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Gender-Based Differences in Academic Achievement of Computer Science Programs

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Abstract: *This study investigated the impact of gender on the academic achievements of Computer Science (CS) students from SNSU. Utilizing a descriptive-comparative method involving a quantitative paradigm, 78 students were selected using a stratified random sampling procedure. The study looked into three dimensions of academic performance including the effectiveness of instructional approaches, active participation in class discussions, and assessment strategies. The findings revealed that female CS students tend to outperform male counterparts in all the three dimensions of academic achievement. Significant differences were recorded in active class participation (females: 3.78; males: 3.62) and assessment approaches (females: 3.81; males: 3.70). However, there was no marked difference in the use of effective instructional techniques between female and male respondents, who gave a similar mean score of*
3.69. This means that instructional technique, quality class discussion, and the fairness of assessment have greater impact on academic achievement compared to gender which has been considered as a determinant of academic achievement especially for technical courses. In response to the identified deficiencies, the authors proposed the Gender Responsive Academic Support Framework (GRASF).

Keywords: gender differences, academic achievement, computer science education, class participation, assessment methods, GRASF, Surigao del Norte State University

I. INTRODUCTION

The discipline of computer science has evolved into one of the most popular disciplines in tertiary education due to its widespread use in people's daily lives in all sectors such as health care, education, communication, and business. To meet the rising demand for technologically competent graduates, colleges have been enhancing their curricula in computer science. On the other hand, concerns regarding gender issues in the computer science industry still exist.

For many years, there has been evidence that women tend to enroll less in courses offered in computer science than men. Master et al. (2021) noted that cultural stereotypes and minimal introduction to computing during childhood, along with a lack of female role models in the computer science industry, are among the factors discouraging women from entering CS programs.

According to Kwon, Lee, and Kim (2025), as learners advance through their learning journey, gender-based differences become even more evident in terms of cognitive engagement and affective involvement in computer science classes. The researchers identified three key reasons for that, namely social pressures, quality of learning environments, and personal traits such as self-confidence and self-worth. Notably, what made their findings important is that it was suggested that the mentioned factors tend to intertwine and influence each other, something that previous studies have largely overlooked (Kwon et al., 2025; Lin & Wong, 2024).

Additionally, Lundberg (2020) emphasized the fact that despite the extensive number of studies devoted to analyzing gender disparities in enrollment rates, relatively few studies explored gender differences in terms of actual performance. In particular, most scholars were interested in the development of gender-based disparities from high school to college, but few attempted to examine the interactions between different types of influencing factors.

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The aforementioned gap is one of the reasons why this research was conducted. The researchers observed from their informal observation that there might be differences between the academic performance of the males and females in the Department of Computer Studies at SNSU despite the university's attempt for inclusion and gender equality. In light of these observations, the researchers developed the GRASF. This framework will assist them in addressing and solving any academic performance gaps of both male and female CS students.

Objectives of the Study

This study aimed to:

1. Explore the effect of gender on academic performance within the Computer Science Program.
2. Investigate how gender influences academic performance measures, such as GPA, grade scores, and participation in extracurricular activities.
3. Establish the reasons behind the variation in academic performances by both male and female students within the Computer Science Program.
4. Find out the methods employed by the program to foster gender equality within its ranks.
5. Offer evidence-based suggestions for improving academic support within the Computer Science Program.

II. REVIEW OF RELATED LITERATURE AND SYNTHESIS

Teaching Strategies

The connection between the teaching strategies used by teachers and gender-related achievement differences in CS programs has remained a recurring theme in educational literature. According to Ashlock et al. (2022), even though female students started the CS program with comparable academic preparedness, their grades declined much faster than that of their male counterparts. One reason could be gender underrepresentation and reduced confidence in technical settings. Earlier studies found out that when female enrollment numbers were low, a GPA difference of 0.2 to 0.4 would favor males while the reverse was the case with even gender representation.

Self-efficacy emerged as a crucial issue discussed by Asante, Ackah, and Frimpong (2023). The authors argue that while both male and female students had almost the same CS skills at the start of the program, males were far more confident than females about their technical ability. Such overconfidence led to better results among the former as compared to the latter. Boys enjoyed an advantage as the predominant members of CS classes in K-12 education.As a result, the findings of the research indicated that peer tutoring and project-based learning enabled the playing ground by increasing the retention rate of female students by about 15 to 20 percent, suggesting the significance of educational strategies that facilitate teamwork and engagement.

According to Cheruiyot et al. (2023), a further significant contribution was the effectiveness of hybrid and technology-based learning techniques in reducing the disparity between male and female performance. Strategies such as flippedclassrooms and simulations have proven themselves as effective tools for achieving greater equality in CS education.

Classroom Participation

The use of active learning in classes became common practice after Aguillon et al. (2020) observed that there was enough evidence to support the positive effects that active learning had on students' learning experiences. Nonetheless, despite such a shift, gender disparities regarding participation behaviors still received little attention, even as research focused on various kinds of participation. This paper examines the participation behaviors among males and females during a semester of an introductory biology class in seven different kinds of participations. According to the results obtained, males were observed to participate more often than what was expected based on their number in the class, and this happened when providing voluntary answers after a discussion within a smaller group setting. On the other hand, female students felt more conscious about their gender in the class and lacked confidence in themselves.

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Academic Performance

Brigham et al. (2021) found that performance differences between male and female CS students had less to do with ability and more to do with participation patterns. Male students tended to dominate visible, public forms of engagement like class discussions and online forums with forum participation rates at 18.5% for males compared to 12.2% for females and this translated into grade advantages. Female students, on the other hand, performed comparatively better in structured, lower-visibility tasks such as surveys and written assignments.

As learning shifted online between 2021 and 2023, participation gaps narrowed and female students' GPAs and retention rates improved. This suggested that the format of participation matters: anonymous or structured modes tend to level the playing field, while competitive and public formats tend to favor male students. Lower female participation in public modes was associated with GPA drops of 0.2 to 0.4 points, reinforcing the idea that diversifying how students can participate leads to fairer outcomes.

Assessment Methods

Trajkovic et al. (2025) found that the type of assessment used in CS courses produced different outcomes by gender. Traditional exams yielded different results compared to project-based work or structured online tests. Female students in particular benefited from clear grading criteria and well-organized course structures. Classes with higher female enrollment also tended to perform better overall, suggesting that the composition of the classroom and the fairness of assessment design both play a role in shaping academic outcomes.

The National Center for Education Statistics (2024) connected early assessment experiences to long-term persistence in CS programs. Female students who felt capable and supported after their first major assessments were more likely to stay in the program. When academic preparation was taken into account, the research found minimal gender differences in degree completion rates suggesting that how students are assessed early on can significantly influence whether they continue.

Uchegbue (2022) further reinforced that gender performance gaps in CS were not consistent across all course types. Male students tended to score higher in highly technical and math-heavy subjects, while female students held their own and sometimes outperformed in general education and elective courses, especially in classes with more female peers. Overall, the evidence did not point to one gender consistently outperforming the other; outcomes depended heavily on the course type, classroom environment, and social dynamics.

Synthesis

Taken together, the literature paints a nuanced picture of gender and academic performance in CS education. Whileolderstudiesoften pointed to male dominancein technical fields,more recent findings show that female students can perform just as well or better when the learning environment is structured, inclusive, and assessment-driven. What drives the gaps, the research suggests, is not innate ability but rather how courses are taught, how participation is structured, and how fairly students are evaluated. These insights directly shaped the conceptual framework of this study and the development of the GRASF intervention.

III. METHODOLOGY

Conceptual Framework

This study was premised on the belief that gender-based disparities in academic performance within a CS program could be addressed effectively through an intervention strategy carefully designed for such a purpose. Specifically, the researchers formulated the Gender-Responsive Academic Support Framework (GRASF) with the aim of ensuring that men and women achieve equal academic achievements in the same program by identifying performance disparities, determining their underlying causes, and targeting them with interventions.

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In this framework, instructional factors are considered the primary variables. By designing teaching strategies, class participation, and evaluation techniques in such a way as to ensure equitable distribution of outcomes, the ultimate objectiveof having equal academic performances among men and women in terms of GPA, class grades, participation levels, and retention is anticipated. The GRASF therefore seeks to lead the CS program to the point at which gender becomesirrelevant in predicting academic achievement.

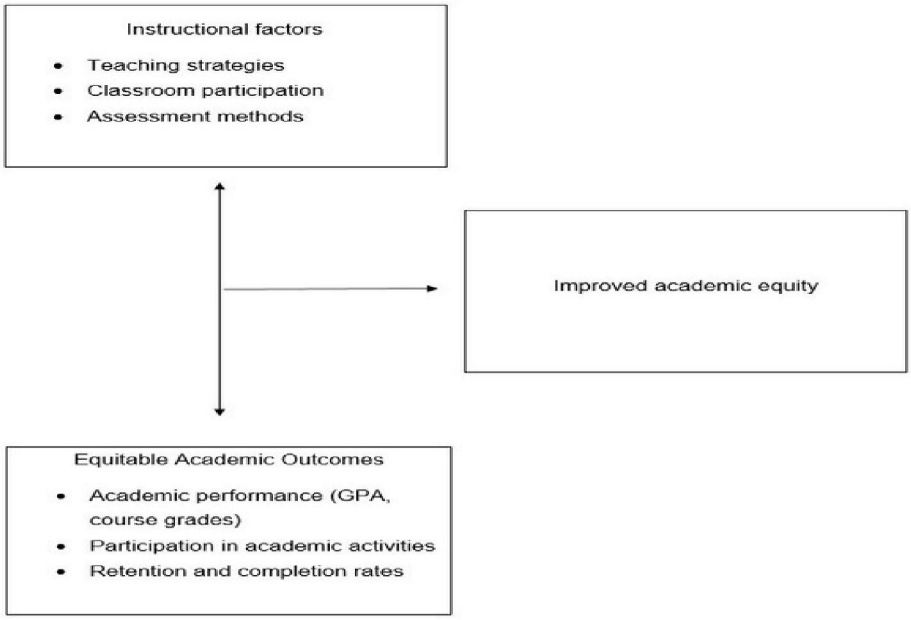

Figure 1: Conceptual Framework of the Study

Research Design

In order to investigate the gender differences in academic performance among CS students in SNSU, a descriptive comparative research design was employed in the current study. Quantitative design was selected since numbers were needed which can be quantified and statistically analyzed. The General Weighted Average became the main indicator used in measuring academic performance since it enabled researchers to compare performances between males and females in different year levels and courses. Descriptive comparative research design became ideal for use in this study since it provided an opportunity to examine whether there was any difference between the two groups being studied.

Participants and Sampling Method

The total number of respondents in this study comprised 78 CS students of all levels in SNSU. To ensure the appropriateness of the sample size for use in representing the entire population, Slovin's formula was employed to determine a 5% error margin in the calculation of the number of people to use in the research process.

In sampling, the technique used was stratified random sampling, where the total population was split up into two strata depending on their gender – namely, male and female, after which respondents were randomly picked from both sexes.

Research Instrument and the Likert Scale

Data for this research were collected through two major sources. The first one consisted in asking for academic records from the Office of the Registrar of SNSU. This source yielded objective data regarding the academic performance of the respondents. On the other hand, a structured questionnaire was administered in order to obtain demographic data like year level and sex as well as students' perceptions about teaching techniques, their classroom participation and assessment practices.

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For the rating scale used in this questionnaire, the interpretation is as follows: 4.50–5.00 = Strongly Agree; 3.50–4.49 = Agree; 2.50–3.49 = Neutral; 1.50–2.49 = Disagree; 1.00–1.49 = Strongly Disagree. Using a standardized form of this rating scale facilitated the quantification of respondents' perception and enabled comparisons between gender groups in an objective manner. The questionnaires were distributed directly by the researchers, assisted by class instructors, during class hours, where ample time was provided for respondents to answer the questionnaire.

Prior to administering the questionnaires, permission was granted from the Office of the Dean of the CCIS. Participants were informed of the study's objectives and gave their informed consent to participate. Participation was completely voluntary and confidentialities of all respondents were assured.

Statistical Tools Used

All data collected were analyzed using the Statistical Package for the Social Sciences (SPSS). The use of descriptive statistics such as the mean and standard deviation were conducted to determine the academic performance of the male and female CS students. The Independent Samples T-test was employed to determine if there were any significant differences between the two groups as far as their grades were concerned. In instances where the assumptions required for testing of hypotheses were violated, the Mann-Whitney U test was used as an alternative test. The One-way ANOVA was also used to analyze the academic performance of students in various year levels, based on gender.

IV. RESULTS AND DISCUSSION

Objective 1: Extent of Gender Disparity in Academic Achievement

Table 1 shows the demographic characteristics of the 78 participants involved in the current research. The largest proportion of the sample consisted of first-year students (n=60); out of all respondents, 41 (52.6%) were females and 36 (46.2%) – males. The age group of most respondents (n=25) was 19 years. As for GPAs, the majority of the sample had grades between 1.5 and 2.0 (n=42) and 2.0 and 3.0 (n=27).

The gender analysis of GPA distribution showed that in both genders, the highest concentration of participants had GPAs from 1.5 to 2.0. Nevertheless, upon analyzing the upper limit of the grade scale, it was seen that more females (n=3) than males (n=1) belonged to the 1.0-1.5 GPA group. This fact indicates that female CS students of SNSU perform slightly better academically. The result is consistent with the findings by Voyer & Voyer (2014), according to which female students demonstrate equal or even higher levels of academic achievements compared to male students if provided with an appropriate environment.

AGE	N	%
18 yrs old	20	26%
19 yrs old	25	32%
20 yrs old	17	22%
21 yrs old	6	8%
22 yrs old	3	4%
23 yrs old	4	5%
24 yrs old	2	3%
GENDER	**N**	**%**
Male	36	47%
Female	41	53%
YEAR LEVEL	**N**	**%**
1st Year	60	78%
2nd Year	4	5%
3rd Year	9	12%
4th Year	4	5%
CURRENT GPA	**N**	**%**
1.0–1.5	4	5%
1.5–2.0	42	55%
2.0–3.0	27	35%
Below 3.0	4	5%

Table 1. Respondents' Demographic Profile (n=60)

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Objective 2: Gender and Academic Performance Indicators

The mean scores of CS students according to gender and dimensions examined in this study are presented in Table 2 below. On average, the females had scores of 3.69 for Teaching Strategies, 3.78 for Classroom Participation, and 3.81 for Assessment Method. Conversely, male CS students achieved an average score of 3.69, 3.62, and 3.70 in these three dimensions respectively. Therefore, the overall averages obtained in these dimensions are 3.69, 3.71, and 3.76 respectively.

It is evident that across the three dimensions, the female students had relatively higher mean scores compared to the male participants. The largest differences were in terms of Classroom Participation and Assessment Method. Based on the results from this study, it can be argued that CS females are generally more active during classroom sessions and respond favorably to the form of assessment used in the classes. Such findings are consistent with previous studies by Voyer and Voyer (2014).

Table 2. Mean Scores of Male and Female CS students Across Three Dimension

Dimension	Female Mean	Male Mean	Overall Mean
Teaching Strategies	3.69	3.69	3.69
Classroom Participation	3.78	3.62	3.71
Assessment Method	3.81	3.70	3.76

Objective 3: Contributing Academic, Social, and Institutional Factors

The gender-related differences seen in this study were not caused by one specific reason but rather resulted from an interplay of contributing academic, social, and institutional reasons. Academically, for example, the structure of the courses and assessment strategies made a big difference in students' achievement results. Socially, such reasons as confidence and peer relations contributed to the extent of student willingness to engage actively in discussions. In terms of the institution, the proportion of female students in the CS program and the inclusiveness of the teaching approach were important contributors to the performance outcome.

This finding is in line with the findings of Kwon et al. (2025), who stated that gender-related differences in computer science cannot be explained by analyzing only one factor but are the result of complex socio-cultural, environmental, and individual psychological contributions.

Objective 4: Existing Support Systems and Instructional Practices

Current Teaching Practices and Support Systems

Another interesting finding from this study relates to how alike male and female respondents rated the teaching techniques applied by teachers at SNSU within the CS department. Specifically, male and female participants reported that their perceptions about these strategies were almost identical as both scored 3.69 on average. Such a similar perception about the way teaching occurs at SNSU demonstrates the fairness of these practices among students regardless of their sex, meaning they do not contribute to gender differences in performance.

The findings confirm the hypothesis presented by Sax et al. (2017), who argue that proper structuring of educational processes helps to minimize the influence of sex on performance.

Objective 5: Discussion of Unexpected Results and Recommendations

One of the most fascinating insights gained from this study is the extent to which it differed from other research on the topic. It is a widely held belief within the body of literature on CS education that male students tend to outperform their female counterparts in technical classes. In this particular case, however, females were seen to be more active in class and perform better on tests than males. Contrary to the common belief that female students lack confidence in technical matters, SNSU's female CS students displayed greater involvement in two out of three areas assessed.

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Another remarkable insight was the equality in the evaluation of teaching approaches between genders, indicating the effectiveness of instructional methods used in the program. This insight contradicts the idea that CS programs are always biased towards male students.

The findings demonstrate once again that preconceptions concerning the performance of male and female students do not hold water. In addition, they emphasize the importance of continuous tracking of trends related to the gender performance of students at SNSU, not as a reaction to a problem but in order to ensure that these positive trends persist and spread to other areas of CS training.

V. CONCLUSION AND RECOMMENDATIONS

Conclusion

The main objective of this research is to find out the correlation between gender and academic performance among CS students of Surigao del Norte State University by considering three factors: teaching strategies, classroom participation, and assessment methods. The results of this survey proved to be rather evident yet quite surprising.

Female students of SNSU have demonstrated a tendency to perform slightly better than their male counterparts regarding all the aforementioned factors. Particularly, the results for classroom participation are as follows: females, 3.78; males,

3.62. The same can be said about assessment methods – females rated it as 3.81 while males gave it 3.70. However, when it came to the factor of teaching strategies, no considerable difference was found since they both gave the method a mean value of 3.69.

Such results challenge the traditional belief that men have an inherent advantage in terms of technical areas. In SNSU, women in the field of Computer Science exhibited greater involvement in class discussions and interactions. This is also reflected in their average GPA, as a higher number of females belonged to the category of the highest GPA range (1.0 – 1.5) than males.

It is safe to say that gender should not be considered an important factor when forecasting the students'

academic performance in the SNSU Computer Science program. It seems like much greater importance lies in course structure, student participation, and assessment techniques. Both genders provided positive assessments for all three factors, meaning that the SNSU Computer Science program has been heading towards the right direction.

Recommendations

1. Formalize the use of GRASF. There is a need for the university to think of GRASF as not only a one-time program but as a continued program, which will monitor how male and female students fare in the curriculum and provide appropriate support to those who struggle in their academics.

2. Keep fostering an environment that embraces innovative pedagogy. Inasmuch as male and female students evaluated the same teaching strategies equally well, there is a need for the faculty to continue coming up with innovative pedagogical practices, especially ones that have been tried and tested, such as collaborative learning.

3. Structure the participation process for all learners. Even though the female students showed better engagement in class compared to their male counterparts in this study, the ideal is for all students to have that kind of participation level. This can be achieved when instructors create activities that enable such students who do not express themselves easily in class to participate through guided group discussions and peer collaboration.

4. Ensure consistency in assessing performance and providing feedback. It was evident from the results that female students performed better in assessment because they were good at organizing themselves based on standardized assessments. Therefore, there is a need for a CS program to have a standardized procedure for assessing student performance and give them constructive feedback.

5 Use higher year level students as subjects in the study. This study had too many students belonging to the first year level, amounting to 76.9%. In future studies, a balanced proportion among the four year levels needs to be considered.

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This way, the researcher will be able to determine the trend of male and female academic performance at each year level.

6. Follow up with a study using official GWA records. While this study's questionnaire-based data provided useful insights, a complementary study that directly analyzes GWA records from the Registrar's Office would offer a more objective and complete picture of how male and female CS students perform academically over time.

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