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GENDER-RELATED DIFFICULTY OF GENERAL PHYSICS: ITS RELATIONSHIP IN ACADEMIC PERFORMANCE AMONG GRADE 12 STEM STUDENTS

(Research article)

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Abstract

Many people believe that physics is a challenging and complex subject that requires a high degree of technical and mathematical expertise. This study aims to determine the degree of gender-related difficulty of General Physics 1 and 2 for Science, Technology, Engineering, and Mathematics (STEM) students in grade 12 at the College of Maasin. Employing complete enumeration, the researchers surveyed the students using their developed questionnaire, which was subjected to validity and reliability tests. As a result of the study, both males and females perceived physics as an "easy" subject. However, it can be observed that female students marked more competencies as "exceptional" than male students. Thus, even though all students demonstrate exceptional academic achievement in physics, it was determined that female students face greater challenges than their male counterparts. Additionally, it was found that there is no statistical correlation between how difficult Physics is and their academic performance. This indicates that even while students perceive physics as relatively easier, their academic performance does not consistently align with this perception. The findings highlight the need to strengthen foundational physics instructions and implement gender-responsive pedagogical strategies to support equitable engagement and confidence among learners.

Keywords: Academic performance, gender, level of difficulty, physics, STEM

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1. Introduction

Physics is a core subject in the Science, Technology, Engineering, and Mathematics (STEM) strand. High school students and physics teachers find the subject challenging because they have to deal with multiple representations at the same time, such as experiments, formulas and calculations, graphs, conceptual explanations, and models are required to grasp the concepts (Candido et al., 2022).

Many people believe that physics is a challenging and complex subject that calls for a high degree of technical and mathematical expertise. According to Lederman and Abell (2020), it is one of the subjects that has the lowest interest of the students among all science subjects, because physics learning includes difficulties that are due to the particular nature of physics knowledge. Concerning this, the 2022 results of the Program for International Student Assessment (PISA), conducted by the Organization for Economic Cooperation and Development (OECD), show that the Philippines ranked 77th out of 81 participating countries, with 77% of students classified as low-performing, which suggests that Filipinos are struggling in science-related subjects. The Department of Education recognizes the urgency of addressing issues and gaps in attaining the quality of basic education in the Philippines. In addition, the 2018 PISA results revealed that female students obtained an average score of 359 points for Scientific Literacy, which was slightly higher without a significant difference from the average score of male students (355 points), which means that both male and female students encounter difficulties in this area. Furthermore, the significant gap in performance between students from private and public schools implies that access to resources and quality of education may play a role in how well students understand physics and other science-related subjects. Finally, the significant gap between Senior High School and Junior High School students' performance highlights the challenges of teaching physics to younger students, which may require specialized teaching methods and more resources to help them succeed. These findings suggest that physics is indeed a challenging subject that requires significant effort, resources, and support to learn effectively. However, others view it as an exciting discipline that has the potential to transform understanding of the world around and to drive technological innovation and progress.

Numerous research studies indicate that while students have a genuine interest in studying physics, they typically view it as a challenging subject (Baran, 2016; Kalender et al. 2020). For STEM students, Physics 1 covers the topics on mechanics of particles, rigid bodies, and fluids, waves as well as heat and thermodynamics. Physics 2 includes topics on electricity and magnetism, optics, the basics of special relativity, and atomic and nuclear phenomena which are taught using the methods and concepts of algebra, geometry, trigonometry, graphical analysis, and basic calculus. Due to its complicated and abstract concepts, students' interest in learning Physics is relatively low.

Recent studies continue to affirm that physics is widely regarded as one of the most difficult science subjects due to its abstract nature and mathematical demands. Musters et al.

(2024) found that students often struggle with physics not because of lack of interest, but due to perceived complexity and low self-efficacy, particularly among female learners. Similarly, Van Dusen (2025) emphasized that recognition and confidence in physics classrooms are unevenly distributed, with female students often underestimating their abilities despite performing equally well. Lastly, the study by Lavonen et al. (2021), suggests that students' declining interest in physics is not solely due to content difficulty but also to the lack of contextual relevance and inclusive pedagogy. When physics is taught in many ways that feel disconnected from real-world applications or students lived experiences, motivation tends to wane.

Gender also seems to play a significant role in students' proficiency in theoretical and practical physics, with male students generally outperforming their female counterparts. Moreover, Baran (2016) found that although female high school students do not report being less knowledgeable than their male counterparts in most areas of the discipline, they do tend to view physics as more challenging than their male classmates. These results are in line with research demonstrating that female students are less likely than male students to pick physics as a subject of study or career and have lower confidence in their physics skills (Miller et al., 2006). Furthermore, research has indicated that female students often view physics as a challenging subject and may encounter unfavorable preconceptions or prejudices from classmates, educators, and the general public. Lastly, Van Dusen (2025), further emphasized that internalized beliefs, rather than actual peer bias, often explain gaps in perceived recognition among female students. These factors can contribute to the underrepresentation of women in physics-related fields and highlight the need for interventions to promote gender equality in science education and careers.

Gender equality is one of the Sustainable Development Goals (SDGs) outlined by the United Nations and constitutes an essential component of sustainable development (Leal Filho et al., 2023). Achieving equality between the genders and empowering all women and girls by 2030 is essential to building a sustainable future (United Nations, 2015). Ending gender-based violence and discrimination, promoting women's economic empowerment, and ensuring that women have equal access to political representation, healthcare, and especially education are all essential to achieving gender equality (Chikwe, Kuteesa, & Ediae, 2024).

The current study is significant as it is the first to be conducted in Maasin, Southern Leyte area. It is anticipated that the current study's findings may lessen gender-based disparities in the field of science. Thus, it is expected that the study's conclusions will address the gap in local literature about this subject matter. Therefore, the purpose of this study is to ascertain to what extent General Physics 1 and 2 are challenging for STEM students in grade 12. Specifically, it sought to answer the following questions:

1. What is the profile of the respondents in terms of academic performance and gender?
2. What is the level of difficulty of General Physics 1 and 2 as perceived by the students?
3. What is the significant difference between the students' perceived difficulty in terms of gender?

4. What is the significant relationship between the students' perceived level of difficulty and their academic performance with respect to gender?

2. Method

2.1. Research Design

This study utilized a descriptive-correlational design under quantitative research. This is used in research to determine the relationship between several factors or variables (McBurney & White, 2009). Descriptive-correlational research design additionally, as stated by Donnelly (2017), describes the patterns of relationships among variables and attempts to identify and explain the underlying processes that give rise to them. This study aimed to determine the relationship between gender-related difficulty in physics and the academic performance of the students.

2.2. Setting and Participants

The College of Maasin, located in Tunga-Tunga, Maasin City, Southern Leyte, was established on August 25, 1924 by Dr. Angel C. Espina. Upon the enactment of the Republic Act 10533, which is the "Enhanced Basic Education Act of 2013" commonly referred to as the K-12 Program, the College of Maasin established its Senior High School in 2016, offering the following tracks: Academic and Technical-Vocational-Livelihood. The Academic track, which is the focus of this study, includes three strands: Accountancy, Business, and Management (ABM); Humanities and Social Sciences (HUMSS); and Science, Technology, Engineering, and Mathematics (STEM). All Grade 12 STEM learners in the College of Maasin, a total of 78 enrollees, 30 male and 48 female learners, participated in the study. The entire population was involved, ensuring that every learner took part in the research.

2.3. Data Collection Instrument

A survey questionnaire developed by the researcher, which included two parts, was used to gather the data. The first part of the questionnaire collected data regarding the participants' gender. The second part constitutes a Likert scale that focuses on the collection of their perception towards General Physics 1 and 2. The respondents were asked to rank the level of difficulty of the course as: (4) Very difficult with a verbal description of "Struggles to describe, explain, and solve (if necessary) the concepts of the lesson"; (3) Difficult with a verbal description of "Has slight difficulty in describing, explaining, and solving (if necessary) concepts of the lesson"; (2) Easy with a verbal description of "Can describe, explain, and solve (if necessary) the concepts of the lesson"; (1) Very easy with a verbal description of "Can easily describe, explain, and solve (if necessary) the concepts of the lesson."

The statements included in the Likert scale were taken directly from the Most Essential Learning Competencies (MELC) and were selected by the instructors teaching General Physics 1 and 2, based on their discussed topics. After the formulation, the survey questionnaire was validated by experts. A language teacher served as an expert in the clarity and comprehensiveness of the statements, and two master teachers in science were tapped as experts

on the validity of the content. The comments and suggestions were then incorporated, and the questionnaire was checked for the final phase.

2.4. Data Collection and Analysis

Before the data collection process, approval for conducting the study was obtained from the school administration. All participants received a clear explanation of the survey's objectives and were assured that their responses would remain strictly confidential. The respondents were given a researcher-made survey questionnaire. Furthermore, the researchers personally gathered the students' academic performance in General Physics 1 and 2, which are the scores for each quarter/grading period, through their instructor.

After the data had been collected, the following tests were used: 1) frequency and percentages to determine the male and female ratio of the respondents, 2) arithmetic mean to get the average academic performance of the learners in Physics 1 and 2, 3) weighted mean to determine the perceived level of difficulty on Physics 1 and 2, 4) t-test to determine the significant difference on the perceived level of difficulty between gender and 5) Spearman's Rank-order Correlation to computed the correlation between learners' perceived level of difficulty and their academic performance with respect to gender.

3. Results

Table 1shows that 30 participants (38.46%) are males, while the majority, comprising 48 students (61.54%) of the respondents, are females. The gender distribution observed in the study signifies a greater presence of female respondents in comparison to male respondents. In fact, in the College of Maasin Senior High School Department, only 37% of the whole population is male while the remaining 63% are female. However, the discrepancy in gender proportions does not affect the results since an appropriate percentage was applied.

Table 1. Gender of the Respondents

Gender	Frequency	Percentage
Male	30	38.46%
Female	48	61.54%
Total	78	100%

Table 2 shows that male learners achieved an average of 90.03%, while female learners obtained a slightly lower average of 89.88%. The results indicate that both male and female respondents performed exceptionally well academically, with only a minimal difference in their average grades. This slight variation does not suggest any meaningful disparity in academic performance between genders.

Table 2. Respondents' Academic Performance

Gender	Average Academic Performance
Male	90.03 %
Female	89.88 %

Table 3 shows the perceived level of difficulty of General Physics 1 and 2 competencies among Grade 12 STEM students. Among the female respondents, eight out of the 24 listed competencies were identified as "difficult", while the remaining were considered "easy". In contrast, male respondents recorded only two competencies as "difficult", with the rest perceived as "easy". These findings suggest that female students encountered more challenges in the subject compared to their male counterparts, although both groups generally found most competencies manageable.

Table 3. Level of Difficulty of General Physics 1 and 2 among Grade 12 Students

	Mean			
Competency	Female	Verbal Description	Male	Verbal Description
Solve measurement problems involving conversion of units, expression of measurements in scientific notation	2.13	Easy	2.30	Easy
Differentiate accuracy from precision	2.48	Easy	2.37	Easy
Differentiate random errors from systematic errors	2.77	Difficult	2.50	Easy
Use the least count concept to estimate errors associated with single measurements	2.79	Difficult	2.47	Easy
Estimate errors from multiple measurements of a physical quantity using variance	2.52	Difficult	2.33	Easy
Estimate the uncertainty of a derived quantity from the estimated values and uncertainties of directly measured quantities	2.56	Difficult	2.47	Easy

Estimate the uncertainty of a derived quantity from the estimated values and uncertainties of directly measured quantities				
Differentiate vector and scalar quantities	1.90	Easy	1.80	Easy
Perform addition of vectors	2.21	Easy	1.97	Easy
Rewrite a vector in component form	2.58	Difficult	2.20	Easy
Calculates directions and magnitudes of vectors	2.35	Easy	2.07	Easy
Convert a verbal description of a physical situation involving uniform acceleration in one dimension into a mathematical description	2.75	Difficult	2.50	Easy
Recognize whether or not a physical situation involves constant velocity or constant acceleration	2.48	Easy	2.17	Easy
Solve for unknown quantities in equations involving one dimensional uniformly accelerated motion	2.46	Easy	2.57	Difficult
Use the fact that magnitude of acceleration due to gravity on the Earth's surface is nearly constant and approximately 9.8 m/s^2 in free fall problems	2.19	Easy	2.17	Easy
Solve problems involving one dimensional motion with constant acceleration in contexts such as but not limited to the "tail-gating phenomenon", pursuit, rocket launch and free fall problems	2.81	Difficult	2.43	Easy
Describe using a diagram charging by rubbing and charging by induction	2.33	Easy	2.20	Easy
Explain the role of electron transfer in electrostatic charging by rubbing	2.21	Easy	2.33	Easy

Describe experiments to show electrostatic charging by induction	2.42	Easy	2.40	Easy
Calculate the net electric force on a point charge exerted by a system of point charges	2.21	Easy	2.40	Easy
Describe an electric field as a region in which an electric charge experiences a force	2.21	Easy	2.10	Easy
Calculate the electric field due to a system of point charges using Coulomb's law and the superposition principle	2.10	Easy	2.03	Easy
Calculate electric flux	1.85	Easy	1.83	Easy
Use Gauss's Law to infer electric field due to uniformly distributed charges on long wires, spheres and large plates	2.06	Easy	2.13	Easy
Solve problems involving electric charges, dipoles, forces, fields and flux in contexts such as but not limited to system of point charges, electrical breakdown of air, charged pendulums, electrostatic ink-jet printers	2.60	Difficult	2.80	Difficult
Mean	2.28	Easy	2.38	Easy

Note: The competencies identified were taken from the Department of Education Curriculum Guide however, only the competencies taught were included.

Tables 4 and 5 present the different perceptions of the difficulty level of Physics courses concerning gender. Analysis of Physics 1 reveals a statistically significant difference between genders, $p = 0.0393$. However, this difference is not observed across all areas of the study. Specifically, Table 5 indicates no significant difference ($p = 0.749$) in perceived difficulty in the topics covered in Physics 2. This suggests that understanding the fundamental concepts of Physics may play a role in mitigating perceived difficulty.

Table 4. Difference on perceived Level of Difficulty on General Physics 1 in terms of Gender

Group	M	SD	W-value	p-value	Decision
Male	2.2778	0.3808	920.5*	.0393	Reject H_0
Female	2.4625	0.3909			

*Significant at 5% level**

Table 5. Difference on perceived Level of Difficulty on General Physics 2 in terms of Gender

Group	M	SD	t-value	df	p-value	Decision
Male	2.2518	0.4686	-0.3217	49.012	.749	Accept H_0
Female	2.2198	0.3495				

*Significant at 5% level**

Table 6 shows the relationship between the students' perceived level of difficulty and their academic performance with respect to gender. For the male respondents, the value indicates a weak and statistically insignificant relationship between their perception of physics as an easy subject and their actual academic performance ($\rho = 0.1873$, $p = .3215$). Likewise, for female respondents, it also marks a weak negative association ($\rho = -0.1980$, $p = .1773$). This result implies that their academic performance does not consistently align with this perception. Thus, there is no significant relationship between the students' perceived level of difficulty and their academic performance with respect to gender.

Table 6. Relationship between the students' perceived level of difficulty and their academic performance with respect to Gender

Groups	ρ(rho)	p-value
Male	0.1873	.3215
Female	-0.1980	.1773

*Significant at 5% level**

4. Discussion

The findings of this study reflect broader global trends in gender and education. As shown in Table 1, the majority of respondents showed a pattern consistent with global data from UNESCO (2020), which reported that females' enrollment rates have surpassed those of males across primary, secondary, and tertiary levels. Between 1995 and 2018, 55% of the global increase in primary and secondary enrollment was attributed to female students, with Southern Asia, particularly India, exhibiting higher female enrollment in both educational stages.

Despite this demographic dominance, academic performance between genders remains comparable. Table 2 reveals that male students achieved an average grade of 90.03% while female students closely followed with 89.88%. This minimal difference supports Baran's (2016) assertion that there is no academic superiority of males over females in Physics. More recent findings by Musters et al. (2024) suggest that while teachers often perceive males as having more innate talent in physics, females are recognized for their effort and self-regulation traits that can contribute to strong academic outcomes despite persistent stereotypes.

However, perceptions of difficulty in Physics reveal a more nuanced picture. Table 3 shows that female respondents identified eight out 24 competencies in General Physics 1 and 2 as "difficult", compared to only two among male respondents. This aligns with Veloo et al. (2015) and Saleh (2014), who observed that female students tend to experience greater difficulty comprehending physics concepts. Yet, Musters et al. (2024) found that females were more likely to engage teachers through questions, suggesting a proactive approach to overcoming perceived challenges. Baran (2016) similarly noted that male students report less difficulty in physics, although no significant difference was found in mean scores regarding abstract concepts. In the present study, both genders ultimately perceived General Physics as "easy" with only a 0.10 difference in mean scores, suggesting that while female students may initially perceive greater difficulty, their overall understanding remains comparable.

Kalender et al. (2020) reported that males generally exhibit higher self-efficacy in Physics, which may contribute to their lower perceived difficulty. However, this trend is not universal across all topics. As shown in Table 5, no significant difference ($p=0.749$) was found in perceived difficulty for Physics 2 topics, indicating that foundational understanding may mitigate gender-based differences in perception. This supports the idea that instructional clarity and conceptual reinforcement can help bridge perceptual gaps.

Further evidence that academic performance and perceived level of difficulty do not correlate to each other can be derived from the study of Marušić et al. (2017), claiming that even while girls outperform boys academically in physics, they view the topic as challenging because they underestimate their own skills and chances of success. This psychological dimension is echoed in recent work by Van Dusen (2025), who found that female students report lower levels of perceived peer recognition in physics classrooms despite receiving similar levels of actual recognition as their male peers. Such disparities in internalized recognition can affect students' physics identity and long-term engagement with the subject.

Overall, the study highlights the need for gender-responsive pedagogical strategies that not only promote academic equity but also address perceptual and affective barriers to learning. By cultivating inclusive environments and reinforcing students' belief in their capabilities, educators can help ensure that both male and female learners thrive in physics and other STEM disciplines.

5. Conclusions

This study examined gender distribution, academic performance, and perceived difficulty of General Physics 1 and 2 among Grade 12 STEM students. The results revealed a higher proportion of female respondents, yet academic performance between male and female students remains statistically comparable. Despite this parity, female students reported more competencies as "difficult", suggesting a perceptual gap that may not reflect actual ability but rather internalized beliefs and confidence levels.

These findings highlight the importance of addressing not only cognitive outcomes but also affective dimensions of learning STEM education. While both genders demonstrated strong academic performance, the disparity in perceived difficulty highlights the need for pedagogical strategies that foster self-efficacy, challenge stereotypes, and promote inclusive learning environments.

To address the perceptual and affective differences observed in this study, educators should adopt inclusive and confidence-building strategies in physics instruction. Activities such as peer-led tutorials, mastery-based assessments, and real-world applications can enhance engagement and reduce perceived difficulty, especially among female students. Promoting gender-inclusive classrooms through equitable participation, stereotype-free language, and visibility of female role models in STEM can help challenge biases and foster self-efficacy. Regular formative assessments should be used to monitor student perceptions and guide instructional adjustments. Finally, professional development for STEM educators must emphasize inclusive pedagogy and culturally responsive teaching to ensure all learners are supported equitably.

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Declaration of Conflicting Interests and Ethics

The authors declare no conflict of interest.

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