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Beyond the Gap: Understanding Gender Disparities in Indonesia's National Science Olympiad Achievements

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Abstract

This research investigates gender disparities in Indonesia's National Science Olympiad (OSN) Achievements. This research uses mix research, quantitative and qualitative. Data for quantitative analysis we get from secondary data, national achievement center website. Qualitative data we get from questionnaire with free response question, and distributed to students, teachers, and special teachers. For quantitative research we use Mann-Whitney U test whereas qualitative research we use content analysis. This research found that males are dominance to females in almost all subjects of National Science Olympiad Achievements significantly. Social stereotypes about boys using more logic and reasoning while females use more emotion, influence female self-perception and performance in understanding math and science. In terms of biology, it also shows that there are concerns of female participants when participating in OSN, they are in the menstrual period. They felt that when they were menstruating, not only did they feel abdominal pain, they also felt unstable emotions. This reduces the performance of female students when participating in the OSN Competition. The stereotype of females taking care of more household tasks or problems, causing less support from parents to female children than that given to male children. The lack of freedom gained by the female students reduces their study time for OSN preparation.

Keywords: Disparities Gender, National Science Olympiad, Stereotypes, STEM.

1. Introduction

In terms of enhancing students' abilities, OSN can serve as an excellent alternative solution to optimize the learning process and outcomes. The OSN is one of the government's efforts to improve educational quality. The enhancement of educational quality is marked by indicators such as improved critical thinking abilities, high reasoning power, as well as students' attitudes and character (Dasar et al., 2019a; Falentino et al., 2024). One of the standards of a student's success is academic achievement, especially in school Academic achievement is the result obtained from the learning process after undergoing a series of learning activities. Currently, students are not only required to succeed in their learning, but other skills are also needed. These additional skills can be in the form of arts or the ability to solve challenging problems related to the Science Olympiad (Ariyanti et al., 2019).

Through the Science Olympiad, students talents and potentials in the field of science can be maximizied effectively, thereby cultivating the best candidates to represent Indonesia in the International Science Olympiad. Through the Olympiad, students are trained to have intellectual excellence and the ability to compete in scientific fields, interacting with other Olympiad participants from various regions or countries, thus fostering a spirit of excellence among students (Falentino et al., 2024). Additionally, students are also cultivated to reasoning alignment with the systematic rules of the scientific method, enabling them to think critically and act scientifically (Darkasih, 2022). The Science Olympiad has proven to exert a positivie influence on students. Schools or educational units can provide training/coaching to students. This preparation for the OSN has been proven to significantly enhance students' knowledge. Furthermore, the ability in analytical skills and problem-solving has also improved (Dasar et al., 2019).

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The participation and achievement of students in Science, Technology, Engineering, and Mathematics (STEM) fields have been a focal point of educational research due to their pivotal role in technological and economic advancements. But unfortunately, women are often in a minor position and receive negative views in today's social structure and civilization (Ahmadi, 2023). The issue of females in STEM is a globally discussed topic with the aim of identifying ways to increase the number of women in these fields (Chapple & Ziebland, 2018). A nuanced understanding of gender disparities within these domains is crucial for fostering inclusivity and equal opportunities in STEM education, with various factors contributing to these differences. For instance, the influence of gender representation within STEM courses, finding that a higher proportion of female students and the presence of female instructors positively impacted female students' academic achievements (Bowman et al., 2022; Putra, 2023). Additionally, studies have highlighted the emergence of gender disparities in academic achievements from early education stages, emphasizing the need for early interventions (Sewasew et al., 2023). In the context of Southeast Asian Countries, parental educational background and gender have been identified as significant determinants of student's science academic achievements (Trinh, 2020).

Traditional gender role beliefs and conformity to social norms significantly influence gender disparities in STEM engagement (Chan, 2022). Continued attention to students' initial experiences, both within educational institutions and externally, is essential to guarantee that girls are afforded opportunities to participate actively in science and engineering practices (Wieselmann et al., 2020). The structure and competitive nature of the National Science Olympiad necessitate a closer examination to discern the underlying factors influencing students' performances and experiences, particularly in relation to gender disparities. Previous studies have indicated that various elements, such as study habits, coaching strategies, and the socio-educational environment, play pivotal roles in shaping students' academic achievements in such competitions (Tahamtani et al., 2017).

Despite the growing body of research on gender disparities in STEM fields, there remains a noticeable gap in the literature specifically addressing gender differences in the achievements of the OSN in Indonesia. While several studies have explored various aspects influencing student's performances and experiences in STEM, focused investigations unraveling the gender-specific challenges, motivations, and performances, in the OSN are limited. Recognizing and exploring these gender nuances within the OSN context is imperatively for a comprehensive understanding of the prevailing disparities. This becomes particularly crucial, given the OSN's significant role in nurturing future scientists and innovators, and its impact on students' educational trajectories and career paths in STEM. Thus, a detailed exploration in this area is not only timely but essential to foster equitable opportunities and outcomes for all participants, regardless of gender.

This research aims to delve deeper into understanding gender disparities in Indonesia's National Science Olympiad (OSN) achievements. Initial findings, based on preliminary surveys, indicate a significant gender disparity in OSN achievements. This study seeks to substantiate these findings further by analyzing historical data of OSN winners over the years and corroborating this with insights gathered from surveys involving OSN participants and educators. The aims of this study are:

a. Analyze the Gender Distribution of OSN Winners (2013-2023)
b. Evaluate Questionnaire Responses from OSN Participants and Alumni
c. Explore the Underlying Reasons for Observed Gender Disparities

2. Literature Review

2.1. National Science Olympiad

The National Science Olympiad (OSN) is a prestigious student olympiad event organized by the national presetation center, which is attended by students from all regions in Indonesia. OSN is present to shape character, train critical thinking, and select children who will represent Indonesia in the international arena. OSN has had a positive impact on careers and better educational opportunities in the future(Falentino et al., 2024). Previous research also explains how OSN contributes to improving the quality of education in Indonesia. OSN has a positive impact on students' learning motivation and academic achievement. The Science Olympiad consists of several fields, depending on the level participated in. At the elementary level, the tested fields are Natural Sciences and Mathematics. At the junior high level, the tested fields are Natural Sciences, Social Sciences, and Mathematics. Then, at the high school level, the tested fields are Mathematics, Physics, Chemistry, Informatics, Biology, Astronomy, Economics, Earth Sciences, and Geography. For the high school level, the selection stages consist of four stages, namely school-level selection (OSN-S), district/city level selection (OSN-K), provincial level selection (OSN-P) and national level selection (OSN).

Culminating at the National Level Selection (OSN), the competition intensifies with the participation of 100 distinguished students per field, who have triumphed in the OSN-P. Each province contributes at least one top-ranking student and can be represented by up to ten students. However, each school is limited to a maximum representation of two students. At this pinnacle of competition, a total of 30 medals are ardently contested in each field, allocated as 5 gold, 10 silver, and 15 bronze medals, symbolizing the zenith of academic excellence in the realm of science (Balai Pengembangan Talenta Indonesia, 2023; Falentino et al., 2024). Previous research has also discussed the importance of intensive coaching for students participating in OSN. The results of coaching showed significant improvements in students' knowledge, skills, and analytical abilities in solving OSN questions (Dasar et al., 2019). In preparing for the OSN, support such as school facilities such as an adequate library is also important to provide learning resources or materials for students (Rahmawaty & Krismayani, 2023). Support from both parents and schools is also needed by students in competing in the OSN (Falentino et al., 2024).

2.2. Gender Disparites in Science

The challenges and opportunities that female face in STEM learning, particularly math Olympiad, are also shared by Female in Bangladesh. Observations of math olympiad participants over the past nine years show a low participation of female students which has decreased over the years from primary to higher levels (Ahmed et al., 2020). Past research has also found significant differences in STEM self-concept between male and female participants. Male generally reported a higher STEM self-concept than female, suggesting an underlying issue in the educational and social environment that affects female's confidence and interest in STEM fields. Although participation in the Science Olympiad positively influenced STEM self-concept for both genders, this positive impact was more pronounced for male. This suggests that while competitions can improve self-concept, they may not be effective in addressing the overall gender gap (Ladewig et al., 2023). Previous studies have also found that stereotypes that associate science with males and liberal arts with females, tend to weaken females' motivation to continue participation in chemistry competitions. Females affected by gender stereotypes tend to have lower interest in chemistry topics, which in turn reduces the desire to continue (Steegh et al., 2021). Even in the world of article writing, females are less likely to be published as lead or senior authors in high-impact medical journals, but when they do their publications are cited less frequently by their peers (Chatterjee & Werner, 2021). In the technology sector, the results are interesting: in non-STEM fields, the treatment of competitive pressures led to a 27% decrease in female participation compared to males. But uniquely in STEM fields, there was no significant difference in the response of males and females to the competition treatment. This suggests that females in non-STEM fields tend to avoid competitive work environments compared to males (Boudreau et al., 2020) Another study also noted that females are severely underrepresented in STEM study programs at polytechnic universities in North Sumatra (Tamba & Chiang, 2021). One of the main reasons identified was the institution's preference for male faculty in these fields, which resulted in the underrepresentation of females at both student and faculty levels in STEM-related programs (Tamba & Chiang, 2021). Research in India also found that there is a significant difference in literacy between males and females, where the rate of literacy for males is 80.9% while for females it is 64.6%. This indicates a slower growth rate in female literacy compared to male literacy. Yet literacy plays an important role in reducing gender disparities (Katiyar, 2016). A study by Pusfarini (Pusfarini, 2017) delved into the gender disparities in science learning achievment. It explored the effectiveness of the Problem-Based Learning (PBL) model in reducing such disparities. The findings revealed that the implementation of PBL could minimize gender gaps in science learning, fostering an environment where both genders can thrive academically.

In the robot Olympiad competition, it was shown that female teams had advantages in communicating but were less good at building robots (Chiang et al., 2024). Other studies have also found that male participants tend to have a higher STEM self-concept than female participants. Strong gender stereotypes can reduce female participants' self-concept and motivation in STEM fields. Female participants often feel less confident and doubt their abilities in science because of these stereotypes (Wood, 2020). The Physics Olympiad in Germany also showed that fewer students participated in the competition, and tended to drop out of the competition faster than male students (Ladewig et al., 2022). The National Science Olympiad (OSN) in Indonesia is a very prestigious Olympic competition and has been shown to have a positive impact on both students' studies and long-term careers (Falentino et al., 2024). Unfortunately, there is no in-depth research on gender disparity in Science Olympiad in Indonesia. So this research is here to fill the void.

3. Research Method

This research uses quantitative and qualitative analysis (Johnson & Christensen, 2014). Quantitative analysis was conducted by analyzing OSN winners from 2013 to 2024 at the high school level in Indonesia (Pusat Prestasi Nasional, 2023). Then followed by statistical tests such as one-sided Mann-Whitney U to see if there is a significant gender difference in the acquisition of medals in the OSN. Qualitative analysis was then conducted by distributing a questionnaire containing free response questions to 118 students who are currently or have been also distributed specifically to 8 teachers from various schools in Indonesia who are known to be involved as coordinators or Olympic teachers in high school. Then to add a deeper understanding of participated in the OSN in various regions in Indonesia. The questionnaire gender disparity, we also conducted a semi-structured interview with a tutor who has been involved for more than 10 years, teaching in the Science Olympiad, especially in the field of Biology. She was chosen because of her vast experience, having taught in the Preparatory Training of the Indonesian biology Olympiad team for the International Biology Olympiad (IBO), and having published various children from various regions to become champions in science Olympiads. The qualitative questions given to students addressed whether they saw or felt there was a gender disparity in the OSN. Teachers and specialized tutors were asked questions about their observations and experiences while guiding children to prepare for the OSN in the context of gender. Qualitative analysis has also been used to analyze gender factors in career choices among Senior High School students (Hadi et al., 2023; Weimann-Sandig, 2020).

4. Results and Discussions

4.1. Analyze the Gender Distribution of OSN Winners (2013-2023)

Based on secondary data obtained from the Pusat Prestasi Nasional, 2023), the acquisition of OSN medals at the national high school level can be seen in Table 1. Then a one sided Mann-Whitney U compare test was conducted to see if there is a significant difference between males and females in the OSN medal race every year. Based on the test we conclude that the number of female Olympic winners is less than male, with U-statistic: 1.0, P-value: 0.00028. We also did the statistical test for every single field and shows that all fields except economics having P-value less than 0.05. So it can be concluded that almost all fields of Science Olympiad in Indonesia, show the existence of gender disparity.

Table 1. OSN winners from 2013 to 2024 at the high school level in Indonesia

Year	Mathematic		Physics		Chemistry		Informatic		Biology		Astronomy		Economy		Geoscince		Geograpic	
	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M
2013	2	28	5	25	10	20	1	29	11	19	12	19	14	16	15	15	14	16
2014	1	29	3	27	9	21	2	28	10	20	4	26	17	13	8	22	14	16
2015	3	27	4	26	12	18	3	27	9	21	11	20	18	12	8	22	11	19
2016	2	28	3	27	9	21	2	29	9	21	3	27	18	12	9	21	7	23
2017	0	32	5	26	4	26	4	26	11	19	10	20	12	18	10	20	11	19
2018	1	29	6	24	4	26	7	24	9	21	8	23	15	15	8	22	11	19
2019	4	27	5	25	1	29	6	24	5	25	5	25	17	13	11	19	4	26
2020	5	25	1	29	8	22	3	27	10	20	3	27	14	16	12	18	7	23
2021	3	27	3	27	13	17	5	25	8	22	6	24	20	10	5	25	8	22
2022	1	29	1	29	12	18	2	28	10	20	4	26	16	14	9	21	10	20
2023	4	26	3	27	8	22	3	27	9	21	5	25	12	18	11	19	9	21

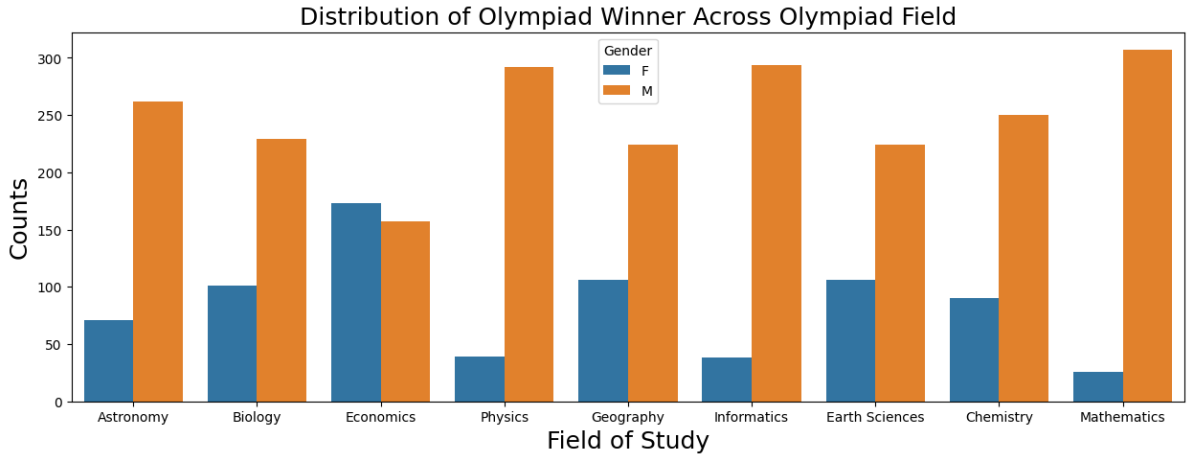

Figure. 1. Percentage of students who win OSN at the National level

4.2. Explore the Underlying Reasons for Observed Gender Disparities

4.2.1. Observations and Opinions from Students

4.2.1.1. Gender Stereotypes and Expectations

Several respondents felt that prevailing gender stereotypes in competitions exist, where males are often perceived as more competent in certain subjects compared to females. Such stereotypes, along with societal expectations, were considered by several respondents as influencing factors in OSN success.

"I think the stereotype that males are better at calculations is very much believed by many people. This is also influenced by data on the number of male winners or scientists compared to females. But in my opinion, if females have the same opportunities and interests then gender does not really matter"

"I think gender differences play a role in how different individuals learn and respond to challenges. There is a stereotype that one gender is better at dealing with pressure, challenges or receiving new information."

4.2.1.1. Physical and Psychological Conditions

Some female respondents expressed those certain physical conditions, such as menstruation, could influence their performance and well-being during competitions.

"The thing I was most afraid of when approaching the OSN period was having my period. I always hope that I will not get my period during OSN because it will be uncomfortable, especially if there is pain in my lower abdomen. In addition, menstruation not only affects physically but psychologically also becomes more emotional. This will certainly greatly affect success in the OSN, especially since the OSN really tests the mental and physical capabilities of its participants."

4.2.1.2. Community and Environment

Responses indicated that the gender composition in the OSN communities and the support from the environment, such as families, can influence participants' experiences and success.

"Because the OSN community is dominated by males, some females might have difficulties mingling in the OSN community."

"I think it depends on the family. In some families, there is sometimes a gap between brothers and sisters. Boys tend to be favored more by parents (only for some families) and girls will be secondary. There may be boys who are fully supported by their families to participate in OSN. They are given more facilities when preparing for it and are not even given homework, so that their time is only focused on preparing for the OSN. Whereas some Indonesian girls tend not to be given the freedom that boys are, so maybe girls do not have as much time as boys to finalize preparations for the OSN."

4.2.1.4. Suggestions and Hopes

Respondents also shared their suggestions and hopes for the future, including changes in gender expectations and stereotypes, and increased opportunities for females.

"I hope Indonesia can participate in more international championship events specifically for women, for example EGOI (European Girls' Olympiad in Informatics) for informatics to motivate Women in STEM."

4.2.2. Observations and Opinions from Teachers

A variety of opinions and observations were collected from teachers regarding gender disparities in OSN achievement. The responses provide a multifaceted perspective, touching on various factors that may influence gender disparities in student success in OSN. Some teachers affirmed observing gender disparities in OSN achievements, particularly noticing a higher prevalence of male winners in certain fields such as Physics and Mathematics.

"From my observation, it is more male students to be champions in OSN than female students"

"My OSN students are almost all boys, and the girls are generally less active."

Others Teachers said that it depends on their subject course and level competition. The disparities were not universally acknowledged across all fields. For instance, in fields like Astronomy, achievements were seen as more balanced between genders. But, in certain subject areas, like Physics and Mathematics, a dominance of male achievers was noticed, corroborated by the experiences of teachers handling these subjects.

"In certain fields, there is no difference between boys and girls. Students who excel are students who are diligent in their studies. For Astronomy, I observe who is diligent in learning, then they are the ones who can penetrate to the national stage. Seeing the acquisition of medals in the field of astronomy there are also female students who can achieve it. However, for certain fields there are differences. For example, in physics and math, it is mostly male students who can achieve medals. In the last few years for physics, 100% of the students who participated in the national competition were male."

"Male students often have better analytical thinking skills, as seen from the number of students who take part in the Biology OSN at the city level, there are still many women, but the higher the level, the fewer the women"

4.2.3. Expert Opinions

A senior biology Olympiad teacher, with extensive experience in teaching across various levels and having been involved in the Indonesian National Science Olympiad training, has contributed insightful opinions concerning gender disparities in Olympiad achievements.

4.2.3.1. Observations on Achievement Disparities

A historical perspective reveals that gender disparities have been persistent over time, with variations observed across different educational levels and subjects. In subjects like Biology, gender representation seems to be more balanced historically, although recent trends show a prevalence of male achievers.

"*For the OSN results of the past few years, most of which are male medalists (maybe those who qualify are also mostly male), maybe it can also be seen in terms of OSN-K and OSN-P questions which tend to be more logical than the old type of multiple-choice questions for the field of biology".*

4.2.3.2. Contributing Factors

Referring to existing research, the teacher mentioned potential biological differences in the developmental stages of male and female brains, which could influence analytical and heuristic problem-solving capabilities.

"*Regarding gender disparity, there has long been research related to the development of male and female brains that are different from a certain age as far as I know"*

"In general, at University A for engineering majors, although there are also women who enter there but usually few. Even if there are, sometimes the students complain about the performance of these female students in group work as far as I know."

"For girls who can get to the "top" in terms of Olympics at school or in their careers, if I notice there are usually female traits that are repressed or reduced, for example in terms of emotions (empathy, sympathy....) which may cause the performance of other parts of the brain to be better, which may be like the male brain"

"Guys are assumed to be more logical while girls are more emotional. Of course, the proportion is different for each person. But based on what I have seen, usually for girls who are "successful" in terms of academics and career, their emotional side is usually not too visible or not too shown. Of course, it is good if it is for a greater cause."

4.3. Explore deeply the reasons for observed gender disparities in OSN achivements

Exploring the underlying reasons for observed gender disparities in OSN achievements is essential for developing strategies to promote gender equality in this context. Our study uncovered various factors that could contribute to the gender disparities observed in OSN achievements.

4.3.1. Gender Stereotypes and Societal Expectations

Several respondents highlighted the influence of gender stereotypes and societal expectations on their preparation and performance in the OSN. They stated that prevailing societal norms and stereotypes, such as the notion that men are inherently superior in logical and analytical thinking, significantly shaped their competition experiences and outcomes. This observation is in line with existing scientific discourse; for example, a study by Nosek underscores the influential role of gender stereotypes in affecting academic performance and shaping students' experiences in educational competitions (Nosek et al., 2009). Another research indicates that gender stereotypes significantly affect academic self-concept and perfomance. Stereotypes, such as the belief that males excel in logical and analytical thinking, can lead to stereotype of conforming to these negative stereotypes. This has been shown to particularly impact female students in STEM fields, affecting their perfomance and interest in subjects like mathemativs and science (Cunningham et al., 2023; Ertl et al., 2017). This support by our finding, student said, *"I think the stereotype that males are better at calculations is very much believed by many people".*

Societal expectations also play a crucial role. Parents and teachers oftenhold and communicate gender-biased expectations regarding students' abilities. For instance, parents may unconsciously support boys more in STEM subject, believing they are naturally more inclined towards these fields, while girls may be steered towards humanities and languages. This biased support and feedback can significantly impact students's self-esteem and academic choices, perpetuating gender disparities in various academic domains (Ertl et al., 2017; Kehinde-Awoyele, Adeowu, et al., 2024). Our finding from teacher said, *"Male students often have better analytical thinking skills, as seen from the number of students who take part in the Biology OSN at the city level, there are still many women, but the higher the level, the fewer the women".*

The preference for in-group (same gender) role models can further reinforce these stereotypes. Studies have shown that children and adolescents are more likely to emulate and trust role models of the same gender, which can lead to the perpetuation of gender-typical behaviors and choices. For instance, boys may be encouraged to pursue logical and analytical tasks, while girls may receive more support in empathetic and nurturing roles, influencing their performance and interest in these areas (Cunningham et al., 2023).

4.3.2. Biological Factors

Biological factors have been highlighted as influential in the preparation and performance of students in the OSN. From our study, female students mentioned physical conditions such as menstruation as a challenge affecting their performance during competitions "*The thing I was most afraid of when approaching the OSN period was having my period. I always hope that I will not get my period during OSN because it will be uncomfortable, especially if there is pain in my lower abdomen. In addition, menstruation not only affects physically but psychologically also becomes more emotional. This will certainly greatly affect success in the OSN, especially since the OSN really tests the mental and physical capabilities of its participants"* Studies have consistently shown that menstruation can adversely affect academic performance due to symptoms such as pain, discomfort, and emotional changes. For instance, menstrual cramps (dysmenorrhea) are a common issue that can lead to absenteeism, decreased concentration, and reduced participation in academic activities. These physical and psychological challenges can significantly hinder a student's ability to performan well during competitions (Bernstein, 1977; Stoilova et al., 2022).

The psychological impact of menstruation includes increased emotional sensitivity and stress, which can further exacerbate the difficulties faced by female students. The anticipation and experience of menstruation during important academic events can lead to heightened anxiety and emotional distress, impacting overall performance.

This aligns with the concept of "stereotype threat", where stress and anxiety related to conforming to societal expectations can impair performance (Stoilova et al., 2022). Additionally, socio-cultural factors play a role. The stigma and lack of adequate menstrual hygiene management can contribute to the stress experienced by female students. These constraints not only affect physical well-being but also contribute to the psychological burden, further impacating academic (Stoilova et al., 2022).

Teachers also brought up potential biological differences in the developmental stages of male and female brains, suggesting an influence on analytical and heuristic problem-solving capabilities, "*Regarding gender disparity, there has long been research related to the development of male and female brains that are different from a certain age as far as I know"*. Studies have found that there are distinct structural differences in the brains of males and females. For instance, males generally have larger brain volumes than females, including greater volume in areas like the amygdala and hippocampus, which are involved in memory and emotional processing. Females, on the other hand, tend to have larger volumes in regions like the prefrontal cortex and the superior temporal cortex, which are associated with social cognition and language skills (Liu et al., 2020). These anatomical differences translate to variations in cognitive abilities and problem-solving approaches. For example, male typically exhibit better visuospatial skills, which aid in tasks like navigating space and visualizing objects in three dimensions. Female, conversely, tend to excel in verbal abilities, fine-motor coordination, and retrieving information from long-term memory. These cognitivie strengths align with the respective brain regions that are more developed in each sex (Liu et al., 2020; University of Cambridge, 2014). From a developmental perspective, these differences in brain structure and function begin to manifest early in life. Research indicates that sex differences in spatial visualization abilities can be observed in infants as young as 2-3 months old. As children grow, these differences become more pronounced, with males typically showing superiori working memory and problem-solving skills in analytical tasks, while females demonstrate strengths in tasks requiring social cognition and language (Goldman, 2017; University of Cambridge, 2014). Incorporating external research, discussed biological differences, including neurological and hormonal variations, as potential factors influencing gender disparities in academic achievements (Penner, 2008). Penner's study suggests that biological factors, in conjunction with environmental influences, could play a role in shaping academic performance and interests, which resonates with the biological considerations raised by participants in our study.

There are other interesting things such as females who achieve the highest performance usually have reduced feminine traits, such as empathy and sympathy, "*For girls who can get to the "top" in terms of Olympics at school or in their careers, if I notice there are usually female traits that are repressed or reduced, for example in terms of emotions (empathy, sympathy....) which may cause the performance of other parts of the brain to be better, which may be like the male brain"*. Studies show that female in leadership positions or competitive academic environments often suppress traits like empathy and emotional expressiveness. This is partly due to societal expectations and stereotypes that equate leadership and success with traditionally masculine traits such as assertiveness and analytical thinking. For instance, the concept of the "alpha female" highlights how women in dominant roles may adopt more competitive and less emotionally expressive behaviors to succeed in male-dominated fields (Sumra, 2019). Prejudice toward female leaders arises when there is a mismatch between the perceived roles of women and the traits required for leadership. Females often feel the need to conform to male-dominated norms, which can lead to the repression of feminine traits to fit into these roles better and achieve success (Abele, 2014). Research indicates that gendered expectations significantly influence career success and satisfaction. Females often face a double bind where must balance exhibiting assertiveness to be taken seriously while managing perceptions of warmth and empathy. The pressure to conform to theses dual expectations can lead to the suppression of traditionally feminine traits in professional settings (Abele, 2014; Sumra, 2019).

4.3.3. Access to Resources and Support

Participants also highlighted disparities in access to resources and support as influencing their OSN achievements. Some respondents felt that male participants might receive more encouragement and support from both familial and educational contexts "*I think it depends on the family. In some families, there is sometimes a gap between brothers and sisters. Boys tend to be favored more by parents (only for some families) and girls will be secondary. There may be boys who are fully supported by their families to participate in OSN. They are given more facilities when preparing for it and are not even given homework, so that their time is only focused on preparing for the OSN. Whereas some Indonesian girls tend not to be given the freedom that boys are, so maybe girls do not have as much time as boys to finalize preparations for the OSN"*. Studies indicate that in some families, boys receive more encouragement and resources compared to girls. This support often includes more time, fewer household responsibilites, and greater investment in educational materials, which can significantly enhance boys' preparation for academic competitiions. In contrast, girls might not receive the same level of support and freedom, which can hinder

their ability to prepare effectively for such events (Global Education Monitoring Report Team, 2020; Kumar & Pandey, 2021). Societal expecatiations and cultural norms also play a crucial role. In many contexts, boys are often prioritized for educational opportunities and extracurricular activities, while girls are expected to contribute more to household chores and caregiving roles. This imbalance limits the time and energy girls can dedicate to academic pursuits, further perpetuating gender disparities in educational achievements (Global Education Monitoring Report Team, 2020; Wang et al., 2023). This aligns with research suggesting that disparities in access to educational resources and support can impact gender disparities in academic achievement (Penner, 2008).

Policy interventions have shown potential in addressing these disparities. Measures such as scholarship for girls, removal of educational fees, and targeted support programs can help bridge the gap. For instance, interventions that provide girls with additional educational resources and support have been effective in improving their academic performance and participation in competitive events (Global Education Monitoring Report Team, 2020). Further enriching this discussion, recent research by Hoferichter, emphasizes the pivotal role of teacher and classmate support in students' academic experiences (Hoferichter et al., 2022). Supportive teacher-student relationships and a nurturing peer network can act as essential resources, bolstering students' resilience, reducing feelings of helplessness, and fostering a conducive environment for academic success and well-being. In the context of the OSN, such supportive networks can be instrumental in navigating the competition's challenges, and enhancing participants' preparation and performance. Ensuring equitable access to these vital resources and support systems is paramount in promoting gender equality and enabling all participants to thrive in competitive academic arenas like the OSN.

5. Conclusion

Through this research, we have analyzed the gender disparity in the Science Olympiad in Indonesia (OSN). Based on the medal acquisition of students from the year 2013 to the year 2023 shows a significant difference in medal acquisition at national level between male and female. Through qualitative analysis, from students, teachers, and expert teachers, it can be formulated that there are 3 important factors that cause gender disparity in OSN; social stereotypes and expectations, biology, and access to resourches & support. Societal stereotypes and expectations such as males being stronger in analysis and logical thinking, which supports them in STEM, whereas females are more geared towards empathy and language, provide additional influences and challenges to female students in the OSN. Biological factors experienced by females especially during menstruation, which cause them to be uncomfortable and emotionally unstable, provide more challenges for female students to compete in the OSN. Certain parts of the brain that differ between males and females also provide additional information on why males are stronger in memory and problem solving, while females are more social and linguistic. A third factor is access to resources and support from people around them such as family. The special treatment given by the family to male students, such as less housework, gave more support to their study preparation for the OSN. Whereas female students are more involved in taking care of and helping with home needs, which reduces the time and energy support for them to study to prepare for the OSN. Therefore, it is important for policy makers, teachers, and parents to be able to take appropriate action in addressing this gender disparity. By providing additional support to female students, such as providing painkillers for menstruating students and giving female students more space and time to develop themselves, learn to prepare for the OSN. There are even students who hope that Indonesia can involve more female students to participate in STEM competitions specifically for females, "I hope Indonesia can participate in more international championship events specifically for women, for example EGOI for informatics to motivate Women in STEM". Through this research, it is hoped that it can open up to all levels of society, especially policy makers, teachers, and parents, to be able to take appropriate actions in supporting equality and opportunities for female students in competing in OSN. Given the enormous impact of OSN, equal access and opportunity to learn and strive is something that should be pursued for both males and females.

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