



Ministry of Education, Youth and Sport
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Policy Brief

Factors Influencing Science and Social Science Stream Choices at Upper Secondary Education in Cambodia

Sokunrith Pov, Ratha Chey, Bunnath Ob, Makara Hak, Linda Seang, and Sophal Souk

Corresponding author: Sokunrith Pov, Email: sokunrithp@gmail.com

Introduction

The Royal Government of Cambodia (RGC) has laid out the Industrial Development Policy (IDP) 2015-2025, which is considered as a crucial mean to move the country from a low-middle-income country to an upper-middle-income country by 2030 and a high-income country by 2050 (RGC, 2015). This ambition is a crucial endeavor to transform Cambodia from an agricultural-base to industrial-base country. To realize its vision, the emphasis on Science, Technology, Engineering and Mathematics (STEM) education in promoting the national economy and developing human resources is one of the vital goals as mentioned in the National Strategic Development Plan (NSDP) 2019-2023 (RGC, 2019).

To align with the RGC's visions and goals, the Ministry of Education, Youth and Sport (MoEYS) has put a strong effort in formulating the New Generation Schools (NGS) and STEM policy in 2016 (MoEYS, 2016a, 2016b). The establishment of NGS and STEM policy aims to promote science education and attract more students to choose science stream at upper secondary education and especially pursue higher education in STEM-related majors. To support the government policy, the Asian Development Bank (ADB) has formulated a project entitled "Second Upper Secondary Education Sector Development Program (USES DP-II)" to provide financial and technical support to improve access to upper secondary education. Among various objectives of the project, one of the vital sub-objectives is to provide an educational grant to students of grades 11 and 12 who choose science stream at the Secondary

Resource Schools (SRS). The primary purpose of this sub-objective is to encourage more students to opt for science stream so that they are also expected to pursue higher education in STEM-related major at university. The project based on this objective has been implemented in SRS of all 25 provinces and cities in Cambodia, including seven disadvantaged provinces namely Koh Kong, Banteay Meanchey, Ratanak Kiri, Mondul Kiri, Stung Treng, Kratie, and Oddar Meanchey. To date, among the total target of 6,000 students, 4,334 students have received this grant nationwide. And, it has been estimated that 1,783 more will receive this grant for the academic year 2020-2021. Through this educational grant, it is expected that there will be an increase in the number of students enrolling in STEM-related majors in higher education (see ADB, 2020; MoEYS, 2020b).

However, it has been found that not only the enrollment in science stream at upper secondary education has been decreasing but also a large number of students choosing STEM-related majors at higher education tend to significantly decline over the years (see Kao & Shimizu, 2020). These trends have become a serious concern for Cambodia to achieve its development ambitions in 2025 and toward 2030 and 2050. An urgent investigation is deemed necessary.

Rationale

As mentioned earlier, although the RGC, MoEYS and ADB have put a strong effort on promoting STEM at upper secondary education and higher education, it has been found that a large proportion of students have increasingly opted for the social science to science stream over the past years at the upper secondary level. The enrollment rate in science stream sharply fell from 94.30 percent in 2014 to only 38.60 percent in 2020, whereas the enrollment rate in social science stream significantly increased from 5.70 percent in 2014 to 61.40 percent in 2020 (MoEYS, 2020a). Due to the significant decrease of enrollment rate in science stream, the present study is deemed as a crucial mean to rigorously investigate and explain in-depth on what might be the main reasons pushing more students to choose social science stream at the upper secondary level in Cambodia.

Recently, there are several studies that have investigated factors affecting major choices at higher education. However, these studies focused on only students and the downtrend of STEM-related major choices at higher education. Additionally, only a quantitative approach was employed (see Kao, 2020; Kao & Shimizu, 2020; Sovansopha, 2019; Sovansopha & Kinya, 2020; Sovansopha & SHIMIZU, 2019). Meanwhile, the current study specifically

focused on factors leading students at upper secondary education to increasingly choose social science stream over science stream.

The results will provide a clear insight into the root causes of a sharp decrease in science-stream enrollment rate to the RGC, MoEYS and especially ADB to find appropriate immediate and future interventions and policy options to attract more students to choose science stream. It will especially provide a clear insight to ADB to evaluate the scholarship grant project for the upper secondary school students choosing science stream in the target provinces. The findings will also indicate whether the project is helping to support the RGC's visions and MoEYS policy to promote STEM education at higher education. Moreover, the results will inform the policymakers and related stakeholders in the education sector on what should be done next to ensure the increase of science-stream enrollment and STEM-related-major graduates. The results will also partly respond to the RGC's goals and visions in 2025 and toward 2030 and 2050.

Promoting STEM in Cambodia

MoEYS has put a strong effort on education reform for improved quality of education, especially to strengthen STEM education, to develop human resources in STEM fields in responding to the vision of the RGC that aims to transform Cambodia to an upper-middle-income country by 2030 and a developed country by 2050. As a reflection of the ministry's commitment, it has been observed that the Policy on Science, Technology, Engineering, and Mathematics (STEM) was developed and implemented in 2021 to promote STEM at general and higher education levels to meet the needs of the labor market and the ASEAN community (MOEYS, 2016a). In 2016, MoEYS also issued another New Generation School Policy (NGS) with seven objectives. For the sixth objective, the policy seeks to improve teaching standards through new approaches, including competitive recruitment, task-based incentives, teacher training on educational technology and STEM, skills in identifying problems and solutions, and teacher career pathway linked to professional development opportunities for teachers (MOEYS, 2016b).

In 2010, MoEYS has issued a "Guidelines on the Practice of General Education Curriculum at Upper Secondary Schools" in line with STEM policy to strengthen students' capacity for higher education and promote STEM education in Cambodia. The initiative was the government's endeavor in producing human resource in the fields of STEM to transform Cambodia from an agriculture-based to an industry-based country. This initiative sets a new

norm to educational stream at upper secondary school where classes are divided into two main streams: science stream and social science stream. Students are required to choose either social science or science stream at grade 10 and enroll in selected stream at grade 11. However, students are also allowed to change a stream choice at grade 12. Annually, students of grade 10 are informed about stream choices on April and register for a preferred stream on May so that the school prepare the number of classes into two streams and announce for the new academic year. Students of both streams are required to take the same 13 subjects for 32 hours per week. There is no difference in subjects for both streams. However, the distinguished feature is only about the number of hours for each subject. Students of social science stream are required to take more hours on social science subjects, while students of science stream are required to take more hours on science subjects (see MoEYS, 2010). The detail of subjects and hours taken are presented in the table below.

Dominant factors on stream choices and recommendations

This study has clearly identified the main reasons that influence science and social science stream choices by reflecting the results through a mixed-method approach. The results of the mixed-method approach made it clear that the results were highly interconnected, leading us to conclude that the results of this approach could be synthesized into a single discovery and combined to interpret from a common phenomenon as discussed below.

Effects of demographic variables

Through previous studies involving STEM studies in Cambodia (e.g., Kao and Kinya, 2020; 2020; 2019; 2020; 2019), we have observed that the results of current study provide additional significantly new findings and perspectives for researchers and policymakers in Cambodia. The current study found that age, Gender, Age, Easy to pass national exam, High passing rate, Want to get good grade, Spend much money for private tutoring and Consider a major in STEM at higher education had significant impact stream choices, which encouraged more students to opt for social science stream over science stream.

The results indicated that students who were poorly educated and at risk of dropping out of schools were older students (e.g., Branson et al., 2014; Colclough et al., 2000; Jorgensen et al., 2009; Li et al., 2013). For social science students, they were often found to come from a group of students having poor performance and being at risk, which led to the fear of failing the exam. Therefore, most of the older students always tended to choose the social science stream because of the ease of national exams, the high passing rate, the desire for good grades,

and less spending for private tutoring classes on science subjects such as Math, Physics or Biology. It could be concluded that the increase in the selection of social science stream because students just wanted to pass the national exam. After passing, they would consider choosing a subject related to STEM in higher education. Thus, whether students chose social science or science stream, it did not influence their desired major choices at higher education.

The decline in the enrollment rate in science stream may not seem to be a good thing, but the results of this research made it clear that the trend and concerns of this decline were not the main problems. Even though most students chose social science stream just to pass the exam, it was found that it was with up to 67 percent more chance that social science students would choose a STEM-related major more than science students. This findings marked that division of social sciences and science streams was problematic for students, teachers and educators as a whole. Because the differences between the two classes depended only on the different number of hours of the subject, students and teachers found it difficult to learn and teach in order to meet the purpose of strengthening students' performance in science subjects. Therefore, to meet this goal, the curriculum for social science and science streams should be adjusted with not only the number of hours but also the contents between the two streams.

Subject mastery

Based on the results of both qualitative and quantitative research, we found that most students chose a stream according to their abilities and preferences. Social science students were found to have poor ability in science subjects such as Mathematics, Physics and Chemistry, but they excelled in Khmer language and Geography. This result is a new finding that complements previous studies, especially the studies of Kao and Kinya (2020; 2020; 2019; 2020; 2019) in Cambodia. Since students were allowed to change streams in grades 11 or 12, there was a student reported to have changed from science to social science class because they did not have the ability to study science subjects and their choice was just to follow their friends'. As a result, a large number of students chose a stream according to their abilities, but there were also some students who were claimed by their students, teachers and principals that they normally follow their friends' choices without considering their abilities. In order to motivate students to choose the appropriate stream according to their abilities, the teacher has a very important role. The teacher is the one who knows best which students are capable in what subject. Therefore, in order to help students, each school should develop a policy to assess students' abilities through the evaluation of teachers in each subject in grade 10, which is a

better way for students to decide the appropriate stream. We can first get students to choose, then the evaluation committee reviews those options and provide feedback to students on whether they can actually study in that class. The evaluation committee can then decide to place the students in each class category. Currently, some schools evaluate students to enter science through exams, but this method does not seem to be effective when the evaluation score is not used appropriately to place students according to the results of the assessment. Only the evaluation by subject teachers through the establishment of an evaluation committee can be more effective.

Mathematics and science self-efficacy

The present study found that learning science in school, science self-concept, and extracurricular activities in science significantly influenced students' stream choices in line with previous studies, such as Kao and Shimizu (2020) and Hackett (1995, as cited in Usher & Pajares, 2009). Social science students seemed to dislike studying sciences in school and thought that science was not important. However, it was observed that about 62 percent of them participated in science activities outside schools more than science students. This finding was related to the initial finding that even though social science students excelled in science subjects, they chose social studies to only pass the exam and then chose STEM-related majors at higher education. Moreover, due to the current technological advancement and promotion of digital education, students have a broad access to study science subjects on social media such as Facebook, where the Ministry of Education, Youth and Sports and other networks always uploads learning contents, especially related to the course that students of any grade can learn. So, students can learn on their own at any time out of schools, especially during Covid-19 pandemic and school closure.

Family related factors

There were a number of family factors that motivated students to choose a social science stream over a science stream, such as parental advice on choosing a stream, children's study expectations, and especially family socioeconomic issues. It was found that these results were strongly correlated with previous studies, such as those of Arslan (2016), Vallejo (2019), Resh (1998), Kao and Shimizu (2020) and Kinyota (2013). The results of the current study showed that the parents of social science students did not give advice to their children and had low expectations for their children's education. And, most of them were living in poverty. About 67 percent of social science students are from poor families. For high school students,

they need a lot of extra time to practice exercise to prepare for the high school diploma exam. For science students, there are many subjects that need to attend more private tutoring classes, such as math, physics, chemistry and biology. Private tutoring is a heavy burden for parents who have to fund their children to pay for private tutoring classes. Especially, it is a heavy burden for low-income families. Therefore, the findings of the current study claim that students just want to pass the exam. They don't need to spend much money on private tutoring classes, especially students from poor families. This makes most students decide to more and more opt for social science stream over science stream. Therefore, family socioeconomic issue really influences the decision to choose a stream. Stream division is not a good strategy and appropriate to livelihood of the majority of Cambodian people due to a huge gap in socioeconomic status.

School related factors

For the school factor, the results showed that the teacher's attention, the teacher's explanation, the teacher's instructions in each subject class, and the school policy and guidance of each school on stream choices significantly influenced the student's decision. Teachers are considered the closest and most knowledgeable of students' abilities. Teachers can motivate students to understand the principles, importance, and career goals when choosing a suitable stream as also claimed by Kao and Shimizu. (2019) and Woolnough (1994). For teaching at the upper secondary level in Cambodia, science teachers are also required to teach social science classes, which the number of hours in science subjects is less than science class a week. It was reported that this matter led social science students to pay less attention to science subjects, which led to less effective teaching and learning. At the same time, social science teachers faced the same problem when teaching science students. It has been observed that the division of classes into two categories not only does not weigh on improving learning, but it also creates problems for students' participation in teaching and learning. This can reduce the effectiveness of student performance for students in both the social science and the science class. As mentioned above, if the class division policy is to be maintained, not only the number of hours should be adjusted, but also the curriculum for both classes should be revised accordingly.

Outcome-expectation related factors

The findings from both qualitative and quantitative studies revealed that students tended to choose science stream because they had an outcome-expectation related STEM fields,

which is consistent with some previous studies (see, Bandura, 1977; Royo & Lamela, 2021; Kinyota, 2013). According to the finding of the current study, it has been found that the selection of science was strongly related to students' expectation, plan, and professional skills after graduating from high schools. It means that students who chose science stream seemed to have the expectation that they would acquire skills for careers related to STEM and hope to earn more money in the future. Therefore, it is very important to guide students to understand the importance of STEM majors and give them advice on STEM majors to attract their attention and encourage them to become interested in STEM. In addition, all stakeholders who work with and advise students also need to understand STEM as well as career choices related to STEM that students want to pursue in the future to guide them to meet their expectations, especially students who expect something in return from mathematics and science.

Encouragement to participate in science and mathematics

Motivation from people around is an important factor in motivating students to decide and do something. In fact, the results of the current study clearly showed that the motivation of parents, principals, and social environment really contributed to encouraging students to choose science stream, which is also in line with some previous studies (see, Koa & Shimizu, 2020; Kinyota, 2003). Meanwhile, parents who are considered the closest people to students have the most opportunity and influence on students' decision making by providing counseling in the process of choosing between science and social science streams. Hence, the understanding of parents of students on academic skills and job market need is really important to help guide students to choose the right stream. In addition, for social environment, it seemed that students had a greater understanding of the needs of the job market in today's Cambodian society. Students choosing science stream thought that current job market trend required them to choose science stream and STEM for job opportunities after graduation.

The results of the current study also found that female students did not seem to be encouraged to choose science stream, but they were alternatively encouraged to choose social science stream. Students who chose social science stream were found to be more likely commended if they chose a course that was not related to STEM. Based on these two factors, it can be concluded that the negative mindset that skills and careers related to STEM is still deemed not suitable for women in Cambodian society.

Scholarship and other factors

It has been found that receiving scholarships provided by ADB projects significantly increased 36 percent chance of science stream choice. This means that scholarship was a motivational agent for high school students to prominently choose science stream. However, the percentage was quite small. It was not possible to guarantee that students who received this scholarship would remain in science stream until they finished high school and chose STEM related majors at the university. In the Binary Logistic regression model, it was found that scholarship fee and the importance of the scholarship did not seem to have influence on stream choices for grade 12 students. Therefore, relying solely on scholarships could not guarantee that there would be an increase in enrollment in science stream at the upper secondary level. Thus, relevant stakeholders need to consider the key factors described above. In addition, this study found that 58.2 percent of students were unaware of the ADB scholarships. Therefore, the information about all types of scholarship should be widely and effectively disseminated to students, especially poor students and outstanding students of science subjects.

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