Examining Students' Perceptions of STEM Subjects and Career Interests: An Exploratory Study among Secondary Students in Hong Kong

Qiaoping Zhang, Hui Min Chia, & Kexin Chen

Abstract

To enhance understanding of factors that may improve students' STEM career participation, we explored Hong Kong secondary students' self-perceptions of STEM subjects and career interests using the STEM Semantic Survey and Career Interest Survey questionnaire. Results showed that most students thought technology was more appealing than science, mathematics, and engineering subjects. Science was the only subject in which male and female students showed similar attitudes. A gender gap was found in these students' career interests in STEM. Students held a neutral to mildly positive stance toward a career related to science, technology, and mathematics but had the least interest in a career related to engineering. Males showed more interest than females in careers related to all four subject areas. Results revealed a need to stimulate students' interest in STEM education and search for ways to make a connection between STEM subjects and future careers through STEM teaching in the classroom. More attention should be paid to encouraging girls to engage in STEM-related activities.

Keywords: STEM education, perceptions of STEM subjects, STEM career interest, gender difference, secondary students

Introduction

It is believed that the new generation's innovation and involvement in STEM-related fields, such as science, engineering, and manufacturing technicians, will be critical to future economic success (National Science Board, 2021; Office of the Chief Scientist, 2020). Furthermore, STEM education has become an important development area in the school curriculum in different countries (Education Bureau [EDB], 2016; Holmlund et al., 2018). Although policymakers and educators made efforts to promote students' interest in STEM subjects and related careers (Heilbronner, 2011; Marginson et al., 2013), the overall enrollment in STEM has decreased over time in many western countries, including the United States (U. S.) (National Student Clearinghouse

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Research Center, 2022), the European Unions (Business Europe, 2011), and Australia (Kennedy et al., 2014). In addition, research on gender differences in STEM has revealed that males were dominant in STEM-related careers for a long time, and females were less interested in STEM subjects and occupations than males around the world (Organisation for Economic Co-operation and Development [OECD], 2015; World Economic Forum, 2017). Women's underrepresentation in STEM disciplines may contribute to gender stereotypes in STEM fields, affecting girls' interest in and career choices in STEM professions (Nosek et al., 2009). Existing research on career intentions in STEM fields tended to focus on Western students in college or students who graduated (e.g., Heilbronner, 2011; Ketenci et al., 2020; Sadler et al., 2012). Less is known about Eastern students' interests in STEM subjects and careers in secondary school. Since 2015, the Hong Kong government began to promote STEM education to better prepare students for the coming technological, scientific, and economic changes. STEM education is a crucial component of the school curriculum (EDB, 2016). Hence, this research examined Hong Kong secondary students' perceptions of STEM subjects and STEM career interests. In particular, the following research questions were addressed in this study:

1. How do Hong Kong secondary school students perceive STEM subjects and STEM-related careers? In particular, is there any subject-related difference in students' perceptions of STEM and STEM careers?
2. Is there any gender difference in students' perceptions of STEM and STEM-related careers?
3. How are students' perceptions of STEM correlated to their perceptions of a STEM career?

Literature Review

STEM Education in Hong Kong

In the Hong Kong education system, children in public schools complete a nine-year compulsory education, including six years of primary school and three years of junior secondary education. After that, most students attend another three years of senior secondary education. The secondary school system comprises junior secondary level (Grade 7 to Grade 9) and senior secondary level (Grade 10 to 12). Science and mathematics are taught as fundamental subjects in junior secondary school. Students study four core subjects (e.g., Chinese Language, English Language, Mathematics, and Liberal Studies) and two or three elective subjects (e.g., Physics, Chemistry, Biology, Economics, Informations and Communications Technology, and Geography) at the senior secondary level. Engineering is not a subject at the secondary level. Usually, Hong Kong students in Grade 9 need to consider their intentions for selecting elective courses with their school teachers for Grade 10. The criteria for allocating Grade 10 elective subjects are based on students' academic performance in different subjects and their preferences.

The rationale of STEM education in Hong Kong emphasizes the integration and application of the four fields. It aims to facilitate students in career planning and enhance students' readiness for the rapid technological, scientific, and economic developments ahead (EDB, 2016). According to Hong Kong Curriculum Development Council (CDC) documents, STEM education is a core developing area in the school curriculum (CDC, 2017a). Among four key elements, technology is defined as "the purposeful application of knowledge, skills and values and attitudes in using resources to create products or systems to meet human needs and wants" (CDC, 2017b, p. iii). Teachers are encouraged to incorporate technology into the teaching of science and mathematics subjects. Students are encouraged to ultimately become technological and scientific knowledge seekers, enabling them to adapt to the dynamic challenges in modern society. Most schools were committed to summoning students to participate in different STEM-related activities, both inside and outside the school environment (EDB, 2016).

Students' Perceptions of STEM Subjects and Careers

Many studies on STEM education have emphasized promoting educational elements that can improve students' academic achievements. For example, a positive relationship was found between students with high self-efficacy in mathematics or science and their postsecondary schooling in STEM fields (Wang, 2013). Similar findings were supported by investigating students with firmer expectancy-value beliefs and their persistence in taking science and mathematics courses (Fan, 2011; Simpkins et al., 2006). Exposing learners to a broader long-life experience can help deal with the discrepancies that arise from the relationship between student attitudes and STEM-related subjects. Learners acknowledge the access they get to real-life encounters in STEM contexts. The opportunities they achieve through interaction with STEM experts are perceived as an essential part of informal learning processes. Previous studies related to secondary school students' perceptions of STEM subjects and careers are now mainly from Western contexts, such as Canada (Franz-Odendaal et al., 2016) and the U. S. (Christensen et al., 2014; Hall et al., 2011; Kier & Blanchard, 2020; Tyler-Wood et al., 2010). Those studies revealed that personal interest, perception, and attitude toward STEM education are critical indicators for examining students' career aspirations and interests in STEM fields. Although Kutnick et al. (2020) reported that Hong Kong secondary students' personal factors influenced their decision in engineering-related careers, studies on Asian secondary school students' perceptions of STEM subjects and related careers are still limited.

Gender Difference in Students' Perceptions of STEM Education

Studies consistently showed that females are underrepresented in STEM-related occupations. There were almost four times as many males as females working in engineering in OECD countries (OECD, 2015). Researchers have provided different explanations for the underrepresentation of females in STEM fields, including gender differences in mathematics ability, ability self-concepts, interests, and occupational and lifestyle values and preferences (Eccles, 2009; Ferriman et al., 2009). Ketenci et al. (2020) reported gender differences in students' self-efficacy and career choices: male students had higher mathematics self-efficacy and chose a STEM-related career more often than their female peers. Similar gender stereotypes were prevalent in school settings, where girls were not as good as boys in mathematics (Riegle-Crumb & Peng, 2021). Even though females' participation and performance in mathematics and science have improved in recent decades, negative perceptions about their skills have remained.

In Wang and Degol's (2017) review, females' learning experiences in schools influenced their decision of whether to pursue a STEM-related career. Various studies investigated gender differences in senior secondary (Grade 11 and above) students' perceptions of STEM-related subjects and careers (Chan & Cheung, 2018; Christensen et al., 2014; Makarova et al., 2019; Riegle-Crumb & Peng, 2021). For example, gender inequalities were identified in Hong Kong senior secondary school students (Chan & Cheung, 2018). Female students in Grade 11 were less likely to pursue at least one STEM elective than male students. Furthermore, among those who had taken STEM-related electives, female students were less likely than male students to take STEM majors in higher education and work in STEM-related fields. However, Christensen et al. (2014) reported that Grade 11 and 12 U. S. female students were more likely to consider STEM-related careers than their male peers. Nevertheless, Grade 11 students had a more positive perception of STEM-related subjects and careers than Grade 12, which proposed more studies from different grade levels to identify whether students' perceptions change across grade levels. With a comprehensive understanding of students' early intentions and preferences in STEM, teachers could make more preparations or feasible adjustments in STEM education at school to facilitate and give chances for students' engagement in STEM-related activities.

Methodology

This research implemented a survey to investigate secondary students' perceptions of STEM and their career interest in STEM. The survey questionnaire was well-developed and used in existing research named STEM Semantics Survey (SS) and Career Interest Survey (CIS; Tyler-Wood et al., 2010; Kier et al., 2014). The questionnaire's internal consistency reliabilities in these studies ranged from .78 to .94 across all the constructs represented in the original survey. Kier et al. (2014) conducted the confirmatory factor analyses with each subscale of CIS (i.e., Science, Technology, Engineering, and Mathematics), finding the normed fit index (NFI) > .80, the comparative fit index (CFI) > .90, and the root mean square error (RMSEA) < .04. Hence, the content validity and construct validity were also satisfactory. When we adopted the questionnaire, we translated scales from English to Chinese using a translation and back-translation procedure. Two secondary school mathematics teachers were asked to check the translation and suggest adaptations, if necessary, until they reached a consensus.

Participants and Procedure

Participants were 112 secondary school Grade 9 to Grade 11 students aged 15 to 17 years (64 males and 48 females) from a government school in Hong Kong. There were four classes in each grade level and around 30 students in each class. Students' academic ability and family background were homogeneous in each grade. Participants were randomly selected by their teachers from each grade regardless of their academic achievement and gender. Finally, we had 30 students in Grade 9, 28 students in Grade 10, and 54 students in Grade 11. Students were asked to complete the 20-minute questionnaire in a classroom. Their participation was entirely voluntary, and their identity was kept confidential.

Instruments

Free-Listing STEM-Related Careers Questionnaire

To explore students' perception of STEM-related careers, at the beginning of the questionnaire, participants were asked to list three occupations when they thought of each of the four STEM discipline areas, including science, technology, engineering, and mathematics. In addition, students' gender and their elective courses were collected in the questionnaire.

Semantics Survey (SS)

Students' perceptions of each STEM subject were measured using the Semantics Survey (SS) (Tyler-Wood et al., 2010). For each STEM discipline, five bipolar pairs of perceptions were presented, including (i) fascinating or mundane, (ii) appealing or unappealing, (iii) exciting or unexciting, (iv) means nothing or means a lot, and (v) boring or interesting. The five pairs were randomly presented for each discipline to minimize the potential order effect. Students were asked to choose one of the seven boxes between each pair of opposites. Average scores were calculated for each discipline area, with higher scores indicating higher levels of positive perception. Cronbach's *alphas* for science, technology, engineering, and mathematics were .80, .86, .87, and .88.

Career Interest Survey (CIS)

To understand secondary students' career interests in STEM, we incorporated the Career Interest Survey (CIS) developed by Kier et al. (2014). The CIS consists of 44 questions that address six social cognitive career factors (e.g., self-efficacy, outcome expectations, goals, interests, contextual supports, and personal disposition) conducive to obtaining more information about a career in the field. We arranged the questions as parallel sets of items addressing individual subject areas, similar to Kier et al. (2014). Students were asked to rate their agreement to statements using a 5-point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*). For each discipline area, average scores were determined. In the current research, Cronbach's *alphas* for science, technology, engineering, and mathematics were .93, .93, .95, and .91, respectively.

Data Analysis

Free-Listing STEM-Related Careers Questionnaire

For the free-listing questionnaire, two researchers categorized and coded the responses into nine occupational groups according to the similarities in the job. The percentage was then calculated based on each career group's number of responses over the total valid responses.

SS and CIS

To examine whether each of the STEM discipline areas was perceived differently by male and female students, a 4 × 2 (subject [science, technology, engineering, and mathematics] × gender [male, female]) multivariate analysis of variance (MANOVA) was conducted, with gender serving as between-subject factors and perception of each of the subject areas serving as within-subject factors. Similarly, to examine whether gender had an impact on students' career interests, we conducted a 4 × 2 (subject [science, technology, engineering, and mathematics] × gender [male, female]) MANOVA.

Results

Students' Responses on Free-Listing STEM-Related Careers

To explore secondary students' perception of STEM-related careers, we hoped to first know their initial image of STEM-related careers. Overall, occupations listed for science and mathematics were more diverse than for technology and engineering, as shown in Table 1. This was also reflected in the number of groups categorized among the three occupations. Results indicated that 65.5% and 41.9% of the participants listed three different occupational groups in mathematics and science, respectively, compared to 34.9% and 31.0% in technology and engineering. As shown in the table, male and female students shared similar ideas of occupations with similar percentages.

Table 1
Percentage of Free-Listing Responses by Gender

	Males (%)				Females (%)			
Careers Groups	**S**	**T**	**E**	**M**	**S**	**T**	**E**	**M**
Architecture & Construction	0.6	1.9	41.0	2.4	--	6.2	42.6	3.1
Business	--	1.3	0.6	29.6	--	0.8	--	33.1
Computer Information Technology	--	51.3	0.6	3.0	--	49.2	3.1	--
Engineer	1.2	1.9	47.2	3.6	--	3.8	40.3	2.3
Health Science	20.9	--	--	--	21.9	--	--	--
Researcher & Developer	16.3	25.6	5.0	5.3	22.6	25.4	5.4	3.1
Scientist	41.9	1.9	--	29.0	39.4	2.3	0.8	24.6
Teacher	19.2	13.8	5.6	27.2	16.1	12.3	6.2	30.8
Others	--	2.5	--	--	--	--	1.6	3.1
Valid Responses	100	100	100	100	100	100	100	100

For science, male and female students could list occupations such as biologist, chemist, and physicist. These occupations were categorized into a broad term, “Scientist.” “Scientist” was mentioned by 41.9% and 39.4% responses from male and female participants, respectively. Students also mentioned other occupations, such as health science-related careers (20.9% for male, 21.9% for female), teacher (19.2% for male, 16.1% for female), and researcher/developer (16.3% for male, 22.6% for female).

For technology, about half of the responses (51.3% for males and 49.2% for females) were categorized into “Computer Information Technology,” which included information technology technician, computer programmer, and game designer. The following two occupations commonly mentioned in both groups were researcher/developer (25.6% for males and 25.4% for females) and teacher (13.8% for males, 12.3% for females).

The top two occupational groups for engineering were “Engineer” and “Architecture and Construction.” “Engineer” was listed by 47.2% male and 40.3% female responses, whereas “Architecture and Construction” was listed by 41.0% male and 42.6% female responses.

For mathematics, three occupation groups shared similar percentages of responses, with “Business” (29.6% for males, 33.1% for females), “Teacher”

(27.2% for males, 30.8% for females), and “Scientist” (29.0% for males, 30.8% for females) being the top three occupation groups.

Students’ Responses to SS

As shown in Table 2, the two main effects (subject and gender) were significantly different, with no significant interaction. Students' perspectives differed across subject areas, as evidenced by the main effect of STEM subjects on students' career interest [F (3, 324) = 11.92, $p < .001$]. Science was the subject students were most interested in, followed by technology, mathematics, and engineering. Mathematics and engineering obtained much lower ratings than science and technology (*ps* ≤ .001). The main effect of gender [F (1, 108) = 7.92, $p = .006$] revealed that males rated higher in technology, engineering, and mathematics (*ps* < .04) than females. In science, there was no gender difference ($p = .25$).

Table 2
Means and Standard Deviations for SS

	Total (n = 112)	Gender: Male (n = 64)	Gender: Female (n = 48)	
	M (SD)	M (SD)	M (SD)	Gender differences
S	4.68_a (1.36)	4.81 (1.28)	4.51 (1.45)	Not significant
T	4.64_a (1.28)	4.86 (1.34)	4.34 (1.14)	Male > Female
E	4.14_b (1.27)	4.45 (1.29)	3.72 (1.14)	Male > Female
M	4.19_b (1.42)	4.50 (1.52)	3.78 (1.16)	Male > Female

Note. Means that share subscripts in the same column do not differ significantly.

Students’ Responses to CIS

There was no significant interaction between the two main effects (subject and gender) (Table 3). Students’ career interests differed across subject areas, according to the main effect of STEM subjects on students’ career interests [F (3, 315) = 15.86, $p < .001$]. Technology-related jobs were the most popular among students, followed by science, mathematics, and engineering. Engineering received considerably lower ratings from students than the other three subjects (*p*s < .001). The main effect of gender [F (1, 105) = 9.06, $p = .003$] indicated that males were more interested in careers related to the four STEM areas than females (*p*s < .04).

Table 3
Means and standard deviations for CIS

	Total (n = 112)	Gender: Male (n = 64)	Gender: Female (n = 48)	Gender differences
	M (SD)	M (SD)	M (SD)	
CIS_S	3.13 (0.85)$_a$	3.33 (0.85)	2.87 (0.80)	Male > Female
CIS_T	3.15 (0.78)$_a$	3.28 (0.80)	2.98 (0.73)	Male > Female
CIS_E	2.78 (0.84)$_b$	2.97 (0.80)	2.54 (0.83)	Male > Female
CIS_M	3.12 (0.79)$_a$	3.26 (0.83)	2.92 (0.68)	Male > Female

Note. Means that share subscripts in the same column do not differ significantly. Abbreviations: CIS_S = CIS scores of science; CIS_T = CIS scores of technology; CIS_E = CIS scores of engineering; CIS_M = CIS scores of mathematics.

The Correlation between SS and CIS

To examine students' perceptions of STEM disciplines and their relations to their STEM career interests, we used Pearson's correlation coefficients separately for males and females (see Table 4). For male students, all variables

Table 4
Zero-Order Correlations of SS and CIS variables

	Variables	1	2	3	4	5	6	7	8
SS	1. S	----	.64**	.72**	.59**	.66**	.52**	.56**	.53**
	2. T	.15	----	.70**	.60**	.42**	.58**	.61**	.49**
	3. E	.19	.35*	----	.73**	.59**	.49**	.68**	.61**
	4. M	.26	.38**	.49**	----	.51**	.57**	.68**	.78**
CIS	5. S	.54**	.38**	.30*	.45**	----	.56**	.63**	.67**
	6. T	.29	.48**	.30*	.31*	.67**	----	.78**	.62**
	7. E	.18	.33*	.66**	.37*	.57**	.66**	----	.68**
	8. M	.42**	.27	.28	.70**	.70**	.52**	.54**	----

Note. Correlations for males are presented above the diagonal and correlations for females are presented below the diagonal. * $p < .05$, ** $p < .01$

were positively correlated, including variables among SS variables (*r*s = .59 to .73), variables among CIS variables (*r*s = .56 to .78), and between SS and CIS variables (*r*s = .42 to .78). For female students, all SS variables were positively correlated (*r*s = .35 to .49) except science, which was not associated with perceptions of the other three subjects. Similar to male students, variables among CIS variables were all positively correlated (*r*s = .52 to .70) among females. In terms of the correlations between SS and CIS, most variables were significantly positively correlated among females. There were a few exceptions: SS science was not correlated with CIS technology, CIS engineering, or SS technology; SS engineering was not correlated with CIS mathematics.

A series of regression analyses examined the associations between SS and CIS variables. Gender was included in all the analyses as mean differences were observed between male and female students. Four SS disciplines were used as independent factors in the regression model, whereas each CIS variable was treated as a dependent variable. Regression results for each of the four CIS areas are seen in Table 5. The findings revealed that each SS discipline was associated with a distinct career interest. Students who scored high on SS science but not on other subjects, for example, were found to be more interested in science-related careers in science, technology, and engineering. In addition, unique and matched associations were observed. In mathematics-related jobs, two predictors were discovered: SS mathematics and SS science were linked to their interest in mathematics-related careers.

Table 5
Standardized Regression Coefficients of SS Controlling for Gender on CIS

	CIS											
Variable	**S**			**T**			**E**			**M**		
	β	*t*	*p*	*β*	*t*	*p*	*β*	*t*	*p*	*β*	*t*	*p*
Gender	-.13	-1.65	.10	-.04	-0.51	.61	-.04	-0.48	.63	-.04	-0.56	.58
SS_S	**.43**	**4.99**	**< .001**	.16	1.78	.08	.02	0.25	.81	**.18**	**2.37**	**.02**
SS_T	.06	0.66	.51	**.37**	**3.66**	**< .001**	.11	1.23	.22	-.01	-0.10	.92
SS_E	.11	1.01	.32	-.02	-0.13	.90	**.50**	**4.75**	**< .001**	-.06	-0.57	.57
SS_M	.19	1.83	.07	.21	1.90	.06	.16	1.63	.11	**.71**	**7.80**	**< .001**

Note. Analyses adjusted for gender. Results with $p < .05$ are bolded. Abbreviations: SS_S = SS scores of science; CIS_T = SS scores of technology; CIS_E = SS scores of engineering; CIS_M = SS scores of mathematics.

Discussion

In this research, we examined one Hong Kong secondary schools students' perceptions of STEM subjects and the relations to their STEM-related career interests. Gender similarities and differences among students' perceptions were explored. The relatively small size of this study limits the transferability and generalizability of the findings. However, some meaningful results help us know secondary students' concerns about STEM. As we observed in the free-listing questionnaire responses, both male and female students were able to link to different types of occupations for each of the STEM areas, which indicates that they had some understanding of the occupation associated with each of the STEM areas. However, this also revealed that students had limited knowledge about technology-related careers: both male and female students linked technology-related careers mainly to Computer Information and Technology. This could be due to their learning experience in a classroom with a greater emphasis on computer-related activities and less on engineering-related activities (Kutnick et al., 2020). Despite the emphasis of the CDC (2017a, 2017b) that technology is closely connected to the other three disciplines (science, mathematics, and engineering), more effort in the integration of technology- and engineering-related pedagogy is still needed to expose to students across the grades to technology and engineering.

The findings also revealed that male and female students were both generally positive toward STEM subjects, but their perceptions slightly differed by the subject areas. Science received the highest rating by students, followed by technology, mathematics, and engineering. In terms of gender similarities and differences, male students were more interested in STEM subjects and STEM-related careers than female students. Science was the only exception with no gender difference. These findings are consistent with former research (Chan & Cheung; 2018; Sadler et al., 2012), where male students favored STEM-related subjects and careers more than their female counterparts. Engineering in SS and CIS had the lowest rating of the four subject areas by both male and female students. Similar results were discovered in the study conducted by Tyler-Wood et al. (2010). They revealed U. S. middle school students had the least positive perception of engineering because of their possible misconceptions of engineers. Besides, students' perceptions of certain careers may be influenced by their experiences outside the school, such as family factors (Kier & Blanchard, 2020) and out-of-school activities (Roberts et al., 2018). Although engineering is not a subject in the secondary school curriculum, further study is needed to investigate the reasons underpinning the low scoring for engineering among Hong Kong secondary school students.

The finding shows that each of the SS subjects was uniquely correlated with the corresponding career interest. Students who showed more positive perceptions of one subject tended to show more interest in careers in the same field. Students' perception of the subject of science also predicted their interest in mathematics-related careers. Regarding gender differences, males' perceptions of the four subjects were positively correlated with their career interests in all four areas. Females' perceptions of science were unrelated to their desire to pursue a profession in technology and engineering. Makarova et al. (2019) found that Swiss secondary students revealed modest disparities between subjects. According to their findings, gender composition in chemistry and biology was nearly equal. Nonetheless, far more men than women had chosen to concentrate on mathematics and physics. One reason could be teachers' expectations (Lee et al., 2015). Lee and colleagues reported that U. S. secondary male students' career choice in STEM was most affected by their teachers' educational expectations and encouragements.

It is understood that students find it challenging to pursue STEM careers if they are not stimulated or intrigued about them early in their daily life. Some research suggests that informal STEM education can complement formal education, such as organizing activities in science camps, learning tours, and meeting with scientists (Roberts et al., 2018; Sahin et al., 2015). However, further exploration is needed on how to connect in-class learning activities with those outside the classroom and how to design hands-on activities and e-learning activities related to STEM. A recent study found that less than 6% of Hong Kong teachers felt well prepared for STEM education (Geng et al., 2019). This situation calls for an emerging challenge to teacher education in STEM fields.

In this study, we only focused on secondary students. However, it is recommended that future studies explore the perceptions of lower secondary school students or even primary school students to provide a clearer picture and a possible trend of Hong Kong students' perceptions of STEM-related subjects and careers. Of course, what students reported about STEM-related subjects and career interests may not reflect their future choices. In the future, more in-depth qualitative research such as student interviews or longitudinal studies can be conducted to identify factors that affect students' interest in STEM subjects and explore effective ways to inspire students to choose STEM-related careers.

Conclusions

Many prior studies emphasized students' learning experiences in STEM activities at school within a Western context. This exploratory study used quantitative methods to evaluate Hong Kong secondary students' perceptions of STEM and STEM-related career interests. Gender differences and similarities in views and career interests in STEM were investigated independently. STEM subjects were favored by both male and female students. Students who showed more positive perceptions of one subject tended to show more interest in the same field careers. Students gave science the highest ranking, while engineering scored the lowest among the four STEM-related subjects. Male students were more interested in STEM-related subjects and careers than female students. The outcomes of this study will be of interest to school teachers and teacher educators in charge of developing STEM curricula or activities for students. The influence of the subject taught on students' perceptions cannot be neglected. It is critical to make STEM aspects visible and relevant in STEM-related subject instruction so students can see and comprehend how different subjects interact. If we wish to bridge the gender gap, we must put more attention and support on female students' participation in STEM activities. Even though the study was done with a limited sample size in Hong Kong, the results provided evidence-based information that can assist educators in identifying and addressing the perceptions and career choices that secondary school students in other locations confront.

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About the Authors

Qiaoping Zhang (zqiaoping@eduhk.hk) is an Assistant Professor in the Department of Mathematics and Information Technology at the Education University of Hong Kong.

Hui Min Chia (s1131888@s.eduhk.hk) is a PhD candidate in the Department of Mathematics and Information Technology at the Education University of Hong Kong.

Kexin Chen (kchen@eduhk.hk) is a Reasearch Assistant in the Department of Mathematics and Information Technology at the Education University of Hong Kong.