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Upper Secondary School Tracking and Major Choices in Higher Education: To Switch or Not to Switch

Kao Sovansophal, Chea Phal and Song Sopheak

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Executive Summary

Strengthening the quality of education, science and technology education is one of the four strategic rectangles of Rectangular Strategy Phase IV and at the heart of Cambodia's ambition to achieve higher-middle-income status by 2030 and high-income status by 2050. To that end, increasing attention has been paid to improving both the quantity and quality of science education from secondary school through higher education. Empirically, it has been demonstrated that upper secondary school science can play a significant role in inspiring students to pursue STEM majors in higher education. Yet, there is evidence of a mismatch between student interest in STEM at upper secondary school and in higher education in Cambodia. Nearly 80 percent of upper secondary school students enrol in the science track, but only about 30 percent of tertiary students pursue a STEM major. Previous studies have investigated how students choose higher education majors in general and STEM fields of study in particular; however, they do not offer in-depth insights into the switch from the science track at upper secondary school to non-STEM majors in higher education, patterns of switches, and the characteristics of switchers versus non-switchers. Towards filling this knowledge gap, the twofold aim of this study was to detail the switches and the patterns of switches from upper secondary school to higher education, and to investigate the factors that have influences on students' decision to switch or not to switch when they choose their majors in higher education after they graduate from upper secondary education.

The study draws on data collected from 1,338 university students in 21 HEIs in Cambodia in 2020. A two-stage sampling approach was employed for the selection of the students. In the first stage, HEIs were randomly selected using probability proportional to size sampling approach and in the second stage, students are randomly selected from the HEIs. Descriptive statistics and statistical tests were used to examine the switching patterns and the characteristics of switchers and probit modelling was employed to find factors associated with students' switching decisions. To check for differences between the total sample and subsamples, the second analysis was performed using three sample groups – total sample, science subgroup and social science subgroup.

The results indicated that Cambodian upper secondary school students are more likely than not to switch academic majors when they enter higher education. The tendency to switch is more common for female science-track students, most of whom chose non-STEM majors such as business, management, accounting and finance. The findings also highlighted differences by gender, school type and school location. Female students, private school students, and urban school students are more likely than their counterparts to switch from science to other non-science majors.

Probit analysis of the full sample revealed that science-track students are more likely to switch to a non-STEM major at university than social-track students to switch to a STEM major. The decision to switch is influenced by students' gender, academic performance and interest in science and mathematics at upper secondary school, family socioeconomic status, and higher education institution (HEI) location. . From the school level – upper secondary school and HEI – upper secondary school factors did not have any significant influence on the probability of switching majors. Rather, the choice about whether to switch or not tended to be influenced by HEI location. Analysis indicates that upper secondary science-track students are more likely to switch to non-STEM majors if they are pursuing higher education in Phnom Penh. Further, scholarship recipients are less likely to switch from science to non-STEM major. This might reflect the fact that science-track students from wealthier families have recourse to

more financial resources to pursue non-STEM related majors, commonly in popular business-related HEIs in Phnom Penh. Also, as students from wealthier families have fewer financial constraints, being a scholarship beneficiary might not be a significant factor affecting their desire to switch. Conceptually, the study findings reinforced the three conceptual foundations which emphasised that students' decisions to pursue or switch from science are associated with individual ability and preference, family support and encouragement, and support and challenges at upper secondary school and university.

The study has also shed light on some practical implications. First, because encouraging students' interest in science and mathematics matters more than ever, teaching approaches that create opportunities for students to engage in practical classroom activities and stimulate their curiosity in science and mathematics should be considered. Efforts to optimise learning experiences should therefore focus on creating a highly interactive teaching-learning environment as a cognitive-activation strategy for promoting students' interest and enjoyment of the subjects they are studying. Also, information about college majors and careers in STEM, targeted at underrepresented female subgroups, should be considered. As quality matters, entrance exam criteria for switchers should also be considered so that more qualified students are doing the same track from upper secondary school to higher education.

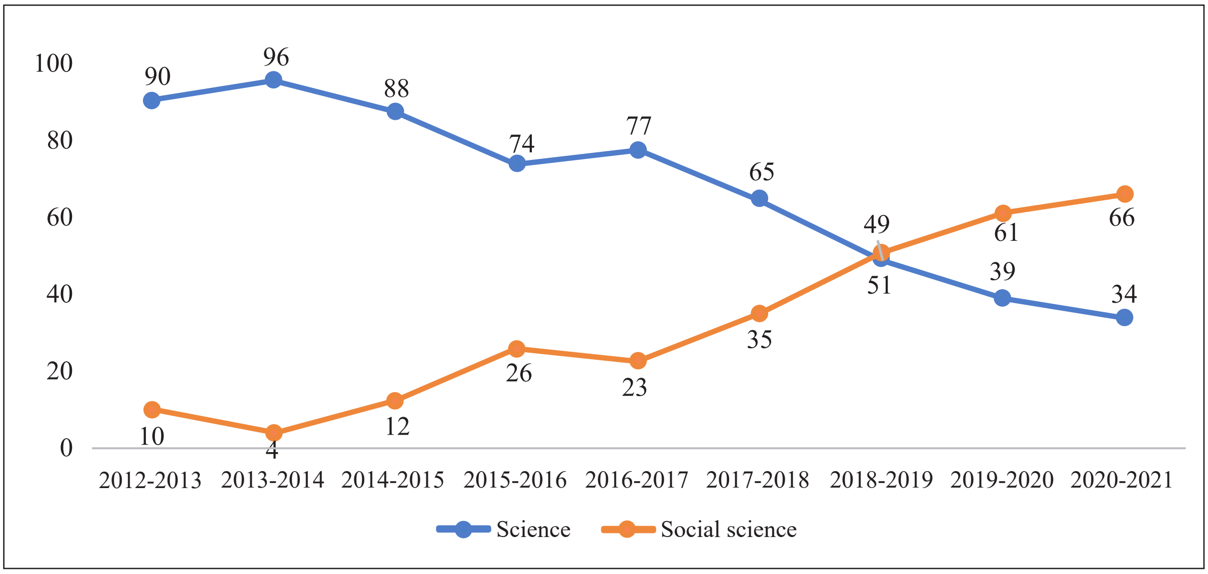
1. Introduction

Developing human resources in science and technology has long been a priority for nations around the world. Preparing an educated workforce to enter science, technology, engineering and mathematics (STEM) occupations is crucial for scientific innovation, technological advancement and economic competitiveness (Darolia et al. 2018; Lichtenberger and George-Jackson 2013; Moakler and Kim 2014; Wiswall et al. 2014). Cambodia is no exception. Enhancing students' STEM competencies, particularly in higher education is one of the priority areas of the Cambodian government as the country shifts from reliance on agricultural development to higher-value industries and sectors and smarter technology that will usher in Industrial Revolution 4.0 (MoEYS 2019a; RGC 2015, 2018, 2019).

To enhance competencies and encourage interest and enjoyment in science and mathematics at upper secondary school, the Ministry of Education, Youth and Sport (MoEYS) has initiated a number of policy initiatives (MoEYS 2014). One of those is the tracking system. The main objective of tracking is to strengthen students' background in science and mathematics at upper secondary school as a foundation pathway to higher education and jobs in STEM (MoEYS 2010a). This requires all 10th grade students to select and study either the science or social science track in the 11th and 12th grades.

When tracking was first implemented, as shown in Figure 1, the vast majority of upper secondary school students chose the science track over the social science track. Between academic years 2012-2013 and 2017-2018, on average, nearly 80 percent of students enrolled in the science track, while the share of social science track was about 20 percent during the same period, (MoEYS 2017). However, the situation is changing dramatically. Despite concerted efforts by MoEYS to encourage more secondary school students to take the science track so as to increase enrolments in STEM majors, the number of science-track students has steadily declined. By academic year 2020-2021, the share of science-track students had dropped significantly to about 34 percent and the share of social science-track students had risen dramatically to 66 percent (MoEYS 2019b, 2021a).

Figure 1: Distribution (percent) of upper secondary school students by science and social science tracks

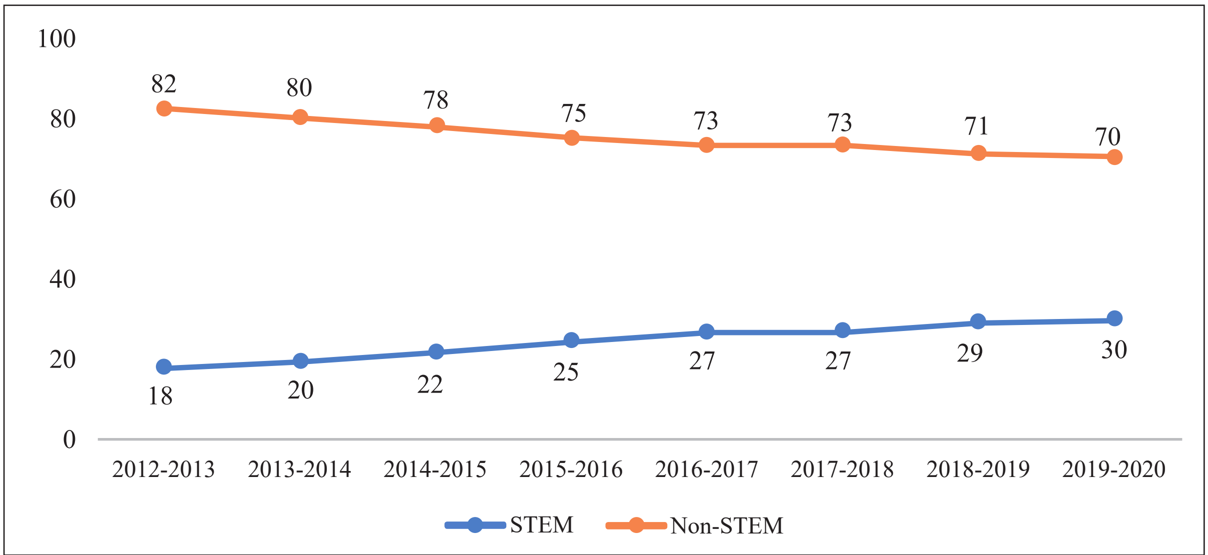


Source: Statistics compiled by the Department of General Education, MoEYS (2021b)

Although upper secondary school students must elect to study either the science or social science track in the 11th and 12th grades, a recent trend has seen many of them switch from science to social science when they move to the 12th grade. Statistically, in academic year 2019-2020, 63,547 grade 11 students were taking the science track but the number decreased to 33,227 in 2020-2021 when they moved up to grade 12. Similarly in 2020-2021, there were 69,842 grade 11 science-track students, only 35,394 continued the science track in 12th grade (MoEYS 2021b). This has serious implications for the uptake of higher education courses in STEM. According to Cambodia's Science, Technology, and Innovation Roadmap 2030, in order to have sufficient STEM human capital, 50 percent of university students must be enrolled in STEM majors by the end of 2030 (RGC 2021).

As Figure 2 shows, although the gap has narrowed over the last decade, there is still an imbalance between enrolments in STEM and non-STEM fields. Cambodia's higher education remains characterised by mass enrolment (and oversupply of graduates) in non-STEM fields such as business, management, economics, humanities and accounting (comprising more than 70 percent of total annual enrolments (MoEYS 2019c). This indicates an unsettling drop in students' interest in and attitudes towards science from upper secondary school to STEM majors in higher education. There are two interesting patterns to note. First, although in a few previous academic years there were more students in the social science track at upper secondary school, there were more students enrolled in non-STEM fields in higher education. Second, while there has been an alarming decline in the proportion of students in the science track at upper secondary school, the number of students enrolling in STEM majors seems to be increasing. Thus, it would be significant to investigate the issues surrounding the switching of academic majors and to determine the characteristics of switchers versus non-switchers.

Figure 2: Percentage of STEM versus non-STEM students at HE



Source: Statistics compiled by the Department of Higher Education (MoEYS, 2021c)

Studies have demonstrated that upper secondary school education is a critical period for attracting students to science as it is significantly correlated with their postsecondary educational choices (Dustmann 2004; Maltese and Tai 2011; Li and Kuan 2018; Shim and Paik 2014; Simpkins, Price and Garcia 2015). Given that the aim of the upper secondary school science track is to provide a pathway to higher education, particularly STEM majors, better understanding of the switches and the patterns of switches from upper secondary to higher education will help ensure that students make well-informed decisions about upper secondary school track and higher education majors.

The main objectives of this study, therefore, are to investigate switching and patterns of switching from upper secondary school track to higher education major, and to determine the influencing factors through the lens of the individual, family, upper secondary school, and HEI. Two questions guide the investigation:

1. To what extent and in what pattern do Cambodian students switch academic majors from upper secondary to higher education?
2. What are the factors influencing switches of academic majors when students transition from upper secondary to higher education?

2. Literature review

2.1 Tracking: definition and types

Tracking has been defined in various ways. This study adopted the definition of tracking used by Oakes (1985, 3) which refers to the "process whereby students are divided into categories so that they can be assigned in groups to various kinds of classes". For the purposes of this study, tracking refers to the last two years of secondary education when students choose between science or social science classes based on their interests and strengths so that they can prepare themselves for higher education majors. The main differences between the two tracks concern compulsory instruction time, content coverage, and the subjects required for the national exit exam (details are discussed in section 2.2). The definition, the form and the type of tracking in education differ around the world. Based on these multiple understandings, LeTendre et al. (2003) developed a typology of tracking, as shown in Table 1.

Table 1: Typology of curricular differentiation (tracking) across nations

Type	Description
School type	Differentiation in the organisational forms of schooling (e.g., vocational versus academic high school).
Course of study	Provision of more than one formal path that students may follow within a given school or school type (e.g., technical high schools have distinct core classes for their chemistry and electrical engineering courses).
Streaming	Differentiation over time in terms of the number and difficulty of courses assigned to different streams (e.g., liberal arts versus science in Japanese high schools). Other terms include tracking or lanes.
Ability grouping	Grouping occurs within one class or grade or students are "pulled out" to study elsewhere, on the basis of some measure or estimate of academic ability (e.g., ability-based reading groups, gifted and talented programs).
Geographical location	Curricular offerings, instructional quality and opportunities to learn differ by geographic location of schools.

Source: LeTendre et al. (2003)

2.1 Tracking in Cambodia

The purpose of tracking in Cambodia is to help students build strong competences in science and mathematics at upper secondary school and to provide clear pathways linked to majors and careers (MoEYS 2010a). Track selection takes place at the end of the 10th grade (the first year of upper secondary school), meaning students study either the science or social science track in the 11th and 12th grades. The key differences between these two tracks are the core subjects, emphasis on curriculum content, compulsory instruction time, and the subjects required and scoring method for the national exit exam. The science track centres on physics, chemistry, biology, earth and environmental science, and mathematics, while the social science track focuses on Khmer literature, history, geography, and morality, civics and citizenship.

In the science track, five sessions/hours of instruction per week are allocated for mathematics and three hours per week for each science subject. In 11th grade and 12th grade, the scores 125 are allocated for mathematics and 75 for each science subject. In some so-called new generation schools (NGS), school that aimed to increase skill levels in STEM subjects at upper secondary school levels, through intensive capacity building in educational technology and STEM and inquiry and problem-based learning methodologies, the number of instruction hours might be higher. By contrast, in the social science track, only three hours of instruction per week are allocated for mathematics and two for each science subject, with the maximum scores of 75 and 50, respectively (MoEYS 2010a). Table 2 illustrates the different emphases (teaching hours) placed on each subject and the subjects that the students in the science and social science tracks need to take in the baccalaureate exam.

Table 2: Weekly hours of instruction in science and social science subjects in traditional upper secondary and new generation schools

Subject	Weekly hours of instruction			Subjects in Baccalaureate exam	
	Traditional upper secondary school		NGS		
	Social science	Science	Science	Social science	Science
Mathematics	3	5	6	C	C
Physics	2	3	4	L	C
Chemistry	2	3	4	L	C
Biology	2	3	4	L	C
Earth & environmental science	2	2	1	L	L
Khmer literature	5	3	5	C	C
History	3	2	2	C	L
Geography	3	2	2	C	L
Morality, civics and citizenship	3	2	3	C	L
Foreign language	2	2	4	C	C
Physical education	1	1	1	N	N
Economic	2	2	1	N	N
Technical education	2	2	4	N	N
Total	**32**	**32**	**40**	**7**	**7**

Source: MoEYS 2010a

Note: C: compulsory subject, L: lucky-draw selective subject, N: not a baccalaureate subject. One of the four lucky-draw selective subjects is chosen (at ministry level) as another compulsory subject for the baccalaureate examination in each study track. Grade 12th students take seven subjects in their baccalaureate exam.

2.3 Admission to higher education in Cambodia

The successful completion of a baccalaureate program is the primary route to higher education in Cambodia, but it is not the only pathway (Chea, Hun and Song 2021). Students can be enrolled through either scholarship (tuition waiver) or fee-paying (MoEYS 2002). Scholarships, particularly those sponsored by the government through MoEYS as a diversity and inclusion initiative, are provided based on four criteria: ability and academic merit, gender, socioeconomic status and geographical location (rural). To apply for a government scholarship, students must choose two majors of interest (as their first and second priorities) (MoEYS 2018a) at any higher education institution (HEI) of their choice from those listed in the so-called annually-developed MoEYS booklet and submit their application to the Department of Higher Education in the second semester of grade 12. The application process starts in mid-March and lasts until the end of May each year.

Scholarship recipients are mostly selected based on their performance in the baccalaureate exam. However, to enrol in a STEM major at some prestigious HEIs – such as engineering at the Institute of Technology of Cambodia (ITC) or medicine at the University of Health Sciences (UHS) – students must also sit an entrance exam. To get into ITC, for instance, students need to take an exam in advanced mathematics, physics, chemistry and logic. To get into UHS, students need to take a so-called national exam which covers mathematics, chemistry and biology. Students can get only one government scholarship at a time to study either their first or second choice of major, depending on their baccalaureate or entrance exam results. In this regard, the track pursued at upper secondary school could shed light on student choice in higher education.

2.4 Conceptual foundation

2.4.1 Major choice model

Building on the notion that "choice is one of the major tenets of both a market economy and a democratic society" (Levin 1991 cited in Hu 1996, 2), Hu (1996, 3) contends that a student's decision-making about choice of major "is an act of matching and combining individual goals with social roles". The major choice model by Hu (1996) divides the decision-making process into the initial choice and the final choice. The initial choice is influenced by individual ability (upper secondary school achievement) and family characteristics (socioeconomic status, parental income, educational aspirations), institutional attributes (HEI type, school and class size, geographic location), advice from significant others (relatives, peers, etc.,), available financial support, perceptions of economic factors (career and job opportunities), and perceived quality of the program. The final choice is influenced by individual ability and family characteristics, perceived program quality, school attributes, and economic perceptions (Hu 1996).

The model integrates four primary models of students' major choice: the econometrics model, sociological model, consumer model, and combined model. Students' views of economic benefit are drawn from the econometric model, and the relationship between students' educational experience/aspirations and socioeconomic status is derived from the sociological model. Personality-related factors of self-fulfilment are developed based on the consumer model with multiple stages and dynamic process, and the availability of information in the decision-making process is consistent with the combined model (Hu 1996).

2.4.2 Social cognitive career theory

Another well-known theoretical model for students' choice of STEM major is social cognitive career theory (SCCT) (see, for example, Lee et al. 2015; Lent et al. 2018; Maltese and Tai 2011; Moakler and Kim 2014; Ruse and Xu 2018; Sahin, Ekmekci and Waxman 2017; Wang and Lee 2019). Developed by Lent et al. (1994) and rooted in Bandura's (1986) general social cognitive theory, SCCT places more emphasis on the relationship between self-referent thought and social processes that guide the behaviour. Lent et al. (1994) theory is cyclical in nature and longitudinal in scope. SCCT has been shown to be immensely heuristic, finding application in a wide range of psychosocial domains including "educational achievement, health behaviours, organisational management and affective reactions" (Bandura 1986). SCCT is also linked to two branches of career inquiry that have also evolved from Bandura's general framework – Krumboltz's (1979) social learning theory of career decision-making and Hacket and Betz's (1981) self-efficacy construct for women's career development. Although SCCT was built on the conceptual foundation of Krumboltz's theory, it is closely aligned with the self-efficacy theory of Hackett and Betz (Lent et al. 2002 cited in Kao 2021, 23). However, the SCCT shares Krumboltz's theory by emphasising on the learning experiences that shape people's occupational interests, values and choices, and acknowledging the influence of genetic factors, abilities, and environmental conditions in decision-making (Kao 2021).

To exhibit the interacting influences among people, environment and their behaviour, SCCT uses a bidirectional model of causality. Simply state, the model illustrates the interplay between personal attributes (internal cognitive and affective states and physical characteristics), external environmental factors, and overt behaviour. Furthermore, to conceptualise personal determinants, SCCT incorporates three significant variables from general social cognitive theory as the basic building blocks: (1) self-efficacy, (2) outcome expectations, and (3) personal goals (Lent et al. 2002). Because SCCT is a social interactionist theory, the theory also takes into account several other factors. For example, personal input (predisposition, gender, race), background contextual affordances (real or perceived supports or barriers) and learning experiences stemming from Krumboltz's social learning theory have also been positioned in the theoretical model of SCCT (Kao 2021).

2.4.3 STEM transfer model

The STEM transfer model developed by Wang (2103, 2017) integrates SCCT. It emphasises that students' choice of STEM major is determined by not only the secondary but also postsecondary contexts. In other words, students' intention to choose a STEM major is influenced by their achievement in mathematics and exposure to science and mathematics at upper secondary school, and their science and maths self-efficacy beliefs. In turn, prior achievements in, and attitudes towards science and mathematics influence these variables. Furthermore, the choice of major is also influenced by postsecondary contextual supports (both academic interactions and financial aid, college readiness in mathematics and science, academic aspiration, and enrolment intensity) and barriers (remediation and external demands from the family) (Wang 2013, 2017; Wang and Lee 2019). In short, this model focuses on the influences of multi-dimensional factors – individual academic readiness and attitude, family support and challenges, and secondary and postsecondary supports.

2.5 Factors influencing academic major choice: empirical evidence

From individual level perspective, a large body of literature on students' choice of science majors is based on theorists' interests. Simply mention, behaviourists look at factors influencing the students' choice of academic majors employing the lens of students' behaviours. Psychologists or experts in academic achievement use psychological or academic achievement perspective to examine this phenomenon. The significant area to examine the factors influencing the students' science outcomes, that is choosing a science major, entailed personal ability and affective factors. From these perspectives, studies have found that gender (e.g., Gunderson et al. 2012; Kao and Shimizu 2019), academic achievement in science and mathematics (e.g., Kao and Shimizu 2019; Westrick, Radunzel and Bassiri 2018; Wang 2013), science and mathematics self-efficacy (e.g., Lent et al. 2018; Sahin, Ekmekci and Waxman 2017; Wang 2013; Wang and Lee 2019), academic track (e.g., Li and Kuan 2018; Wang and Lee 2019; Shim and Paik 2014), and outcome expectations (e.g., Nugent, Barker and Welch 2015; Wang 2013, Wang and Lee 2019) exert significant influence on students' choice of higher education majors in general and STEM majors in particular.

Also, social science researchers often explain the different students' outcomes in science (students' academic major in science versus social science) utilising the deficiencies within the home environment of the students (e.g., Miller and Kimmel 2012; Wang 1995). According to human capital theory, students gain differential exposure to different cultural capital from their families and home and different access to social networks within their communities (e.g., Nui 2017). Research studies have revealed several variables at home that could influence students' choice of major in higher education, particularly in STEM fields. These include parental education (e.g., Seymour and Hewitt 1997; Crisp, Nora and Taggart 2009; Hodson and Freeman 1983), family socioeconomic status (e.g., Niu 2017; Xie, Fang and Shauman 2015), and relatives' influence (e.g. Kao and Shimizu 2019; Poeu 2017; Seymour and Hewitt 1997).

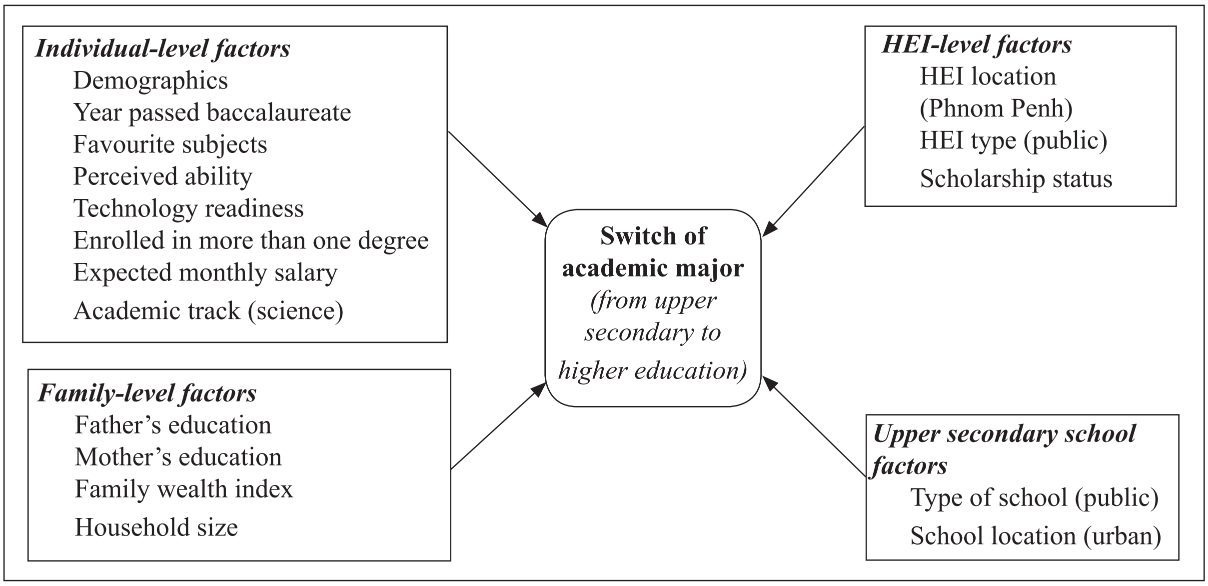
Last, the practices at school are also significant for understanding how students make their choices of academic majors. To be specific, upper secondary school time enables students to decide whether to pursue STEM majors and careers after graduation (e.g., Darolia et al. 2018; Lee, Min and Mamerow 2015; Maltese and Tai 2011; Simpkins, Price and Garcia 2015). Variables at upper secondary school can either motivate secondary school students to study and strengthen their background competence in science and mathematics and thus decide to pursue the STEM majors, or they can push students away from the STEM pipeline. The effects of educational institutions' pull factors were also reported to be significant (Hu 1996; Wang 2013, 2017; Wang and Lee 2019).

3. Methodology

3.1 Conceptual framework

Framed by a set of concepts, synthesis of empirical evidence, and data availability, Figure 3 illustrates the key variables investigated in this study. The outcome variable is whether or not students switch academic majors in the transition from upper secondary school to higher education. The independent variables are broadly divided into four categories: individual, family, upper secondary school and HEI factors.

Figure 3: Conceptual framework of the current study



Source: Developed by the authors based on the concepts discussed in Section 2 and available data

3.2 Sampling and sample

The study employed a two-stage sampling method. Stage one involved the random selection of HEIs using systematic sampling with probability proportional to size, measured by total student enrolment. As of 2020, there were 124 HEIs in Cambodia (MoEYS 2020), but not all of them are under the direct supervision of MoEYS. Sixteen different ministries have responsibility for overseeing HEIs, but the majority (80 and 25, respectively) of HEIs come under MoEYS and the Ministry of Labour and Vocational Training. For logistics reasons, CDRI sought permission to conduct research in the HEIs under these two ministries. Lists of all active HEIs registered with MoEYS were obtained from the Department of Higher Education. Small-sized HEIs (fewer than 500 students) and branch campuses were dropped from the sampling frame, leaving 75 HEIs for first-stage sampling. A total of 21 HEIs, of which 12 are private and four located outside the capital, were selected. Next, student lists at the selected HEIs were obtained for second-stage simple random sampling. The number of student participants selected from each selected HEI was proportional to the total number of first-year undergraduate students enrolled.

Table 3: Demographic information about the sample

Variables	N	%	Variables	N	%
Gender			***Geographical area***		
Male	666	49.8	Phnom Penh	567	42.4
Female	672	50.2	Province	771	57.6
Study track			***Upper secondary school location***		
Science	814	60.8	Urban area	381	28.5
Social Science	524	39.2	Provincial capital	280	20.9
Major			District town	486	36.3
STEM	206	15.4	Rural area	191	14.3
Non-STEM	1132	84.6			

Source: Estimated by the authors based on the student survey

Data was collected from 1,338 higher education students from 21 HEIs in 2020. Seventeen of the HEIs are located in Phnom Penh and four in different provinces. Table 3 provides demographic information about the sample. Overall, the sample comprised almost equal proportions of male (49.8 percent) and female (50.2 percent) students, 60.8 percent of whom elected to study the science track and 39.2 percent the social science track at upper secondary school. The sample comprises more non-STEM than STEM students. A minority (15.4 percent) of the participants were studying for a STEM major and 84.6 percent a non-STEM major. The largest shares of the sample attended upper secondary school in district towns (36.3 percent) and urban areas (28.5 percent), and the smallest share (14.3 percent) went to rural upper secondary schools.

3.3 Data collection procedure

A survey questionnaire was designed and prepared in digital format using KoBoToolbox. The questions collected a wide range of information, encompassing students' characteristics, family and educational backgrounds, and higher education experiences including during the Covid-19 pandemic. In July 2020, a three-day training workshop was organised to familiarise 15 enumerators with the survey questions and to instruct them on how to use the tablet-based KoBoCollect app. The questionnaire was pre-tested before using it to collect data. The survey was rolled out from 20 July through 14 September 2020. All 1,338 selected students were interviewed face-to-face in digital format.

3.4 Data analysis model

The study sought to investigate switching of academic majors from upper secondary school to higher education and the factors (individual, family, upper secondary school, HEI) that influence switching. The collected data was analysed in two stages. First, to examine the switches and patterns of switches, descriptive statistics using frequency and crosstabulation were employed. Second, to identify the factors that influence the likelihood of switching, probit modelling was performed. The dependent variable was coded dichotomously (0=non-switcher, 1=switcher).

Table 4 illustrates the variables for the probit analysis. After dropping observations without complete information, there were 1,281 observations for the analysis. After full-sample analyses, sub-sample analyses for the science-track and social-track students were performed. For each sample group, three models were run: (1) with all dependent variables in the conceptual framework, (2) without mathematics and science as favourite subjects at secondary school, and (3) without perceived performance in mathematics and science at secondary school. This generated insight into which factors – mathematics and science as favourite subjects and perceived performance of mathematics and science – have a more significant effect on the likelihood of switching.

Table 4: Variables included in the probit analysis model

Variable	Obs	Mean	Std. Dev.	Min	Max
Dependent					
Major switch (non-switcher)	1,281	0.540	0.499	0	1
Independent					
Individual-level factors					
Academic track (science)	1,281	0.624	0.485	0	1
Gender (female)	1,281	0.512	0.500	0	1
Age (years)	1,281	21	2.178	17	50
Technology readiness index	1,281	3.171	0.328	1.938	4.563
Multi degree	1,281	0.101	0.302	0	1
Perceived good at maths	1,281	0.218	0.413	0	1
Perceived good at physics	1,281	0.271	0.445	0	1
Perceived good at chemistry	1,281	0.206	0.405	0	1
Perceived good at biology	1,281	0.170	0.376	0	1
Maths is favourite subject	1,281	0.302	0.459	0	1
Physics is favourite subject	1,281	0.272	0.445	0	1
Chemistry is favourite subject	1,281	0.206	0.405	0	1
Biology is favourite subject	1,281	0.176	0.381	0	1
Expected monthly salary (USD)	1,281	450.30	325.20	90	5,000
Year passed baccalaureate exam					
2017	1,281	0.273	0.446	0	1
2018	1,281	0.388	0.487	0	1
2019	1,281	0.188	0.391	0	1
Family-level factors					
Household size	1,281	5.235	1.781	1	15
Father's education (upper secondary)	1,281	0.313	0.464	0	1
Mother's education (upper secondary)	1,281	0.184	0.388	0	1
Family wealth index	1,281	-0.003	0.716	-2.373	2.312
Upper secondary school-level factors					
Public school	1,281	0.887	0.317	0	1
School location					
Provincial capital	1,281	0.207	0.405	0	1
District town	1,281	0.516	0.500	0	1
HEI-level factors					
Phnom Penh	1,281	0.81	0.400	0	1
Public HEI	1,281	0.68	0.470	0	1
Scholarship	1,281	0.022	0.146	0	1

Source: Estimated by the authors based on the student survey.

Note: - Technology readiness index is constructed based on Parasuraman and Colby (2015)'s 16 attributes.
- Family wealth index is calculated based principal component analysis (PCA) using 35-item questions related to family durable assets.

4. Results

4.1 Switching and characteristics of switchers

4.1.1 Switch of academic majors

The results in Table 5 indicate that more students switched their majors on transition from upper secondary school to higher education than continued with similar subjects. Specifically, 54.4 percent of the 1,338 participants were switchers and the other 45.6 percent were non-switchers. This apparent trend could be said to reflect the "swing from science", a term coined by Dainton (1968) to describe the long-term and widespread decline in interest in science.

Table 5: Percentage of switchers versus non-switchers (n=1,338)

Trend	Frequency	Percentage
Switchers	727	54.4
Non-switchers	611	45.6

Source: Estimated by the authors based on the student survey

As indicated in Table 6, of the 727 switchers, 93.1 percent switched from the science track at upper secondary school to non-STEM majors in higher education. This is a worrying trend. A small minority (6.9 percent) switched from the social science stream to a STEM major at university, possibly related to individual ability and the requirement to have studied a science subject and/or maths at a higher level. Secondary school students who studied social sciences tended to choose a non-STEM major at university. Of the 611 non-switchers, 77.6 percent were social science track students and 22.4 percent were science-track students. Overall, only 14.0 percent of the 1,338 student participants had taken up a STEM-related major.

Table 6: Patterns of subject uptake in upper secondary to higher education (n=1,338)

Trend	Frequency	Percentage
Switchers *(n=727)*		
Social science to STEM	50	3.7
Science to non-STEM	677	50.7
Non-switchers *(n=611)*		
Social science to non-STEM	474	35.4
Science to STEM	137	10.2

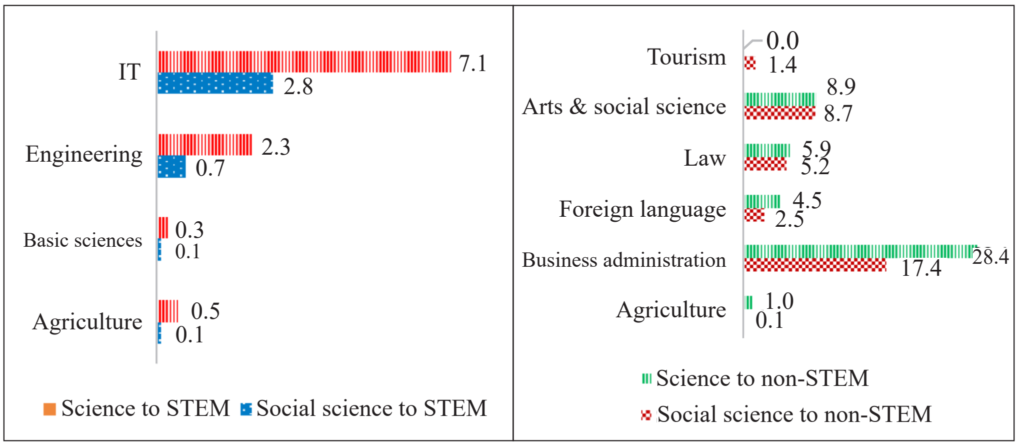
Source: Estimated by the authors based on the student survey

4.1.2 Characteristics of switchers

Having discussed the overall patterns of switching from initial subject choice at secondary school to study different fields at university, it is important to look at the student characteristics that might influence switching. This section examines switching patterns by field of study, gender, school type and school location.

First, Figure 4 details the distribution of switchers and non-switchers by field of study. Notably, science-track students who chose a STEM-related major were mainly studying information technology (7.1 percent) and engineering (2.3 percent). Very few were studying agriculture (0.5 percent) or basic sciences (0.3 percent), which given the need for such expertise is concerning. Science to non-STEM switchers (28.4 percent) and social science non-switchers (17.4 percent) were mainly enrolled in business administration courses (e.g. business management, accounting and finance). The second and third most popular fields among these two groups were social science and arts (e.g. public relations, public administration, education and social work) and law.

Figure 4: Distribution (percent) of switchers and non-switchers by field of study (n=1,338)

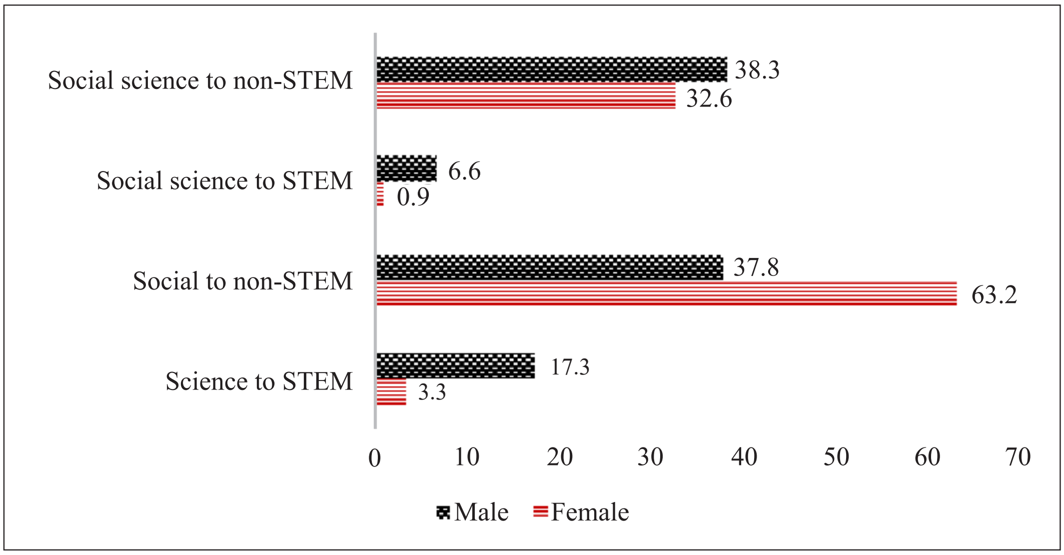


Source: Estimated by the authors based on the student survey

The chi-square ($\chi2$) test of association was performed to examine the relationship between switching and field of study. Analysis of the results revealed evidence of association between field of study and whether or not students were switchers or non-switchers. The relationship between these variables is statistically significant, $\chi2$ (df = 27, n = 1,338) = 1320.90, $p <$ 0.01. This indicates that switching patterns vary according to field of study (i.e., information technology, agriculture and business administration).

Second, as shown in Figure 5, more male than female students had switched from the social science track in upper secondary to a STEM major in higher education, whereas more female than male students had switched from the science track to a non-STEM major. Of the total sample of 1,338, 63.2 percent of science to non-STEM switchers were female and 37.8 percent were male. By contrast, male social science to STEM switchers outnumbered their female counterparts (6.6 percent versus 0.9 percent). A similar pattern was evident for science persisters, 17.3 percent of whom were male and only 3.3 percent female. This indicates that female students are more likely than male students to switch out of science to non-STEM subjects.

Figure 5: Pattern of switching (percent) by gender (n=1,338)

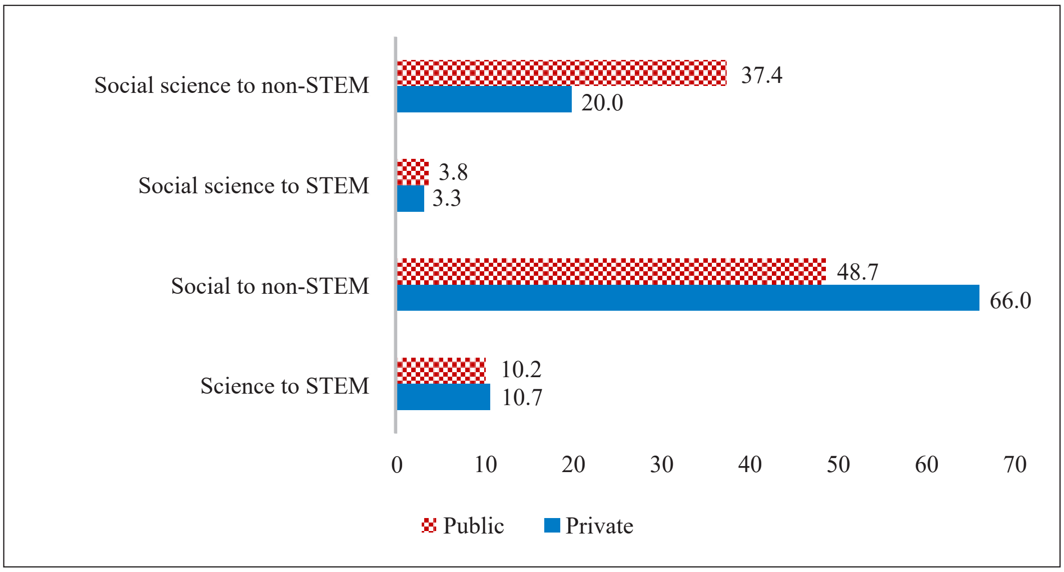


Source: Estimated by the authors based on the student survey

Chi-square testing revealed evidence of association between gender and whether or not students were switchers or non-switchers. The relationship between these variables is statistically significant, $\chi2$ (df = 3, n = 1,338) = 138.93, $p < 0.01$. This indicates that switching patterns differ significantly by gender in that female students are more likely than male students to switch from science to non-STEM majors.

Third, the type of upper secondary school is an influencing factor. As Figure 6 shows, more private school (66.0 percent) than public school students (48.7 percent) had switched from the science track in upper secondary to non-STEM majors in higher education. Conversely, at 3.3 percent and 3.8 percent respectively, almost equal proportions of social science to STEM switchers were from private and public schools.

Figure 6: Pattern of switching (percent) by school type (n=1,338)

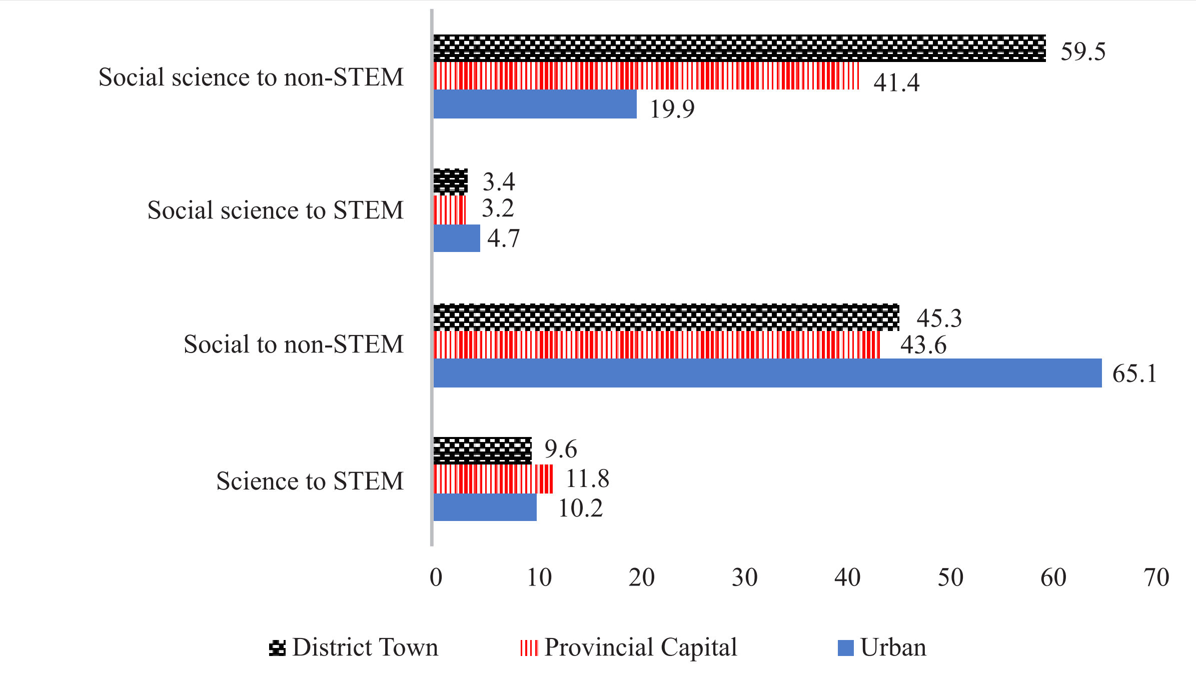


Source: Estimated by the authors based on the student survey

Chi-square ($\chi2$) test was performed to examine the relationship between switching and school type (public versus private). The results revealed a statistically significant relationship between these variables, $\chi2$ (df = 3, n = 1,338) = 19.37, $p < 0.01$. This indicates that patterns of switching vary significantly according to whether students attend a private or public upper secondary school. Private school students tend to switch from the science track to non-STEM majors whereas public school students tend to persist with social sciences (i.e. non-switchers).

Last, the geographic location of upper secondary schools noticeably influenced patterns of switching. As illustrated in Figure 7, students from urban schools were more likely to be science to non-STEM switchers. Specifically, 65.1 percent of urban science-track students had switched to non-STEM majors. Similarly, students (mainly science to non-STEM switchers and social science non-switchers) from schools located in provincial capitals were more likely to choose non-STEM majors. Students from district town schools were more likely to be social science non-switchers (59.5 percent) and science to non-STEM switchers (45.3 percent).

Figure 7: Pattern of switching (percent) by upper secondary school location (n=1,338)



Source: Estimated by the authors based on the student survey

Chi-square (χ2) testing revealed evidence of association between upper secondary school location and whether or not students were switchers or non-switchers. The relationship between these variables was statistically significant, $\chi 2$ (df = 6, n = 1,338) = 60.60, $p < .01$. This indicates that switching patterns vary significantly depending on the geographical location of upper secondary schools. Students from district town schools tend to be social science non-switchers, whereas urban school students are more likely than their counterparts to be science to non-STEM switchers.

In sum, based on these descriptive findings, it can be concluded that Cambodian upper secondary school students are more likely than not to switch majors when they enter higher education. This is particularly the case for science stream students, most of whom tend to choose non-STEM majors such as business administration, management, accounting and finance. Analysis by field of study, gender, school type and school location revealed different switching patterns. Female students, private school students and urban students are more likely than their counterparts to be science to non-STEM switchers.

4.2 Factors influencing academic major switch

Individual performance and preferences, family background and HEI location have significant effects on a student's decision to switch academic major. Table 7 reports the marginal effects of three probit models on students' decisions about whether or not to switch majors. Only selected variables with significant relationships are reported in the table; the full results can be found in Appendix A.

The model in column (1) includes all the variables, that in column (2) excludes favourite subjects (maths, physics, chemistry, and biology) and that in column (3) excludes being good at the four subjects. In all three models, upper secondary school study track (science), being female, family wealth index, HEI in Phnom Penh, and being a scholarship recipient displayed significant effects on the likelihood of switching major.

In model (2), when science and mathematics as favourite subjects were excluded from the analysis, the model retained the significant variables of the first model and signified the influence of ability in mathematics. Last, in model (3) where ability in science and mathematics were excluded, influence was signified by mathematics and physics as favourite subjects.

Table 7: Average marginal effects on the probability of major switch (selected variables)

Variables	**(1)**	**(2)**	**(3)**
	Margins	**Margins**	**Margins**
Study track (science)	0.474***	0.470***	0.471***
	(0.021)	(0.019)	(0.020)
Gender (female)	0.116***	0.121***	0.117***
	(0.018)	(0.019)	(0.018)
Good at maths	-0.024	-0.054**	
	(0.031)	(0.023)	
Maths as favourite subject	-0.039		-0.055**
	(0.031)		(0.023)
Physics as favourite subject	-0.043		-0.044*
	(0.032)		(0.023)
Family wealth index	0.057***	0.056***	0.057***
	(0.018)	(0.017)	(0.017)
HEIs in Phnom Penh	0.099***	0.097***	0.099***
	(0.026)	(0.026)	(0.026)
Scholarship	-0.093*	-0.098*	-0.093*
	(0.052)	(0.054)	(0.052)
Favourite subjects	Included	Excluded	Include
Perceived ability	Included	Included	Excluded
N	*1,281*	*1,281*	*1,281*

Note: Robust standard errors in parentheses; *** p <0.01, ** p <0.05, * p <0.1.

First, as shown in Table 7, looking at individual-level factors, science-track students are 47 percent more likely than social science-track students to enrol in non-STEM majors in higher education. This probability is statistically significant at p <0.01 across all three models. Gender is the second most influential factor. As reported in the descriptive findings, female science-track students are more likely than female social science students and male science students to enrol in non-STEM majors. Holding other factors constant, female students are around 12 percent more likely than their male counterparts to be switchers. This influence is significant at $p < 0.01$. In model (1) when both favourite subjects and perceived performance are included in the estimation, their relationships with switching decisions are not statistically significant; however, as seen in models (2) and (3) when favourite subjects and perceived performance are separated, students whose favourite subjects are mathematics and/or physics and students who are good at mathematics are less likely to be switchers. Statistically, students are 5.5 percent and 4.4 percent less likely to be switchers if their favourite subjects at upper secondary school are mathematics and physics, respectively. Students who are good at mathematics are also less likely to be switchers.

Second, of the four family-level factors included in the probit model, only the family wealth index exhibited a significant effect on students' likelihood of switching academic majors. Students from better-off families are more likely to switch academic majors. An increase of 0.716 (one standard deviation) in the family wealth index increases the probability of switching academic majors by around 4.0 percent.

Third, of the variables included in the probit models, upper secondary school factors do not display any significant influence on the probability of switching. Rather, the decision about whether or not to switch tended to be influenced by HEI location. The results suggest that upper secondary school students enrolling in Phnom Penh-based HEIs are about 10 percent more likely to switch majors. The likelihood is significant at $p < 0.01$. Further, being a scholarship beneficiary reduces the likelihood of switching and this relationship is statistically significant at $p < 0.10$.

Subsample analysis

As mentioned earlier science-track students are more likely to be switchers, therefore it is intriguing to examine whether or not the factors associated with switching differ between science-track and social science-track students. Table 8 reports the marginal effects of probit models from the subsample analysis with selected variables that are found to be significantly associated with major switching (see Appendix A for the full set of results).

The results indicate that female science-track students are about 25 percent more likely than their male counterparts to switch their academic majors; in contrast, female social science-track students are less likely to switch their academic majors. Although the analysis detected no significant association between the technology readiness index (TRI) and major switching in the whole sample, the TRI is negatively correlated at $p < 0.05$ with science-track students' decisions to switch majors. In other words, technology readiness helps students to stay in the STEM pipeline during their transition from upper secondary to higher education. An increase of 0.328 (one standard deviation) in TRI reduces the probability of switching academic majors by nearly 3.0 percent. In addition, the effect of the TRI is significant among science-track students, but not social science-track students. Another interesting finding is the effect of subject preference on students' decisions about whether or not to switch academic majors. The subsample analysis shows that if students like mathematics or physics at upper secondary school they are less likely to switch from the science track to non-STEM majors and more likely to switch from the social science track to STEM in higher education.

For family-level factors, socioeconomic status measured by the wealth index is negatively associated with academic major switch, but is statistically significant at $p < 0.01$ among science-track students and not statistically significant among social science-track students. In other words, science-track students from higher socioeconomic status backgrounds are likely to switch to non-STEM subjects in higher education, but socioeconomic status has no influence on the likelihood of social science track students switching their majors. For science-track students, father's education level is positively correlated with academic major switch at $p < 0.1$. If the father's education level is higher than upper secondary school, there is a higher likelihood that social science students will switch to STEM majors. Location of upper secondary school and year of upper secondary school graduation remain insignificant even when the whole sample is separated into science-track and social science-track groups.

At the HEI level, the science-track subgroup analysis indicates a strong positive relationship between enrolment in public HEIs and major switch as well as between enrolment in Phnom Penh-based HEIs and major switch. This means that switchers from the science track are likely to enrol in non-STEM majors at public HEIs in Phnom Penh. The social science-track subgroup analysis indicates that the association between enrolment in Phnom Penh-based HEIs and major switch is statistically insignificant and that enrolment in public HEIs is negatively correlated with major switch. In other words, non-switchers from the social science track are likely to enrol in public HEIs.

Table 8: Average marginal effects on the probability of major switch in subsample analysis (selected variables)

Variables	Science track			Social science track		
	(1)	(2)	(3)	(4)	(5)	(6)
Study track (science)						
Gender (female)	0.252***	0.259***	0.252***	-0.158***	-0.152***	-0.158***
	(0.023)	(0.023)	(0.023)	(0.033)	(0.032)	(0.033)
TRI	-0.084**	-0.083**	-0.082**	0.003	0.006	0.005
	(0.039)	(0.039)	(0.039)	(0.034)	(0.033)	(0.034)
Perceived good at maths	0.001	-0.057**		-0.026	0.026	
	(0.036)	(0.027)		(0.054)	(0.047)	
Maths as favourite subject	-0.082**		-0.080***	0.076*		0.062*
	(0.035)		(0.026)	(0.040)		(0.035)
Physics as favourite subject	-0.071**		-0.050**	0.047		0.035
	(0.034)		(0.024)	(0.055)		(0.041)
Family wealth index	0.087***	0.081***	0.085***	0.031	0.026	0.028
	(0.022)	(0.022)	(0.022)	(0.025)	(0.024)	(0.025)
Father's education-USS	-0.034	-0.035	-0.033	0.050*	0.052*	0.050*
	(0.028)	(0.028)	(0.028)	(0.028)	(0.027)	(0.028)
HEI in Phnom Penh	0.155***	0.150***	0.153***	-0.011	-0.007	-0.008
	(0.031)	(0.031)	(0.031)	(0.033)	(0.033)	(0.033)
Public HEI	0.086***	0.086***	0.085***	-0.076***	-0.075***	-0.075***
	(0.027)	(0.027)	(0.027)	(0.026)	(0.026)	(0.026)
Favourite subjects	Included	Excluded	Included	Included	Excluded	Included
Perceived ability	Included	Included	Excluded	Included	Included	Excluded
N	*799*	*799*	*799*	*468*	*468*	*468*

Note: USS – upper secondary school; robust standard errors in parentheses; *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

5. Discussion and conclusion

5.1 Discussion

A key finding from the study is that a majority of switchers are from the science track. To some extent, this reflects the social reality of the Cambodian context. First, although reports often state that to move the country forwards, Cambodia needs more STEM graduates, most students tend to swing away from science when they move to higher education. More than 40 percent of the 1,338 students participanted in this study took their baccalaureate exam in 2017-2018 or earlier. In that academic year, albeit more upper secondary students were in the science track, the higher education landscape showed the opposite trend. This mismatch might be due to students' academic performance in and their passion for science and mathematics. As evidence, during the 2015 national exam, out of 83,325 students, only 23.3 percent passed the mathematics portion, while 41.7 percent passed the biology portion. However, in order to pursue higher education in STEM, students need to have a strong academic background in science (physics, chemistry and biology) and mathematics (MoEYS 2010a). Moreover, according to the outcomes of the Program for International Student Assessment for Development (PISA-D), Cambodian 15-year-old (grade 7 and above) students outperformed those in Senegal and Zambia in all subjects, and their academic performance in mathematics was comparable to those in other PISA-D member states (Cambodia scored 325 and the PISA-D average was 324). However, their performance in science was significantly lower than that in other PISA-D and ASEAN member states (Vietnam, Thailand, Indonesia and Singapore). Their performance was especially lower than students in OECD member nations. Cambodian students scored 330 (out of roughly 700) in science, whereas students in PISA-D member countries scored 349 on average (MoEYS 2018b). This finding might perpetuate a false belief among Cambodian students that STEM is for "the brightest" students only. Students tend to pursue STEM majors if they believe they are good at maths and/or science (Eng and Szmodis 2016).

Another interesting finding is the gender difference in patterns of switches, notably that female science-track students are more likely to switch to non-STEM majors. Some anecdotal evidence might explain this phenomenon. First, at upper secondary school, there are more female students than male students. According to statistics from the Department of General Education (MoEYS 2021b), in academic year 2020-2021, female students accounted for 60 percent of science-track students. Science-track students usually perform better and challenge themselves more than social science-track students. The findings also confirmed that gender does matter when it comes to choice of STEM majors. Wiswall et al. (2014) stated that STEM majors are characterised by a "chilly environment," where female students can feel unwelcome as STEM subjects and careers are usually perceived as male-dominated spheres. This environment might also be influenced by their family's perception of STEM majors. Students might be more interested in STEM if they felt their parents valued STEM disciplines (Eng and Szmodis 2016). Yet, female students seemed to perceive that women are suited to jobs in air-conditioned offices such as in accounting and finance but not outdoor work in engineering or electronics. Thus, most of the female switchers tended to stream towards business-related institutions. For example, 140 female students from our sample were enrolled at the National University of Management. Of those, 80 percent had switched from the science track to non-STEM majors.

One of the government's concerns is the high rate of switching from the science track to non-STEM majors. This study has identified that, at the individual level, gender, technology readiness, mathematics performance and preference for mathematics and physics are the influential factors behind switching decisions. The findings also suggest if students have strong interests in mathematics and physic subjects, they are less likely to switch to non-STEM majors and that students 'interests are more important than their academic performances when it comes to major decisions. These findings have implications for the transition from upper secondary school to higher education in Cambodia.

At upper secondary school, female students are more likely to choose the science track (Kim 2006; Stokking 2000). On its own, being female is not a significant predictor of persistence in science. Contextually, female students' track choice is not strongly connected to their major or career choice, as in the case of male students. Female students' choice of the science track might be due to the perception that it will provide them with an open choice to various higher education majors (Kao and Shimizu 2019). However, female science-track students will switch to non-STEM majors. Although students need to have passed the baccalaureate exam before they can enrol in higher education, those that do not have good enough grades in the required subjects can sit entrance exams in order to gain admission to non-STEM majors (MoEYS, 2009. This allows students a free choice about whether or not to switch.

The current findings are consistent with the conceptual framework, which postulates that an individual's intention to pursue a certain field of study (non-switcher) is the consequence of the sequential cumulative effects of numerous learning experiences gained during science and mathematics classes (Lent et al. 2002; Wang 2017). Students will be more likely to stay the course if their favourite subjects are mathematics and physics. So the question is why students are not interested in science and mathematics. Teaching quality and teaching approaches, availability of teaching resources, and school culture might also contribute to this phenomenon (Eng and Szmodis 2016; Woolnough 1994). Some Cambodian upper secondary schools might still be at a disadvantage in that they cannot access enough qualified teachers and teaching resources (Khieng, Madhur and Chhem 2015).

Science switchers are more likely to come from wealthier families. One interesting observation to help explain this phenomenon is that students from wealthier families might plan for a more "open choice of major" than their counterparts. They could, for instance, benefit from private tutoring at upper secondary school to enhance their academic achievement, especially in science and mathematics. This could lead to a wider range of higher education opportunities. Also, because wealthier students have better financial support, they could try out different majors or HEIs until they find a major or institution they really like. Conversely, students from low-wealth families might not have enough money to switch majors and are more likely to be scholarship beneficiaries. As indicated, students are 9.3 percent less likely to be a science switcher if they have a scholarship.

5.2 Conclusion

From the results and discussion, it is reasonable to conclude that Cambodian upper secondary school students are more likely to switch their majors when pursuing higher education. This is more likely for female science-track students. Although female students choose the science track at upper secondary school, their interest in science tends to decline and they are more likely to choose non-STEM majors such as business management, finance and accounting. Further analysis found that the decision to switch or not to switch is associated not only with individual academic ability and preferences, but also family socioeconomic status and school and university supports. Female science-track students from high-wealth families are more likely to be science switchers, especially if pursuing business-related majors in Phnom Penh-based HEIs. However, the likelihood of switching is reduced if students like to study and if they perceive they are good at science and mathematics at upper secondary school.

The study has also provided some recommendations to address the reasons why students switch majors on transition from upper secondary to higher education. First, because students' interest in science and mathematics matters, teaching approaches that create opportunities for them to engage in practical classroom activities and stimulate their curiosity in science and mathematics should be considered. Science educators at upper secondary school level and especially from early grades should put more emphasis on "how" rather than "what" when teaching science and mathematics. There should be more focus on the application of science and mathematics knowledge and skills in real-life situations, particularly in reading and mathematics and problem-solving, rather than simply copying content from textbooks. Second, efforts to optimise learning experiences should focus on creating highly interactive teaching-learning as a cognitive-activation strategy for promoting interest and enjoyment in mathematics and science. Put simply, increasing only teaching hours in the current science track would be misguided and unlikely to inspire learning without interactive teaching methods that involve inquiry-based and project-based activities. Also, the provision of information about college majors and career guidance in STEM, targeted at underrepresented female subgroups should be considered. To that end, priority should be given to enhancing the perceived competences and self-efficacy beliefs of girls and women, especially regarding their abilities in science and mathematics, so as to foster a sense of identity as future scientists throughout secondary school to postsecondary education and career pathways. Science teachers could also work to challenge and change parents' preconceptions and gender stereotypes about mathematics and science. As quality matters, the higher education entrance examination criteria should also be reconsidered so that more qualified students can follow the same track from upper secondary school to higher education.

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Annex A: Full results from probit analysis of factors influencing switch of academic majors

Variables	All			Science track			Social track		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Margins	Margins	Margins	Margins	Margins	Margins	Margins	Margins	Margins
Study track (science)	0.474***	0.470***	0.471***						
	(0.021)	(0.019)	(0.020)						
Gender (female)	0.116***	0.121***	0.117***	0.252***	0.259***	0.252***	-0.158***	-0.152***	-0.158***
	(0.018)	(0.019)	(0.018)	(0.023)	(0.023)	(0.023)	(0.033)	(0.032)	(0.033)
Age	0.003	0.002	0.003	0.009	0.007	0.009	-0.003	-0.004	-0.003
	(0.006)	(0.006)	(0.006)	(0.008)	(0.008)	(0.008)	(0.007)	(0.007)	(0.007)
TRI	-0.036	-0.036	-0.036	-0.084**	-0.083**	-0.082**	0.003	0.006	0.005
	(0.030)	(0.030)	(0.030)	(0.039)	(0.039)	(0.039)	(0.034)	(0.033)	(0.034)
Enrolled in multiple degrees	0.040	0.043	0.039	0.043	0.051	0.047	0.029	0.022	0.028
	(0.033)	(0.033)	(0.033)	(0.039)	(0.039)	(0.039)	(0.054)	(0.057)	(0.054)
Perceived good at maths	-0.024	-0.054**		0.001	-0.057**		-0.026	0.026	
	(0.031)	(0.023)		(0.036)	(0.027)		(0.054)	(0.047)	
Perceived good at physics	-0.002	-0.035		0.029	-0.027		-0.025	0.017	
	(0.031)	(0.023)		(0.034)	(0.025)		(0.059)	(0.050)	
Perceived good at chemistry	-0.015	-0.008		0.001	-0.013		0.053	0.010	
	(0.035)	(0.025)		(0.039)	(0.029)		(0.086)	(0.065)	
Perceived good at biology	-0.010	0.004		-0.018	-0.014		0.031	0.067	
	(0.038)	(0.026)		(0.046)	(0.031)		(0.060)	(0.066)	
Maths as favourite subject	-0.039		-0.055**	-0.082**		-0.080***	0.076*		0.062*
	(0.031)		(0.023)	(0.035)		(0.026)	(0.040)		(0.035)
Physics as favourite subject	-0.043		-0.044*	-0.071**		-0.050**	0.047		0.035
	(0.032)		(0.023)	(0.034)		(0.024)	(0.055)		(0.041)
Chemistry as favourite subject	0.016		0.004	-0.016		-0.017	-0.076		-0.030
	(0.035)		(0.026)	(0.040)		(0.030)	(0.089)		(0.063)
Biology as favourite subject	0.015		0.008	0.000		-0.014	0.086		0.099
	(0.036)		(0.026)	(0.046)		(0.031)	(0.062)		(0.061)
Expected monthly salary	0.000	0.000	0.000	0.000	0.000	0.000	-0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Year passed Bac. II (2016 and before)									

Passed Bac. II in 2017	0.001	0.001	0.001	0.013	0.007	0.014	-0.052	-0.048	-0.056
	(0.033)	(0.033)	(0.033)	(0.040)	(0.041)	(0.040)	(0.052)	(0.053)	(0.056)
Passed Bac. II in 2018	0.012	0.012	0.011	0.044	0.038	0.044	-0.027	-0.027	-0.030
	(0.036)	(0.036)	(0.035)	(0.042)	(0.042)	(0.041)	(0.054)	(0.056)	(0.058)
Passed Bac. II in 2019	-0.002	-0.002	-0.002	-0.030	-0.038	-0.027	0.031	0.026	0.026
	(0.044)	(0.044)	(0.044)	(0.053)	(0.054)	(0.053)	(0.069)	(0.070)	(0.071)
Family wealth index	0.057***	0.056***	0.057***	0.087***	0.081***	0.085***	0.031	0.026	0.028
	(0.018)	(0.017)	(0.017)	(0.022)	(0.022)	(0.022)	(0.025)	(0.024)	(0.025)
Household size	-0.007	-0.007	-0.008	-0.008	-0.007	-0.007	-0.007	-0.006	-0.006
	(0.005)	(0.005)	(0.005)	(0.007)	(0.007)	(0.007)	(0.008)	(0.008)	(0.008)
Father's education-USS	0.009	0.007	0.009	-0.034	-0.035	-0.033	0.050*	0.052*	0.050*
	(0.023)	(0.023)	(0.023)	(0.028)	(0.028)	(0.028)	(0.028)	(0.027)	(0.028)
Mother's education-USS	0.005	0.005	0.005	0.007	0.006	0.006	0.038	0.039	0.037
	(0.028)	(0.028)	(0.028)	(0.033)	(0.033)	(0.033)	(0.039)	(0.039)	(0.039)
Public USS	0.010	0.010	0.010	0.027	0.024	0.029	-0.064	-0.061	-0.064
	(0.034)	(0.034)	(0.034)	(0.036)	(0.036)	(0.036)	(0.050)	(0.050)	(0.050)
USS location (Phnom Penh)									
Provincial	-0.035	-0.035	-0.037	-0.003	-0.003	-0.006	-0.046	-0.050	-0.043
	(0.031)	(0.031)	(0.031)	(0.038)	(0.038)	(0.037)	(0.039)	(0.039)	(0.039)
District and rural	-0.010	-0.012	-0.011	0.015	0.008	0.013	-0.016	-0.016	-0.015
	(0.029)	(0.029)	(0.029)	(0.036)	(0.036)	(0.036)	(0.044)	(0.044)	(0.043)
HEIs in Phnom Penh	0.099***	0.097***	0.099***	0.155***	0.150***	0.153***	-0.011	-0.007	-0.008
	(0.026)	(0.026)	(0.026)	(0.031)	(0.031)	(0.031)	(0.033)	(0.033)	(0.033)
Public HEIs	0.034	0.035	0.035	0.086***	0.086***	0.085***	-0.076***	-0.075***	-0.075***
	(0.023)	(0.023)	(0.023)	(0.027)	(0.027)	(0.027)	(0.026)	(0.026)	(0.026)
Scholarship	-0.093*	-0.098*	-0.093*	-0.070	-0.086	-0.070			
	(0.052)	(0.054)	(0.052)	(0.088)	(0.092)	(0.089)			
N	*1,281*	*1,281*	*1,281*	*799*	*799*	*799*	*468*	*468*	*468*

Note: - USS: upper secondary school; robust standard errors in parentheses
*** p <0.01, ** p <0.05, * p <0.1.

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