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The Relationship of Senior High School Strands and Academic Performance in College among Computer Engineering Students: Basis for Policy Guideline Development

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Abstract:- This study explores the relationship between senior high school strands and college academic performance among Computer Engineering students. Given the diverse preparatory pathways in high school, students bring varied levels of foundational knowledge and skills into college, which may influence their success in specialized fields like engineering education. Using a quantitative analysis of academic records, the researchers compared the average grades of students from different strands, including Science, Technology, Engineering, and Mathematics (STEM), Accountancy, Business and Management (ABM), General Academic Strand (GAS), and Technical-Vocational-Livelihood (TVL). Findings showed that STEM students generally achieve higher college grades, suggesting their curriculum aligns well with the rigorous demands of engineering. Conversely, students from non-STEM strands such as ABM and TVL display moderate to lower performance, revealing potential gaps in preparatory coursework. These results emphasize the importance of curriculum alignment in senior high school to meet the demands of college programs, particularly to enhance academic support strategies for non-STEM students transitioning into engineering fields.

Keywords:- *Senior High School Strands, Academic Performance, Computer Engineering Students, Policy Guideline.*

I. INTRODUCTION

The Philippine education system has recently introduced senior high school (SHS) tracks as part of the K-12 curriculum, providing students with specialized preparatory pathways before college. The SHS program offers students a choice of strands, including Science, Technology, Engineering, and Mathematics (STEM); Accountancy, Business, and Management (ABM); General Academic Strand (GAS); Humanities and Social Sciences (HUMSS); and Technical-Vocational-Livelihood (TVL). These strands aim to equip students with foundational knowledge and skills aligned with their intended college fields, facilitating a smoother transition to higher education. However, despite these efforts, concerns remain regarding the alignment between high school preparation and the demands of specialized college programs, particularly in rigorous technical fields like Computer Engineering.

Computer Engineering is a highly technical and interdisciplinary field that demands strong foundations in mathematics, science, and analytical skills. Students entering this field come from diverse SHS strands, each providing varying degrees of preparation in these critical areas. For example, STEM students typically receive more intensive training in mathematics and science, which are core components of Computer Engineering education. In contrast, students from ABM or TVL backgrounds may lack this preparation. Consequently, it is essential to examine whether students from non-STEM strands face challenges in meeting the academic demands of Computer Engineering and if the SHS curriculum adequately prepares students from all strands for success in this field.

According to Pascua and Navalta (2019), the significant influence of senior high school (SHS) strands on students' academic performance in higher education, particularly in mathematics and science-intensive programs such as engineering. Their study revealed that students from the STEM strand tend to perform better in college courses requiring advanced analytical skills, attributing this to their rigorous training in mathematics, physics, and other technical subjects during SHS. Conversely, students from strands like ABM or TVL often encounter challenges in adapting to the academic demands of engineering programs due to limited exposure to these core subjects. The researchers emphasized the importance of aligning SHS curricula with the specific requirements of higher education programs to ensure equitable preparation and reduce performance gaps among students from different strands. These findings emphasize the need to evaluate how diverse SHS strands impact the readiness of students entering interdisciplinary fields like Computer Engineering.

This study explores the relationship between SHS strands and academic performance in college among Computer Engineering students. Specifically, it seeks to analyze whether students from different strands perform differently in Computer Engineering courses and if certain strands correlate with higher academic success in college. Using a quantitative analysis of academic records, this research will compare students' average grades from STEM,

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ABM, GAS, HUMSS, and TVL strands. The findings are expected to provide insights into the alignment of SHS preparation with college academic demands and may inform curriculum and policy development, bridging programs, and targeted academic support for non-STEM students.

II. METHODOLOGY

This study utilizes a quantitative research design to explore the relationship between senior high school (SHS) strands and academic performance in college among Computer Engineering students. The primary data source comprises the academic records of Computer Engineering students from various SHS strands, including Science, Technology, Engineering, and Mathematics (STEM); Accountancy, Business, and Management (ABM); General Academic Strand (GAS); Humanities and Social Sciences (HUMSS); and Technical-Vocational-Livelihood (TVL). These academic records encompass grades from core Computer Engineering subjects, as well as foundational courses in mathematics, science, and engineering.

Data collection entails acquiring permission from the college administration to access anonymous student records, thereby ensuring confidentiality and adherence to ethical standards. For each student, information about their SHS strand and corresponding grades in relevant college courses is recorded and compiled into a secure database for analysis. The data is subsequently processed to calculate the average grades for each student in core Computer Engineering, mathematics, and science courses.

For the analysis, descriptive statistics, such as means and standard deviations, are employed to summarize and compare the average grades of students across different SHS strands This test aids in identifying which SHS strands are associated with higher or lower academic performance in college. Additionally, post-hoc comparisons are utilized to highlight specific differences between the groups.

III. RESULTS AND DISCUSSION

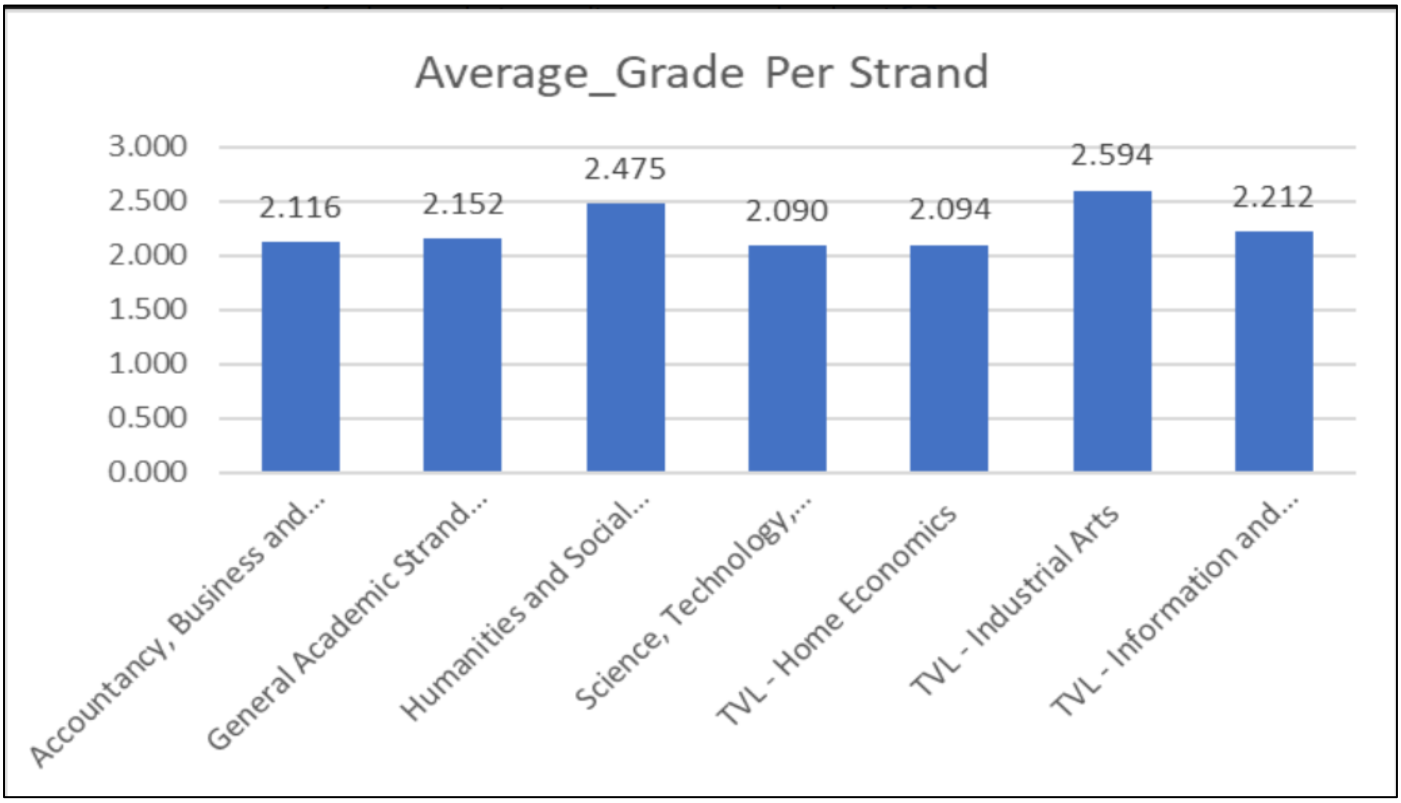

Fig 1 Average Grade for Senior High School Strand

Figure 1 displays the average grades for each senior high school strand. The "Science, Technology, Engineering, and Mathematics (STEM)" strand boasts one of the lowest average grades at 2.090, indicating strong academic performance. In contrast, the "TVL - Industrial Arts" strand shows the highest average grade of 2.594, suggesting relatively lower performance among its students. The other strands, such as "Accountancy, Business, and Management (ABM)," "General Academic Strand (GAS)," and "TVL - Home Economics," demonstrate moderate performance, with average grades ranging from approximately 2.1 to 2.2. This pattern may reflect the diverse academic strengths exhibited across the different strands.

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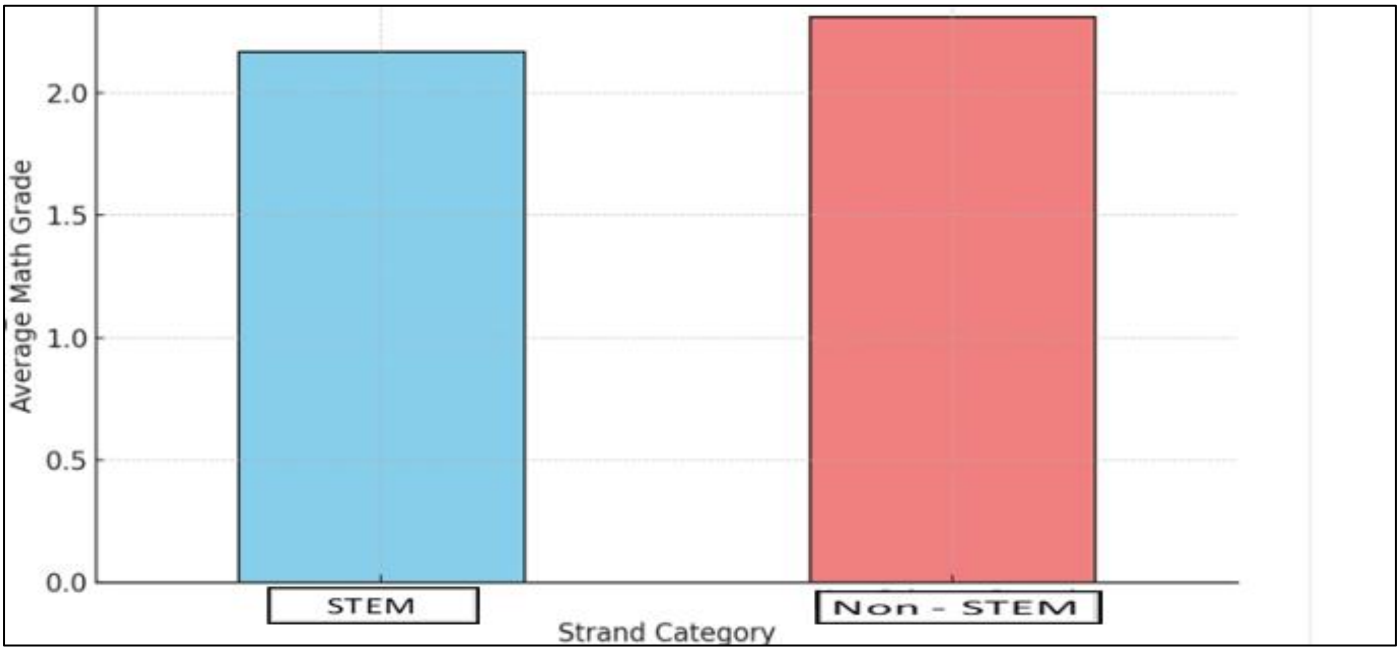

Fig 2 Average Math Performance STEM vs Non-STEM Strands

The comparison reveals that students in the science strand (STEM) have a marginally higher average math grade than their non-science strand counterparts, who average just slightly higher than the science students. This indicates that science strand students may possess a stronger foundation or better adaptability to college-level math courses, enabling them to achieve slightly superior performance. Nonetheless, the proximity of the averages suggests that non-science students are also excelling, likely due to effective learning strategies or supportive resources that allow them to keep pace with their science strand peers.

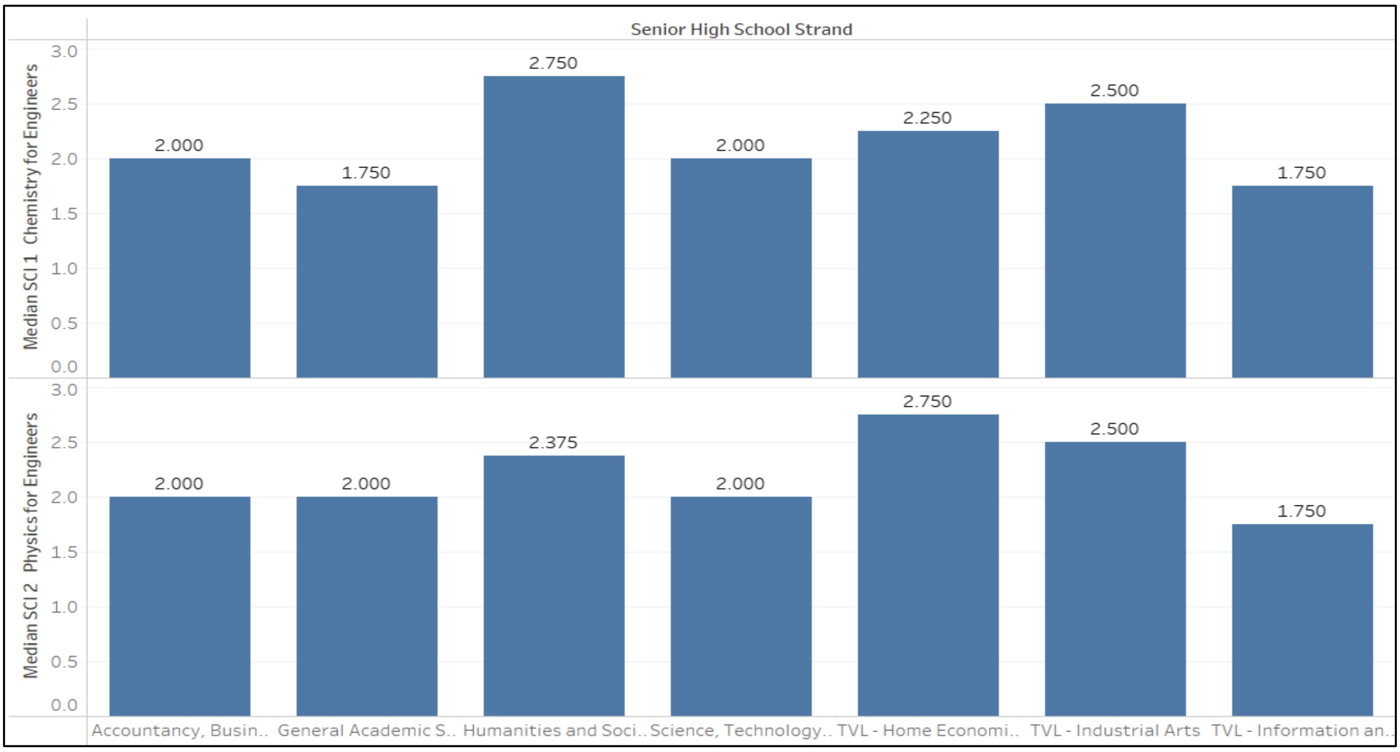

Fig 3 Average Grades for Chemistry and Physics for Engineers

The chart presents the median grades for "Chemistry for Engineers" and "Physics for Engineers" among students from various senior high school strands. Students enrolled in the Science, Technology, Engineering, and Mathematics (STEM) strand exhibit notably consistent performance, achieving a median grade of 2.0 in both subjects. This indicates that their specialized high school curriculum equips them with a strong foundation in these critical science disciplines, essential for success in engineering courses.

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In contrast, students from non-STEM strands, such as Accountancy, Business, and Management (ABM) and the General Academic Strand (GAS), display more varied results. ABM students also attained a median of 2.0 in both subjects, paralleling the STEM performance, while GAS students fared slightly better in Chemistry, with a median grade of 1.75. However, students from the Humanities and Social Sciences (HUMSS) strand exhibited lower performance, particularly in Chemistry, where they received a median grade of 2.75, suggesting possible gaps in their preparation for science-intensive courses.

The Technical-Vocational-Livelihood (TVL) strands, including Home Economics, Industrial Arts, and Information and Communication Technology (ICT), also demonstrate variability in performance. TVL-ICT students achieved a median grade of 1.75 in both subjects, which is relatively higher than their counterparts in other TVL strands, likely due to the integration of technical and analytical skills in their curriculum. Conversely, TVL-Home Economics and TVL-Industrial Arts students scored lower, particularly in Chemistry, with median grades of 2.5 and 2.75, respectively, indicating limited exposure to scientific content.

In summary, the chart emphasizes that STEM students are better prepared in foundational science subjects, while non-STEM and TVL students exhibit diverse performance levels, possibly reflecting varying degrees of science preparation. These findings suggest that students from non-STEM strands, particularly those in TVL, would benefit from additional academic support in Chemistry and Physics to more effectively meet the demands of a Computer Engineering curriculum.

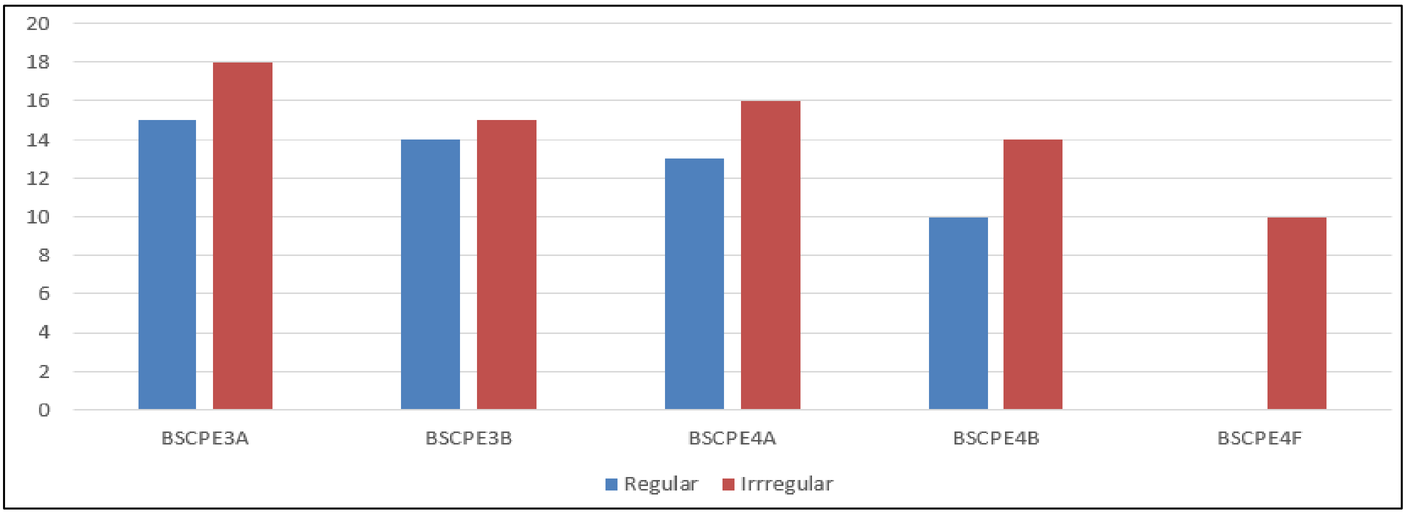

Fig 4 Distribution of Regular and Irregular Students across Different Sections

The bar chart illustrates the distribution of Regular and Irregular students across various sections (BSCPE3A, BSCPE3B, BSCPE4A, BSCPE4B, and BSCPE4F). Sections BSCPE3A and BSCPE4A feature the highest total student counts, with BSCPE4A exhibiting a well-balanced proportion of Regular and Irregular students. In contrast, sections such as BSCPE4B and BSCPE3B demonstrate a closer ratio of Regular to Irregular students. Notably, BSCPE4F has the fewest total students, with a significant representation of Irregular students. This chart highlights the variations in student composition among different sections, indicating that larger sections generally encompass a more diverse mix of student statuses.

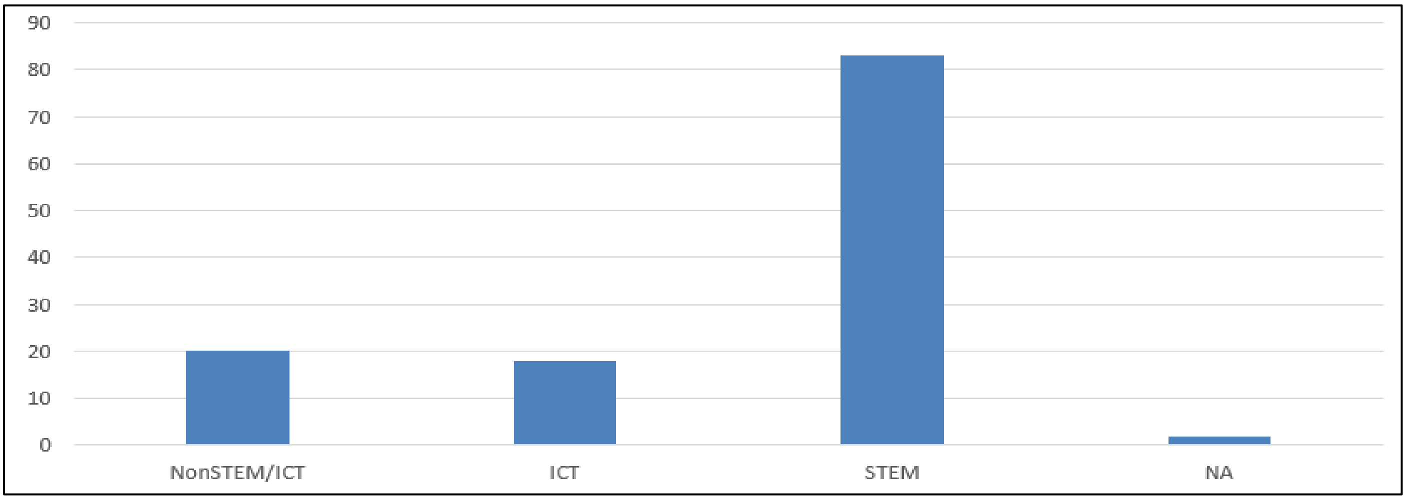

Fig 5 Distribution of Students based on their Academic Strands

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The bar chart depicts the distribution of students according to their academic strands: STEM, ICT, Non-STEM/ICT, and NA (not available or unspecified). STEM leads the chart, showcasing the highest number of students, and significantly surpassing the other categories. Both ICT and Non-STEM/ICT exhibit relatively similar, yet considerably smaller student populations in comparison to STEM. The NA category reflects the lowest representation, suggesting a minimal number of students with unspecified strands. This pattern underscores a strong preference or alignment among students in the STEM category within the dataset.

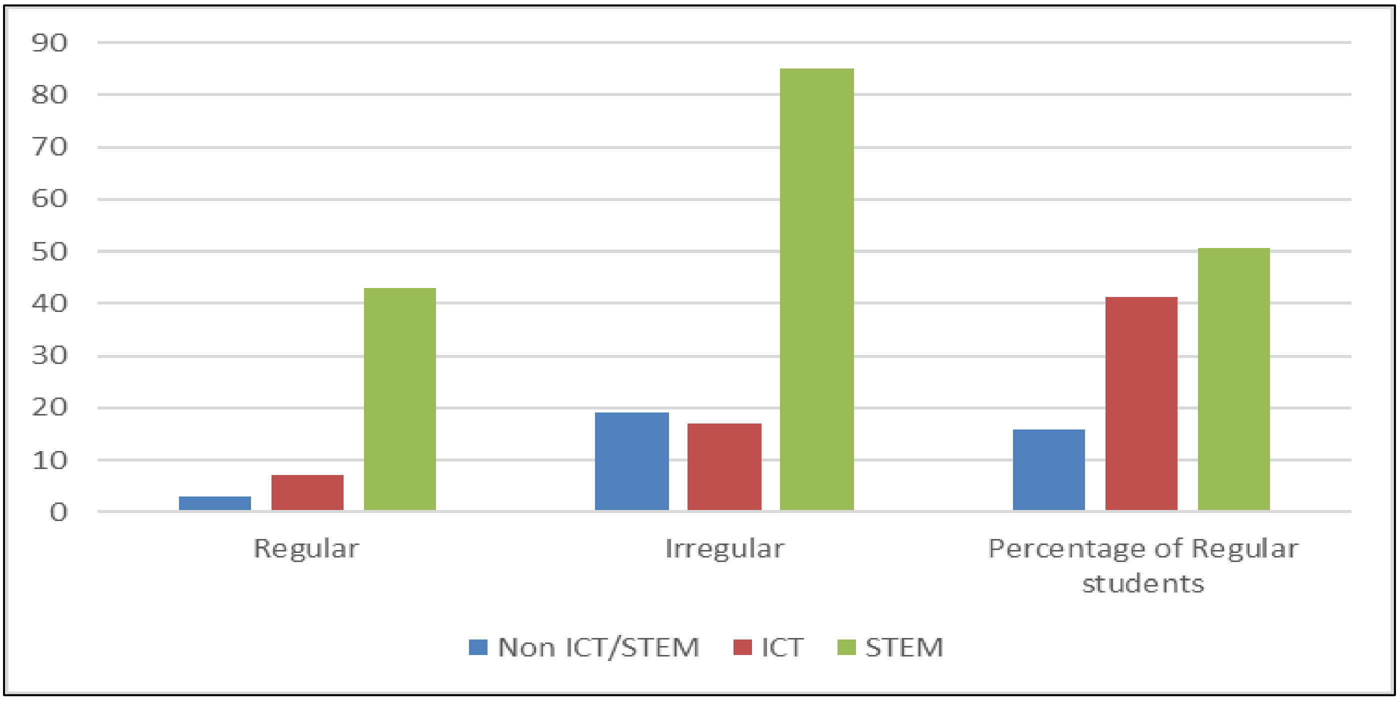

Fig 6 Distribution of Regular and Irregular Students Across Three Strands: Non-ICT/STEM, ICT, and STEM

The bar chart illustrates the distribution of Regular and Irregular students across three strands: Non-ICT/STEM, ICT, and STEM, along with the percentage of Regular students within each strand. STEM leads in both the Regular and Irregular categories, displaying a significantly higher number of Irregular students compared to Regular ones. ICT presents a more balanced distribution, with noteworthy contributions from both Regular and Irregular students. In contrast, Non-ICT/STEM has the lowest overall representation, with very few students in either category. When examining the percentage of Regular students, ICT and STEM exhibit relatively higher proportions, with STEM slightly ahead. This suggests not only STEM's dominance but also highlights challenges in ensuring regular attendance among its students.

Table 1 Personal Interest

Statements	Mean	SD	Remarks
1. My decisions are made based on my personal preferences and desires	4.23	0.87	Strongly Agree
2. I carefully evaluate my skills and abilities when selecting the Engineering Course	3.93	0.82	Agree
3. I have made a deliberate choice from a position of freedom	4.12	0.80	Strongly Agree
4. I believe my disposition and habits are well-suited for the path I have chosen	3.80	0.89	Agree
5. I have carefully chosen an engineering course that aligns with my skills and interests	3.93	0.86	Agree

- Overall Mean = 4.00
- Standard Deviation = 0.85
- Verbal Interpretation = Agree

The table indicates that personal interest plays a significant role in the respondents' selection of an engineering course, evidenced by an overall mean score of 4.00 (SD = 0.85), which corresponds to a verbal interpretation of "Agree." Respondents express strong agreement that their decisions are guided by personal preferences (4.23) and a sense of freedom in their choices (4.12), highlighting their autonomy and clarity in the decision-making process. They also agree that they assess their skills and align their choices with their abilities and interests, scoring 3.93. However, there is slightly less confidence regarding the suitability of their disposition and habits for their chosen path, which received a score of 3.80. Overall, these findings suggest that respondents prioritize their personal preferences and engage in a thoughtful decision-making process when selecting their engineering course.

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Table 2 Family Influence

Statements	Mean	SD	Remarks
1. I chose my college course based on my parents' careers	2.27	1.21	Disagree
2. I select my course based on my parents' preferences	2.59	1.22	Disagree
3. My parents pushed me to enroll in the specific Engineering Course	2.16	1.17	Disagree
4. My parents urged me to register for a particular engineering course	2.14	1.06	Disagree
5. Upon my parents' advice, I decided to pursue this Engineering Course	2.93	1.34	Neutral

- Overall Mean = 2.42
- Standard Deviation = 1.20
- Verbal Interpretation = Disagree

The table indicates that family influence has a minimal impact on the respondents' choice of an engineering course, with an overall mean score of 2.42 (SD = 1.20), which corresponds to a "Disagree" interpretation. Respondents largely disagree that their decision was influenced by their parents' careers (2.27), preferences (2.59), or pressure to enroll in a specific course (2.16). Similarly, they disagree that their parents encouraged them to register for a particular engineering program (2.14). The only statement that received a neutral interpretation (2.93) pertains to pursuing the course based on their parents' advice. Collectively, these findings suggest that the respondents' decisions were primarily independent of direct parental influence.

Table 3 Peer Influence

Statements	Mean	SD	Remarks
1. I was impacted by the perspectives of my classmates.	2.45	1.16	Disagree
2. I am worried about being excluded by my friends.	2.06	1.12	Disagree
3. The decision of my friend is my decision as well	1.91	1.03	Disagree
4. I consulted with my friend before deciding on an engineering course	2.16	1.14	Disagree
5. My peers and I had the same preference	2.40	1.16	Disagree

- Overall Mean = 2.20
- Standard Deviation = 1.12
- Verbal Interpretation = Disagree

The table reveals that peer influence has a minimal effect on the respondents' choice of an engineering course, as indicated by an overall mean score of 2.20 (SD = 1.12), which is interpreted as "Disagree." Respondents indicated a lack of agreement with the idea that their decisions were significantly influenced by their classmates' opinions (mean score of 2.45), concerns about social exclusion (2.06), or the desire to align their choices with those of their friends (1.91). Additionally, they expressed disagreement with the notion of consulting friends before making their course decisions (2.16) or having similar preferences as their peers (2.40). These findings suggest that the respondents' choices regarding course selection were primarily independent of peer opinions or pressures.

Table 4 Job Opportunity

Statements	Mean	SD	Remarks
1. I choose the engineering course because of its high demand.	4.27	0.90	Strongly Agree
2. I choose the Engineering Course based on salary expectations	4.05	0.89	Agree
3. I prioritize selecting the Engineering Course based on its potential job opportunities and long-term stability	4.19	0.92	Agree
4. I choose the Engineering Course based on its potential future job opportunities	4.27	0.90	Strongly Agree
5. I selected the Engineering Course based on its current presence in the news and job market	4.22	0.89	

- Overall Mean = 4.20
- Standard Deviation = 0.90
- Verbal Interpretation = Agree

The data indicates that job opportunities are a crucial factor influencing respondents' choice of engineering courses, with an overall mean of 4.20 (SD = 0.90), which is interpreted as "Agree." Respondents strongly affirm that their selection was driven by the high demand for the field (4.27) and the potential for future job opportunities (4.27). They also express strong agreement that the visibility of the course in news media and the job market played a significant role in their decision (4.22). Furthermore, they agree that salary expectations (4.05) and the potential for long-term job stability (4.19) were influential in their choice. These findings indicate that respondents place a high priority on courses that offer promising career prospects and relevance in the current market.

Table 5 Financial Condition

Statements	Mean	SD	Remarks
1. I selected this engineering course based on the financial considerations related to my family's income	3.26	1.01	Neutral
2. I decided to pursue the Engineering Course after considering the overall tuition expenses	3.14	1.02	Neutral
3. I opted for the Engineering Course due to the available scholarship opportunities	3.01	1.12	Neutral
4. I have opted for an Engineering Course that will not impose financial strain on my parents	3.30	0.99	Neutral
5. I have selected the Engineering Course intending to improve my family's financial situation	3.84	1.01	Agree

- Overall Mean = 3.31
- Standard Deviation = 1.03
- Verbal Interpretation = Neutral

The table indicates that financial conditions exert a neutral influence on respondents' decisions to pursue an engineering course, with an overall mean score of 3.31 (SD = 1.03), which is interpreted as "Neutral." Most statements related to financial considerations, such as choosing the course based on family income (3.26), tuition costs (3.14), scholarship availability (3.01), and minimizing financial strain on parents (3.30), received neutral responses. However, respondents did express agreement (3.84) that their choice of course was motivated by a desire to enhance their family's financial situation, reflecting a forward-looking perspective on financial stability. In summary, financial factors are acknowledged, but they do not serve as the primary motivators for the decision.

IV. CONCLUSIONS AND RECOMMENDATIONS

The study concludes that personal interest plays a significant role in students' decisions to pursue engineering courses, as they prioritize their preferences, freedom of choice, and alignment with their skills and interests. In contrast, the influence of family and peers is minimal; respondents largely disagree that their choices were shaped by their parents' desires or peer group dynamics. However, job opportunities emerge as a crucial motivating factor, with students expressing strong agreement that the demand for engineers, potential job prospects, salary expectations, and market trends heavily influence their decisions. Financial considerations are viewed as neutral, with students recognizing factors such as tuition costs and scholarships but not deeming them as primary drivers. Nonetheless, there is consensus that improving their family's financial situation remains an important motivator.

In light of these findings, it is recommended to enhance career guidance programs in senior high schools to assist students in aligning their interests with available career opportunities. Workshops aimed at parents and peers can foster a supportive environment that respects students' individual goals. Universities should also provide updated information on the job market to steer students toward in-demand careers and expand financial aid and scholarship programs to reduce financial barriers. Additionally, bridging programs for non-STEM students are suggested to address gaps in foundational knowledge and ensure preparedness for engineering courses. Finally, implementing monitoring systems to track students' academic performance and career success will enable continuous improvement of support programs and ensure curriculum alignment with industry needs.

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