

GIRLS IN STEM: INFLUENTIAL FACTORS IN SUBJECT CHOICES

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RESEARCH ON “BRIDGING THE INFORMATION GAPS TO RETAIN AND RAISE GIRLS’ INTEREST IN STEM EDUCATION”



Girls in STEM: Subject Choices and Influential Factors

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Executive Summary

Gender disparities in science, technology, engineering, and mathematics (STEM) persist globally, limiting women's participation in some of the most dynamic and well-paid sectors of the modern economy.

This study examines gender-based differences in subject choices across secondary and tertiary education in Zambia and explores the underlying factors shaping students' interest, self-efficacy, and engagement in STEM. The study investigates five key areas across junior secondary (Grade 9), senior secondary (Grade 12), and final-year university students: 1) reasons for subject selection, 2) willingness to study STEM subjects if not compulsory, 3) changes in attitudes toward STEM during schooling, 4) self-assessed academic performance, and 5) perceived adequacy of information and support to succeed in STEM disciplines.

Findings reveal that intrinsic interest, perceived practical utility, and self-efficacy are the most influential factors in subject choice at all educational stages. While the influence of parents and teachers was moderate overall, girls placed greater value on such advice than boys.

Gender gaps in self-confidence were most pronounced at the junior secondary level but diminished by university. Both genders expressed relatively low enthusiasm for computer studies and chemistry. Interestingly, girls reported higher self-assessed performance in physics and chemistry than boys. However, girls' perceived adequacy of support declined sharply from junior to senior secondary levels.

The study calls for age-specific, gender-responsive, and subject-focused strategies that foster confidence, enhance relevance, and sustain institutional support throughout students' educational journeys.

1. Introduction

Gender disparities in science, technology, engineering, and mathematics (STEM) remain a global challenge. Despite decades of advocacy and policy efforts, women continue to be markedly underrepresented across STEM education and careers, particularly in engineering, physics, and computer science (Iscan, 2025). Even in life sciences where gender parity has nearly been achieved, fewer women advance to senior positions (Brown, 2008; Lerchenmueller and Sorenson, 2018; UNESCO, 2021). In 2023, women accounted for 49% of total employment in non-STEM occupations but only 29% in STEM, reflecting a modest rise of just 1.6 percentage points since 2015 (World Economic Forum, 2023).

STEM skills underpin sustainable industrialisation, technological innovation, and the broader achievement of the Sustainable Development Goals. Hence, achieving gender parity in STEM is fundamental to fostering resilient, inclusive societies (European Institute for Gender Equality, n.d.; UNESCO, 2021). Persistent gender gaps exacerbate the global shortage of STEM skills and restrict women's access to some of the most dynamic and well-paid sectors of the 21st-century economy; thereby perpetuating structural inequalities and exclusion (Encinas-Martin and Cherian, 2023; World Economic Forum, 2025). For example, in the rapidly growing artificial intelligence sector, women make up less than one-third of professionals and are even scarcer in senior technical roles (World Economic Forum, 2023; UNESCO, 2021; Young, Wajcman and Sprejer, 2021). As Pal, Lazzaroni and Mendoza (2024) observe, *'the gender gap represents a significant loss of potential talent in one of the most crucial industries of our time'*.

Why gender gaps in STEM persist today?

Research suggests that systematic gender imbalances in STEM fields stem from a complex interplay of structural, cultural, and educational factors, including stereotypes, social expectations and self-efficacy beliefs. These influences may help explain why, despite evidence that girls perform as well as, or even better than, boys in science and mathematics (Francis, 2010; UNESCO, 2022), they continue to be underrepresented in STEM education and subsequent careers.

A prominent stream of studies attributes this disparity to gendered patterns in students' academic preferences and subject choices during the formative stages of education, which strongly shape later specialisation and hence career pathways (Meoli, Piva and Righi, 2024). Evidence shows that students' attitudes toward science are largely formed during adolescence, with girls' interest in STEM declining sharply from around age 11 onward (Accenture, 2017; Archer et al., 2010; Stoeger et al., 2013; Trotman, 2017). These early attitudes, which become apparent in secondary school, are strong predictors of subsequent participation in STEM higher education and careers (Sutch et al., 2016).

The persistent 'leaky pipeline' metaphor (Alper, 1993) captures not only the recruitment barriers but also systematic failure to retain women in STEM fields, even when their interest and

ability levels match those of men (Calhoun, Jayaram and Madorsky, 2022; Lykkegaard and Ulriksen, 2019; Meoli et al., 2024). The progressive disengagement in STEM subjects underscores the need for timely interventions that empower students, particularly girls to make confident, informed subject choices in secondary education before structural and cultural barriers foreclose their opportunities (Prieto-Rodriguez, Sincock and Blackmore, 2020; Sutch et al., 2016).

Current state of play in Africa

Across much of Africa, entrenched gender norms and cultural expectations continue to shape perceptions of women's roles, reinforcing structural inequities that limit their participation in STEM (Founou et al., 2023; Mushawatu, 2024; UNESCO, 2024a). These biases compound the continent's persistent 'leaky pipeline'. The World Economic Forum (2023) projects that Africa will require an additional 23 million STEM professionals by 2030 to meet growing demands in engineering, healthcare, and information technology. Yet, STEM graduation rates in many countries still fall below 20% (AUC/OECD, 2024). Although Africa has the world's highest proportion of women among STEM graduates of around 47 percent (Montoya, 2024), the absolute number of STEM graduates remains too small to fill these needs.

Continental frameworks such as the African Union's Agenda 2063 and the Science, Technology and Innovation Strategy for Africa (STISA-2034) highlight the priority of cultivating an inclusive, technologically skilled and innovative workforce (Adebayo, n.d.; African Union, 2025; STISA-2034). Given Africa's youthful demographics and near gender parity in the working-age population, reversing gendered subject choices and strengthening women's participation in STEM is pivotal to fully mobilising the continent's human capital and advancing equitable, innovation-driven development (Okafar, 2019; UNESCO, 2024a).

2. About this Work

This study addresses gender-based differences in subject choices across secondary and tertiary education and explores the underlying factors that influence these patterns. It forms the second component of a broader project investigating gendered variations in subject selection within the African context. The first report focused on differences in how male and female students use information sources to guide their subject choices at these educational stages.

2.1. The Research Context

Zambia, a landlocked country in southern Africa, was the empirical location of this study. Zambia is an average African country in terms of economic and human development - it was ranked 22nd place among the 52 African countries in the Human Development Index 2025.

Since the introduction of the 'free basic education' policy in 2002, the country has made remarkable progress in achieving nearly universal access to primary education, with a net enrolment rate of an impressive 97% in 2024 (Ministry of Education Zambia, 2024). Building on this achievement, the 2022 Free Education Policy, covering Early Childhood Education through secondary school in government institutions, seeks to accelerate enrolment, particularly at the

secondary level by eliminating tuition, examination, and Parent-Teacher Association (PTA) fees (National Assembly of Zambia, 2023). However, challenges remain in enhancing the transitions of students from primary to secondary school education, and from secondary to tertiary education. The secondary school net enrolment rate was close to 50% in 2024 (Ministry of Education Zambia, 2024); and the gross enrolment rate of tertiary education is notably low at only around 7% in the same year. This has prompted the government to make an ambitious goal of doubling the higher education enrolment rate to 15% by 2030 (University World News, 2024).

The country has attained near gender equitable enrolment at both primary and secondary levels. Completion rates for girls are now comparable to, or even surpass, those of boys. Nonetheless, gender disparities persist at the tertiary level, where male students constituted about 54% of total gross enrolment in 2022. This gender gap remarkably widens at postgraduate levels, with women only comprising 35% of all doctoral candidates in 2022 (Higher Education Authority Zambia, 2024).

Moreover, enrolment is heavily skewed towards Health and Welfare (32%) and Business, Administration, and Law (24%), with only 20% of students pursuing degrees in STEM disciplines such as Agriculture, Engineering, ICT, and the Natural Sciences, according to 2022 data. Even fields like ICT (4.4%) and Engineering (6.5%) that offer more promising career prospects are underrepresented. Although participation in STEM was low among both male and female students, the ratio was consistently higher in favour of male (e.g. 25% of all male students in 2022) than of female (14% of all female students in 2022) (Figure 3).

The low participation in STEM study in general stands in contrast to the priorities outlined in the country's Eighth National Development Plan, which underscores the central role of STEM in Zambia's long-term socio-economic transformation. The country has an urgent need for targeted strategies to not only achieve gender parity in higher education but also stimulate interest and participation in STEM fields, to better align educational outcomes with the national development goals. Zambia's efforts and challenges in promoting equitable education, particularly at tertiary level and in STEM subjects, reflect broader trends across many African countries. There are similar enrolment imbalances and underrepresentation in enrolment to STEM fields in the continent (Mutsvangwa and Zezekwa, 2021; United Nations, 2022).

Zambia makes a representative case for exploring factors that shape students' subject choices throughout their educational journey, particularly regarding STEM pathways. The findings can yield valuable insights for designing targeted interventions not only for Zambia but also are adaptable across the continent.

Figure 1: Number of students sitting final year secondary school examinations

Source: Examinations Council of Zambia (2024) and Ministry of Information and Media, n.d.

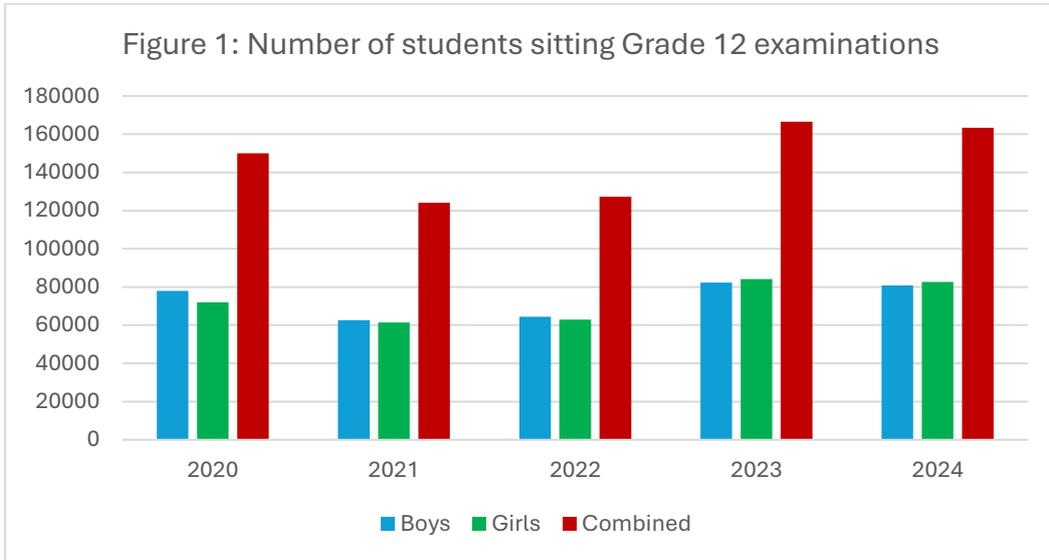


Figure 2: Pass rate of students sitting Grade 12 examinations (2020-2023)

Source: Examinations Council of Zambia (2024)

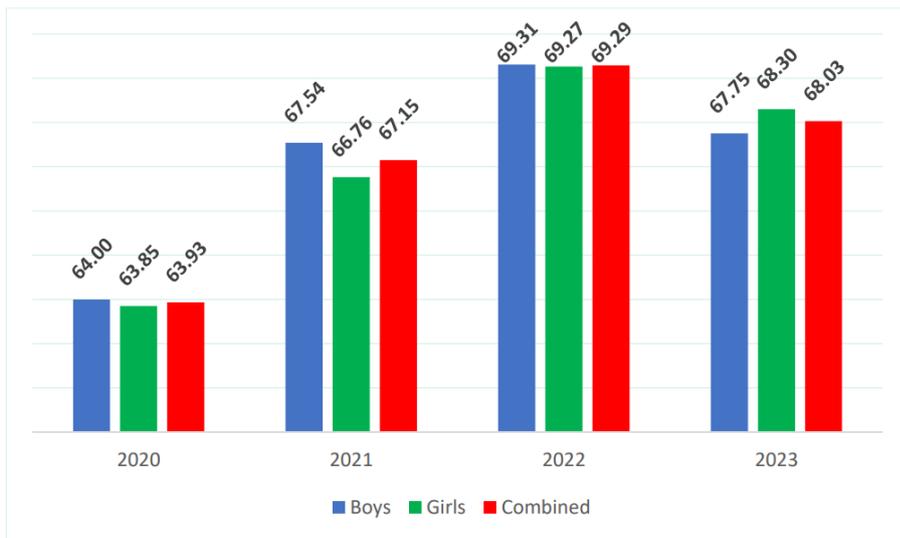
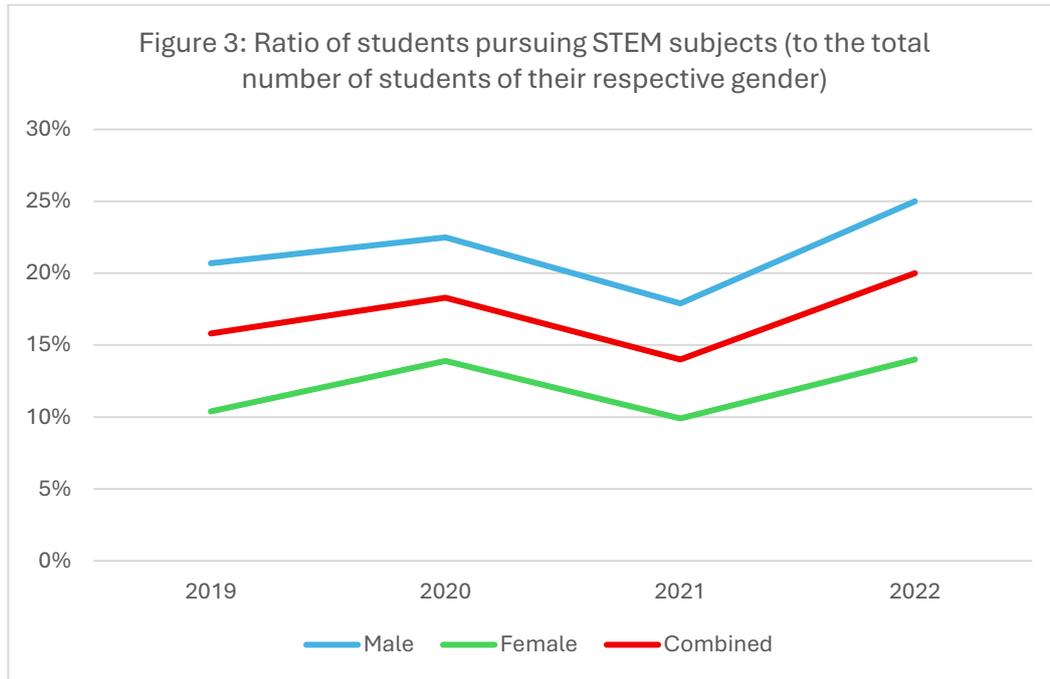


Figure 3: Ratio of male and female students pursuing STEM subjects in universities, to the total number of students of their respective gender (2019 – 2022)

Source: Higher Education Authority, Republic of Zambia (2024)



2.2. Data Collection

Data were collected from junior secondary school (Grade 9), senior secondary school (Grade 12), and university students (Final Year) using structured questionnaires. The survey covered both genders pursuing different subject choices. Electronic questionnaires were used to facilitate access. The survey was administered by an experienced local researcher, supported by teaching staff in the selected schools.

Of the 836 completed questionnaires collected from two public universities and four STEM secondary schools in four different provinces of Zambia, a total, 540 were usable. Table 1 depicts the breakdown of the 540 respondents by gender and educational stage.

Table 1: Respondents by gender and educational stage

| Education stage | Gender | Number | Age range | Has direct family members trained and/or employed in STEM fields |
|-----------------------------|--------------|------------|--------------|--|
| Junior Secondary (Grade 9) | Male | 61 | 12-17 | 75% |
| | Female | 78 | 12-17 | 59% |
| | Total | 139 | 12-17 | 66% |
| Senior Secondary (Grade 12) | Male | 80 | 16-21 | 70% |
| | Female | 122 | 16-20 | 57% |
| | Total | 202 | 16-21 | 62% |
| University (Final Year) | Male | 118 | 19-25 | 42% |
| | Female | 81 | 19-25 | 47% |
| | Total | 199 | 19-25 | 44% |

This report presents findings of **FIVE** dimensions using the survey data, providing a deep and comprehensive understanding of patterns of subject choices and factors shaping them:

1. Important reasons for selecting subjects of study

- a. **Junior Secondary students** rated 12 possible reasons for selecting optional subjects, using a five-point Likert scale ranging from 1 ('Does not apply at all') to 5 ('Extremely important').
- b. **Senior Secondary and University students** rated 14 possible reasons for choosing a major field of study at university using the same five-point Likert scale.

2. Likelihood to select STEM subjects if they were not mandatory

- a. **Junior Secondary students** were asked (Yes/No) whether they would choose to study *Mathematics, Integrated Science, and Computer Studies* if these subjects were not compulsory. An open-ended field allowed them to explain their reasons.
- b. **Senior Secondary students** were asked (Yes/No) whether they would choose to study *Mathematics, Biology, Physics, Chemistry, and Computer Studies* if these subjects were not compulsory. An open-ended field was also provided for their explanations.

3. Change in senior secondary students' attitude toward STEM subjects

Senior Secondary students were asked to indicate whether their opinions about STEM subjects listed above have changed during their secondary schooling by selecting one of the below four statements:

- I always like this subject and still do.
- I used to dislike this subject, but I like it since secondary school
- I never like this subject from primary school; and I still don't like it
- I neither like nor dislike this subject; I am required to study it.

4. Self-assessed academic performance in STEM subjects comparing to non-STEM ones

Senior Secondary students were asked to self-assess their academic performance in the subjects listed above using a five-point Likert scale ranging from 1 ('Much Poorer') to 5 ('Much Better').

5. Perceived adequacy of support and information to do well in STEM subjects

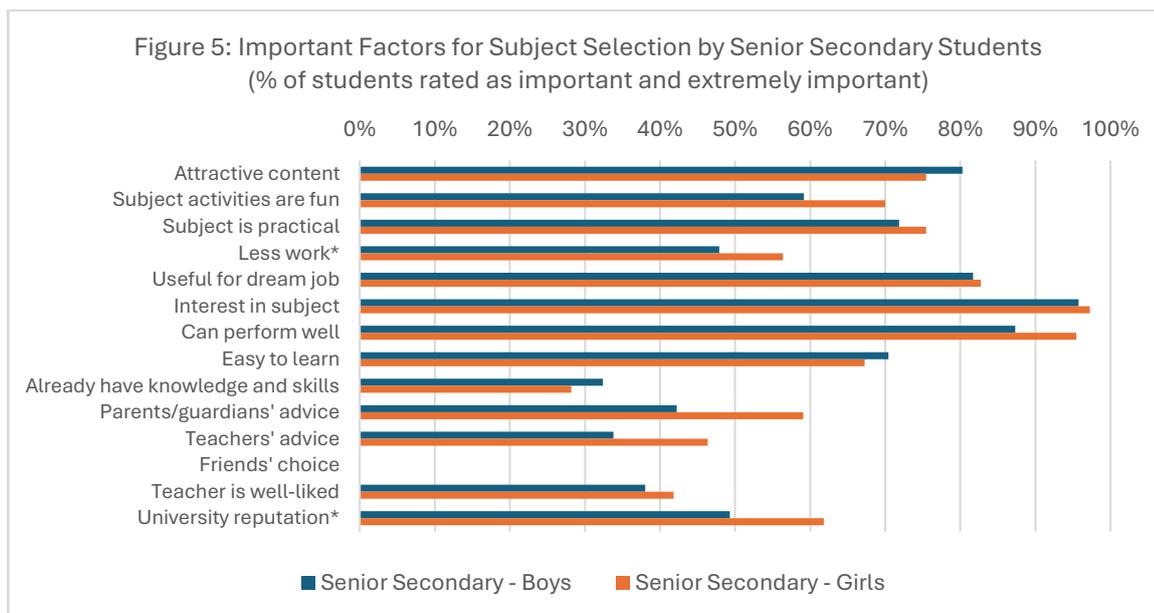
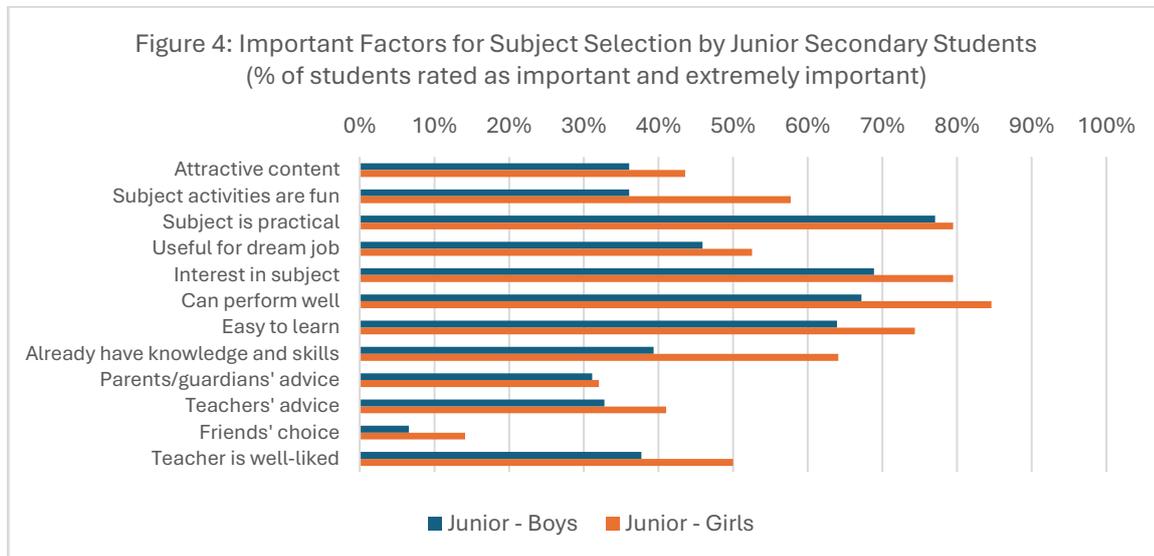
Junior and Senior Secondary students were asked whether they agree they have adequate support and information needed to do well in STEM subjects, using a five-point Likert scale ranging from 1 ('Strong Disagree') to 5 ('Strongly Agree').

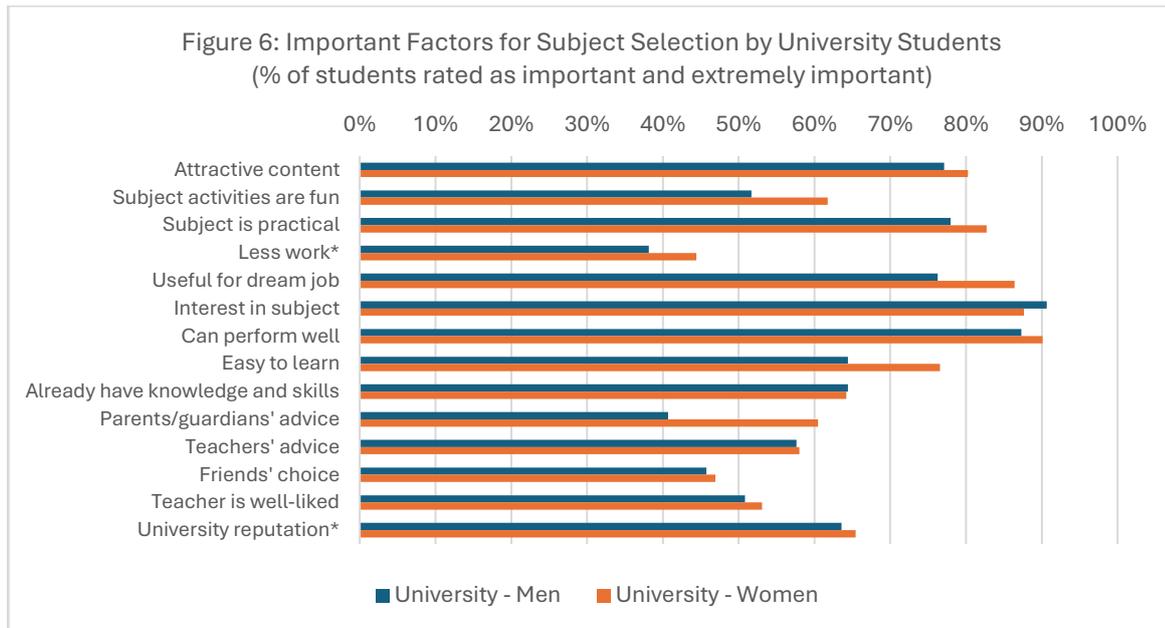
3. Key Findings

3.1. Important factors influencing subject choice

Students' subject choices are complex decisions shaped by a wide range of factors. These include individual attributes such as interest and enjoyment, sense of relatedness, family and socio-economic background, self-efficacy, and beliefs about a subject's practical value for future career. There are also external and contextual influences, including advice from parents, teachers, peers,

and other significant persons, perceptions of subject quality and teaching standards, and school or program reputation (Edeh and Oyamp-Itomp, 2024; Palmer, Burke and Aubusson, 2017).





N.B. The two factors 'Less work' and 'University reputation' were included in survey on senior secondary and university students only.

What are the key factors within and across the three educational stages?

The survey results (see Figures 4, 5 and 6, and Table 2) highlight **interest in the subject** and **self-efficacy** as the two consistently critical factors across all three educational stages, aligning with prior research (e.g. Edeh & Oyamb-Itomp, 2024; Halim, Mohd Shahali and H Iksan, 2021; Iscan, 2025; Palmer et al., 2017; Sakellariou & Fang, 2021).

Three key divergences emerged:

- **Relevance to desired careers** was rated as important by nearly 80% of senior secondary and university students, but only about half of junior secondary students, likely reflecting less career focus at earlier stages.
- **Attractiveness of subject content** followed a similar pattern: only 40% of junior secondary students considered it important, compared to nearly 80% at senior secondary and university levels.
- **Existing knowledge and skills** were important for only 30% of senior secondary students, but over 60% of university students. Notably, junior secondary students showed marked gender differences in opinions of this factor.

In contrast to extant research that emphasises the deterministic influence of parents on students' career development (e.g. Edeh and Oyamb-Itomp, 2024; Stefani, 2024), **parental advice** was deemed important only by 30% of junior secondary students – both boys and girls – and roughly half of senior secondary and university students. However, there are marked gender differences in the rating across students in these two stages.

Similarly, **teacher's advice** carried greater weight for university students than for junior or senior secondary students, implying a shift toward valuing expert guidance with educational

maturity (Li et al., 2021). In summary, the findings that fewer junior secondary students regarded parents and teachers of significant influential may reflect limited discussion, growing autonomy of student, or the tendency of parents and teachers not to intervene much in students' early subject choices.

Peer influence remained particularly weak, with no senior secondary students and only about 10% of junior students rating it as important (Keller, 2022; Vit, Lenkewitz and Krause, 2025). This finding contrasts with evidence that peer effects typically intensify during adolescence (Andersen and Hjortskov, 2022; Battiston et al., 2020; Lorenz et al., 2022; Raabe, Boda and Stadtfeld, 2019), suggesting that contextual or cultural conditions may shape this dynamic differently. However, the proportion of students rating peer influence as important increased noticeably by nearly 45 percent points at the university level, likely reflecting greater role of peer support and collaboration in the learning environment. Research suggests that this shift underscores the growing importance of social belonging, shared academic interests, and mutual support in shaping students' engagement and persistence in higher education (Chaffee et al., 2025; Wu, Thiem and Dasgupta, 2022).

Overall, individual factors, including intrinsic value associated with interest and enjoyment, perceived utility value such as practicality and relevance to personal career aspirations, and subject-specific self-efficacy emerged as the most important determinants in our findings. In contrast, the influence of parents, guardians, friends, and teachers was not ranked among the key factors at any educational stage. This finding departs from much of the existing literature grounded in social cognitive theory and studies emphasising social and relational influences on subject choice. This pattern, observed among students in our sample, may reflect broader demographic shifts and contextual realities across African societies, where economic pressures and persistent youth unemployment coexist with a young, more educated, and more entrepreneurial population is redefining traditional collectivist norms and placing greater emphasis on personal initiative and self-determination in shaping their own career choices.

Are there gender differences in factors influencing subject selection?

Research consistently shows that girls and women often have lower self-confidence in their competence to succeed in STEM compared to their male peers, which significantly discourages them from pursuing STEM education and careers (OECD, 2015; The African Academy of Science, 2020; Young et al., 2021). This occurs despite evidence that girls can perform as well as, or even outperform, boys in science and mathematics (Francis, 2010; UNESCO, 2022).

Our findings indicate that this confidence gap is most pronounced at the junior secondary level but diminishes at senior secondary and university levels. At the junior secondary stage, a notably higher proportion of girls, by about 10 to 20 percentage points, consider factors such as believing they **can perform well**, finding the subject **easy to learn**, and already **possessing relevant knowledge and skills** as important in their subject choices (Table 2). These factors reflect their confidence, self-efficacy, and perceived capabilities. While slightly larger proportion of boys than girls considered it important for **a subject to be easy to learn** at the senior secondary level (Figure 5), this factor was found to be more important to women at the university level, by about 10 percentage points (Table 2).

Differences also exist in how girls and boys value various **subject attributes**. **Utility** value of subject (i.e. subject is practical) was consistently among the top five reasons for subject selection for both genders (Table 2). Although a slightly higher proportion of girls and women across all stages considered utility important, the gaps were small. The proportion of boys who regarded this factor as important was highest at the junior secondary level (79%). On the other hand, notable higher proportion of girls and women across all stages than boys and men claimed **subject fun to learn** as important, by 22 percentage points at junior level and 10 percentage points at senior and university level (Figures 4, 5 and 6).

At the university level, a higher proportion of female students considered **attractive subject content and the relevance to desired careers** as important, by 7 and 10 percentage points, respectively compared to male students. Similarly, **a lighter workload** was considered important by a greater proportion of female students at senior secondary and university levels, by 8 and 6 percentage points, respectively. A substantially higher proportion of female students at the senior secondary level valued **university reputation** when selecting their major, by 12 percentage points compared to their male peers. These findings suggests that girls and women may place greater emphasis on the utility and perceived value of their educational choices (Iscan, 2025).

A higher proportion of female students at all educational stages considered **advice from parents, guardians, and teachers** important, compared to male students. The gender gap in valuing teachers' advice was more pronounced at both junior and senior secondary levels, with 8 and 10 percentage points more female students, respectively, rating it as important. Parental or guardian advice was valued by substantially more female students at senior secondary and university levels, by 17 and 19 percentage points, respectively. Nevertheless, in contrast to emphasis in extant literature, advice from significant persons was not among the top five most important factors for subject selection for either gender at any stage.

Table 2: Most important factors to male students' subject choices by educational stage

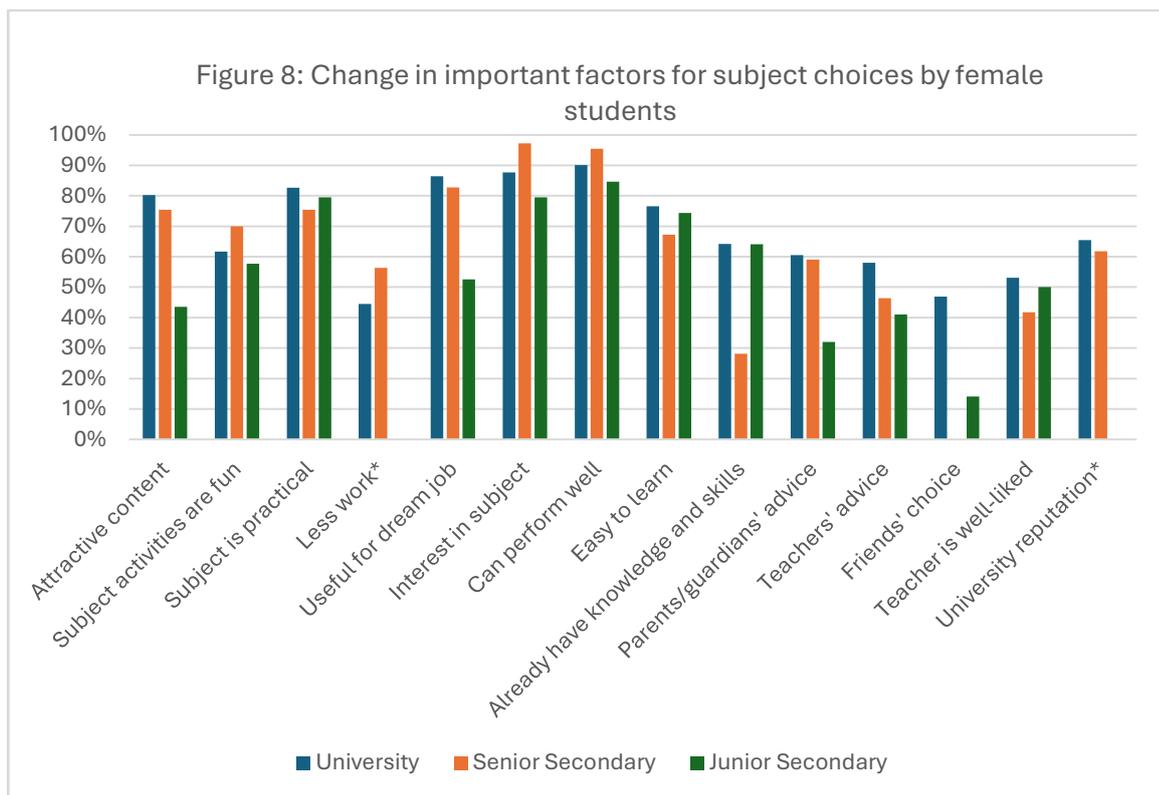
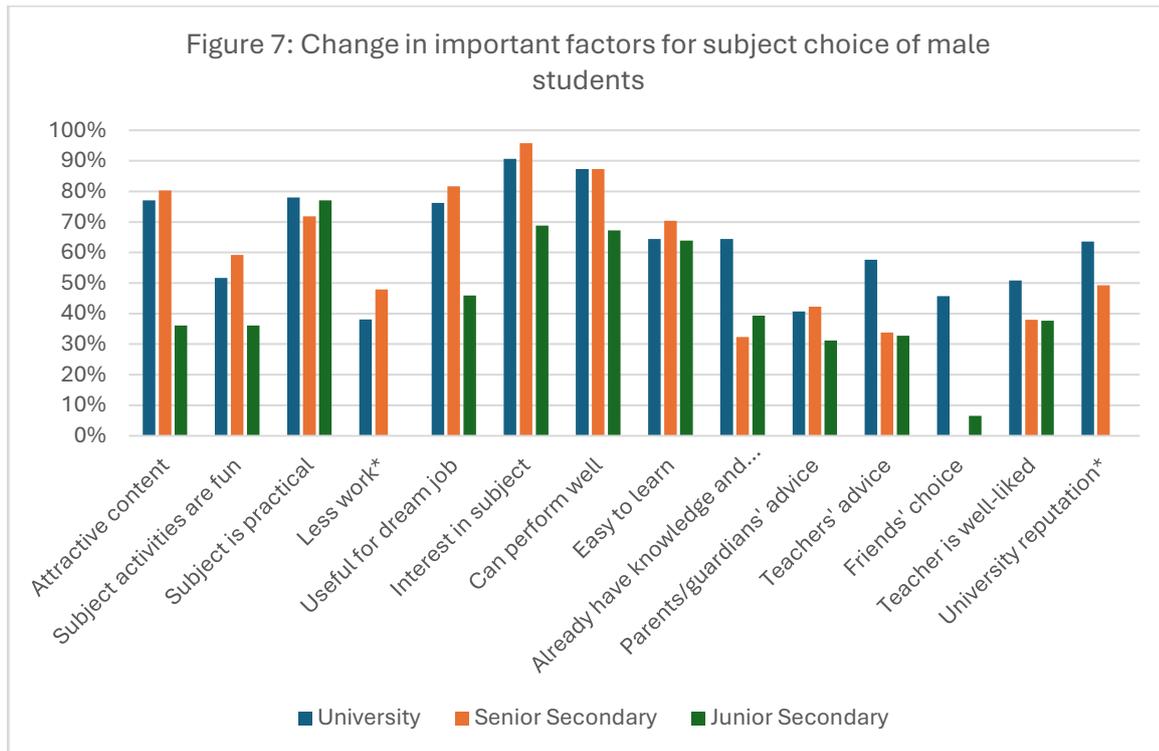
| Educational Stage | Top 5 factors valued by the highest proportion of students | |
|-------------------|---|---|
| | Male Students | Female Students |
| Junior Secondary | <ol style="list-style-type: none"> 1. Subject is Practical, 77% 2. Interest in the Subject, 69% 3. Can Perform Well, 67% 4. Easy to Learn, 64% 5. Useful for Dream Job, 46% | <ol style="list-style-type: none"> 1. Can Perform Well, 85% 2. Subject is Practical, 79% 3. Interest in the Subject, 79% 4. Easy to Learn, 74% 5. Already have knowledge, 64% |
| Senior Secondary | <ol style="list-style-type: none"> 1. Interest in the Subject, 96% 2. Can Perform Well, 87% 3. Useful for Dream Job, 82% 4. Attractive Content, 80% 5. Subject is Practical, 72% | <ol style="list-style-type: none"> 1. Interest in the Subject, 97% 2. Can Perform Well, 95% 3. Useful for Dream Job, 83% 4. Attractive Content, 75% 5. Subject is Practical, 75% |
| University | <ol style="list-style-type: none"> 1. Interest in the Subject, 91% 2. Can Perform Well, 87% 3. Subject is Practical, 78% 4. Attractive Content, 77% 5. Useful for Dream Job, 76% | <ol style="list-style-type: none"> 1. Can Perform Well, 90% 2. Interest in the Subject, 88% 3. Useful for Dream Job, 86% 4. Attractive Content, 80% 5. Easy to Learn, 77% |

Do important factors in students' subject choices change by educational stage?

The salience that students ascribe to particular factors to subject selection is likely to change as they advance in educational stages, reflecting interplay between internal cognitive development and external contextual influences in shaping perceptions, beliefs, and aspirations (Bailey et al., 2015; Demetriou et al., 2022). Our survey results provide detailed insights into how influencing factors vary by gender across three educational stages, revealing patterns in how students' priorities and motivations evolve over time.

For male students, notable shifts were observed across several key factors influencing subject choice (see Table 2 and Figure 7):

1. **Interest and confidence in one's ability** emerged as the most influential reasons for subject choice across all educational stages, with a higher proportion of students at the senior secondary (96% girls and 87% boys) and university (91% girls and 87% boys) levels placing strong value on these factors. In addition, **possessing knowledge and skills related to a subject** were more highly valued by university students than by those in secondary school.
2. **Attractive subject content** and **subject is fun** were not considered important by most junior secondary students. However, a larger proportion of students at senior secondary and university levels valued them as important to their subject choices.
3. **The relevance of a subject to desired careers** became increasingly salient, valued by 82% senior secondary and 76% university students, compared to only 46% junior secondary students. Considered alongside Point 2 and the finding that the practicality of the subject remained consistently important across all stages, this indicates a growing appreciation for both the intellectual engagement and emotional satisfaction derived from the subjects studied.
4. **Teacher and peer influence** was reported to hold more significance for university students than for those in secondary school.



N.B. The two factors 'Less work' and 'University reputation' were applied in survey on senior secondary and university students only.

For female students, the shifts in key factors influencing subject choices across the three educational stages were broadly consistent with those observed among male students. However, notable differences emerged in two specific factors (Figure 8).

1. **Parents' and guardians' influence** became significantly more prominent at the senior secondary and university levels, with the proportion of students considering it important with nearly 28 percentage points higher than at the junior secondary level. Yet, this factor was not among the top important factors across all stages.
2. **Possessing knowledge and skills related to the subject** was valued at both the junior secondary and university levels. However, few female students at the senior secondary level considered it important, possibly reflecting reduced perceived relevance or confidence in their competence. The renewed emphasis at the university level likely reflects the growing specialisation and complexity of subjects, where having strong knowledge and belief in one's ability to perform well become decisive factors in subject choice. It may also indicate that those who continued with the subject recognised its growing importance for future goals.

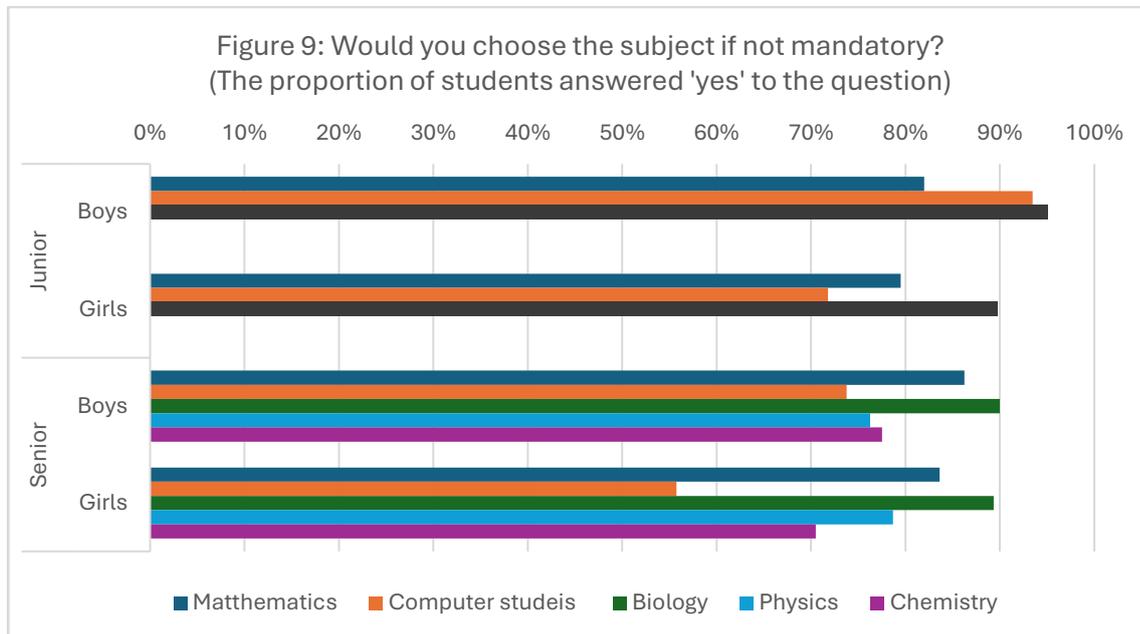
3.2. Student Willingness to Choose STEM Subjects Beyond Mandatory Requirements

Most policymakers aspire to build scientifically and technologically literate populations to remain competitive and adaptable in an innovation-driven economy. Strengthening such competence is vital for fully leveraging human capital and advancing sustainable national development. The African Development Bank (2019) warns that many African countries remain unprepared for the Fourth Industrial Revolution, hindered by persistent deficits in digital and mathematical literacy and a shortage of STEM-qualified graduates. In response, many governments have embedded and prioritized STEM within national curricula at the secondary level, making STEM education and skills training compulsory from early schooling. Yet it remains unclear whether such mandates genuinely translate into sustained interest and long-term participation in STEM, particularly among girls and women, given the persistence of other systemic barriers (Giffney and Lane, 2025; Sevilla, Luengo-Aravena and Farias, 2023). Consequently, the capacity of these measures to bridge capability gaps and cultivate an inclusive, resilient STEM workforce is still open to question.

This section of the report presents survey findings on the likelihood that students across three educational stages would choose STEM subjects if they were not mandatory. The results offer deeper insight into students' intrinsic attitudes toward and interest in STEM, providing a basis for assessing how effectively current educational approaches foster genuine engagement and long-term participation in STEM fields.

In Zambia, secondary school subjects are typically organized into five broad categories: business (2 subjects), practical (7), STEM (8), languages and literature (11), and social and religious studies (5). At the junior secondary level, English, Mathematics, Computer Studies, Civics, and Integrated Science are compulsory for all students. At the senior secondary level, English and Mathematics remain mandatory, along with core subjects specific to each academic stream. For example, students in the STEM stream are required to take additional mathematics, biology, chemistry, and physics. Consequently, this study focused on STEM-designated

secondary schools, where STEM subjects are compulsory, to gain deeper insights from students already immersed in STEM pathways.



N.B.: The third dark line for junior secondary school refers to Integrated Science

The survey results (see Figure 9) reveal distinct gendered and subject-based trends in students' willingness to choose STEM subjects if they were not mandatory. Across both educational levels, boys show consistently higher preferences for all STEM subjects compared to girls, with the gender gap particularly wide in computer studies at the senior level. Despite its compulsory status and the widely proclaimed promise in the digital era, computer studies receives the lowest voluntary uptake by both boys and girls. This unexpectedly low interest may reflect not only contextual barriers such as infrastructure barriers and limited access to technology, but it also concerns about curriculum relevance or excessive complexity that fail to engage students meaningfully.

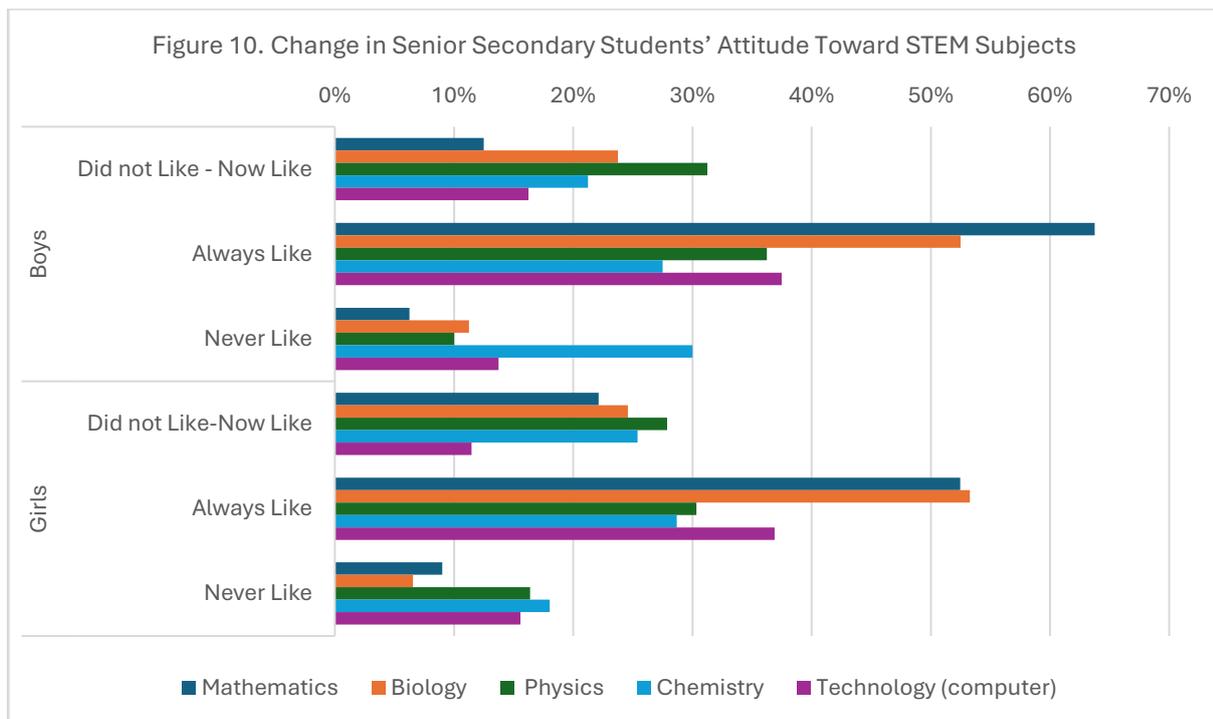
Mathematics and biology enjoy the broadest appeal, especially at the senior secondary level, while chemistry and computer studies attract far less interest if not mandatory. Gender differences are marked: at senior level, 18% fewer girls than boys would choose computer studies, and 8% fewer would choose chemistry. However, girls are slightly more inclined than boys to opt for physics, and the gender gap in mathematics and biology is minimal (1–2%). This challenges common stereotypes of physics and mathematics as male-dominated subjects, suggesting that girls' interest in these fields may be stronger than often assumed (Keenan and Gupta, 2022; Morondo, 2024; UNESCO, 2024b; van der Vleuten et al., 2016). Existing research indicates that such gendered preferences are context-dependent and influenced by curriculum design, cultural factors, and encouragement, rather than innate ability. Thus, these findings suggest significant potential for more balanced gender participation, even in traditionally male-dominated STEM subjects, if educational environments actively foster meaningful support, inclusivity, and advance a more gender-neutral identity in these disciplines to engage all students equitably (van der Vleuten et al., 2016; Sax et al., 2016).

Notably, students at junior secondary are considerably more likely to select integrated science - a combined subject— than to specialise in pure science subjects as they advance. This may suggest a general openness to scientific literacy without a corresponding willingness to specialize in traditional STEM pathways.

Overall, the data questions the effectiveness of mandatory curricula in generating lasting STEM engagement, especially among girls, and points to the need for more targeted strategies beyond compulsion to cultivate a diverse and resilient STEM workforce (The African Academy of Science, 2020).

3.3. Change in Senior Secondary Students’ Attitude Toward STEM Subjects

Building on the above findings about secondary school students’ willingness to choose STEM subjects in non-compulsory settings, this study also explores whether senior secondary students change their perception (i.e. like the subject more or less) after studying them. Assessing patterns such as consistently like, persistent dislike, emerging interest and dislike can provide additional useful information.

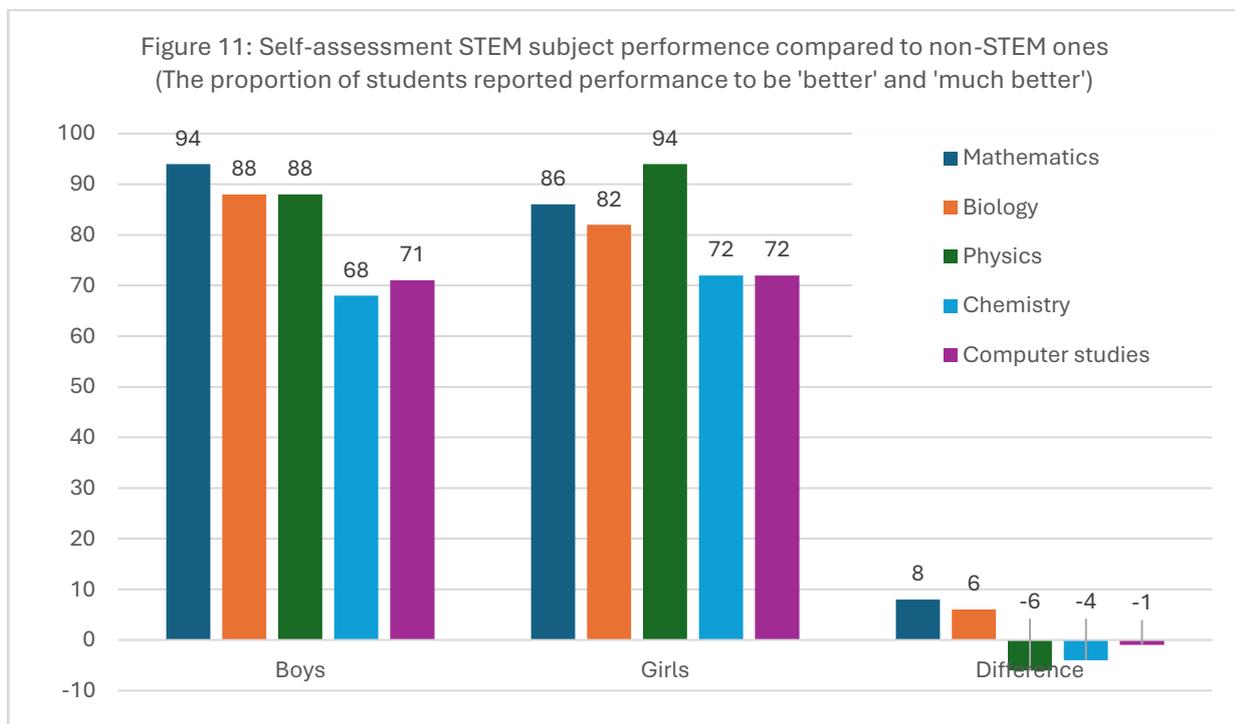


The survey data (see Figure 10) reveal that, by their final year, more than half of all senior secondary students reported they had **consistently liked mathematics and biology** throughout their schooling. Nonetheless, a substantial share, particularly for **physics, mathematics, and biology indicated a positive change in attitude**, with about one in five students growing to like these subjects after initially disliking them. This indicates that subject exposure and experience during secondary school can positively influence students’ enthusiasm for STEM disciplines. **Persistent neutrality or dislike was more commonly observed in chemistry and computer studies**, suggesting these areas may present greater challenges in fostering sustained student interest.

By gender, boys showed particularly strong and sustained liking for mathematics and biology, with around two-thirds consistently reporting positive attitudes. Among those who initially disliked physics, 31% of boys and 28% of girls came to like it by their final year, highlighting similar levels of attitudinal change between genders. However, persistent disinterest remained notable, especially for chemistry, with 30% of boys and 18% of girls continuing to dislike it. This gender difference suggests that while both groups can grow to appreciate certain STEM subjects through exposure, some areas particularly chemistry and computer studies require targeted engagement strategies to foster and sustain student interest.

3.4. Gender Differences in Self-Assessed STEM Subject Performance Compared to Non-STEM ones

The survey findings discussed in Section 3.1 indicate that self-efficacy, defined as students' confidence in their ability to perform well in a subject, remains a key determinant of subject choice for both male and female students across all stages of study. To explore gender-related differences in confidence more closely, this section analyses senior secondary students' self-assessed performance in STEM subjects. While extensive research documents gender gaps in self-efficacy, particularly disadvantaging girls and women in STEM, these disparities vary by context and subject. Our findings contribute to this complex evidence base, suggesting potential departures from the conventional belief that lower perceived competence is the primary barrier to women's sustained participation in STEM education and careers.



The findings (see Figure 11) show that a great majority of students, well over 70% reported their performance in STEM subjects as better than in non-STEM subjects. Among the STEM disciplines, biology, mathematics, and physics stand out, with over 80% of all students reporting superior performance relative to other subjects. Chemistry and computer studies lag slightly

behind, but still have around 70% students indicating better performance, suggesting these two subjects may present more challenges for students. Overall, the proportion of students confident in their STEM performance is high, reflecting positive self-assessment of their capabilities in these core areas.

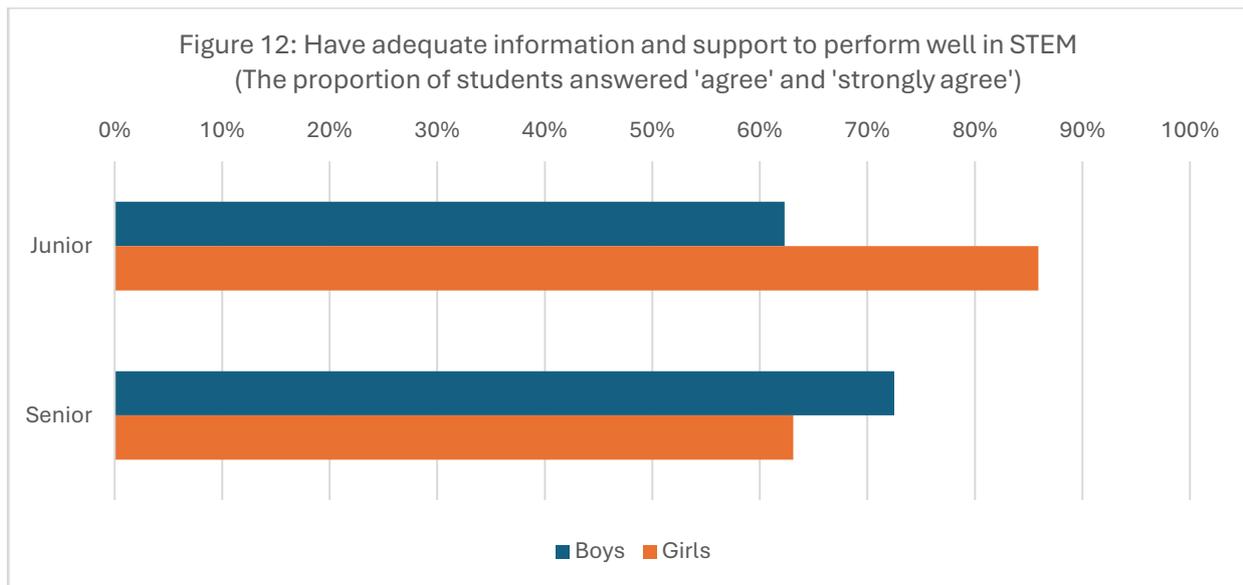
When examined by gender, distinct patterns in self-assessed performance are evident. A greater proportion of girls reported performing better in physics and chemistry compared to non-STEM subjects than boys. Conversely, the proportion of boys reporting stronger performance in mathematics and biology relative to non-STEM subjects was higher than girls. The relatively lower self-assessment scores for chemistry and computer studies among both genders reinforce observations from attitudinal patterns discussed in Sections 3.2 and 3.3, suggesting these subjects might be less preferred or perceived to be harder to master, and that their mandatory status may significantly influence students' choices.

3.5. Adequacy of information and support to do well in STEM subjects

Building on the self-assessed performance of STEM subject relative to non-STEM subjects, the survey asked students whether they felt they had sufficient information and support to perform well in STEM subjects. Overall, more than two-thirds of the students reported receiving adequate guidance and support for their STEM studies (see Figure 12).

At the junior secondary level, 86% of girls indicated that they had the information and support they needed, compared with 62% of boys. However, this pattern reversed at the senior secondary level. The proportion of girls who believed they had adequate support dropped by over 20 percentage points to 63%, while the share of boys who felt adequately supported rose by 11 percentage points to 73%.

These findings suggest that while younger girls initially feel well supported in STEM, this confidence declines as they advance through school. A possible explanation lies in the increasing specialisation and difficulty of STEM subjects at senior levels and the nature of support (e.g. after class coaching and tutoring) that may favour boys that may be freer to hang around after schools than girls. If guidance, resources, and encouragement do not evolve alongside this increasing complexity and increasing social and cultural demands as students mature, girls may feel less supported and equipped to handle the challenges. Addressing these gaps requires targeted interventions that reinforce mentoring, subject-specific support, and equitable access to advanced STEM learning opportunities.



4. Conclusions

The main challenge in designing and implementing measures to attract more female student to STEM study, retain them, and support their future aspirations is the lack of clarity regarding challenges that are age-specific, gender-specific, and STEM-specific. Some of these issues are less related to gender and STEM but more to age.

For instance, career-related concerns are more closely linked to age than to STEM disciplines or gender. Both girls and boys at the junior secondary school level may have considered future career opportunities when selecting a subject of study, but such considerations were not among the primary concerns as they are for senior secondary school and university students. This pattern was evident in one question directed to junior secondary students: *‘What do you wish to become when you complete school?’* Although the survey was undertaken in STEM-focused schools and clearly underlined STEM, some junior secondary school students expressed aspirations to become soldiers, police, lawyers, or clergy alongside more traditional STEM professions such as engineers and medical doctors.

Some issues, however, are STEM-specific. Across all educational stages and age groups, both boys and girls expressed a notable dislike for computer studies, followed by chemistry. This pattern remains consistent regardless of whether the question was phrased directly (for example, *‘Would you choose the subject if not mandatory?’*) or indirectly through statements that reflected respondents’ sentiments over time (for example, *‘I didn’t like the subject but now I like it.’*). The reasons cited for the dislike appear unrelated to either gender or age. While we initially assumed that students might dislike STEM subjects because they are time-demanding such as requiring lengthy laboratory and field research hours, the most frequently cited reasons were heavy content loads, excessive use of equations, and a perceived lack of practical relevance to real life. These are issues that schools could address through improved pedagogical designs that emphasise practical application and experiential learning, including field-based and hands-on activities.

We have also sought to identify several gender-specific issues. For instance, girls weighed advice from parents and teachers more heavily than boys did. Girls were more likely to choose a subject that was perceived to be fun to learn, taught by well-liked teachers, had less workload, and practical to real life. Notably, girls at both junior and senior secondary levels expressed a significantly stronger dislike for computer studies than boys did. These and the other factors identified above were distinctly gender-specific and could be targeted in campaigns to increase girls' and women's interest and participation in STEM.

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