INVERGE JOURNAL OF SOCIAL SCIENCES
https://invergejournals.com/
ISSN (Online): 2959-4359, ISSN (Print): 3007-2018
Volume 5 Issue 1, 2026

# STUDENTS' INCLINATION FROM PURE SCIENCES TO COMPUTER SCIENCE: AN EXPLORATORY CROSS-SECTIONAL STUDY

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**DOI:** https://doi.org/10.63544/ijss.v5i1.227

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**Article History:**
Received: 01.01.2026
Accepted: 19.01.2026
Published: 28.01.2026

**Abstract**

*Students' academic preferences have changed a lot in the past few years. They are more interested in computer science (CS) as compared to pure sciences. This study aims to investigate the motives behind this shift among Intermediate-level students. A five-point Likert scale was used to conduct a cross-sectional, questionnaire-based survey. Response of 1,231 participants, including teachers and students from 11th and 12th grades was recorded. Descriptive statistics, including the mean and standard deviation, were calculated. T-test and ANOVA test were applied to measure the statistical significance difference among different groups. The significance of the results was compared using p-value ($p = 0.05$). The results reveal that students perceive that pure sciences are hard to understand with limited old lab equipment and provide few job opportunities. On the other hand, computer science was strongly linked to better job prospects, higher pay, job security, and being useful for modern technology. Students' preference for technology-based education was also strengthened by schools' focus on computer science programs, government policies that encourage digital skills. Parents' influence and students' own exposure to social media and digital environments further strengthen their interest to CS. Results also indicate that there is statistical significance difference between teachers and students, especially when it came to career goals and how schools set priorities. This study concludes that; the inclination from pure sciences to CS is more due to structural and socioeconomic factors than a lack of interest in science. To keep both sciences in line, we need to make science education more modern, make career paths clearer, and fair educational policies.*

**Keywords:** Career, Computer Science (CS), Education, Learning, Pure Sciences, Students, Teachers, Technology

## Introduction

The growing interest of students in computer science (CS) reflects the changing nature of education, where opportunities, technological progress, and digital integration career have a larger impact on what students want to study. The trend of students embracing CS and technology in the classroom is driven by career benefits and the rapid growth of the technology sector. This leaning highlights the unification of computational and data science skills across disciplines (Gouvea, 2023). People are starting to realize that the practical skills like; data science and information technology are in line with the job market now and in the future which makes students more interested and inspired towards CS (Soleymani, et al., 2024). Study done shows that uniting CS with other fields such as engineering and science can make people more creative and better at solving problems. However, these approaches can also make it harder to plan lessons and use resources (Anh, et al., 2024). Teaching pure sciences like physics with computer simulations and other tech tools can make students more interested and positive about the subject. However, this might not be enough to get them to want to learn CS and technology directly (Ayasrah et al., 2024). Gamification and interactive platforms make learning more entertaining, and the growth of digital and online learning environments in CS education makes students even more enthusiastic to learn.

As the students are more interested in technology-based education, greater emphasis should be on automation, AI, and data-driven systems. Evidence from Pakistan (Shafiq, et al., 2025) suggests that early exposure to AI-enhanced learning settings enhances students' understanding of ideas and elevates their interest in technology-oriented fields compared to traditional pure sciences (Qayyum, et al., 2024). This transformation is a sign of more drastic changes that occur in schools throughout the world as they familiarize themselves with digital economics. The increasing emphasis on automation, data science, and intelligent systems has reinforced the shift by the students to technology-based education. Thus, analysing childhood learning experiences, institutional settings, and technological factors, the proposed study will focus on the identification of the major factors contributing to the formation of academic interests.

### *Slanting Pure Sciences to Computer Science (CS)*

Fields that are technology intensive are now leading in the innovation, employment and long-term financial benefits in economics and education. It is the digital economy, as well as the introduction of data-driven systems, that has made computer science a major force behind modernization and productivity. Over the last 20 years, more students have chosen CS and technology over traditional sciences because of changes in the job market. They perceive that in this field; the use of technology provides more financial benefits and job security. According to recent studies, between 2023 and 2025, higher education is undergoing a structural change, whereby the enrolment into pure science majors is reducing because it seems to lack employability. The number of students in CS, on the other hand, expanded a lot from 2018 to 2024 (reference figure 1). This is because it is dynamic in fields that are increasing promptly like; cyber security and artificial intelligence (Khan, et al., 2023; M. Rashid, et al., 2025). Students are finding pure sciences to be more and more abstract, hard to understand, and hard to employ in real life. Learners are less motivated and engaged in the process since they should memorize things by heart, their educators adhere to outdated methods, and the laboratories are not well furnished and modernized. Recent study reveals that science education is important for developing scientific attitudes and psychomotor skills that help people understand themselves and the world around them (Ahmad, et al., 2025). Studies on early childhood and foundational education in Pakistan (M. Rashid, et al., 2025) indicate that insufficient early exposure to inquiry-based and technology-enhanced learning adversely affects long-term interest in scientific disciplines (M. Rashid, et al., 2025). The decline in scientific enrolment at higher academic levels may be partially due to these initial educational shortcomings.

After the pandemic "economic realism" makes this difference even bigger. Looking at the number of students who took physics and chemistry classes in 2020, we can see that students are more aware of return on investment (ROI) because of the unstable economy and rising costs of education. In pure sciences, you need a PhD to get a good job, but CS graduates can now get good starting salaries with just a bachelor's degree, which is drawing talent away from traditional STEM fields. The "CS + X" curriculum model also combines CS with biology (bioinformatics), physics (computational physics), and the arts, making it a universal language for scientific inquiry (Kalhor & Bahrak, 2023). These statistics show that the things that schools worry about most are changing a lot. Students' choices are influenced by rapid changes in

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https://invergejournals.com/
ISSN (Online): 2959-4359, ISSN (Print): 3007-2018
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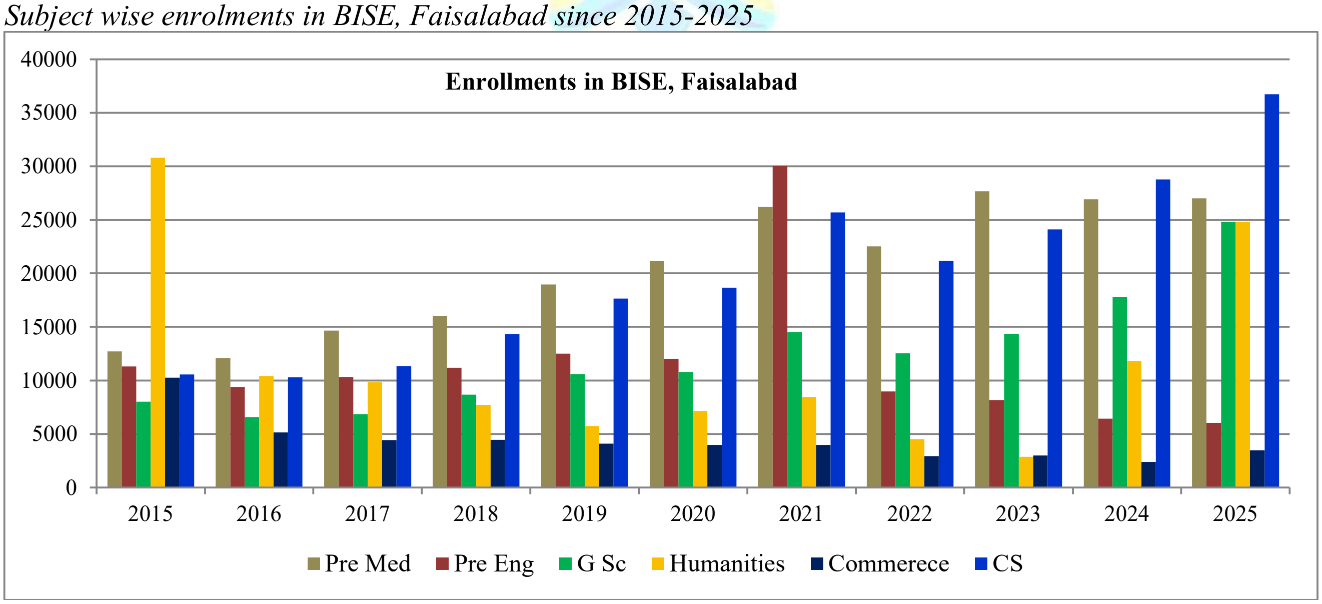
technology, economic factors, and the availability of diverse emerging fields. This is making CS a more popular choice, but it could also make traditional pure science fields less significant.

Developing countries such as Pakistan have such changes being hastened by the problems with the education system. According to the statistics in higher education, particularly in science subjects which are majorly reliant on the laboratory use and continuous development of concepts, the COVID-19 pandemic had a long-term impact on the continuity of lessons, the willingness of students to go to school, and their interest in education. The results of a countrywide cross-sectional study revealed that higher secondary students experienced great learning losses, declines in motivation, and lack of confidence in their academic skills when schools were shut down in the long term (A. Rashid, et al., 2024). Such post-pandemic education pressures can have made the students have more interest in technology-oriented jobs such as computer science (CS) that is believed to be more flexible, accessible online, and more aligned to the needs of the future workforce.

The tendency of science students to the CS is rather high since the previous decade. The enrolment data of the Board of Intermediate and Secondary Education (BISE) in Faisalabad (https://www.bisefsd.edu.pk/InterResults.aspx) shows that enrolments in computer science among students have significantly increased in number between the years 2015 and 2025 as Figure 1 shows. The population of students enrolling in computer science grew by over three times between 2015 (10,577) and 2025 (36,739). Conversely, the enrolment in more traditional streams, like Pre-Engineering (Pre Eng) had low enrolment of 6,032 in 2025 compared to high enrolment of 30,050 in 2021. Conversely, the enrolment of students in General Science (G Sc) and Pre-Medical (Pre Med) programs varied enormously and by a slight margin. This trend belongs to a bigger one concerning the choice of majors by students. Due to some of these reasons such as the needs of the labour market, employability perceptions, and growth of computer science driven careers, more students are opting to pursue computer science.

**Figure1**

*Subject wise enrolments in BISE, Faisalabad since 2015-2025*




***Pedagogical and Structural Blockades in Pure Sciences***

Students are reportedly finding pure science to be more challenging and are not as fascinated by it. This can be attributed to the old modes of teaching, deficiencies in laboratory facilities as well as unclear career prospects. This is entirely the opposite of that in career-oriented disciplines such as computer science, which are interactive. In a 2024 review, it is stated that standard lectures often lead to passive disengagement meaning that they do not show how theory is applied in practice. This approach, as described by Bayona (2024) and Bevizova (2024), demotivates students and promotes rote learning instead of more participative courses such as computer science and increases the difficulty gap (Bayona, 2024; Bevizova, et al., 2024).

A recent study also concluded that students who do not have access to the latest simulation tools and experimental equipment cannot develop the so-called technological self-efficacy required to secure the employment in the contemporary world. Due to this aspect, the field is not as relevant as the digital space of software engineering (Stevens, Anderson, & Carlson, 2024). It is harder to find an education in pure sciences as opposed to technology where job opportunities are more direct. A 2023 STEM job map states that the two primary elements in students majoring in computer science are career prospects and expected earnings. On the other side, students who want to pursue pure science are more afraid about their jobs and needing PhDs to get it. This "employability discrepancy" causes many students who are interested in science to switch to technology fields because they offer quick and clear returns on investment (López, et al., 2023). Due to these academic, technological, and career-related harms, students believe that pure sciences are harder to get into and less fulfilling.

### *Economic Motivations and Social Teamsters*

Computer science is very tempting to students because it has strong economic incentives. It is useful in real life and works well with modern technology. It is a very good-looking alternative to traditional pure sciences. Compared to traditional pure sciences, graduates with a degree in CS have higher starting salaries and are more likely to find work quickly. This shows that this field is quite appealing from a business point of view. Studies of the job market show that from 2023 to 2024, CS degrees will pay more than general science degrees. A 2023 study found that CS graduates are more likely to get "Expert" jobs that require a lot of skill right after they graduate. This is different from physics and biology graduates, who often start in lower paying "Associate" jobs or go back to school. This gap in employability is what puts students in desire to study computing. Two of the primary motivations behind the choice are its future career prospects and its financial stability (Hunt, et al., 2025). People believe that CS is helpful and practical since it is a way to learn how to write the code, analyse data, and create the software that functions in the real world.

The utility value of CS increases due to the large number of people who use it over the Internet. This is not comparable to pure physics or chemistry which is more abstract. A qualitative study in 2023 showed that digital games and online space are seen by students as the so-called growth platforms by means of which students can be acclimatized to working with technologies and highly structured systems, and thus degrees in CS could become easier to earn (Li et al., 2023).

The parental influence on the choice of their career has a huge impact on their children, particularly in the field of IT jobs, which is regarded to be secure and rapidly expanding. Studies have shown that decision on major in technology largely depends on the family and perception of the parent about the trend in the industry. This is because they usually advise students against more risky careers in pure science, and instead opt to take the technical sector that is perceived to be safe. (López et al., 2023). In general, CS is a better choice because it offers money, the chance to use skills in the real world, a chance to learn about digital technology, and help from parents. This makes the gap between fields that focus on technology and those that focus on pure science even bigger.

### *Institutional Priorities and Societal Impact*

Students' academic choices are heavily influenced by institutional and social factors. Many of them prefer CS to more traditional pure sciences only due to the aesthetic appeal of the institutions. According to recent studies colleges and universities are spending more money on digital projects like high-performance computing (HPC) centres and coding labs to meet the growing demand for technical skills (Fernández, et al., 2023). On the other hand, departments of pure science don't get any new money, and their buildings are getting old. A report from 2025 said that big cuts to federal grants were bad for basic science research. Because of this difference in funding, there is a "quality gap" for students. CS students have access to modern labs, while physics and chemistry students do not have enough resources (Briscoe, et al., 2025). In CS, students learn by doing projects and using interactive models that get them involved right away by making real things. On the other hand, pure science education often uses lectures that are heavy on theory, which makes it harder to apply what you've learned and hurts memory (Beye & Woods, 2024).

Due to the government initiatives, "digital sovereignty" and knowing how to use AI have become more significant national goals. In 2024, a number of countries started programs that pay students to get degrees in data science, cyber security, and artificial intelligence. These structures also take money away from basic science education that is already declining. This change reflects that fields related to technology will be very important for the economy in the future (Stevens, et al., 2024). As a result, these institutional priorities and social influences and government priorities make CS more attractive, while at the same time making traditional pure science education seem less valuable and less accessible.

## Methodology

### *Study Design and Participants*

This study was conducted on questionnaire-based survey design to examine factors influencing students' declining interest in pure sciences and increasing preference for CS. The target population included Intermediate-level students and teachers from colleges and higher secondary schools of Faisalabad division.

### *Sample Size and Sampling Technique*

Participants were recruited using a convenience sampling method. A total of 1231 respondents (students and teachers) who met the inclusion criteria and completed the questionnaire were included in the final analysis.

### *Data Collection Tool and Procedure*

Data were obtained through a structured, self-administered questionnaire utilizing a five-point Likert scale (Strongly Disagree to Strongly Agree). The questionnaire assessed perceptions regarding pure sciences, computer science, institutional factors, and career prospects. The questionnaire was sent out electronically via Google Doc Forms and was open from September 1, 2025, to October 31, 2025. The people who answered could choose to take part, and their names were not made public.

### *Inclusion and Exclusion Criteria*

Students enrolled at the Intermediate level and teachers teaching at the same level who provided complete responses were included. Students other than Intermediate classes and, non-teaching staff of the institutions were excluded.

### *Ethical Considerations*

The study adhered to ethical standards consistently and participants were apprised of the study's objective, anonymity was guaranteed, and informed consent was inferred through voluntary engagement.

### *Data Analysis*

Data were extracted from Google Doc Forms and transferred into Excel and IBM SPSS V-23. Responses were quantified utilizing a five-point Likert scale, with numerical coding ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). Descriptive statistics, including the mean and standard deviation, were calculated for each item. T-test was conducted for gender comparison whereas; ANOVA test was applied to measure the statistical significance difference among teachers and student.

## Results

Out of the 1,231 respondents, 796(64.7%) were male and 435(35.5%) were female. The sample comprised 255(20.7%) teachers educating at the Intermediate level and 976(79.3%) students, including 479

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https://invergejournals.com/
ISSN (Online): 2959-4359, ISSN (Print): 3007-2018
Volume 5 Issue 1, 2026

(38.9%) from 11th year and 497(40.4%) from 12th year. With respect to locality, 298(24.2%) respondents were from rural areas, while 933 (75.8%) belonged to urban areas. The demographic profile of the participants is presented in Figure 2.

**Figure 2**
*Pi-Chart showing demographic profile with frequency responses*

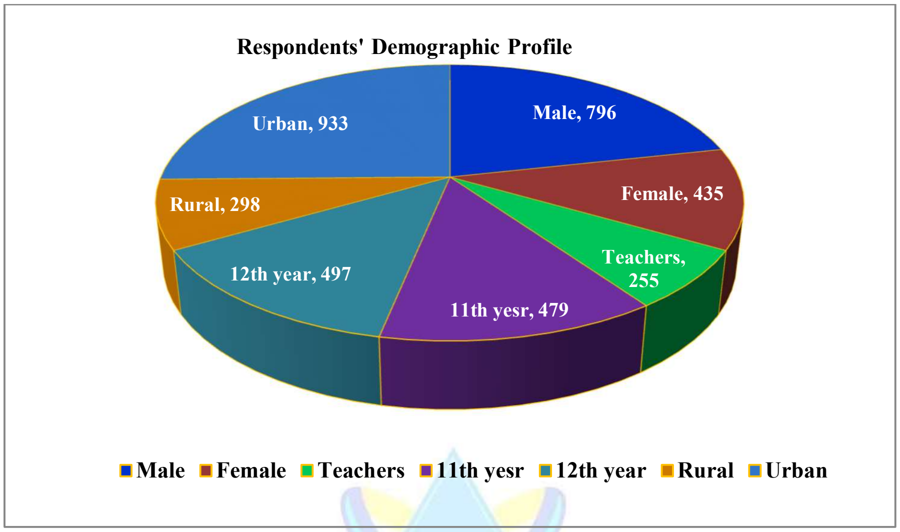


Table 1 presents the frequency distribution, mean scores, and gender-based comparisons of perceptions regarding pure sciences and CS using a five-point Likert scale. The mean scores for all items ranged from 3.57 to 4.19, indicating an overall agreement among respondents regarding the increasing preference for CS over pure sciences. Standard deviation values (0.94-1.22) suggest moderate variability in responses. Gender comparisons' significance was compared with p-value (p = 0.05) with confidential level of 95%.

**Table 1**
*Frequency distribution and statistical response of the respondents*

| Qs. | Items | SDA f (%) | DA f (%) | N f (%) | AG f (%) | SAG f (%) | Mean ± SD | T-test P-value |
|---|---|---|---|---|---|---|---|---|
| 1 | Do you think, pure sciences (Physics, Chemistry, Biology, Mathematics) are more difficult than CS? | 41 (3.3) | 156 (12.7) | 117 (9.5) | 494 (40.1) | 423 (34.4) | 3.90 ± 1.11 | 0.020 |
| 2 | Pure science subjects require a lot of memorizations rather than understanding. | 40 (3.2) | 185 (15) | 104 (8.4) | 514 (41.8) | 388 (31.5) | 3.83 ± 1.13 | 0.240 |
| 3 | Science practical and laboratory work are insufficient or outdated in my institution. | 36 (2.9) | 150 (12.2) | 144 (11.7) | 487 (39.6) | 414 (33.6) | 3.89 ± 1.09 | 0.614 |
| 4 | The shortage of skilled science teachers in the institutions is the cause of decline of interest of the students. | 41 (3.3) | 172 (14) | 115 (9.3) | 461 (37.4) | 442 (35.9) | 3.89 ± 1.14 | 0.773 |
| 5 | Parents also encourage their children to study CS rather than pure sciences due to demand in job market. | 34 (2.8) | 98(8) | 105 (8.5) | 459 (37.3) | 535 (43.5) | 4.11± 1.04 | 0.072 |
| 6 | CS is more relevant to modern technology and future trends. | 22 (1.8) | 77 (6.3) | 87 (7.1) | 498 (40.5) | 547 (44.4) | 4.19 ± 0.94 | 0.561 |
| 7 | CS provides better career opportunities and higher salaries. | 28 (2.3) | 91 (7.4) | 136 (11) | 499 (40.5) | 477 (38.7) | 4.06 ± 1.00 | 0.324 |

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https://invergejournals.com/
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| Qs. | Items | SDA f (%) | DA f (%) | N f (%) | AG f (%) | SAG f (%) | Mean ± SD | T-test P-value |
|---|---|---|---|---|---|---|---|---|
| 8 | The government policies and educational trends encourage IT and CS over pure sciences. | 105 (8.5) | 134 (10.9) | 169 (13.7) | 503 (40.9) | 320 (26) | 3.65 ± 1.22 | 0.935 |
| 9 | Job security in CS is better than in pure sciences. | 32 (2.6) | 167 (13.6) | 161 (13.1) | 478 (38.8) | 393 (31.9) | 3.84 ± 1.10 | 0.829 |
| 10 | CS subjects are easier to understand compared to pure sciences. | 33 (2.7) | 147 (11.9) | 133 (10.8) | 487 (39.6) | 431 (35) | 3.92 ± 1.08 | 0.643 |
| 11 | Students are more motivated to study CS due to social media, gaming, and internet use. | 25 (2) | 82 (6.7) | 94 (7.6) | 521 (42.3) | 509 (41.3) | 4.14 ± 0.96 | 0.048 |
| 12 | Teachers of CS seem more motivated than teachers of pure sciences. | 59 (4.8) | 212 (17.2) | 193 (15.7) | 435 (35.3) | 332 (27) | 3.62 ± 1.19 | 0.072 |
| 13 | My institution gives more importance to CS than pure sciences. | 58 (4.7) | 242 (19.7) | 202 (16.4) | 395 (32.1) | 334 (27.1) | 3.57 ± 1.21 | 0.023 |
| 14 | There is a lack of scholarships or financial incentives for pursuing pure sciences. | 30 (2.4) | 170 (13.8) | 168 (13.6) | 486 (39.5) | 337 (30.6) | 3.78 ± 1.08 | 0.271 |
| 15 | I personally find CS more interesting than pure sciences. | 41 (3.3) | 148 (12) | 128 (10.4) | 439 (35.7) | 475 (38.6) | 3.94 ± 1.13 | 0.001 |
| 16 | I would prefer a future career in CS rather than pure sciences. | 50 (4.1) | 150 (12.2) | 119 (9.7) | 476 (38.7) | 436 (35.4) | 3.89 ± 1.14 | 0.046 |
| 17 | If given equal opportunities, I would still choose CS over pure sciences. | 51 (4.1) | 162 (13.2) | 125 (10.2) | 479 (38.9) | 414 (33.6) | 3.85 ± 1.15 | 0.112 |
| 18 | I personally think the future of IT is more reliable and bright as compared to pure sciences because they also depend upon IT. | 39 (3.2) | 120 (9.7) | 103 (8.4) | 469 (38.1) | 500 (40.6) | 4.03 ± 1.08 | 0.788 |

Results reveal that a large proportion of respondents perceived pure sciences as more difficult than CS, with over 74% agreeing or strongly agreeing (Q1: M = 3.90 ± 1.11), and a significant gender difference observed ($p = 0.020$). Most participants also thought that pure sciences put more emphasis on memorization than on understanding concepts (Q2: M = 3.83 ± 1.13), but there was no significant difference between men and women. Many people said they were worried about laboratories that weren't big enough or were out of date (Q3: M = 3.89 ± 1.09). They also said they thought there weren't enough skilled science teachers, which led to fewer students being interested (Q4: M = 3.89 ± 1.14). These perceptions were uniform across genders ($p > 0.05$).

Most of the people who answered said that institutions put more emphasis on computer science than on pure sciences (Q13: M = 3.57 ± 1.21). There was a statistically significant difference between men and women ($p = 0.023$). There was also a strong feeling that there weren't enough scholarships and financial rewards for pure sciences (Q14: M = 3.78 ± 1.08). People also thought that government policies and trends in education were good for IT and CS (Q8: M = 3.65 ± 1.22). Gender-based comparisons for these institutional and policy-related items were predominantly non-significant ($p > 0.05$).

The results show that most people agreed that CS offers better job prospects, pay, and job security (Q7: M = 4.06 ± 1.00; Q9: M = 3.84 ± 1.10). People also thought that parents pushed their kids toward CS because there were a lot of jobs in that field (Q5: M = 4.11 ± 1.04). While these views were widely shared, gender differences were generally not statistically significant. CS was overwhelmingly regarded as more relevant to modern technology and future trends (Q6: M = 4.19 ± 0.94). Respondents also believed CS subjects to be easier to understand than pure sciences (Q10: M = 3.92 ± 1.08). A strong endorsement (Q11: M = 4.14 ± 0.96) of the impact of social media, gaming, and internet exposure on motivating students toward CS was found, with a notable gender difference ($p = 0.048$). People thought that CS teachers were more motivated than pure science teachers, but this was not based on gender (Q12: M = 3.62 ± 1.19).

A strong personal preference for CS was apparent, as the majority of respondents considered it more engaging than pure sciences (Q15: M = 3.94 ± 1.13), favoured prospective careers in CS (Q16: M = 3.89 ± 1.14), and selected it even when presented with equal opportunities (Q17: M = 3.85 ± 1.15). Statistically significant gender differences were observed in personal interest ($p = 0.001$) and career preference ($p = 0.046$). Optimism regarding the future reliability of IT compared to pure sciences was also high (Q18: M = 4.03 ± 1.08).

**Statistical Analysis**

To examine differences in perceptions among teachers, 11$^{th}$ year students, and 12$^{th}$ year students, one-way Analysis of Variance (ANOVA) was performed on all questionnaire items (Q1–Q18). Table 2 presents a summary of ANOVA results organized by thematic realms, while detailed item-wise ANOVA and post hoc comparisons are provided as Supplementary Tables S1 and S2.

Table 2 shows summarized results of a one-way ANOVA that compares teachers, 11$^{th}$ year students, and 12$^{th}$ year students in major perception areas related to pure sciences and computer science. Results of the ANOVA indicate that statistically significant differences among groups occur on 14 of 18 items, particularly in the domains of career opportunities, institutional focus and levels of perceived importance with CS ($p < 0.05$). Questions relating to career opportunities and personal preference (7, 9, 15-17) demonstrated the strongest influences and the F-values up to 33.11 ($p < 0.001$). This demonstrates the fact that there was a considerable disparity between the groups of responding people. On the other hand, no strong differences observed were in the perceptions of old-fashioned laboratory facilities (Q3), teaching resources (Q4) and future dependence on information technology of pure sciences (Q18), which show that there is the general consensus of educators and students on these topics, regardless of their academic status and grade level.

Q5 and Q6 discussed the influence of social exposure and technological interaction on academic preference of students. ANOVA indicated that significant differences ($p < 0.05$) existed and the F-values were between 5.02 and 9.47. Results indicate significant differences among teachers and 11$^{th}$ and 12$^{th}$ year students regarding the influence of institutional priorities, academic support availability, and education policy on academic choices ($p < 0.05$, F-values 4.12 to 11.36). Additionally, motivational factors and digital exposure's role in academic interest showed significant group differences ($p < 0.05$, F-values 3.27 to 8.95) as per ANOVA results.

**Table 2**
*Summary of One-Way ANOVA Results across Key Perception Domains*

| Perception Domain | Representative Items | F (Range) | p-value | Group Difference |
|---|---|---|---|---|
| Perceived difficulty of pure sciences | Q1, Q2, Q10 | 6.14–14.78 | <0.05 | Significant |
| Infrastructure & teaching resources | Q3, Q4 | 0.43–1.98 | >0.05 | Not significant |
| Social and technological influence | Q5, Q6 | 5.02–9.47 | <0.05 | Significant |
| Institutional & policy influence | Q8, Q13, Q14 | 4.12–11.36 | <0.05 | Significant |
| Career prospects & employability | Q7, Q9, Q15-Q17 | 9.84–33.11 | <0.001 | Highly significant |
| Motivation & digital influence | Q11, Q12 | 3.27–8.95 | <0.05 | Significant |
| Future orientation toward IT | Q18 | 0.26 | >0.05 | Not significant |

To identify specific group differences, Tukey's HSD post hoc test was conducted for all items with significant ANOVA results. A summarized comparison is presented in Table 3, while full item-wise comparisons are included in Supplementary Table S2.

The results of the Tukey HSD post hoc comparisons have been summarized in table 3, revealing the magnitude of the differences between teachers, 11th year students, and 12th year students. The post hoc test showed that the teachers were always different compared to students particularly on those items that involved career opportunities, institutional goals and personal interest on computer science. Teachers showed less agreement with statements that supported CS, while students, especially those in the 12th year, showed much higher levels of agreement. There were not many differences between 11th year and 12th year students. However, when there were, 12th year students showed a stronger preference for CS. This is because they were more aware of their career options and felt more pressure to make decisions as they got closer to leaving their colleges or higher secondary schools.

**Table 3**

*Summary of Tukey Post Hoc Comparisons between Groups*

| Comparison Groups | Direction of Difference | Interpretation |
|---|---|---|
| Teachers vs 11th year students | Significant ($p < 0.05$) | Students show higher inclination toward CS |
| Teachers vs 12th year students | Highly significant ($p < 0.01$) | Teachers less supportive of CS dominance |
| 11th vs 12th year students | Limited significance | Preference for CS stronger in 12th year |

## Discussion

The results of this study underscore the complex factors influencing students' academic preferences, indicating a distinct transition from pure sciences to computer science at the Intermediate level. In terms of perceived difficulty, most respondents thought that pure sciences were harder and more rote-based than CS. This validates previous studies demonstrating that perceptions of academic difficulty and insufficient conceptual engagement significantly hinder sustained interest in scientific fields. (Shah, et al., 2018). Consistent with global reflections on STEM aspirations, our results show those institutional and environmental factors-including perceptions of outdated laboratories, inadequate resources, and differential emphasis on CS curricula play a crucial role in shaping subject choices (Bukhari, et al., 2025).

Previous studies have shown that the educational environment and access to modern technology are important factors that can help students make career choices. These studies also stress that using technology tools effectively can make students more interested and motivated in STEM fields (Karim Ragab 2025). When it comes to career choices, the students in this sample strongly agreed that CS has better job prospects, better chances of getting a job, and more financial stability than pure sciences. This observation coincides with the existing evidence, suggesting that future-focused workforce expectations form a substantial part of educational choices among young people (Subasman & Aliyyah, 2023). The same policy research results highlight family and peer effects as factors that determine the career path of students, which align with our findings in respect to parental support and social trends (Hussain, et al., 2024).

This study verifies extensive international research demonstrating that the relevance of technology and digital culture markedly increases students' interest in computing and related disciplines. There is a strong agreement that CS is important for modern technology. This reflects global trends in which digital literacy, transformation (Rafiq-uz-Zaman, 2023) and the rising importance of computational thinking are increasingly integrated into educational paradigms (Haider, et al., 2025; Zhou & Shirazi, 2025). In fact, digital proficiency and exposure to technology platforms have been extensively documented to increase academic motivation and relevance of the subject (Yaseen, et al., 2025).

Findings show that exposure to social media, gaming and internet are perceived to be influential in making students interested in computer science. Digital platforms make students more at home with technology and the traditional learning more interesting than computational thinking. Research from

Pakistan indicates that students who frequently engage with social media and online content are more inclined towards technology-oriented learning and future careers (Tabassum, et al., 2025), which is consistent with our findings. The observed gender difference indicates that digital interaction patterns may differ between male and female students, potentially affecting their motivation and confidence in pursuing computer science.

The question about the motivation of teachers and teaching strategies suggests that the difference between computer science and pure sciences in the contact with pedagogy can also influence the choice of the subjects. Our respondents believed that the CS teachers would be more interesting compared to other teachers. This perspective reflects common fears in the educational research about the need of technology-enhanced and dynamic pedagogies in all areas (Naz & Hussain, 2025). Significantly, items assessing personal preference and future orientation exhibited substantial correlation with global research indicating a connection between students' personal interests and perceived utility value and career outcomes. The stronger personal preference for computing and the willingness to choose it even under equal opportunity conditions reflect evidence that students prioritize future employability and relevance over traditional academic identity or intrinsic interest alone (Zhou & Shirazi, 2025).

The finding of this study highlights the growing impact of social context and technology on educational trajectories at the intermediate level, suggesting that the advancement of pure sciences requires a more robust integration of contemporary technologies and socially pertinent learning experiences. According to the results of the one-way ANOVA, statistically significant differences were found between teachers, 11$^{th}$ year students, and 12$^{th}$ year students in some areas of perception associated with switching between the pure sciences and the computer science. Especially, these areas affected perceived challenge of pure sciences, institutional focus, career opportunities and motivation factors brought about high results ($p < .05$), meaning that these perceptions are varied across groups. 12$^{th}$ year students were more aligned than teachers in their perceptions of computer science regarding employment opportunities, future relevance, and ease of understanding. This supports previous studies on the impacts of career expectations in subject choice (Wang & Degol, 2013).

Post hoc analyses elucidated these trends: teachers exhibited significant differences from both student groups, confirming that educators and students possess distinct frames of reference concerning technology's role in education. Conversely, the disparities between 11th and 12th-year students were more limited and primarily manifested in career-focused items, supporting the notion that advancement through the educational system intensifies career readiness concerns and, consequently, the attractiveness of applied science fields (Tai, et al., 2006). These developmental changes correspond with cognitive and motivational theories indicating that older students progressively consider utility value and outcomes in their academic choices (Eccles & Wigfield, 2002).

Two areas that did not show significant group differences were outdated labs and the future reliance of pure sciences on IT. This shows that both teachers and students have the same view of the limitations of the infrastructure. It resembles a study by Itzek et al. (Itzek-Greulich et al., 2015) indicating that the gaps in the educational resources of science learning environment concerns many individuals. The fact that there were no significant differences in perceptions with the future reliability of IT in relation to pure sciences point to the fact that even though the level of agreement varied.  There was mutual understanding of the continued importance of technology in education.

The outcomes of the ANOVA indicate that the differences in group perceptions of things are not accidental but organized. The clearest rift is the difference in the way teachers and students understand career, institutional focus, and inspirational factors. These results are in line with the vast of evidence that found out that the academic choices of students are determined by a combination of labour market anticipations, psychosocial factors, and educational environment variables that differentiate student perceptions and those of educators (Archer et al., 2012). The trend that 12$^{th}$ year students are more inclined to take up CS subjects can prove the point that the topic choice among students is better defined as they

INVERGE JOURNAL OF SOCIAL SCIENCES
https://invergejournals.com/
ISSN (Online): 2959-4359, ISSN (Print): 3007-2018
Volume 5 Issue 1, 2026

grow older and learn more about their future opportunities. The concept is supported with a long-term investigation of the STEM attrition and choice (Tai et al., 2006).

## Conclusion

This exploratory cross-sectional study shows that Intermediate-level students in Faisalabad are moving away from pure sciences and toward computer science. The findings reflect that this change is influenced by a combination of educational, institutional, financial, and sociocultural provisions. Students believe that the pure sciences are difficult to learn, rely on memorizing, and are complicated by outdated labs and the unavailability of resources. CS, on the other hand, is viewed as more fascinating, up to date with technology, and according to the expectations of employers nowadays. The motivations of career are highly valued as far as the subject choice is concerned. According to the respondents, CS is associated with improved employment opportunities, increased income, job security, and improved payoff on their education. These ideas develop with the assistance of parental support, the impact of social media, and the rising popularity of tech-related professions. In addition, it appears that the government policies and institutional priorities lean towards CS, which helps to prove that education based on technology is a safer and more visionary option.

Comparison of teachers, $11^{th}$ year students and $12^{th}$ year students revealed huge differences in the way they thought about things, particularly regarding the job opportunities and focus of the school. The educators were less convinced that CS was the most significant subject, and students, particularly those in their $12^{th}$ grade who were about to undergo such a significant shift in their academic life were more apt to choose CS as they were more knowledgeable about career choices and money. Everyone is worried about old lab equipment, which shows that there is a problem with the system that affects science education for everyone, no matter what their academic role is. Inclusively, the findings suggest that the declining interest in pure sciences is not a rejection of science itself

## Recommendations

The study's results suggest the following recommendations:

1. Changing from rote learning to inquiry-based, problem-solving, and application-oriented teaching methods can make pure science subjects less hard and knowledgeable.
2. At the Intermediate level, structured career counselling programs should be set up to show student's career options available in the pure sciences.
3. Improving laboratory facilities should be one of the priorities of educational authorities. This must be accompanied with the inclusion of recreations, virtual laboratories and the use of computational tools in order to enable the students to appreciate concepts better and become more engaged in pure sciences.
4. In order to prevent the structural marginalization of foundational sciences, policymakers and the institutions should ensure that CS and pure science departments receive equal funding and resources.
5. By participating in continuous improvement programs which train them in new skills such as how to teach and the use of technology in the classroom, science teachers can be better in their vocations and students can better regard them.
6. Offering targeted scholarships, research grants, and financial incentives could motivate academically proficient students to involve in pure sciences, even with extended academic trails.

## Future Work

The studies carried out in the future need to employ longitudinal research design to track the changes in student preferences and examine how early educational experiences can affect academic and career paths. Improving sample representation at regional levels would expand generalizability when comparing to the nation. Qualitative techniques such as interviews or focus groups may give some understanding of what motivates and what acts as a hindrance. The reinstatement of pure sciences as viable career options by comparison of interdisciplinary models may help. The impact of alterations in policies, curriculum, and infrastructure on the enrolment trends is also to be considered in order to strategize on smart education and retain a good science education in the context of emerging technologies.

**Limitations of the Study and Future Work**

The research has certain limitations associated with the study design cross-sectional, convenience sampling, and use of self-reported data, which could be viewed as a limitation to the generalizability and biased responses. Besides, the results are limited to Intermediate-level setting.

**Acknowledgement**

The authors acknowledge all the respectable teachers and students who participated in this study and give their valuable input to complete this research. Special thanks to the first year student Qamar Sultan who put his maximum efforts to complete the survey forms from the students.

**Conflict of Interest**

Author declares no conflict of interest in this study.

**Statement of Data Availability**

The corresponding author can provide the data used in this study upon request.

**Source of Funding**

None

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https://invergejournals.com/
ISSN (Online): 2959-4359, ISSN (Print): 3007-2018
Volume 5 Issue 1, 2026

## Supplementary Tables (S1 & S2)

**One-way ANOVA test was conducted to assess the significance of teachers and students (11th year, 12th year).**

**Table S1: One-Way ANOVA**

| | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| Q1 | Between Groups | 76.759 | 2 | 38.379 | 32.667 | .000 |
| | Within Groups | 1442.723 | 1228 | 1.175 | | |
| | Total | 1519.482 | 1230 | | | |
| Q2 | Between Groups | 79.701 | 2 | 39.850 | 33.114 | .000 |
| | Within Groups | 1477.826 | 1228 | 1.203 | | |
| | Total | 1557.527 | 1230 | | | |
| Q3 | Between Groups | 4.336 | 2 | 2.168 | 1.821 | .162 |
| | Within Groups | 1462.193 | 1228 | 1.191 | | |
| | Total | 1466.530 | 1230 | | | |
| Q4 | Between Groups | 8.466 | 2 | 4.233 | 3.270 | .038 |
| | Within Groups | 1589.612 | 1228 | 1.294 | | |
| | Total | 1598.078 | 1230 | | | |
| Q5 | Between Groups | 9.010 | 2 | 4.505 | 4.207 | .015 |
| | Within Groups | 1314.836 | 1228 | 1.071 | | |
| | Total | 1323.846 | 1230 | | | |
| Q6 | Between Groups | 6.845 | 2 | 3.423 | 3.869 | .021 |
| | Within Groups | 1086.363 | 1228 | .885 | | |
| | Total | 1093.209 | 1230 | | | |
| Q7 | Between Groups | 6.928 | 2 | 3.464 | 3.494 | .031 |
| | Within Groups | 1217.502 | 1228 | .991 | | |
| | Total | 1224.431 | 1230 | | | |
| Q8 | Between Groups | 11.207 | 2 | 5.604 | 3.808 | .022 |
| | Within Groups | 1807.189 | 1228 | 1.472 | | |
| | Total | 1818.396 | 1230 | | | |
| Q9 | Between Groups | 27.830 | 2 | 13.915 | 11.782 | .000 |
| | Within Groups | 1450.322 | 1228 | 1.181 | | |
| | Total | 1478.153 | 1230 | | | |
| Q10 | Between Groups | 69.069 | 2 | 34.535 | 30.897 | .000 |
| | Within Groups | 1372.599 | 1228 | 1.118 | | |
| | Total | 1441.669 | 1230 | | | |
| Q11 | Between Groups | 6.323 | 2 | 3.162 | 3.453 | .032 |
| | Within Groups | 1124.513 | 1228 | .916 | | |
| | Total | 1130.837 | 1230 | | | |
| Q12 | Between Groups | 81.805 | 2 | 40.902 | 30.463 | .000 |
| | Within Groups | 1648.805 | 1228 | 1.343 | | |
| | Total | 1730.609 | 1230 | | | |
| Q13 | Between Groups | 90.346 | 2 | 45.173 | 32.423 | .000 |
| | Within Groups | 1710.897 | 1228 | 1.393 | | |
| | Total | 1801.243 | 1230 | | | |
| Q14 | Between Groups | 9.354 | 2 | 4.677 | 3.972 | .019 |
| | Within Groups | 1445.970 | 1228 | 1.177 | | |
| | Total | 1455.324 | 1230 | | | |
| Q15 | Between Groups | 79.633 | 2 | 39.816 | 33.033 | .000 |
| | Within Groups | 1480.156 | 1228 | 1.205 | | |
| | Total | 1559.789 | 1230 | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Q16 | Between Groups | 33.970 | 2 | 16.985 | 13.399 | .000 |
| | Within Groups | 1556.660 | 1228 | 1.268 | | |
| | Total | 1590.630 | 1230 | | | |
| Q17 | Between Groups | 42.491 | 2 | 21.245 | 16.567 | .000 |
| | Within Groups | 1574.798 | 1228 | 1.282 | | |
| | Total | 1617.288 | 1230 | | | |
| Q18 | Between Groups | 4.046 | 2 | 2.023 | 1.739 | .176 |
| | Within Groups | 1428.654 | 1228 | 1.163 | | |
| | Total | 1432.700 | 1230 | | | |

## Post Hoc Tests

**Table S2: Multiple Comparisons Tests**

Tukey HSD

| Dependent Variable | (I) Role in education | (J) Role in education | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower Bound | Upper Bound |
| Q1 | Teacher | 11th year | -.6509* | .0840 | .000 | -.848 | -.454 |
| | | 12th year | -.5701* | .0835 | .000 | -.766 | -.374 |
| | 11th year | Teacher | .6509* | .0840 | .000 | .454 | .848 |
| | | 12th year | .0807 | .0694 | .475 | -.082 | .244 |
| | 12th year | Teacher | .5701* | .0835 | .000 | .374 | .766 |
| | | 11th year | -.0807 | .0694 | .475 | -.244 | .082 |
| Q2 | Teacher | 11th year | -.6737* | .0850 | .000 | -.873 | -.474 |
| | | 12th year | -.5583* | .0845 | .000 | -.757 | -.360 |
| | 11th year | Teacher | .6737* | .0850 | .000 | .474 | .873 |
| | | 12th year | .1154 | .0702 | .228 | -.049 | .280 |
| | 12th year | Teacher | .5583* | .0845 | .000 | .360 | .757 |
| | | 11th year | -.1154 | .0702 | .228 | -.280 | .049 |
| Q3 | Teacher | 11th year | -.1377 | .0846 | .234 | -.336 | .061 |
| | | 12th year | -.1530 | .0841 | .163 | -.350 | .044 |
| | 11th year | Teacher | .1377 | .0846 | .234 | -.061 | .336 |
| | | 12th year | -.0153 | .0699 | .974 | -.179 | .149 |
| | 12th year | Teacher | .1530 | .0841 | .163 | -.044 | .350 |
| | | 11th year | .0153 | .0699 | .974 | -.149 | .179 |
| Q4 | Teacher | 11th year | -.1992 | .0882 | .062 | -.406 | .008 |
| | | 12th year | -.0508 | .0876 | .831 | -.256 | .155 |
| | 11th year | Teacher | .1992 | .0882 | .062 | -.008 | .406 |
| | | 12th year | .1484 | .0728 | .104 | -.023 | .319 |
| | 12th year | Teacher | .0508 | .0876 | .831 | -.155 | .256 |
| | | 11th year | -.1484 | .0728 | .104 | -.319 | .023 |
| Q5 | Teacher | 11th year | .2077* | .0802 | .026 | .019 | .396 |
| | | 12th year | .2141* | .0797 | .020 | .027 | .401 |
| | 11th year | Teacher | -.2077* | .0802 | .026 | -.396 | -.019 |
| | | 12th year | .0064 | .0663 | .995 | -.149 | .162 |
| | 12th year | Teacher | -.2141* | .0797 | .020 | -.401 | -.027 |
| | | 11th year | -.0064 | .0663 | .995 | -.162 | .149 |
| Q6 | Teacher | 11th year | .0161 | .0729 | .973 | -.155 | .187 |
| | | 12th year | .1620 | .0725 | .066 | -.008 | .332 |
| | 11th year | Teacher | -.0161 | .0729 | .973 | -.187 | .155 |
| | | 12th year | .1459* | .0602 | .041 | .005 | .287 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 12th year | Teacher | -.1620 | .0725 | .066 | -.332 | .008 |
| | | 11th year | -.1459* | .0602 | .041 | -.287 | -.005 |
| Q7 | Teacher | 11th year | -.0076 | .0772 | .995 | -.189 | .174 |
| | | 12th year | .1478 | .0767 | .131 | -.032 | .328 |
| | 11th year | Teacher | .0076 | .0772 | .995 | -.174 | .189 |
| | | 12th year | .1554* | .0638 | .040 | .006 | .305 |
| | 12th year | Teacher | -.1478 | .0767 | .131 | -.328 | .032 |
| | | 11th year | -.1554* | .0638 | .040 | -.305 | -.006 |
| Q8 | Teacher | 11th year | .2424* | .0940 | .027 | .022 | .463 |
| | | 12th year | .2276* | .0934 | .040 | .008 | .447 |
| | 11th year | Teacher | -.2424* | .0940 | .027 | -.463 | -.022 |
| | | 12th year | -.0147 | .0777 | .980 | -.197 | .168 |
| | 12th year | Teacher | -.2276* | .0934 | .040 | -.447 | -.008 |
| | | 11th year | .0147 | .0777 | .980 | -.168 | .197 |
| Q9 | Teacher | 11th year | -.4073* | .0842 | .000 | -.605 | -.210 |
| | | 12th year | -.2386* | .0837 | .012 | -.435 | -.042 |
| | 11th year | Teacher | .4073* | .0842 | .000 | .210 | .605 |
| | | 12th year | .1687* | .0696 | .041 | .005 | .332 |
| | 12th year | Teacher | .2386* | .0837 | .012 | .042 | .435 |
| | | 11th year | -.1687* | .0696 | .041 | -.332 | -.005 |
| Q10 | Teacher | 11th year | -.6340* | .0820 | .000 | -.826 | -.442 |
| | | 12th year | -.4993* | .0814 | .000 | -.690 | -.308 |
| | 11th year | Teacher | .6340* | .0820 | .000 | .442 | .826 |
| | | 12th year | .1347 | .0677 | .115 | -.024 | .294 |
| | 12th year | Teacher | .4993* | .0814 | .000 | .308 | .690 |
| | | 11th year | -.1347 | .0677 | .115 | -.294 | .024 |
| Q11 | Teacher | 11th year | .0618 | .0742 | .683 | -.112 | .236 |
| | | 12th year | .1789* | .0737 | .041 | .006 | .352 |
| | 11th year | Teacher | -.0618 | .0742 | .683 | -.236 | .112 |
| | | 12th year | .1171 | .0613 | .136 | -.027 | .261 |
| | 12th year | Teacher | -.1789* | .0737 | .041 | -.352 | -.006 |
| | | 11th year | -.1171 | .0613 | .136 | -.261 | .027 |
| Q12 | Teacher | 11th year | -.6972* | .0898 | .000 | -.908 | -.486 |
| | | 12th year | -.3994* | .0893 | .000 | -.609 | -.190 |
| | 11th year | Teacher | .6972* | .0898 | .000 | .486 | .908 |
| | | 12th year | .2978* | .0742 | .000 | .124 | .472 |
| | 12th year | Teacher | .3994* | .0893 | .000 | .190 | .609 |
| | | 11th year | -.2978* | .0742 | .000 | -.472 | -.124 |
| Q13 | Teacher | 11th year | -.7339* | .0915 | .000 | -.949 | -.519 |
| | | 12th year | -.4295* | .0909 | .000 | -.643 | -.216 |
| | 11th year | Teacher | .7339* | .0915 | .000 | .519 | .949 |
| | | 12th year | .3043* | .0756 | .000 | .127 | .482 |
| | 12th year | Teacher | .4295* | .0909 | .000 | .216 | .643 |
| | | 11th year | -.3043* | .0756 | .000 | -.482 | -.127 |
| Q14 | Teacher | 11th year | -.1604 | .0841 | .137 | -.358 | .037 |
| | | 12th year | .0262 | .0836 | .947 | -.170 | .222 |
| | 11th year | Teacher | .1604 | .0841 | .137 | -.037 | .358 |
| | | 12th year | .1866* | .0695 | .020 | .024 | .350 |
| | 12th year | Teacher | -.0262 | .0836 | .947 | -.222 | .170 |
| | | 11th year | -.1866* | .0695 | .020 | -.350 | -.024 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Q15 | Teacher | 11th year | -.6745* | .0851 | .000 | -.874 | -.475 |
| | | 12th year | -.5552* | .0846 | .000 | -.754 | -.357 |
| | 11th year | Teacher | .6745* | .0851 | .000 | .475 | .874 |
| | | 12th year | .1194 | .0703 | .206 | -.046 | .284 |
| | 12th year | Teacher | .5552* | .0846 | .000 | .357 | .754 |
| | | 11th year | -.1194 | .0703 | .206 | -.284 | .046 |
| Q16 | Teacher | 11th year | -.4472* | .0873 | .000 | -.652 | -.242 |
| | | 12th year | -.2436* | .0867 | .014 | -.447 | -.040 |
| | 11th year | Teacher | .4472* | .0873 | .000 | .242 | .652 |
| | | 12th year | .2036* | .0721 | .013 | .034 | .373 |
| | 12th year | Teacher | .2436* | .0867 | .014 | .040 | .447 |
| | | 11th year | -.2036* | .0721 | .013 | -.373 | -.034 |
| Q17 | Teacher | 11th year | -.5040* | .0878 | .000 | -.710 | -.298 |
| | | 12th year | -.3016* | .0872 | .002 | -.506 | -.097 |
| | 11th year | Teacher | .5040* | .0878 | .000 | .298 | .710 |
| | | 12th year | .2024* | .0725 | .015 | .032 | .373 |
| | 12th year | Teacher | .3016* | .0872 | .002 | .097 | .506 |
| | | 11th year | -.2024* | .0725 | .015 | -.373 | -.032 |
| Q18 | Teacher | 11th year | -.0767 | .0836 | .630 | -.273 | .120 |
| | | 12th year | .0517 | .0831 | .808 | -.143 | .247 |
| | 11th year | Teacher | .0767 | .0836 | .630 | -.120 | .273 |
| | | 12th year | .1284 | .0691 | .151 | -.034 | .290 |
| | 12th year | Teacher | -.0517 | .0831 | .808 | -.247 | .143 |
| | | 11th year | -.1284 | .0691 | .151 | -.290 | .034 |

*. The mean difference is significant at the 0.05 level.