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Gender Equality in Science Classrooms: Examining the Implementation of Gender-responsive Approach and its Impact on Science Education

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Abstract. Gender-responsive education promotes gender equality at schools and can be attained by addressing students' gender issues through gender responsiveness. In view of gender equality, the study examined the experiences of two Science teachers in implementing a gender-responsive approach to instruction and its impact on students' learning in secondary Science classrooms. Data were gathered through purposive sampling and descriptive phenomenology, supplemented by follow-up interviews, and then analyzed using Colaizzi's phenomenological approach. The interviews were conducted through online video calls with a semi-structured questionnaire. With thorough analysis, five major themes emerged from the teachers' shared experiences. These themes pertain to the students' genders and performances, gender-responsive approaches and methodologies, and the effects and challenges of implementing a gender-responsive approach in Science education. Furthermore, the teachers' gender responsiveness was reflected in preparing lessons, instructional materials, gender-fair language, extracurricular activities, a profiling system, sharing, group work and projects, reporting and presentation, problem-solving and laboratory activities, games, and assessments. Consequently, the teachers affirmed that gender equality among Science classroom students was achieved. With the surge of concerns surrounding students' gender, a gender-responsive approach must be upheld. Though the study's results directly relate to Science education, it is hoped that it will contribute to the pedagogical knowledge of teachers in other disciplines in integrating gender and addressing gender issues in the classroom.

Keywords: gender equality; gender responsiveness; gender-responsive approach; Science classrooms; students' gender issues

1. Introduction

Gender issues, such as bias, stereotyping, inequality, gaps, bullying, and discrimination, have directly affected society's workforce, business, and education. Notably, there have been debates about gender equality and equity for over a century (Meinck & Brese, 2019). In academia, it is known that gender is a significant factor within schools worldwide (Nishimura, 2017). Though commonly observed within the school (Hernandez & Cudiamat, 2018), the school is still a significant asset for alleviating gender issues (Wigati, 2019). In response, the United Nations Educational Scientific and Cultural Organization (UNESCO) declared gender as one of the most crucial lessons within the educational sector (Meinck & Brese, 2019). Introducing gender in classrooms will minimize gender bias and may serve as a strategic place to address gender equality (Wigati, 2019). An effective way is to integrate gender into the school's curricula and instruction (Galamgam et al., 2021).

Over the years, there has been a gradual increase in the gender parity index (GPI), which shows the enrollment ratio between male and female students. It implies that there are more enrolled females than males, indicating an increasing dropout rate among males (Belal, 2009; Nishimura, 2017). The GPI also shows an increase in gender gaps which may be ascribed to the rise of gender-sensitive policies (Belal, 2009). Nonetheless, despite the surge in the attendance of females, women still need to be as well educated as men (Evans et al., 2020). With the recognition of gender variance, it must be acknowledged that there is the presence of students who identify as lesbian, gay, bisexual, transgender, and queer (LGBTQ) at schools, regardless of their profiles in terms of ethnicity, race, and age (Mitchell & Mitchell, 2019).

Gender issues impact the professionalism of teachers and the students' perceptions, actions, and achievements (Meinck & Brese, 2019). There is a modest opinion among teachers that women are dependent on men (Toraman & Ozen, 2019). There is an observed increase in the percentage of female teachers compared to males at all levels worldwide (Anderson, 2019). The female teachers' availability may also affect school girls' attendance (Belal, 2009). The non-differentiation of teaching style and instruction between male and female teachers contributes to the students' differences in academic achievement and engagement (Barnett-Cooper, 2012). Using teaching strategies that promote the inclusion of gender positively affects students' development (Ananga, 2021; Lee, 2021). The type of training affects how teachers perceive gender (Dickey, 2014; Kollmayer et al., 2020): likewise, using learning materials, including textbooks and online resources, which depict gender stereotypes where more men are portrayed and commonly illustrated as famous characters than women (Lee, 2021).

Among the various subjects offered in schools, it is evident that Science education contributes to a nation's prosperity, welfare, and security (Abraha et al., 2019; Abraha et al., 2021). With equity in education, students are already assured of equal rights to a quality Science education (Jalak & Nasri, 2019). Though the integration of gender is apparent in instruction, its construct in Science is still ambiguous, creating a challenging atmosphere that surrounds both gender and

Science. No notable studies support the connection between gender and the construction of scientific knowledge (Hearn & Husu, 2011). Even with the exponential progress of science and technology, women are still not widely acknowledged owing to gender issues. Women are less frequently portrayed as the one who leads, invents, works, and does science and technology, while males are extensively presented. There is atypical women's participation in handling and conducting science and technology within organizations, including schools (Hearn & Husu, 2011). The presence of societal and traditional views of women and the number of schools for girls affect women's educational status (Shayan, 2015). Even with the implementation of Science, Technology, Engineering, and Mathematics (STEM) curricula, there are lingering concerns that it will amplify educational inequalities considering that females are still disadvantaged in the field (Kulakoglu & Kondakci, 2022).

With the numerous studies related to gender in the educational sector, it is apparent that there are gender issues surrounding both teachers and students. Gender-related issues include the disparity among the teachers and their teaching strategies (Ananga, 2021; Barnett-Cooper, 2012; Belal, 2009; Lee, 2021; Toraman & Ozen, 2019), the context of the school, policies, and curricula (Dickey, 2014; Kollmayer et al., 2020; Wigati, 2019), and effects of gender on students' performance (Ananga, 2021; Barnett-Cooper, 2012; Lee, 2021; Meinck & Brese, 2019). However, in Science education, most studies concentrated on the preferences and perceptions of males and females regarding STEM subjects (Kang et al., 2019; Makarova et al., 2019) and their career aspirations (Meinck & Brese, 2019). Therefore, there is still the lingering challenge surrounding the vague relationship between gender and Science teaching.

To further understand the context of gender in Science education leading to gender equality, this study aimed to examine the experiences of how the teachers implemented a gender-responsive approach in instruction and its impact on students' learning in Science classrooms. With the broad scope of lessons and varied learning activities in Science to support the students' development, understanding the approaches and other significant measures to address students' gender-related issues are relevant. Specifically, this study aimed to (a) determine how the teachers employed gender responsiveness to attain gender equality among the students and (b) determine gender-responsive teaching strategies used in delivering Science lessons and learning activities.

2. Literature Review

Studies among students enrolled in STEM have indicated gender differences. For career aspirations, boys are often seen in professions related to STEM in contrast to girls, who prefer trades in the social sciences (Meinck & Brese, 2019). Female students are more interested in Biology, while males prefer Physics and Chemistry (Kang et al., 2019). Mathematics, Physics, and Chemistry are perceived as masculine, with Mathematics being strongly regarded as masculine by both female and male students. This masculinity associated with Science subjects poses significant challenges among women (Makarova et al., 2019). In Science teaching, homogenous group interactions result in a gender-responsive collaboration. It

creates a learning environment for all students to benefit significantly from learning activities. Teachers need to provide more hands-on experience to sway the interest of females (Kang et al., 2019). A virtual laboratory also improves student achievement (Akhigbe & Adeyemi, 2020). Providing varied activities suited for both genders is also an inclusive approach, bearing in mind that practical activities are preferred by male students, while females prefer verbal communication (Dickey, 2014). Moreover, teachers must be cautious in choosing instructional materials such as textbooks that exhibit fewer gender-biased and stereotypical images and texts (Lee, 2021).

Based on social norms and culture, the Philippines is matriarchal. However, owing to Spanish colonialism, patriarchal culture in the country is embedded (Anonuevo, 2000). Nevertheless, in recent years, the Philippines has led the East Asia and Pacific (EAP) region and even the world regarding gender equality. This is owing to the country's progressive promotion of equal access to jobs among women and the enactment of laws to eradicate discrimination against women (Buchhave & Belghith, 2022; Philippine Commission on Women, 2014). In Philippine history, it is observed that males were considerably better educated than females. However, in recent years, male students have been observed to be lagging behind females, causing a wider gender gap (Paqueo & Orbeta, 2019). It was claimed that the curricula, teaching pedagogy, and educational materials are gender-biased (Philippine Commission on Women, 2014). Concerning this, the Department of Education (DepEd) issued the Gender-Responsive Basic Education (GRBE) policy that is aligned with gender and development (GAD) according to the country's constitution. The GRBE policy ensures that all genders have equal access to learning opportunities and addresses gender issues, consequently attaining gender equality among the students.

As defined by the DepEd, gender responsiveness refers to undertaking activities to correct gender discrimination and bias, resulting in gender equality and equity (Department of Education, 2017; Galamgam et al., 2021). Gender responsiveness can be achieved using the gender-sensitive approach, which takes into consideration gender disparities in developing a curriculum and setting classroom rules. This approach is inclusive since it entails presenting the gender component to the learning materials and incorporating gender-sensitive publications into the course readings and homework (Mihajlović Trbovc & Hofman, 2015). Owing to the pandemic, a partnership between the DepEd and the United States Agency for International Development (USAID) created several DepEd TV shows that advocate gender equality and fairness (Department of Education, 2021). This example of a gender-responsive education program was observed to create multiplier effects (Galamgam et al., 2021).

Studies suggest that school and curricula interventions need to be more gender responsive. For teachers, progressive awareness of their students' gender identity, including complex terminologies and language, will lead to non-discrimination (Mitchell & Mitchell, 2019). Teachers may also consider and integrate gender in the curricula, lesson plans, and learning activities (Abraha et al., 2021; Zhu et al., 2022) that must accommodate and address learning needs (Abraha et al., 2021).

Having faculty members and administrators open to communication and support is crucial (Mitchell & Mitchell, 2019). It is suggested that stakeholders may develop extracurricular activities and gender-related resources (Zhu et al., 2022). Creating a welcoming and inclusive classroom will further foster communication (Mitchell & Mitchell, 2019), thereby contributing to gender equality in classrooms.

3. Methodology

3.1. Research design

The phenomenological approach was used to examine the teachers' experiences (Langdridge, 2017) on how they implemented a gender-responsive approach in Science instruction. Specifically, this study utilized descriptive phenomenology, which is used to explore and describe the lived experiences of individuals (Christensen et al., 2017) and to understand further the aspect of those experiences (Matua & Van Der Wal, 2015). Furthermore, bracketing was applied to eliminate bias in results, whereby the researchers put aside their own beliefs, feelings, and assumptions (Lester, 1999). In conducting a phenomenological study, Boyd (2001) and Groenewald (2004) considered that around two to ten participants are already sufficient to aim for saturation to attain the study's research objectives.

3.2. Participants of the study

The study involved two teacher-participants from Cordillera Administrative Region (CAR), Philippines, during the school year 2021 – 2022. The participants were selected through purposive sampling, enabling the selection of knowledgeable and experienced participants on the phenomenon under study (Creswell et al., 2011). The participants were faculty members teaching at the secondary level and specializing in Science. No other criteria in the selection process were included owing to the educational situation affected by the pandemic. Specifically, Participant A has more than eight years of teaching experience at the junior high level in a public school. On the other hand, Participant B has more than three years of teaching experience in the senior high level of a laboratory school of a state university.

3.3. Data collection, management, and analysis

The conduct of this study upholds the practice of scientific inquiry and the ethical and professional standards in doing research. A semi-structured interview was the primary means of collecting the data. An interview guide consisting of items covering the participants' overall teaching experiences (Magnusson & Marecek, 2015) was used to ensure detailed information. Owing to the pandemic and the observance of health protocols, the interview was conducted through online video calls for both participants with their informed consent. Follow-up interviews were also conducted to recognize the participants' experiences and attain data saturation comprehensively. The follow-up interview led to emerging insights based on the reflection of the results (Polkinghorne, 2005). It also provided opportunities for clarification (Smith, 1994) and enhanced the validity of the gathered data (Holter et al., 2019).

The seven-step phenomenological approach of Colaizzi (1978) was utilized in data analysis. Using this approach, the results are a “concise yet all-encompassing

description of the phenomenon under study". First, the researchers re-read all the raw and translated transcriptions a few times to familiarize themselves with the contents and gain a deep understanding. Second, statements or phrases directly significant to the phenomenon under study were identified and extracted. Third, meanings were formulated from the recognized and extracted meanings. The fourth step involved clustering the formulated meanings into common themes of all the accounts. Fifth, inclusive descriptions of the themes were developed. Sixth, the descriptions were condensed into a short statement that is essential to the structure of the experiences. Lastly, the vital structures were validated by the participants (Morrow et al., 2015). This process enabled the collection and understanding of the participants' experiences of implementing a gender-responsive approach.

4. Findings

Five main themes emerged from the validated data of the participants' experiences pertaining to (a) the students' genders and their relation to behaviors and performances, (b) gender-responsive teaching approaches, (c) gender-responsive teaching methodologies and strategies, (c) effects of gender responsiveness, and (d) challenges of implementing gender-responsive Science education. However, it must be noted that both participants emphasized that the gender-responsive approaches they shared were only applicable in regular, face-to-face classes rather than during the height of the pandemic owing to the distance and modular approach where direct interaction was restricted.

4.1. Gender of the students and their performance

The first theme relates to the gender of the students whom the participants taught. Determining the students' gender affected how the teachers implemented gender responsiveness into their instruction. Accordingly, gender also plays a relevant role in the students' performances.

4.1.1. Gender of students

According to both participants, their students were familiar with the context of gender identity and expression as well as gender issues such as bullying. In their classes, there will always be LGBTQ students. However, they noted that these students only comprised a minority of the class. Both participants had students who were very straightforward about their gender during their self-introduction. Some students were also very expressive with their behaviors and how they dressed to show their gender identity. As Participant B expressed:

> *"You can identify the gender of the students even if they do not tell you. It sometimes shows how they dress, move, and use make-up when they come to school."*

However, Participant B implied that the students' appearance will not always correctly identify their gender. Sometimes, their gender will be determined as the school year progresses or if the students share it themselves. Additionally, Participant B stated that gender-related problems in the classroom were less likely to happen since students were already exposed to and were already accepting of the members of the LGBTQ. In support of this, Participant A indicated:

> *"It is already an unspoken rule among the students since gender is well-represented in the classroom. It is already expected that some LGBTQ students will be enrolled in each class."*

4.1.2. Behaviors and performance of students

In the Philippine secondary education Science classrooms, four major subjects of Science are taught: Biology, Chemistry, Physics, and Earth and Space Science. In these fields, both participants observed differences in the students' behaviors and performances concerning their gender. Both participants claimed that females were more interested and active in Biology. Participant A mentioned that maturity among females, including LGBTQ students, was prevalent when the lessons related to life cycles, puberty, reproductive systems, and sex education. In contrast, the males approached these topics pretentiously yet enthusiastically. Female students were more mature in learning lessons and better at memorizing. As Participant B stated:

> *"Females were more interested in Biology since it is more about concepts and terminologies. Ladies were generally better at memorizing Biology terms compared to gentlemen."*

In Physics, both participants have the same claims that males were more active than females. Males were faster at computing problem sets and deriving formulas; they also asked more questions. Participant A added that male students tended not to review their notes but were nevertheless able to solve problem sets. As Participant A noted:

> *"Boys were quick to solve problems. They were faster when it came to computations. Thus, they were able to give immediate answers but are not always correct."*

In Chemistry, the participants had contrasting observations. Participant A claimed the females excelled since the subject involved memorization activities. As shared by Participant A:

> *"The ladies were excelling and better at memorization, just like in Biology. They could memorize the elements, chemical symbols, and formulas."*

In contrast, Participant B indicated that all genders were active and performed well in Chemistry. As Participant B implied:

> *"There were no observable differences among the gender of my students as to who was more interested or active in Chemistry. They performed equally."*

Lastly, in Earth and Space Science, Participant A stated that LGBTQ students performed better. Participant A specified that these subjects revealed more of the creativity and resourcefulness of LGBTQ students. The subject involved more creation of projects and outputs such as models and dioramas. As Participant A mentioned:

> *"LGBT students were creative and expressive with their ideas, opinions, and projects, especially with climate change. They were able to use recycled materials to do their projects."*

On the other hand, Participant B claimed that female students performed well in Earth and Space Science. Accordingly, these subjects involved many terminologies rather than computing problems. As Participant B shared:

> *"Females were excelling. They can memorize most descriptions and characteristics. Ladies are better at memorization as compared to males."*

In general, both participants noted that LGBTQ students were not commonly observed to excel or perform better in Science than males and females. This scenario was due to their small numbers in class. Participant A further explained that LGBTQ students were viewed by their classmates as 'all-rounders' who could do well in most subjects but not in Science. As Participant A conveyed:

> *"Members of the LGBT excelled more in extracurricular activities such as dancing and performances but were not very observable in Science."*

4.2. Gender-responsive approaches

The second theme is associated with how the participants employed gender responsiveness in teaching Science. The participants' gender-responsive approaches not only pertain to their ways but are also related to the gender responsiveness of the school.

4.2.1. Preparing lessons

Participant A stated that specifying gender-responsive strategies or activities in their lesson plans is unnecessary. However, specific contents of the lesson plans may be highlighted to indicate the gender-responsive approach when required. Participant A added that gender-response conduct was also innate and sometimes depended on the situations that may occur during instruction. Participant B shared that gender responsiveness is not particularly identified in the syllabus but must be implemented and may be identified. Participant B added that gender responsiveness is not always dependent on the topic but is applied to the learning activities. Participant B gave an example:

> *"In the solar system, there is no male or female gender on the planets. I only integrated gender when the students were grouped to create models collaboratively or when the topic was biological."*

Participants used varied resources to prepare instructional materials (IMs), which are a variety of educational materials and resources used to support the teaching and learning process. They searched for visual examples that showed gender equality, such as pictures of scientists or related professions, including books, clip-arts, and video clips. However, both participants said they primarily used visuals that only showed a specific gender owing to limited resources. In this case, the participants clearly explained to their students that the general context is applied across all genders. As Participant B shared:

> *"I explain why my IMs were presented in that way. For example, with the use of colors in my cartolina. I explain that it not gender-specific. What if it is the only material available, and I do not have the time to buy other colors."*

4.2.2. Gender-fair language

Both participants used gender-fair language in referring to their students and in giving examples. The participants mentioned that they tried to use gender-neutral pronouns such as ″they″ instead of ″he″ or ″she″. Both participants used the students' preferred names when calling on them, such as during recitations. However, Participant A implied that using gender-neutral terms is not always applicable in Science. Using gender-specific pronouns or names is also necessary when teaching Science concepts. Participant A gave an example:

> *"It is not always applicable at all times. For example, we cannot use 'they' when discussing menstruation. That term is specifically applied to girls, so I must use 'she'."*

4.2.3. Extracurricular activities

It is common practice for educational institutions to conduct national or local celebrations. Celebrations concerning gender include National Children's Month, National Breastfeeding Month, and Anti-Violence Against Women and Children (VAWC), among others. Both participants implied that these gender-related celebrations were integrated into Science where their students could participate. Participant A shared that through these celebrations, students would gain a further understanding of gender equality and that it significantly helped when discussing specific topics. Participant B added that the students also attended seminars related to GAD. As Participant A mentioned:

> *"It exposes my students to other gender-related activities outside the classroom. So, discussing some concepts is easier since the students already have prior knowledge."*

4.3. Gender-responsive teaching methodologies and strategies

The third theme details the gender-responsive teaching methodologies and strategies employed by the participants. By doing so, students' gender issues were addressed in delivering lessons and providing learning activities.

4.3.1. Profiling system

At the beginning of the study, Participant A collected students' personal data information using a self-designed survey form that had to be signed by the student and their parents or guardians. These forms were confidential and exclusively used by the participant in classes. Part of the survey forms relates to the students' experienced gender issues. Participant A used the form in order to gain insight into the students' backgrounds to address gender issues immediately and to be able to identify teaching strategies in advance. As Participant A conveyed:

> *"I have my profile which I termed as profiling of students. It looked like an index card. This is not just in terms of gender but also to further understand the student's history regarding their experiences concerning their genders."*

4.3.2. Sharing

Participant A encouraged sharing in class. Accordingly, when it comes to gender-related topics, sharing allows the students to express themselves and correct misconceptions about their gender identity. Some gender-related topics include

gendered social norms, sex education, and bodily changes during puberty, among others. Sharing also allowed them to explain their gender preferences and gender-related issues such as bullying and discrimination, thereby enabling the teacher and their classmates to understand them better. As Participant A indicated:

> *"It is essential to learn and have a deeper understanding of what the students are going through. These opportunities will let the students know how they will be understood. Students could share what they were experiencing, causing their classmates to understand them better."*

4.3.3. Group work and projects

Participant B explained that the mixing of genders must be applied to group work and projects to reflect gender equality. There must be no group consisting of either males or females only. Participant B altered the groupings when homogenous-gendered grouping was done and added other genders, including LGBTQ students, within the group. As Participant B indicated:

> *"I gave them the leeway to choose their groupmates or partners, but I needed to check it. If there were homogenous groups, I would give them other options, such as revising the groupings and adding different gender into the group."*

Participant A implied that there should be no dominant gender in leadership. All group members could choose their leader based on the student's ability and not their gender. Participant A added that if the same groupings were used long term, all members were given an equal opportunity to be leaders. As Participant A shared:

> *"Choosing a student to become a leader regardless of gender will lessen gender problems in the group. Plus, they will all experience being the group leaders."*

4.3.4. Reporting and presentation of outputs

Participant B explained that all genders were well represented when it came to reporting or during the presentation of outputs. Every student must discuss or report in class. Participant B implied that the gender of the students was not a factor when it came to reporting. In the case of Participant A, gender-specific lessons were sometimes given to the opposite gender. This allowed the students to learn concepts and better understand the lessons where familiarity may be developed. As an example, Participant A shared:

> *"I will give the topic of the menstrual cycle to be discussed by the males. Aside from the definitions, they must discuss further what should be done to help when females are on their period and how to address the problems they may encounter."*

4.3.5. Problem-solving activities

Even though males were quick in problem-solving, both participants gave their students equal problem-solving opportunities. For Participant A, assigning a particular problem to be solved in advance would ensure that all genders were well represented. Participant B indicated that various genders were called up to solve a problem on the board. When there are two problems, equal distribution will be done. As Participant B shared:

> *"From the students raising their hands, I choose different genders to solve the problems on the board. I only assign problems to specific students when a few raise their hands."*

4.3.6. Laboratory activities

Both participants commonly observed that male students prefer to refrain from handling laboratory tools and equipment when performing laboratory activities. Performing the procedures was also done mainly by females and LGBTQ students. According to Participant B, males feared they might break the materials, whereas females and LGBTQ students were gentler in handling tools and equipment. In this case, Participant B implied a need to explain how to perform the laboratory activity and emphasized that each student in the group had to participate. Therefore, all students are given an equal chance of performing tasks for all conducted laboratory activities. As Participant B mentioned:

> *"I let them have the equal opportunity to hold and use the laboratory tools and equipment so that they will not be at a loss in the future, especially when they go to college. I gave them equal chances and exposed them to lab activities."*

4.3.7. Games

In utilizing games as a learning activity, Participant B grouped the students heterogeneously based on gender. Specific rules were given to the students, and they were not allowed to break them. This allowed effective communication and encouraged teamwork. Participant B added that the students' critical thinking skills were developed since they developed and applied strategies to maintain the game rules while simultaneously learning. Participant B gave an example:

> *"One of the rules was to be linked together at all times. One of the group's strategies was to tie their clothes together instead of holding hands since they were embarrassed to hold the hands of the opposite sex. In another group, they could hold hands, but the boys and girls were arranged in succession. In another group, LGBTQ students were placed between boys and girls."*

4.3.8. Constructing assessments

Participant A indicated that common names were used when giving problem sets. Giving realistic situations would also ensure clarity among the students. For Participant B, when the names of males were used in the first problem, the second problem had to use a female name, allowing equal distribution of genders in problem sets. Both participants also explained that they avoid relating and giving examples of problems that are gender biased such as relating strength and power to males and slowness and weakness to females. As an example, Participant B explained:

> *"I use standard examples. If not, I use factual records and real-life events, such as records of athletes in the Olympic Games. There was also no need to use gendered names since the names were already specified in these events."*

4.4. Effects of a gender-responsive approach

The fourth theme relates to the significant effects of implementing a gender-responsive approach in Science instruction. It impacts the students' learning development, performance, and achievements. As a result, gender equality is attained in Science classrooms.

4.4.1. Attainment of gender equality

Participant A explained that the teacher's role is to construct learning objectives and design activities integrating gender. This provides equal learning opportunities among the students and prevents gender issues. In doing so, all students participate well during discussions and activities. As Participant A shared in planning for activities:

> *"No specific activities were given based on gender since the students would complain. Students might ask: Why is the activity only done by the males, which is, in fact, as females, we can also do that? This will make the students realize that lessons and activities are not only specific to a particular gender."*

Participant B explained that the students would not feel isolated but instead involved during lessons and activities. This led to active communication and participation in group work. There was no conflict among the students. Hence, they perform without restrictions according to their capabilities.

4.4.2. Boost the confidence of students

Both participants agreed that implementing a gender-responsive approach in Science teaching impacted the students' confidence levels. Participant A claimed a significant difference in the students' confidence levels during the start of classes compared to the end of the school year. It affects not only the performance of the students but also their personal development as well. As Participant A reported:

> *"There was a noticeable increase in the confidence level of the students. Their confidence was better at the end of the grade than on the first day of class. Sometimes, I observed a total change."*

In the case of Participant B, the increase in the students' confidence level was related to their gender expressions. Accordingly, the institution's policy states that cross-dressing is allowed in the school: however, students must process their consent forms. This allowed the students to express themselves and participate freely. The students can confidently recite, solve problems on the board, and give presentations in front of the class. As Participant B shared:

> *"Cross-dressing is allowed inside the school. Boys can also have long hair. This allowed them to be expressive of their genders. It is directly observable that the students were overflowing with confidence."*

4.5. Challenges affecting gender responsiveness

The last theme relates to the challenges experienced by the participants in employing gender responsiveness in Science classrooms. These challenges did not only affect the teachers' instruction but their students' learning as well.

4.5.1. Student-related factors

Though gender equality is achieved in the classrooms and the students were familiar with their gender identity and could express their gender, both participants claimed that the student was the main factor affecting gender responsiveness in Science. Participant A stated there were difficulties in introducing gender-related topics since some students perceived them as inappropriate or lewd. As Participant A shared:

> *"Some of the topics were considered taboo by the students, like reproductive systems. Other students may want to keep it private and avoid talking during discussions."*

Participant B stated that some students did not feel welcome, could not fully express themselves, and did not participate well in class when they were in a group that was not accepting of their gender. This situation limited how gender responsiveness was applied since divergence already existed among the students. As shared by Participant B:

> *"If the students are in a group that is not open-minded, expressive, and not accepting, they will tend to stop talking and choose not to participate well."*

4.5.2. Culture-related factors

With the diversity of students, varied cultures and beliefs are present within the classroom. Both participants stated that culture is a factor that affects how gender is integrated into Science. Participant B explained that sometimes it was difficult to explain topics related to gender or to correct misconceptions owing to the student's cultural background, beliefs, and norms. During discussions, some students were very timid about sharing and tended not to participate well, thereby affecting their performance. Participant A explained that there were limitations on how students expressed themselves. Some LGBTQ students were being bullied because of how a particular culture perceived them. Some cultures are still not very accepting of LGBTQ members. However, Participant B noted that bullying related to gender is no longer common among students and rarely happens. As Participant B shared:

> *"Well, especially in our locality, our culture is not very vocal and not accepting of the gender preferences of some students. Some cultures force them to act according to their sex and not their gender since the community views it negatively."*

5. Discussion

The inclusion of gender in school has been observed to reduce gender issues and promote awareness of gender equality and equity (Abraha et al., 2019; Wigati, 2019). In this study, both Participants A and B shared that there were more females than males, and a minority of LGBTQ students in the class, reflecting the gender gap in the enrollment ratio similar to the observations of Belal (2009) and Nishimura (2017). However, this is already an implication that all genders are well represented in Science classrooms. Though there have been positive developments in addressing gender issues in Science education, gender differences in the students' performances are still observable (Meinck & Brese, 2019; Kang et al., 2019; Makarova et al., 2019). In Physics, both Participants A and

B claimed that male students were faster in computing problem-solving activities, which may indicate that they have better kinesthetic modalities than females. This relates to the works of Honigsfeld and Dunn (2003) and Sarabi-Asiabar et al. (2014) who found that the kinesthetic learning style is dominant among male students.

Participant A observed that females were better in Chemistry, while Participant B claimed that both genders performed equally. The LGBTQ students were more creative in Earth and Space Science, as observed by Participant A, while the females excelled according to Participant B. Lastly, both participants observed that female students performed better in Biology. Accordingly, females excel at memorization which may relate to their sharper conceptual understanding, as supported by Severiens and Dam (1997), compared to the creativity of LGBTQ students and the problem-solving speed of the males. Further, both participants observed that LGBTQ students did not generally excel in Science but were more creative and better at executing performances. Currently, studies supporting the creativity skills of LGBTQ students are lacking. Nonetheless, the gender differences in the students' performances may be affected by their preferences, perceptions, and interests in Science, as identified by Kang et al. (2019) and Makarova et al. (2019). However, Halpern et al. (2007) noted that the relationship between students' performances and their genders has no specific and clear explanations and that other factors must be considered.

In the utilization of a gender-responsive approach in preparing Science lessons, both participants indicated the integration of gender in their preparation of teaching and learning activities and in the selection of IMs that cater to the students' needs (Abraha et al., 2021). Though similar to the works of Hearn and Husu (2011) and Lee (2021), there were still challenges in preparing educational materials since most resources are gender biased, which shows a majority of male characters compared to females. It posed limitations on how the participants integrated gender in creating IMs. This may also include pretence challenges for the students. According to USAID (2017), instead of helping the students to address gender issues, the educational materials may negatively reinforce gender roles and can discourage and affect their academic performances negatively if not utilized appropriately. Nonetheless, ensuring that the IMs present gender equality exposes the students to positive meanings and will allow them to understand that all social groups are equal (Lee, 2021; USAID, 2017).

As part of teaching, both participants used gender-neutral terms, such as ‘they’ instead of ‘he/him’ or ‘she/her’, or using the students’ specific names. Calling or addressing the students using their preferred names relates to their gender identity. Using gender-neutral forms instead of masculine and feminine characters is becoming a common trend, as USAID (2017) highlighted. By using gender-fair language in Science, non-specific representations of gender in lessons may impact students' perceptions, lessen how they view gender stereotypes, and lead to non-discrimination, as Mitchell and Mitchell (2019) emphasized. Apart from delivering instruction, the participants allowed and provided extracurricular gender-related activities in which the students could participate.

These activities helped in the students' learning development outside the classroom. Apart from the lesson plans, other gender-related activities could supplement students' understanding and learning (USAID, 2017). They could support the students in developing an appreciation for others' differences and similarities and sharing or discussing pertinent ideas and issues surrounding gender.

Both participants utilized various gender-responsive teaching methodologies and strategies to promote students' gender equality in the Science classrooms, similar to those reported by Ananga (2021) and Lee (2021). It implied full implementation of gender responsiveness in facilitating instruction in support of the DepEd's (2017) GRBE policy. Utilizing gender-responsive teaching methodologies and strategies forces the students to learn and recognize the characteristics of other genders. For group work, allowing mixed groups of students fosters gender-responsive collaborations, which conforms with the views of Akhigbe and Adeyemi (2020). Ensuring that males participate in laboratory activities established their involvement in performing the procedures. Sharing among students enabled them to know one another and express who they are concerning their gender identity. Assigning tasks to all students gave them equal chances to learn and participate. Ensuring every student gives a presentation and leads in group activities ensures a balanced gender representation. In effect, gender-responsive approaches significantly affect the students' performance, as USAID (2017) underscored.

Due to gender responsiveness by both participants, there has been a noticeable impact on the students. The participants shared that there has been a progressive decline in the traditional view of gender separating males and females in congruence with the views of Beechey and Moon (2015), Toraman and Ozen (2019), and Shayan (2015). This declining traditional view includes the presence of LGBTQ students in the classrooms. This promoted the attainment of gender equality in Science classrooms, leading to equal opportunities for learning among the students. The increase in students' confidence levels influenced them to participate actively and be more confident of their gender identity, which agrees with the observations of Akbari and Sahibzada (2020).

Though the gender-responsive approach is deemed adequate, there were challenges identified by the participants. The personal perceptions of students regarding gender affected how the participants conducted gender responsiveness, thereby creating conflicts of interest that affected instruction. There is the expectation and the assertation of how males and females must behave and act based on culture and tradition, as noted by Schalkwyk (2000). Some of the students were bullied because of gendered cultural views, thereby limiting them from actively participating. However, the participants noted that bullying due to gender differences rarely occurred. This may relate to the need for culture to change and be adaptive as society needs to respond to social and economic shifts correlated with globalization, the progress of science and technology, and societal pressures, as stressed by Schalkwyk (2000). Consequently, the implementation of a gender-responsive approach by

Participants A and B was fruitful, helping to attain gender equality and providing equal access to learning opportunities among the students in the Science classrooms.

6. Conclusion

Educational institutions continue to help in addressing gender issues and promote gender equality. Teachers have been instrumental in this endeavor and have played significant roles by providing equity in education and employing gender responsiveness. Gender responsiveness in education reflects understanding gender and how to respond systematically to gender differences among students. The study's findings offered a glimpse into implementing a gender-responsive approach in Science education. There is a clear indication that both participants integrate and relate gender in their preparation of lessons and learning activities, even with the limited educational resources that portray gender issues in Science. Gender responsiveness was shown by using varied teaching approaches and methodologies that addressed gender differences among the students. Despite the challenges, gender-responsive approaches and methodologies enabled them to address gender issues and attain gender equality in Science classrooms. The equal learning opportunities and increased confidence of the students strongly support this.

However, it must be emphasized that the relationship or role of gender in Science is still only vaguely understood. Nevertheless, the study justifies that the implementation of a gender-responsive approach does not only attain gender equality but also impacts students' performances in Science classrooms. The study can also contribute to the findings and results of related studies concerning students' gender and addressing gender issues in the classroom. However, it must also be noted that the study's findings only relate to the experiences of the two participants on how they integrated a gender-responsive approach in their Science classrooms and does not represent general experiences of Science teachers at the basic secondary level. It is suggested that further studies be undertaken.

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8. References

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