvement, while close to 0 indicates minimal improvement (Colt et al., 2011; Coletta & Steinert, 2020). The P3 improvement is determined using the N-gain percentage criteria in Table 2 (Hake, 1998).

Table 2. N-Gain Criteria

N-Gain	Interpretation
$0.70 \leq \boldsymbol{G} \leq 100$	High
$0.30 \leq \boldsymbol{G} < 0,70$	Medium
$\boldsymbol{G} < 0.30$	Low

Qualitative analysis in this study was conducted through content analysis of open-ended questionnaire responses. Data from the questionnaire were grouped based on four main indicators: co-curricular materials, co-curricular worksheets, students' co-curricular activities, and educators' teaching methods. Furthermore, students' responses were analyzed to identify thematic patterns that indicated the level of satisfaction (satisfied or unsatisfied) and difficulty (experiencing or not experiencing difficulties) for each indicator. This process was done through coding to provide initial categories, which were then processed into relevant main themes. The data obtained were enriched with direct quotes from students to provide a clearer picture of the level of learning satisfaction after participating in physics co-curricular activities based on Makassarese local wisdom.

RESULT AND DISCUSSION

The rationale for using co-curricular activities in this study is the limited time allocated for classroom subjects (intracurricular), making it ineffective for developing the Pancasila Student Profile (P5). Meanwhile, co-curricular activities, which offer more flexible time, are underutilized by educators in reinforcing subject matter while also strengthening P5. This co-curricular program was conducted over five weeks, with students focusing on completing one physics co-curricular activity each week for approximately 3 to 5 hours, providing more flexibility than intracurricular lessons. The key descriptions of the co-curricular activities are as follows.

An educator began a co-curricular activity by conducting an apperception by presenting a physics phenomenon closely related to students' daily lives. Apperception aims to increase students' curiosity and stimulate them to ask questions. Apperception in every co-curricular activity is based on students' daily activities, simple problems in the students' environments, and complex problems that require simple to complex solutions. This activity shows the adaptation of the four types of learning approaches, which state that students' initial understanding of the problem can be determined through the relevance and quantity of questions asked by students. Educators asked questions or demonstrations about problems that must be solved or answered. Independently, students trained their independence in thinking, acting, and behaving based on their abilities and experiences to express opinions. Students joined groups formed according to the *a'bulo sibatang* norm, where one group member became the group leader (*pinggawa*). As a group, students built cooperation and participation to agree on one answer or solution to the problems from the educator. Next, group leaders discussed with the educator to mutually agree on the solution or answer to the problem.

Educators provided worksheets independently to students to train their ability to make measurements so that their reports are reliable. Furthermore, students participated and built cooperation in problem-solving activities agreed upon in one class. In this activity, the norms of *a'bulo sibatang* were implemented comprehensively, where each student shared responsibility before the activity. Students respected and helped each other's group members' roles. Students supported each other, and each student was entirely responsible for the results of the agreed-upon group work. Furthermore, each group submitted the results of their group's work to other groups. Each student could ask questions or respond to the group's presented work.

At the end of the activity, the educator reinforced the importance of *a'bulo sibatang* and feedback related to learning activities to be implemented in the following co-curricular activities. In addition, students were also allowed to ask questions about activities carried out as a form of reflection. The end of the physics co-curricular activity based on Makassarese local wisdom is an independent assignment for students that must be completed on time. The assignment aims to enrich knowledge and train self-discipline to fulfill the agreement.

Table 3. Physics Co-Curricular Activity Based on *A'bulo Sibatang* Local Wisdom

Topic	21st-Century Learning Adaptation Activity	*A'bulo sibatang* Integration	P3 Indicator
Apperception Questions	**DL:** finding physical quantities in seawater and finding constant seawater density	Not engaging in destructive competition	Asking questions (Critical Thinking Skills)
Independent Thinking	**IL:** investigation on how to use physical quantity measuring instruments, changes in seawater density before and after boiling, and the hypothesis of salt mass from seawater.	Not engaging in destructive competition	Thinking in a solution-oriented and flexible manner (Creative Thinking Skills)
Group Discussion	**PBL:** understanding problems based on seawater objects, understanding problems based on the concept of seawater density, and understanding problems based on the use of seawater	Justifying each other Being honest with each other Respecting each other Being together in joy and sorrow	Participating in decision-making (Communication Skills) (Collaboration Skills)
Independent Learning	**PjBL:** Conducting a project to determine the quantities measured in seawater, designing and implementing a method to determine seawater density, and designing and implementing the use of seawater into salt by cooking.	Not engaging in destructive competition	Conducting measurements for reliable data (Scientific Integrity)
Group Learning		Justifying each other Being honest with each other Respecting each other Being together in joy and sorrow	Participating in decision-making (Communication Skills) Cooperating (Collaboration Skills)
Group Presentation		Justifying each other Protecting each other's honor Being together in joy and sorrow Respecting each other	Asking questions (Critical Thinking Skills)
Evaluation Questions		Not engaging in destructive competition	Asking questions (Critical Thinking Skills)
Independent Assignment		Not engaging in destructive competition	Self-Discipline

The paired t-test analysis of pretest and posttest was conducted to determine the significance of the differences in P3 before and after treatment. In addition, the t-test results also became empirical data on the impact of local wisdom-based physics co-curricular activities on P3, as presented in Table 4.

Table 4. Paired T-Test of P3 Pretest And Posttest

Paired Differences					t	df	Sig. (2-tailed)
Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
			Lower	Upper			
-19.89258	9.83188	1.76586	-23.49894	-16.28622	-11.265	30	.000

Table 4 shows that the significance value (Sig.2-tailed) obtained as a result of the paired t-test of the P3 pretest-posttest was 0.000 (<0.05). Thus, there is a significant difference in students' P3 before and after participating in physics co-curricular activities based on Makassarese local wisdom. A further analysis was carried out by calculating the N-Gain percentage to see the significance of the difference. The percentage of N-Gain on the six indicators before and after the implementation of co-curricular physics activities based on Makassarese local wisdom is presented in Figure 1. There was an increase in P3 in the low and medium categories, 15 (48.39%) and 16 (51.61%), respectively.

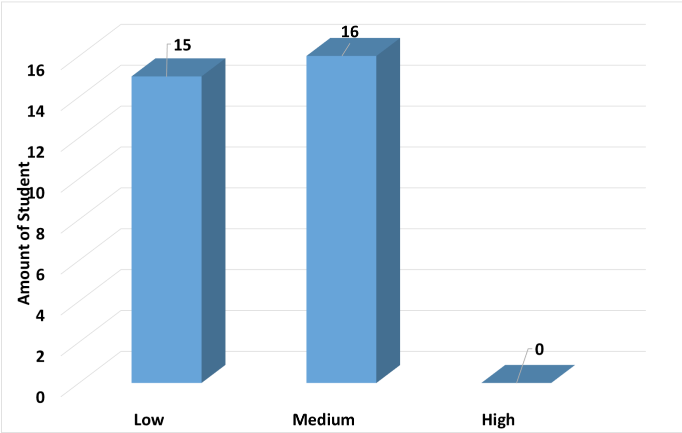

Figure 2. N-Gain of P3

Figure 2 shows the N-Gain of P3 as a whole based on the results before and after implementing physics co-curricular activities based on Makassarese local wisdom. However, based on further analysis, each dimension of P3 was in the low and medium categories. The N-gain of each indicator is presented in Figures 3 and 4.

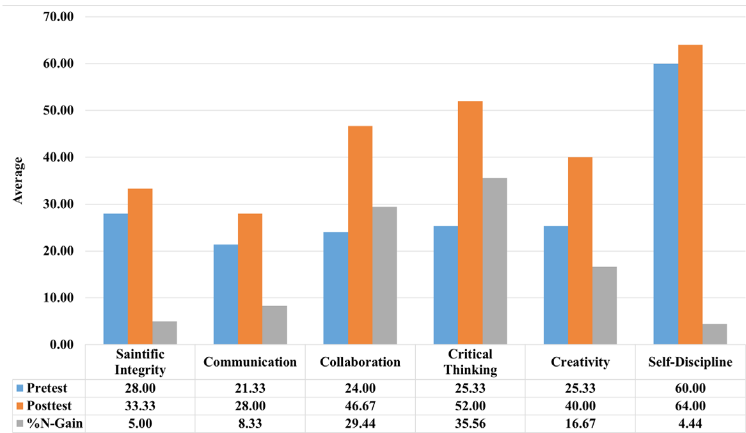

Figure 3. The Average Pretest-Posttest of Each P3 Indicator in the Low N-Gain Category

Figure 3 shows the N-Gain percentage value in the low categories in each P3 dimension. The results showed significant improvements across all dimensions, with critical thinking (35.56%) and collaboration (29.44%) showing the most significant improvements, suggesting that students developed stronger problem-solving and teamwork skills. Meanwhile, self-discipline has the highest posttest score (64.00) but the lowest %N-Gain (4.44), indicating that students already have a solid foundation in this area. These findings show that integrating local wisdom into the 21st-century learning approach effectively improves students' character and competence, which aligns with the goals of P3.

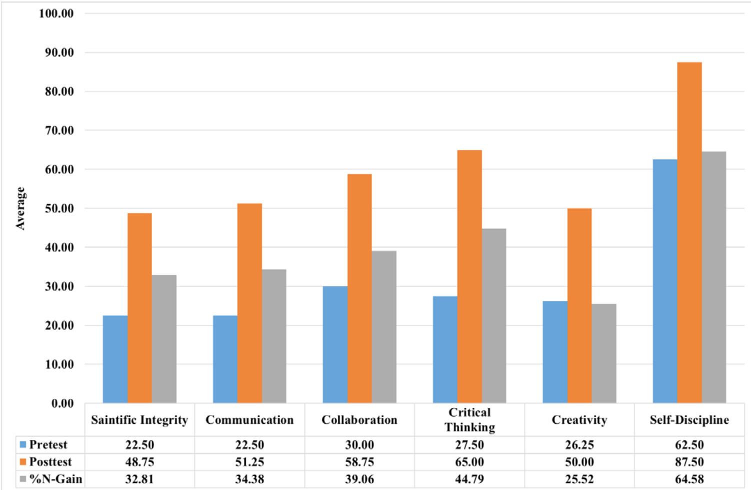

Figure 4. The Average Pretest-Posttest of Each P3 Indicator in the Medium N-Gain Category

Figures 3 and 4 show the percentage value of N-Gain in the low and medium categories in each P3 dimension. Students who achieved the highest to lowest N-Gain in Figure 3 are sequentially in critical thinking, mutual cooperation, creativity, global diversity, faith in God, and independence. Meanwhile, students who achieved the highest to lowest N-Gain in Figure 4 are sequentially in the dimensions of independence, critical thinking, mutual cooperation, global diversity, faith in God, and creativity. Figures 3 and 4 show that P3 improved after participating in Makassarese local wisdom-based physics co-curricular activities in the low and medium categories. All six P3 dimensions have improved. This finding is in line with Fauziah et al. (2023) that learning activities based on the local wisdom of the local community have strong relevance to implementing the Merdeka curriculum, especially P3. Ulfah and Purwanti (2020) stated that learning materials based on local wisdom have improved students' cooperation. Local wisdom is interpreted as a system in the social and environmental order of the community (Nengah Lestawi & Bunga, 2020), so it is very natural if local wisdom is used as a social system in learning activities to support the achievement of learning objectives.

In addition to the findings of P3 improvement, students' learning satisfaction was also revealed in this study as an indicator of the impact of physics co-curricular activities based on Makassarese local wisdom. Qualitative analysis through semi-structured interviews on physics co-curricular activities revealed that 100% of students were satisfied with all aspects of the physics co-curricular activities based on Makassarese local wisdom. However, some students still experience difficulties with certain aspects of the activities. The interview data were then interpreted into a percentage diagram of student learning satisfaction presented in Figure 5. These learning satisfaction results also confirm the significance of the Pancasila Student Profile (P3) enhancement experienced by students through the Makassarese local wisdom-based physics co-curricular activities.

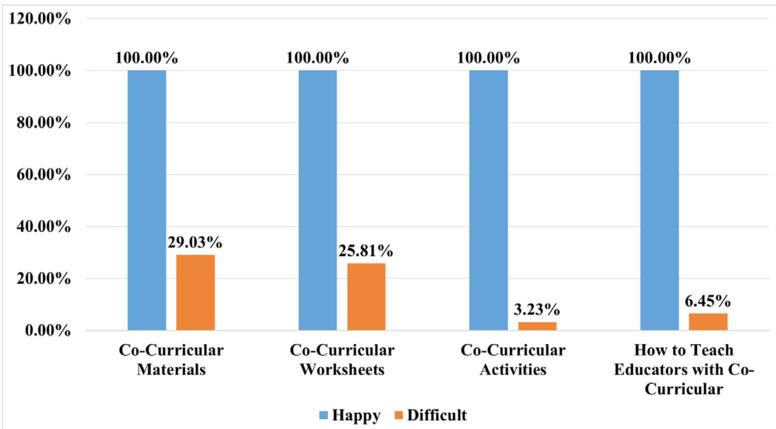

Figure 5. Students' Learning Satisfaction

Figure 5 shows that 29.03% of students had difficulty learning the material in the physics co-curricular activities based on Makassarese local wisdom. Through an open questionnaire, students stated, "because I do not understand physics" and "because I have never studied physics, but I try not to have difficulty answering questions." These answers indicate that some students still consider physics difficult. However, 70.97% of students felt satisfied and did not experience difficulties. Students stated, "I have no difficulties. I am happy and enthusiastic about participating in physics activities."

Based on Figure 5, 25.81% of students had difficulty using student worksheets in physics co-curricular activities based on Makassarese local wisdom. Through an open questionnaire, students stated, "Because I do not know how to write questions." The answer indicates that some students still need help in making questions. However, 74.19% of students felt happy and did not experience difficulties with the co-curricular worksheets.

One of the novelties of the Makassarese local wisdom-based physics co-curricular activities is integrating 21st-century learning in its application so that the P3 increases even though some students still experience difficulties in certain aspects. Physics co-curricular activities based on Makassarese local wisdom by integrating PBL characteristics make it a meaningful learning approach. PBL contributes to contextually presenting problems as a stimulus to enhance students' curiosity (Lee et al., 2024; Silva et al., 2024). In PBL, students work in small groups to solve problems with the help of a tutor (Margunayasa et al., 2019). PBL focuses on problem-solving and offers various advantages, such as facilitating the acquisition of knowledge, stimulating the ability to solve problems, increasing intrinsic learning interest, deepening understanding, developing communication skills, teamwork, presentation, and critical evaluation, encouraging independent learning, and strengthening skills (Ding & Cheng, 2024; Zhang et al., 2024). The follow-up of PBL to more complex problems that require practical solutions is to adapt the PjBL approach. According to Ismail et al. (2024), students can improve their ability to solve practical problems systematically and increase their understanding and motivation to learn through PjBL. PjBL contributes to physics co-curricular activities based on local wisdom from Makassarese. PjBL has a distinctive learning characteristic as a final product in solving problems directly related to students' culture and daily lives (Sagita et al., 2022; Martawijaya et al., 2023). The PjBL framework includes practices for knowledge management, practical skills development, design-based learning, critical understanding, reasoning, collaboration, and social transformation and reformation (Lee et al., 2024).

Local wisdom-based physics co-curricular activities integrating the IL approach can influence students' skills in using various physics measuring instruments in the investigation process. The main activity in IL is an investigation that involves designing and implementing experiments based on investigation questions, which is very appropriate when carried out collaboratively (Cassum & Fatima, 2024). The IL approach effectively improves students' decision-making skills with an average N-Gain in the high category (Hariyono et al., 2024). In addition, for IL to be more effective, students need adequate prior knowledge to build on (Sisman et al., 2024), as students still struggle to understand physics co-curricular activities. IL can also provide an instructional framework that supports the development of broader intellectual insight and scientific process skills in students, such as making scientific measurements (Hardianti & Kuswanto, 2017). IL is also believed to develop critical thinking skills (Rusdiyana et al., 2024). This belief is in line with the opinion of Margunayasa et al. (2019) that the learning approach that can accommodate science, such as physics as knowledge and processes, is the IL approach.

By integrating the DL approach, local wisdom-based physics co-curricular activities can influence students' critical thinking by using various learning resources to discover concepts, including those closely related to students' local wisdom activities (Gunawan et al., 2020). Prayogi et al. (2024) state that an exploration-based approach such as DL can strengthen students' critical thinking skills. Discovery in learning also provides opportunities for students to always actively participate in building their academic honesty by following educator guidelines (Sugiarti & Husain, 2021). The characteristics of DL that contribute to improving students' P3 are reporting findings to their groups to share new information that they encounter individually while simultaneously training group collaboration and communication skills through questions and searching for further information (Silvita et al., 2024). In addition, DL also provides new abilities for students (Murtiyasa & Al-Karomah, 2020).

In addition to 21st-century learning, the main focus of this study is to examine in depth the implementation of *a'bulo sibatang* values in co-curricular activities at school. *A'bulo sibatang* is a highly respected social concept in Makassar culture, depicting unity, cooperation, and strong solidarity. Implementing *a'bulo sibatang* in learning supports students in developing tolerance, nationality, social awareness, communication, curiosity, appreciation for achievement, love of peace, environmental awareness, and responsibility (Jamaluddin et al., 2022). Traditionally applied in Makassarese life, these values are now introduced in education to provide students with a strong moral and social foundation. Through the integration of these values into co-curricular activities, this study aims to improve P3. For the Makassarese people, *a'bulo sibatang* is a social concept and an actual practice manifested in various aspects of life, including in informal education, passed down from generation to generation. However, the values of Makassarese local wisdom have transformed and reflected changes in socio-economic ethics in society (Tajuddin & Asmar, 2024). Thus, incorporating the values of *a'bulo sibatang* into co-curricular activities can provide a new nuance in the educational process that does not only focus on academic aspects but also the development of students' characters and skills according to their local wisdom. In co-curricular activities, the values of *a'bulo sibatang* can be implemented through various activities emphasizing teamwork, mutual support, cooperation, and assistance (Afrianti et al., 2024). For example, in group project activities, students are taught to work together effectively, share responsibilities, and appreciate each team member's contribution. This approach helps them achieve academic goals and develop essential social skills in everyday life. This example is in line with the meaning of *a'bulo sibatang*, which is equivalent to "integrated commitment" to help each other with the principles: rebba sipatokkong (supporting each other), mali siparappe (helping each other to survive), and malilu sipakainge (reminding each other towards goodness) (Nuh, 2016).

The *a'bulo sibatang* norm also encourages people to live together in peace, side by side in harmony, strengthen unity, and facilitate interaction at any time (Akil et al., 2014). The *a'bulo sibatang* norms as the basis for co-curricular activities also align with efforts to improve P3. The values of *a'bulo sibatang* directly support collaboration and communication skills because both emphasize the importance of solidarity and establishing cooperation. In addition, communication and collaboration skills also help students build good relationships, face challenges, learn better, and develop character, leadership, and social engagement positively (Estimurti et al., 2024). Through implementing *a'bulo sibatang*, students are taught to become competitive individuals and individuals with social concerns and awareness of the importance of cooperation in a diverse society (Wannewitz & Garschagen, 2024). This is very important in a pluralistic Indonesian society, where cultural, religious, and ethnic diversity are characteristics that must be maintained and respected. In local wisdom-based physics co-curricular activities, educators can create activities that allow students to be directly involved in exploring and practicing the values of *a'bulo sibatang* as a strengthening of character or self-identity according to their respective local wisdom.

The identity crisis arising from the erosion of local culture and wisdom in globalization can be prevented early by implementing physics co-curricular activities based on local wisdom. Through physics co-curricular activities that raise local wisdom, it impacts students who are invited to get to know and appreciate their cultural heritage. For example, in physics co-curricular activities based on Makassarese local wisdom, students learn physics concepts and how they are learned through the social system adopted by their local culture of *a'bulo sibatang*. This way, they learn to appreciate and maintain local wisdom while competing in an increasingly global world. Furthermore, physics co-curricular activities based on local wisdom have also contributed to helping students build a strong sense of self-confidence and identity. When students understand and appreciate their cultural heritage, they tend to have a higher sense of pride in their identity as part of a particular cultural community. This is important to prevent an identity crisis when the younger generation feels alienated from their culture and heritage, so it is hoped that 21st-century learning should be integrated with the local wisdom of students. However, this study has certain limitations, including a relatively small sample size and a short implementation period, which may limit the generalizability of the findings. Additionally, the use of self-reported data could introduce social desirability bias, as students may have provided responses they believed were expected. Future research should expand the sample size, extend the duration of the study, and incorporate a control group to assess better the long-term impact of integrating local wisdom into physics co-curricular activities.

CONCLUSION

This study concludes that co-curricular physics activities based on Makassarese local wisdom effectively improve students' P3 and positive learning satisfaction. In addition, this study also has an impact on preventing the erosion of Makassarese cultural identity and improving students' academic understanding. Thus, co-curricular activities based on Makassarese local wisdom function as a means of education and to build and strengthen students' cultural identity, making them students who are not only academically intelligent but also have strong character and Pancasila spirit.

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