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Comparative Study of Achievement and Participation in the National Science Olympiad: A Case Study of Java and Non-Java Regions

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Abstrak

Kurikulum Merdeka memberikan kesempatan kepada seluruh siswa Indonesia untuk mengeksplorasi bakatnya, salah satunya melalui Olimpiade Sains Nasional (OSN). Tujuan dari penelitian ini adalah untuk menganalisis partisipasi dan prestasi siswa pada OSN lintas wilayah di Indonesia. Penelitian ini dilakukan dengan menggunakan pendekatan kuantitatif dan teknik *cluster random sampling*. Kategori responden dibagi berdasarkan wilayah domisili siswa yaitu Jawa dan non Jawa. Partisipasi dan prestasi siswa di kedua wilayah tersebut menunjukkan bahwa siswa berdomisili Pulau Jawa masih mendominasi partisipasi dan prestasi di OSN. Penelitian ini juga menemukan bahwa fasilitas sekolah, biaya, dan kurangnya dukungan guru serta orang tua menjadi hambatan utama bagi siswa di luar Jawa. Dampak OSN juga sangat bermanfaat, terutama dalam mendukung studi dan karir siswa, serta meningkatkan peluang kesempatan pendidikan yang lebih baik di masa depan. Hasil ini memberikan informasi penting mengenai perlunya pemerataan peningkatan dukungan dan akses bagi siswa serta sekolah di seluruh wilayah Indonesia untuk mengikuti OSN.

Kata kunci: Olimpiade Sains Nasional, Prestasi siswa, Kesenjangan Pendidikan, Wilayah, Hambatan.

Abstract

The Merdeka Curriculum provides opportunities for all Indonesian students to explore their talents, one of which is through the National Science Olympiad (OSN). This study aims to analyze student participation and achievement in OSN across regions in Indonesia. This research was conducted using a quantitative approach and cluster random sampling technique. Respondent categories were divided based on student domicile areas: Java and non-Java. The participation and achievement of students in both regions showed that students domiciled in Java Island still dominate participation and achievement in OSN. The study also found that school facilities, costs, and lack of support from teachers and parents are the main obstacles for students outside Java. The impact of OSN is also very beneficial, especially in supporting students' studies and careers, as well as increasing the chances of better educational opportunities in the future. These results provide essential information on equitable improvements in support and access for students and schools in all parts of Indonesia to participate in the OSN.

Keywords: *National Science Olympiad, Student Achievement, Educational Disparity, Region, Barriers.*

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INTRODUCTION

Compared to other ASEAN countries, Indonesian education is still lagging. From 2000 to 2018, Indonesia has not achieved the average score set by The Programme for International Student Assessment (PISA). Throughout its participation in PISA assessments, Indonesia has consistently ranked in the bottom ten among other nations (Yusmar & Fadilah, 2023). Participation in the National Science Olympiad (OSN) can be an excellent alternative solution to enhance students' abilities, marked by indicators like improved critical thinking, high reasoning abilities, and students' attitudes and character (Dasar et al., 2019). A student's academic achievement is one of the success standards of a school. Nowadays, students are not only demanded to excel academically but also required to have other skills, such as arts or abilities related to the Science Olympiad (Ariyanti et al., 2019). The "Merdeka Belajar" curriculum emphasizes the formation of the Pancasila student profile (Nurun Alanur et al., 2022). This profile directs educational policies, guiding educators in shaping students' character. One dimension of the Pancasila profile is critical reasoning, and participating in the OSN can significantly enhance this aspect (Kemendikbudristek, 2023).

The National Science Olympiad, commonly referred to as OSN, is a yearly event orchestrated by the government. Besides promoting thinking, this event is also instrumental in assembling the Indonesian national team for international competition. In the elementary stages, the contests are centered around Science and Mathematics. For the middle school stage, the subjects expand to include Science, Social Studies, and Mathematics. At the high school stage, the spectrum broadens to nine subjects, namely Biology, Physics, Mathematics, Chemistry, Computer Science, Astronomy, Geography, Earth Science, and Economics. The pathway to selection begins at the school level (OSN-S), escalates through the city level (OSN-K), advances to the provincial level (OSN-P), and culminates at the national level (OSN) (Balai Pengembangan Talenta Indonesia, 2023).

Through the OSN, students' scientific talents and potential are expected to be optimized, preparing them to represent Indonesia in the International Science Olympiad. Participation in the Olympiad trains students to excel intellectually, compete academically with other regional or international participants, and nurture a spirit of achieving the best. Additionally, it nurtures reasoning in line with the scientific method, enabling critical thinking and scientific attitudes and actions (Darkasih, 2022). Currently, the equalization of education quality across Indonesia remains a critical issue. Although efforts have been made to expand educational access to every student at various learning stages, the quality of education across regions remains unequal (Safarah & Wibowo, 2018). This research is motivated by the need to address this divide. It is guided by two primary questions: Are there disparities in OSN participation and achievement between students from Java and non-Java regions, and if so, what factors contribute to these disparities? Additionally, how does participation in the OSN influence students' academic trajectories and future career choices?

The study's goal is to provide data-driven recommendations to policymakers and educational practitioners to improve OSN participation and achievement across Indonesia. It seeks to uncover strategies to enhance access to the OSN, thus promoting equal opportunities for all Indonesian students to excel. The research outcomes are intended to support schools and teachers in navigating and mitigating the challenges faced by students engaging in the OSN and to contribute to national efforts in cultivating scientific talent for international stages.By investigating these aspects, the study will fill a critical gap in the literature about students' engagement in the OSN across regional divides in Indonesia and provide actionable insights into facilitating a more inclusive and successful environment for scientific exploration and competition among students.

METHOD

In addressing the disparity in educational achievements across different regions in Indonesia, this study employed a quantitative approach, focusing on the comparison of participation rates and achievement levels in the National Science Olympiad (OSN) between students from Java and non-Java

regions. Specifically, the research scrutinized the extent of students' engagement with the OSN and the highest accolade attained—categorized into gold, silver, bronze, or honorable mention. To systematically investigate the proposed hypotheses—firstly, that a significant difference exists in the OSN participation rates and achievement levels between the two student populations, and secondly, that OSN involvement has a positive impact on the participants' educational and career trajectories—data were gathered from a substantial sample of students and alumni. The criteria for alumni inclusion were those who had graduated in or after 2002, the inception year of the OSN, with the student participants being at a minimum educational level of junior high school at the time of the survey.

The data collection instrument, a structured questionnaire, was meticulously designed to extract information on four key aspects: the respondents' educational and career outcomes influenced by OSN participation, the perceived future educational opportunities afforded by their engagement in the OSN, the challenges encountered during the OSN participation, and the perceived discrepancies in support or resources available between schools in Java and non-Java regions. The questionnaire results were analyzed based on their categorization into Java and non-Java groups. Respondents' participation was measured based on whether they had ever participated in the National Science Olympiad (OSN) or not. This data was analyzed in percentage form and then visualized in a graph. A diverse array of dissemination channels was leveraged to ensure a broad reach and a representative sample. These included collaborations with educational training institutions, outreach through school teachers, and networking with university faculty members. The target was to secure a minimum of 100 participants each from Java and non-Java to ensure adequate statistical power for comparative analysis. Statistical treatment of the data entailed a percentage-based analysis to illuminate the distinctions and correlations between participation and achievements, as well as to explore the respondents' experiences and perceptions. This analytical approach was chosen for its capacity to convey findings in a straightforward, interpretable manner. The study was carried out in a concentrated three-week period at the beginning of September 2023, a strategic choice aligned with the academic calendar and availability of the target demographic. This timing was also conducive to maximizing response rates and obtaining current reflections on the OSN experience.

From the questionnaire, 434 respondents were obtained, with 114 originating from Java and 318 from non-Java. This significant difference in respondents is due to the larger area of non-Java compared to Java itself. Consequently, percentages were used by the researcher to analyze the differences in student participation in the OSN in both regions. The focus of this study is on two main groups, namely the Java group and the non-Java group. Student participation and achievement in the OSN were treated as dependent variables, while the independent variable was the students' domicile regions (Java and non-Java).

RESULT AND DISCUSSION

The questionnaire results were analyzed to assess the participation rates in the National Science Olympiad (OSN) across two distinct regions: Java and non-Java. Participation was defined broadly, including any level of the OSN—city, provincial, or national. For the Java region, out of 114 respondents, 92 had participated in the OSN, equating to a participation rate of approximately 81%. In contrast, in the non-Java region, out of 318 respondents, 124 had engaged with the OSN at any level, resulting in a participation rate of 39%. These calculations were made by dividing the number of participation who had experience with the OSN by the total number of survey respondents from each region and then multiplying by 100 to convert the figure to a percentage. For instance, in Java, 92/114 x 100 = 80.7%, which rounds to approximately 81% and in non-Java, 124/318 x 100 = 39.0%. This comparative analysis reveals a stark contrast in OSN participation between the two regions, with the participation rate in non-Java being less than half of that in Java (Figure 1.).

These results show a twofold difference, illustrating that student participation in non-Java is significantly lower compared to those in Java. This condition may affect students' opportunities to hone their skills and gain new opportunities in their educational achievement. The government and

educational departments play a crucial role in socializing the OSN to many non-Java schools. Considering the limited number of non-Java schools that send their students to participate in the OSN, the government and educational departments need to intensify the socialization of the OSN to these schools.

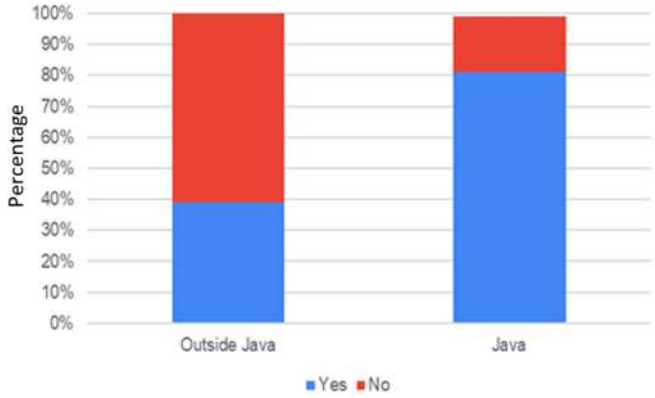

Figure 1. Respondents Who Have Participated in the OSN

In further examining the respondents' achievements in the OSN, we delved into their performance at the national level. The distribution of OSN awards, divided into gold, silver, bronze medals, and honorable mentions, is depicted in Figure 2. To quantify the level of success, we calculated the proportion of participants who became champions at the national level within their respective groups.

In the Java region, from the 114 respondents who have participated in the OSN (across city, provincial, or national levels), an impressive 55 have emerged as winners at the national level, translating to a winning rate of about 48.2%. Contrastingly, in the non-Java region, out of 192 respondents who have engaged with the OSN at any level, 37 achieved national victory, constituting a winning rate of approximately 19.3%. This yields a stark contrast in the national OSN success rate, with Java participants approximately two and a half times more likely to win at the national level compared to their non-Java counterparts. The Java region's winning rate of 48.2% significantly surpasses the 19.3% rate of non-Java, reinforcing the dominance of Java region in the national echelons of the OSN.

These observations underscore a pronounced regional disparity in the realm of scholastic achievement at the national level, potentially prompting a discussion on the distribution of resources, training, and support that facilitates such accomplishments. The data highlights the necessity to probe into the underlying factors that contribute to this divide and to consider strategies that might level the playing field for future participants from all regions.

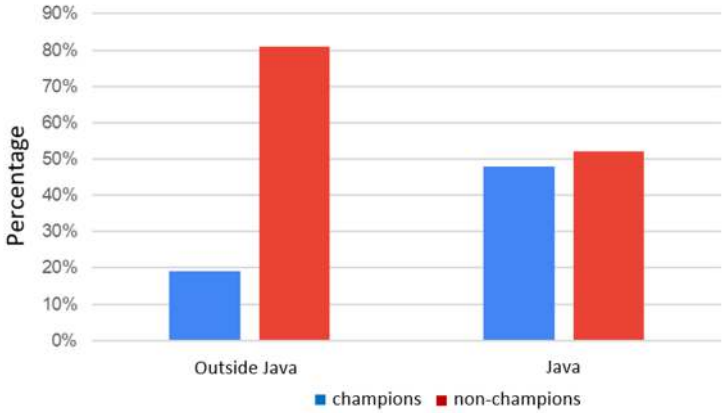

Figure 2. OSN Respondent Achievements

Figure 3 also shows that respondents from the Java region dominate more in pursuing gold, silver, and bronze medals. Meanwhile, respondents from non-Java more often received honorable mentions. Therefore, in addition to excelling in the percentage of students who become champions nationally, the Java region is also superior in competing for higher championship positions than non-Java. They often become 1st, 2nd, or 3rd champions rather than honorable mentions. This could happen due to the lack of training provided to non-Java students in preparing for the OSN.

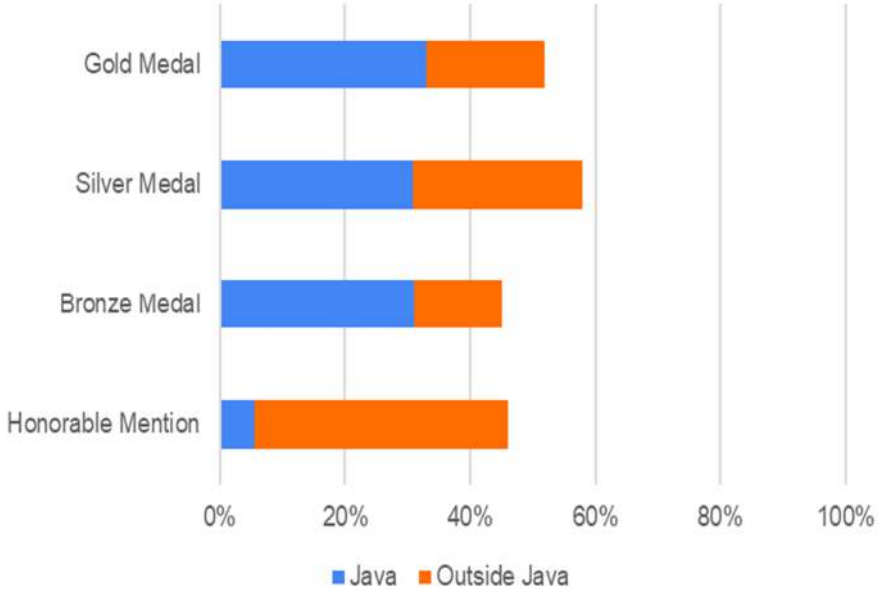

Figure 3. Championship Achievements in the National OSN

Specialized training for each field can significantly support student preparation. For example, algorithm coaching for students in the field of informatics who will compete in the OSN has been proven to enhance students' understanding and preparation (Setyawan, 2023). Additionally, coaching conducted in the city of Surabaya for junior high school students also showed an improvement in the abilities of the coached students in answering science olympiad questions (Bustomi & Sudarsono, 2021). According to Mandailina and Syaharuddin, there needs to be further coaching regarding olympiad material, considering that the delivery of material at the school level, especially in their research at the junior high level, is still very minimal (Mandailina, 2018). Moreover, olympiad coaching also needs to emphasize strengthening concepts and familiarizing students with OSN questions (Sarkity et al., 2020).

The next essential consideration is understanding the factors that pose challenges or obstacles for students, especially non-Java students, when participating and competing in the OSN. From Figure 4, the main factors that become obstacles for respondents are school facilities (42%), costs (17%), and support from teachers and parents (16%). This is also in line with the unequal quality of education in Indonesia. Additionally, the cost to participate in OSN coaching or training is expensive, making it quite challenging for non-Java students to find instructors. Besides the above external factors, personal factors such as reluctance to learn and difficulty in managing time also pose challenges for students (10%), and another 16% come from various other external factors such as students living in dormitories, making it challenging to find study time, not having a conducive place to learn, and other factors. Figure 5, shows students' perception of schools' support of their participation in OSN. The figure shows that 80% of respondents agree that there are still differences in support and facilities between schools in Java and non-Java. This can be an important note for the government to improve education equality, considering the significant impact.

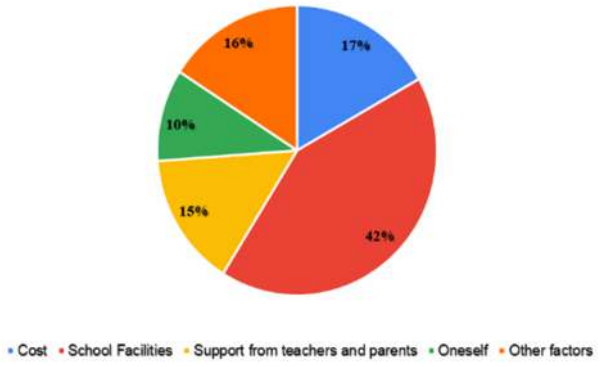

Figure 4. Biggest Obstacles to Participating in the OSN

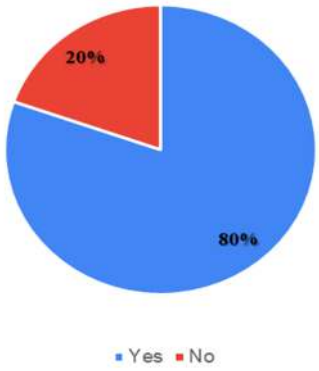

Figure 5. Percentage of student perception toward the school support

School facilities stand as the primary obstacle for students to participate and clinch victories in the OSN. This is relevant, considering many schools are still reluctant to participate in the Science Olympiad. Moreover, not all schools and educators are equipped to provide Olympiad-level materials, which further discourages these institutions from participating. Not all schools have effective management and quality laboratories. For instance, in Jembrana District, the high school laboratory equipment they examined did not meet the government's minimum standards (Katili et al., 2013). In addition to the labs, an inadequate school library also acts as a barrier for students seeking learning references. Adding new books to libraries can enhance students' reading interests. Hence, the quality of school laboratories and libraries should be a priority.

The cost is another factor that inhibits students. Since students might not receive adequate facilities from their schools, they often seek external resources and training. Enrolling in Olympiad coaching from specialized institutions typically incurs significant expenses, and not all students can afford to join these paid institutions. The next critical factor is the support from teachers and parents. Teachers and parents play a crucial role, both directly and indirectly, in students' participation and competitiveness in the OSN. Parents and teachers can influence character formation in students (Ramdan & Fauziah, 2019). The OSN does not just test students' cognitive and analytical abilities but also their mental and psychological endurance. A robust mental foundation is essential, and character development is significantly influenced by the support from teachers and parents. Aside from character, parents and teachers can also foster students' creativity (Pusitaningtyas, 2016). Creativity is a vital asset for students to solve OSN problems. Unfortunately, support from parents and teachers remains minimal in Indonesia, especially for non-Java children.

Another pivotal factor impacting student participation in the National Science Olympiad (OSN) is the level of support provided by schools. While the encouragement from individual teachers is important, it is the institutional backing from schools that establishes the foundational structures enabling student success. This includes not only moral and motivational support but also the provision of resources, training, and the creation of an environment conducive to study and preparation for competitions such as the OSN.

The cost of participation, which can be a significant hurdle, is more effectively addressed when schools offer structured programs and allocate funds to support their students' involvement in the OSN. External resources and specialized coaching can incur significant expenses that are not always affordable for students or their families. Hence, school-sponsored initiatives can mitigate these financial constraints and widen access to valuable preparatory experiences.

Other factors, like personal ones, are largely a result of the absence of the three fundamental factors mentioned above. Quality self-control, learning ability, and time management can be enhanced with support from teachers and parents. Ultimately, the onus falls on the students—whether they want to learn or not. Other factors also come into play, like students having younger siblings that frequently

disturb study time, or students living in boarding environments where finding study time becomes challenging, among other unique situations.

From the above discussion, it is hoped that the government and related parties will reconsider the quality of school facilities, especially in schools non-Java. Proper school facilities can significantly assist students in utilizing all available resources for learning. The government's outreach to non-Java schools needs to be amplified.

Improving the quality of teachers in guiding Olympiad participants is paramount. Training teachers in in-depth materials and OSN question drills will equip them to recognize and analyze OSN questions, enabling them to guide students participating in the OSN more effectively (Hikmah Marisda, 2020). Proper training for both students and teachers is an excellent solution for enhancing educational equity in Indonesia, especially in the Science Olympiad. This stance is further supported by prior research by Fauzan, which indicates that teachers respond positively to student training (Fauzan & Dzikrullah, 2018).

To mitigate financial constraints and provide equitable opportunities for OSN participation, it is essential for regional educational departments to take a more active role. These departments should not only facilitate specialized training for teachers but also establish comprehensive support systems to nurture and promote excellence in the Science Olympiad. By providing resources and coordinating efforts across schools, educational departments can ensure that every student, regardless of their socio-economic background, has access to quality coaching and mentorship. Moreover, educational departments can spearhead initiatives to highlight the significance of the OSN to teachers, parents, and the broader community, ensuring sustained engagement and support. Such institutional backing is vital to level the playing field, allowing students from all regions to compete effectively in the OSN. Provinces should be encouraged to develop localized strategies that address the unique challenges faced by their students, thereby fostering an environment where talent can flourish and be recognized at a national level. Students representing each province should receive attention and training from their regional education departments to compete with students from other regions. There should be continuous promotion of the importance of the OSN to both teachers and parents so they can support their children in participating in the OSN

The results of the questionnaire regarding the influence of the OSN on student careers can be seen in Figure 6. Based on the figure, 59% of respondents said it was very helpful, and 30% said it was helpful. In total, 89% of respondents gave a positive response regarding the influence of the OSN in providing education and career opportunities. Figure 7 shows that 64% strongly agree, and 29% agree that the OSN has a positive influence on opening future educational opportunities. Both data indicate that over 80% of respondents agree that the OSN has a positive impact on their careers and future educational opportunities.

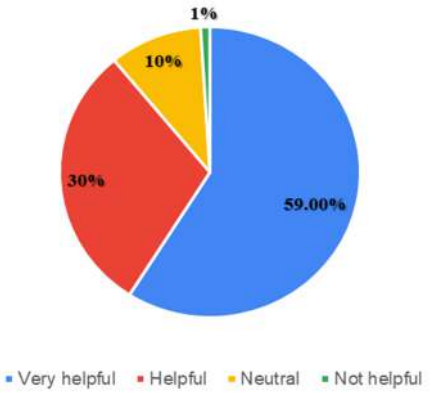

Figure 6. Influence of OSN on Education and Career

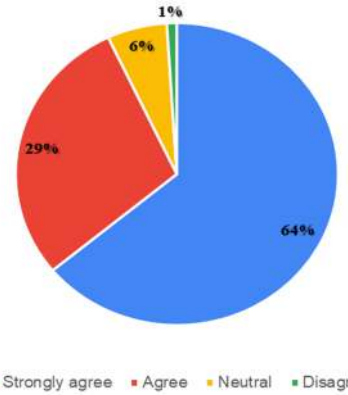

Figure 7. Positive Impact of OSN on the Future Educational Opportunities.

This data indicates that the OSN can allow students to get better career opportunities. The direct

impact that students can feel if they manage to win this competition is receiving a championship certificate. The OSN certificate is very beneficial in enhancing students' chances of being accepted at the university or school of choice and giving them the opportunity to get scholarships. An analysis of student participation and achievement in scientific competitions, such as Science Olympiads, reveals a profound influence on students' interest and success in STEM fields. According to a study published in Springer, participation in Science Olympiads significantly correlates with an increase in STEM career interest among high school students (Smith et al., 2021). The study posits that the challenges and learning experiences faced during these competitions not only enhance students' scientific knowledge and problem-solving skills but also bolster their enthusiasm for science and technology pursuits. This underlines the potential of competitive platforms like the OSN in nurturing future scientists and innovators, making a compelling case for increased support and resources, particularly in regions where participation is lagging. Additionally, through the OSN, participants are trained to think critically, be independent, work hard, and have resilient mental strength. This is invaluable character-building capital that will always be inherent in students.

CONCLUSION

Our study illuminates clear regional disparities in the National Science Olympiad (OSN) participation and achievement between Java and non-Java regions. Java-based students not only participate more frequently but also achieve higher levels of success, often securing national titles. Such achievements are less prevalent among their non-Java peers, suggesting regional inequities in educational opportunities.The research questions set out to uncover these inequalities and their underlying causes. It was found that limitations in resources, accessibility to quality training, and socio-economic constraints predominantly account for the discrepancies. Furthermore, our findings substantiate that OSN participation significantly influences students' academic and professional directions, fostering competencies beneficial for future STEM career pathways.Efforts to democratize the availability and quality of science education, particularly in underrepresented regions, are vital for bridging these gaps. The government and educational institutions are called upon to invest in targeted initiatives that elevate both the awareness and the infrastructure supporting OSN engagement. These actions are pivotal in nurturing a more diverse and inclusive landscape for aspiring scientists across Indonesia.

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