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**Working Paper**

## Mentoring, educational preferences, and career choice: Evidence from two field experiments in Bhutan

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# MENTORING, EDUCATIONAL PREFERENCES, AND CAREER CHOICE

## EVIDENCE FROM TWO FIELD EXPERIMENTS IN BHUTAN

*Ryotaro Hayashi, Hyuncheol Bryant Kim, Norihiko Matsuda, and Trinh Pham*

**NO. 762**

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Ryotaro Hayashi, Hyuncheol Bryant Kim,  
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No. 762 | December 2024

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## ABSTRACT

We use data from two separate randomized control trials to examine whether career mentoring influences the educational preferences and career choices of Bhutanese students in grades 10 and 12. These mentoring programs provide information on technical and vocational education and training (TVET) for grade 12 students and science, technology, engineering, and mathematics (STEM) education systems for grade 10 students; labor market outcomes; and mentors' experiences in each field. Despite the contrasting levels of recognition and stigma associated with TVET and STEM, both programs are generating greater interest among students, as indicated in their stated preferences. While there are also positive changes in the mindset and attitudes of students in grades 10 and 12, the increased interest does not translate into increased applications and enrollments. We interpret these findings as supporting the importance of nonmonetary factors in shaping educational decision-making.

**Keywords:** STEM, TVET, career mentoring, education choices, Bhutan

**JEL codes:** I23, I24, J4, J24





# 1. INTRODUCTION

Extensive literature has documented significant heterogeneity in labor market outcomes among students from different degree levels and fields of study (Altonji, Blom, and Meghir 2012; Kirkeboen, Leuven, and Mogstad 2016). These findings highlight the importance of helping students make informed decisions about their education, which can greatly impact their future careers. This is particularly pronounced in many developing countries, where students and their guardians often grapple with limited information relevant to the labor market. For example, in Uganda, experimental evidence shows that mentorship support, which provides entry-level labor market information and encouragement improves the school-to-work transition of vocational trainees (Alfonsi, Namubiru, and Spaziani 2024).

Similarly, in Bhutan, lack of access to labor market information has been identified as a contributing factor to the country's escalating youth unemployment rate (UNDP 2023; ILO 2024), which reached 28.6% in 2021 (Bhutan National Statistics Bureau 2022). Many workers in the tourism and hospitality industries were laid off because of the travel restrictions during the pandemic. However, there were also structural labor market issues of higher youth unemployment among arts and humanities graduates compared to science and technology graduates. In 2023, the Royal University of Bhutan significantly reduced the number of admissions in the arts and humanities because of high youth unemployment in this area. This radical change was criticized, and people argued that they should have been informed about educational career choices in earlier grades.

While this change in the university admission system came as a surprise, the Ministry of Education and Skills Development (formerly known as the Ministry of Labor and Human Resources and the Ministry of Education) of Bhutan, and the Asian Development Bank (ADB) had initiated collaborative efforts to provide information on educational career options.<sup>1</sup> Under these programs, students in grades 10 and 12 are paired with mentors who offer up-to-date information on two distinct systems: technical and vocational education and training (TVET) and science, technology, engineering, and mathematics (STEM). The TVET mentoring program involves four one-on-one face-to-face meetings between grade 12 students and mentors who are either current TVET students or TVET graduates. During these meetings, grade 12 students receive standardized information on entry requirements, application processes for TVET institutes, labor market outcomes, and job prospects for TVET graduates. In addition, the mentors share their experiences as TVET students. Similarly, the STEM mentoring program pairs grade 10 students with mentors who are currently undergraduate or graduate STEM students. Alongside information about the importance of STEM education, these mentors also address other aspects similar to those of the TVET program. Overall, both mentoring initiatives aim to guide students toward informed educational career choices.

To evaluate the impact of these mentoring programs, we conducted a two-stage randomized controlled trial involving 76 schools with 10th graders and 36 schools with 12th graders. These schools were assigned as either treatment schools or control schools. In the control schools, students are referred to as “control students.” Within each cohort of students in the treatment schools, we randomly divided students into two groups: the treatment group (referred to as “treatment students”) and the spillover group (referred to as “spillover students”). Spillover effects can also be expected for their peers who did not receive direct tutoring support (Berlinski, Busso, and Giannola 2023).

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<sup>1</sup> Key initiatives include the expansion of the existing TVET system through the ADB-funded Skills Training and Education Pathways Upgradation Project and Pathways for Emerging Skills and Jobs Project (ADB 2018; ADB 2023). The government is also strengthening STEM education to accelerate the adoption of technology (Royal Government of Bhutan 2024). In Bhutan, skills training is important for improving welfare, but training could be more successful when it is combined with job placement services, entrepreneurship development, and mentoring (Chun and Watanabe 2012). These efforts aim to equip individuals with up-to-date information and employment-oriented skills.

Students in the treatment group were then randomly paired with volunteer mentors from the same geographic areas. These mentors underwent standardized training provided by trained school counselors. In total, there were 140 mentors and 700 mentees for the TVET mentoring program and 200 mentors and 1,000 mentees for the STEM mentoring program.

First, we find that the STEM mentoring programs significantly increase students' interest and attitude. In particular, 10th graders assigned to the treatment group are 16.2 percentage points more likely to select the science stream as their first preference, compared to an average of 43.6% in the control group. In addition, the STEM mentoring program positively influences 10th graders' attitudes toward science; subjective knowledge of the field of study; their beliefs about parental, peer, and societal approval; their peer preferences; and their expected satisfaction and self-assessment of their ability to pursue the science stream.

Although the evidence is somewhat limited, there are indications of improvement in students' efforts as reflected in their test scores and graduation exam pass rates. In particular, treatment students show a 5.2 percentage point increase in the likelihood of passing the national board exam compared to spillover students, whose average pass rate is 70%. However, we find no evidence that career mentoring influences students' final career decisions. There is no statistically significant impact on the likelihood of 10th grade students switching to a STEM-related stream in the following academic year.

Second, although TVET mentoring programs increase students' knowledge and interest, it did not translate to a change in attitudes toward TVET. Among 12th grade students in the treatment group, the number of those who consider TVET in their top three choices increased by 5.9 percentage points, compared to the control group mean of 15.9%.<sup>2</sup> The program also improves students' perceived knowledge of different aspects of the field, from the typical life of a TVET student to labor market outcomes and job prospects. However, there is no evidence of a significant effect on all other intermediate outcomes, such as biases against blue-collar jobs, beliefs about others' approval, peer preferences, and students' perceived abilities and expectations related to pursuing TVET education.

Despite the program's positive effects on TVET preferences, we find no evidence that career mentoring affects students' final career decisions toward this area. In particular, there is no statistically significant impact on the likelihood of 12th grade students applying to, being admitted to, or enrolling in TVET institutes 9 months after the mentoring program. In summary, the two mentoring programs studied here target different Bhutanese student cohorts, with distinct characteristics in terms of the general perception of the respective fields of study. While STEM subjects are highly valued, TVET faces a strong social stigma. However, both programs yield similar outcomes: they generate greater interest in the respective fields of study among the treatment students. While these positive changes in mindsets and attitudes are encouraging, this increased interest does not necessarily translate into increased actual enrollment. Since the science stream is competitive, students may require additional time and support to prepare for the national exams. The increase in TVET applications may also require additional support to address the social stigma.

We interpret these findings as supporting the importance of nonmonetary factors in educational decision-making. This is consistent with recent literature on the determinants of educational choice. Previous studies have documented that students, especially those from disadvantaged backgrounds, often have incorrect beliefs about labor market outcomes. When provided with accurate information, students respond by updating their educational choices and changing their decisions (Hastings, Neilson, and Zimmerman 2015; Wiswall and Zafar 2015a, 2015b; Baker et al. 2018; Kerr et al. 2020). However,

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<sup>2</sup> For TVET, we used the top three choices because students rarely select TVET as their first preference in our baseline and follow-up surveys.

most of these studies focus on college students, so it is not yet clear whether similar findings apply in the context of TVET and youth in low-income settings. Recent evidence highlights the important role of nonpecuniary outcomes, such as parental approval and student ideology, rather than pure labor market prospects, in shaping Pakistani students' educational decisions (Delavande and Zafar 2019).

The TVET mentoring program takes place in a context where there is a strong negative stigma associated with students' decisions. Stigma could affect labor market decisions (Osman and Speer 2023), and TVET is often considered for students who do not qualify for admission to general higher education. Unfortunately, this perception contributes to the undervaluation of TVET, which offers valuable career pathways. Given the highly selective nature of the science stream, the results for 10th graders are perhaps not surprising given the relatively low intensity of the mentoring program, which focuses on providing information and guidance rather than academic support. Nonetheless, the STEM program demonstrates that with the right mentoring and accurate information, students can change their perception and invest more in their studies. This finding is relevant in areas where private tutoring is not common or is restricted by government policy.

Our research contributes to the existing literature on mentoring interventions that aim to inform students in their educational career choices. Despite the prevalence of mentoring programs for young people, there is limited evidence of their causal impact on educational career decisions, particularly in low-income settings. The systematic review of tutoring suggests consistent and substantial impacts on learning outcomes (Nickow, Oreopoulos, and Quan 2024), but the available evidence on the impact of voluntary mentoring interventions on educational career guidance is mixed.<sup>3</sup> For example, in the United States, undergraduates providing advice and assistance during the college application process increases college enrollment among female students but not among male students. These differential effects are partly explained by variations in self-reported labor market opportunities (Carrell and Sacerdote 2017). Similarly, having university students as volunteer mentors to provide career guidance and foster self-esteem improves the labor market prospects of students from low socioeconomic status in Germany (Resnjanskij et al. 2024), and mentoring for children from low socioeconomic status can increase the likelihood of entering in a high academic track (Falk, Kosse, and Pinger 2020). In contrast, in France, a career mentoring program facilitated by volunteer professionals from various fields and aimed at helping mentees explore their career paths, primarily influences students' academic ambitions without significantly affecting their concrete plans, knowledge of the professional world, or motivation for schoolwork (Behaghel, Chiodi, and Gurgand 2017). In Argentina, career mentoring combined with financial support also has a moderate impact on academic mindset, perseverance, and learning strategies (Ganimian et al. 2020).

The remainder of the paper is organized as follows. Section 2 describes the Bhutanese education system, the students' general perceptions of TVET and STEM education, randomization, and mentoring programs. Section 3 describes the data sources and the construction of key variables. Section 4 discusses the empirical strategy and section 5 reports our results. Section 6 concludes with an outlook on future research areas.

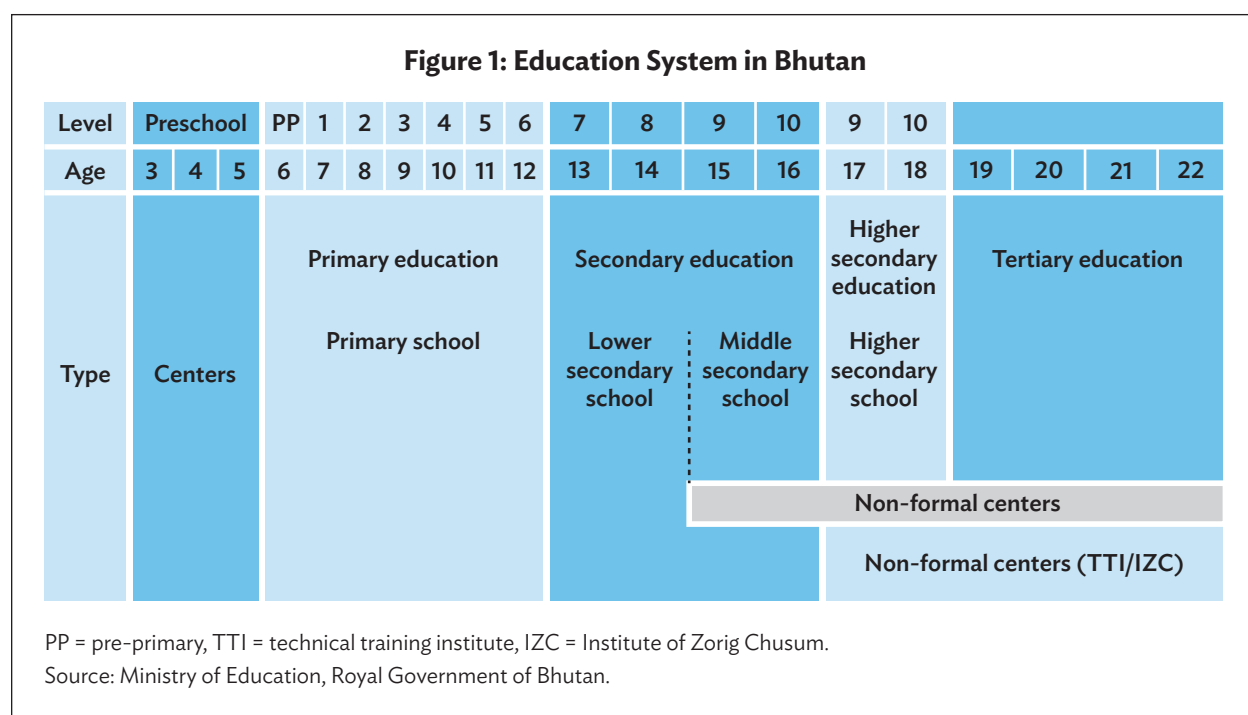
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<sup>3</sup> See Rodriguez-Planas (2014) and citations therein for a review of earlier evidence from high-income settings.

## 2. CONTEXT, PROGRAMS, AND RESEARCH DESIGN

### 2.1 The Education System in Bhutan

Figure 1 illustrates the structure of general education in Bhutan. The academic calendar, which often begins in March, consists of two terms. Students take midterm exams at the end of the first term (July) and final exams at the end of the second term (December). The school system consists of 11 years of basic education (preprimary to grade 10). At the end of grade 10, students are required to take a national board examination—the Bhutan Certificate for Secondary Education (BCSE).



After grade 10, students can continue their education either in general education at higher secondary schools or in vocational education at technical training institutes. Admission to higher secondary schools and academic streams is determined by BCSE performance in grade 10. Students who do not qualify for public schools can continue their studies at private schools or enroll in vocational courses at public and private training institutes.

At higher secondary schools, students must choose to enroll in one of four streams: arts, commerce, science, and *Rigzhung* (studies of culture and tradition). Students who enroll in the science stream have more options to choose STEM-related majors at tertiary institutes, whose eligibility criteria often require good academic performance in math and science subjects. At the end of grade 12, students sit for a national-level exam, the Bhutan Higher Secondary Education Certificate (BHSEC).

After grade 12, students can continue their studies at tertiary institutes or technical training institutes. Admission to public tertiary institutes is predominantly determined by BHSEC performance.<sup>4</sup> However, enrollment in public technical training institutes for grade 12 students is usually based on grade 10 academic performance.<sup>5</sup>

## 2.2 Labor Market Outcomes and General Perception of TVET and STEM

### Technical and Vocational Education and Training

Despite its potential in terms of labor market prospects, the vocational education system has received limited recognition among Bhutanese students. According to reports from Bhutan's Ministry of Labor and Human Resources (2020) and Ministry of Education (2019), only 845 students were enrolled in vocational institutes compared to more than 12,000 students enrolled in tertiary education in 2019. Our baseline survey shows that less than 5% of upper secondary students reported having taken a TVET course in school, and less than 20% chose TVET as one of their top three educational options after graduation (Hayashi, Matsuda, and Yageta 2023). The most cited reason for not taking a TVET course is that students are unaware that such a course exists (50% of the sample), while only 10% said they were not interested in TVET. In addition, students consistently reported that they know less about TVET compared to university education in terms of admission criteria, application procedures, typical student life, curriculum, and future careers, among others. Bhutanese students also tend to underestimate job prospects after TVET graduation. Male (female) students believe that only 45% (39%) of 30-year-old men (women) with a TVET degree have a regular wage job, compared to 81% (80%) according to official statistics calculated from labor force surveys. More than 70% of TVET graduates with national certificate II and above were employed within 1 year of graduation (Ministry of Education and Skills Development 2024). Also, the average earnings that students, especially female students, believe a TVET graduate can earn in their 30s is relatively lower than the official statistics. More than 10% of the sample believe that the average earnings of a full-time worker with a high school diploma is higher than that of a TVET graduate, which is again inconsistent with the official statistics.

### Science, Technology, Engineering, and Mathematics

In contrast, STEM education is highly valued by Bhutanese students. Our baseline survey shows that more than 50% of 10th graders rank the science stream as their top educational choice for 12th grade. Students believe that this academic program is highly valued by their parents, friends, and society. However, the number of students enrolling in this academic stream is rather low. The most cited reason for this is poor performance in math and science compared to other subjects. Students also state that studying the science stream is less enjoyable compared to other academic streams. On the contrary, many Bhutanese students take up humanities based on their personal interest without considering the potential employment opportunities. Moreover, humanities are considered less competitive and relatively easy for university admission and graduation (Wangdi, Wangmo, and Wangdi 2023).

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<sup>4</sup> For example, to be eligible for the bachelor's degree program in data science at Sherubtse College, Royal University of Bhutan, in the academic year 2022, students are required to be from the science stream and have a BHSEC pass certificate with a minimum of 55% in math. The eligibility criteria for a bachelor's degree in life science are students in grade 12 with a pass certificate in the national exam, with minimum marks of at least 55% in biology and 45% in chemistry grades (Sherubtse College. Admission into RUB Programmes for the Academic Year 2024. <https://www.sherubtse.edu.bt/admission/>).

<sup>5</sup> For example, the minimum qualification to apply for the automobile mechanic national certificate II at the Technical Training Institute of Thimphu is passing the BCSE (Ministry of Education and Skills Development. <http://www.education.gov.bt/?p=79367>).



University graduates with a STEM degree have better employment opportunities than those with a liberal arts degree. For example, the 2021 Labour Force Survey Report showed that men and women aged 28–34 with degrees in arts, humanities, and social sciences consistently had higher unemployment rates and lower average monthly salaries than STEM graduates (Hayashi, Matsuda, and Yageta 2023). As a result, in January 2023, the Royal University of Bhutan decided to discontinue some programs in arts and humanities, such as language and history. Instead, new programs such as project management, data science and analytics, were introduced. This sudden change has increased the anxiety of Bhutanese secondary school students in the arts stream (Lamsang 2023).

## 2.3 Program Descriptions and Study Design

In 2021, Bhutan's Ministry of Education and Skills Development, in partnership with the Asian Development Bank, conducted two field experiments targeting grade 10 and 12 students in public and private schools across the country. In these interventions, volunteer mentors are paired with grade 10 and 12 students to provide them with up-to-date information on various aspects of the TVET and STEM systems, while giving students the opportunity to learn from the experience and receive career guidance from current students or graduates of these programs, with the goal of informing students in their educational choices and decision-making. In this section, we describe the program designs and the mentoring programs.

### Study Design

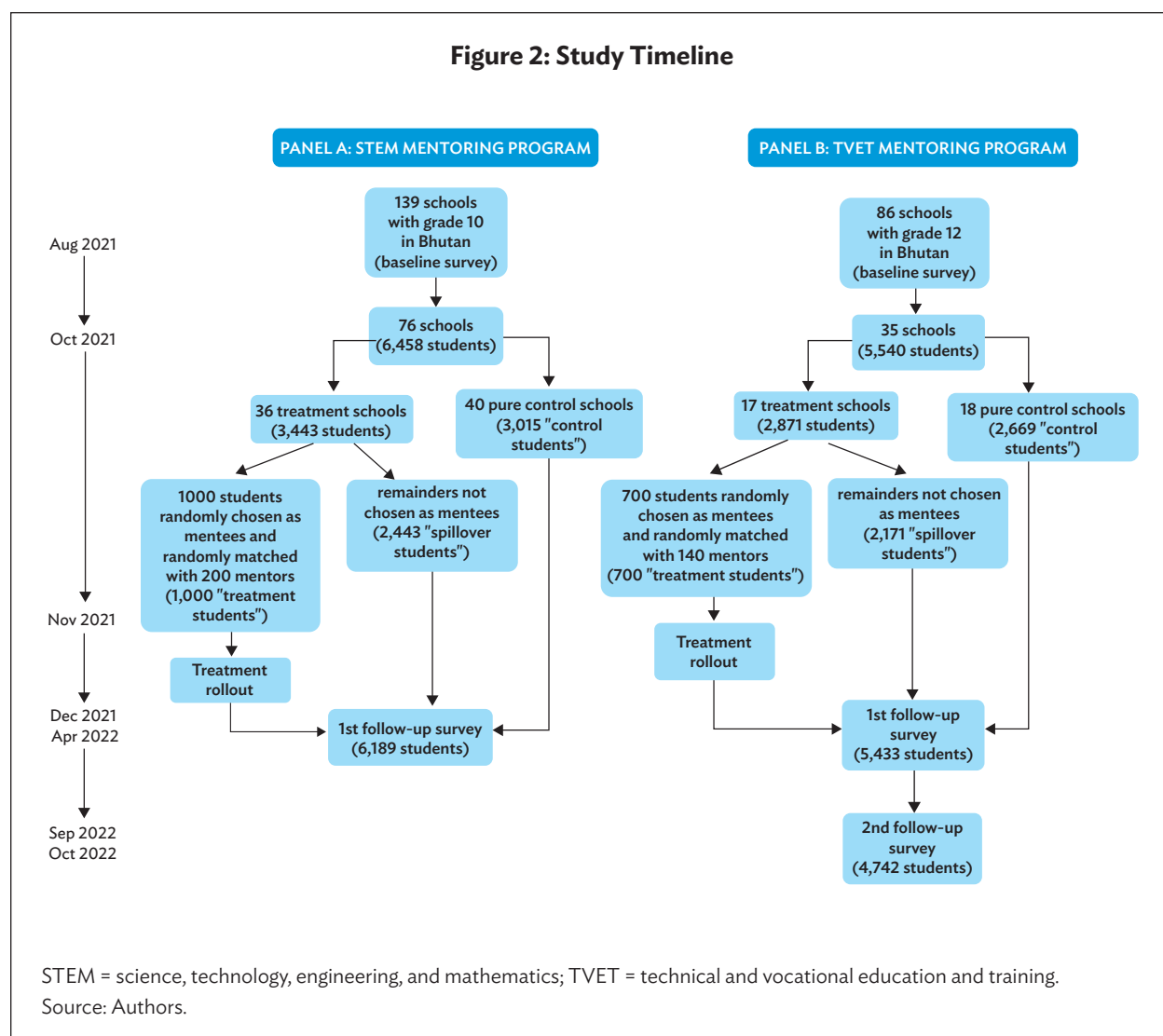
The study timeline is summarized in Figure 2. The baseline surveys were conducted in the summer of the 2021–2022 academic year (August–September 2021). The first follow-up survey of 10th and 12th grade students was conducted shortly after the completion of the mentoring program and before the students' final exams (December 2021). However, due to the outbreak of the coronavirus disease (COVID-19) pandemic, the survey was postponed to March 2022. The second follow-up survey was conducted among the baseline 12th grade students in September 2022, after the students had made their final decisions about tertiary and vocational education.

The mentors for the programs were recruited around the same time as the baseline survey. The mentors for grade 10 students are current undergraduate and graduate students pursuing a degree in STEM subjects (hereinafter referred to as STEM mentors), while the mentors for grade 12 students are current TVET students and TVET graduates (TVET mentors).<sup>6</sup> The final list consists of 200 mentors for grade 10 students and 140 mentors for grade 12 students.

The mentoring program was provided through a two-stage randomization, with the first stage at the school level and the second stage at the student level. Starting from the baseline survey, we restricted our sample to 76 schools (with grade 10 students) located within a 3-hour drive of six STEM colleges. These schools were then stratified by geographic location, school size (total enrollment), and public or private status, and randomly divided into two groups: treatment schools (36 schools) and control schools (40 schools).<sup>7</sup>

<sup>6</sup> The criteria for STEM mentors are (i) currently pursuing a bachelor's or master's degree in STEM subjects from one of the six colleges (namely, College of Natural Resources, College of Science and Technology, Gyalpozhing College of Information Technology, Jigme Namgyel Engineering College, Sherubtse College, and Royal Thimphu College); and (ii) having scored at least 65% of the overall academic performance in grade 12. TVET mentors must (i) be currently enrolled or have already graduated from one of the five TVET institutes (TTI Khuruthang, TTI Samthang, IZC Thimphu, TTI Thimphu, and IZC Trashiyangtse); and (ii) have scored at least 45% of the overall academic performance in grade 12.

<sup>7</sup> The six STEM colleges include the College of Natural Resources, College of Science and Technology, Gyalpozhing College of Information Technology, Jigme Namgyel Engineering College, Sherubtse College, and Royal Thimphu College.



From the sample of 36 schools with grade 12 students located near technical training institutes (TTIs) or the Institute of Zorig Chusum (IZC), which provides skills training in traditional Bhutanese arts and crafts, we also stratified and randomly assigned 17 treatment schools and 18 control schools.<sup>8</sup> In each treatment school, we again randomly divided students into two groups: the treatment group and the spillover group. Students in the treatment group were randomly paired with mentors in the same geographic area, with each mentor having five mentees. We refer to the students in the control-only schools as control students, the students who were assigned as mentees in the treatment schools as treatment students, and the students who were not assigned as mentees in the treatment schools as spillover students. Treatment students could opt out of the mentoring program and declined mentee slots were not reallocated.

## 2.4 Intervention: Career Mentoring

The mentoring program consisted of four one-on-one meetings between student mentees and mentors. Each meeting lasted approximately 1 hour. The meetings were held either face-to-face or online, depending on travel conditions such as the distance between mentors and mentees, travel time, and

<sup>8</sup> The five TVET institutes are TTI Khuruthang, TTI Samthang, IZC Thimphu, TTI Thimphu, and IZC Trashiyangtse.



COVID-19-related restrictions. In addition to official meetings, mentors and mentees were encouraged to communicate frequently via other means, such as text messaging.

To ensure the quality of the mentoring program, the mentors had to attend a 5-day training before the program began. In these sessions, mentors were introduced to and discussed codes of conduct, the importance of specific areas of study, communication and facilitation skills, and proper documentation meetings between mentor and mentee. These training sessions were conducted by trained school counselors from the Ministry of Education under the guidance of a local counseling expert. In addition, mentors received information on various aspects of the science stream or TVET institutes, including applications, admission requirements, important deadlines, and factors to consider when deciding whether to enroll. They were also provided with labor market statistics on the employment rates, types of employers, and earnings of individuals between the ages of 28 and 34 with certain educational qualifications. These statistics were based on data from the 2018–2019 Bhutan Labor Force Survey, disaggregated by gender and educational attainment. Other program components, such as student life sharing, were based solely on the mentors' own experiences. Further details on mentor recruitment and training can be found in Appendix.<sup>9</sup>

The first meeting between mentor and mentee focused on understanding the mentees' plans after middle school (for 10th grade students) and high school (for 12th grade students), which helped to identify any career-related concerns. Mentors then introduced the mentees to the TVET/STEM (science stream) system, provided relevant information about available courses, and shared their own experiences as students. At the subsequent meetings, mentors and mentees discussed labor market information in each field of study and possible career paths for graduates. In addition, the mentors provided the mentees with knowledge about various aspects of the TVET system for grade 12 students or the science stream for grade 10 students based on their experiences. During these sessions, the mentors addressed any relevant questions from the mentees. After each meeting, the mentors submitted brief reports summarizing the topics discussed, progress on career plans, and outcomes of the meeting. These reports allowed the research team to monitor program participation rates and mentoring progress.

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<sup>9</sup> The Appendix is available at xxx.

### 3. DATA AND VARIABLE CONSTRUCTION

#### 3.1 Data and Attrition

Our study draws on several data sources, including administrative test score data, the administrative database for middle school or high school and TVET students, and student surveys.

The baseline survey was conducted online in school computer labs under the guidance of teachers. Information was collected on demographic data, perceived academic performance, preferences, and beliefs regarding education and future employment.

We administered follow-up surveys to all 10th and 12th grade students at baseline and shortly after completion of the mentoring programs in December 2021 (endline survey for grade 10 and first follow-up survey for grade 12). We assess students' updated preferences, beliefs, and objective knowledge about the admissions process. We achieved relatively low attrition rates in the 10th grade sample, with rates of 4.3% for treatment students, 5.2% for spillover students, and 3.2% for control students (Table 1). Importantly, these attrition rates showed no statistically significant differences between these groups, except for a 2.0 percentage point difference between spillover and control students, which is significant at the 10% level. Attrition rates were low among 12th grade students: 2.1% among treatment students, 2.3% among spillover students, and 1.7% among control students, with no statistically significant differences between groups.

We conducted a second follow-up telephone survey of grade 12 students in September 2022 to collect information about their final educational decision. Despite our considerable efforts to contact this group of students, frequent changes in phone numbers and limited access to other forms of communication, such as personal emails, made the follow-up survey particularly challenging. As a result, the survey attrition rates remained high at 15.7% for treatment students, 17.1% for spillover students, and 15.1% for control students. Reassuringly, these rates are not statistically different from one another at conventional levels (Table 1).

**Table 1: Sample Attrition**

	Follow-Up Survey (April)		Administrative Test Score Data	
	(1)	(2)	(3)	(4)
<b>Panel A: Grade 10 students</b>				
Treatment Student (TREAT)	0.011	0.011	0.009	0.009
	(0.008)	(0.008)	(0.006)	(0.006)
Spillover Student (SPILL)	0.020*	0.020*	0.006	0.006
	(0.012)	(0.011)	(0.004)	(0.004)
Observations	6,458	6,458	6,458	6,458
Adjusted R-squared	0.007	0.008	0.003	0.003
Control group mean	0.032	0.032	0.022	0.022
p-value (TREAT)-(SPILL)=0	0.328	0.316	0.713	0.650
Additional controls	No	Yes	No	Yes

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Table 1 *continued*

	Follow-Up Survey (April)		Follow-Up Survey (September)		Administrative Test Score Data	
	(1)	(2)	(3)	(4)	(5)	(6)
<b>Panel B: Grade 12 students</b>						
Treatment Student (TREAT)	0.004	0.005	-0.006	-0.008	0.013	0.013
	(0.009)	(0.007)	(0.024)	(0.025)	(0.011)	(0.011)
Spillover Student (SPILL)	0.006	0.006	-0.020	-0.021	0.013	0.013
	(0.006)	(0.005)	(0.018)	(0.018)	(0.009)	(0.009)
Observations	5,540	5,540	5,540	5,540	5,540	5,540
Adjusted R-squared	0.003	0.008	0.003	0.006	0.007	0.008
Control group mean	0.017	0.017	0.151	0.151	0.015	0.015
p-value (TREAT)-(SPILL)=0	0.838	0.868	0.493	0.533	0.965	0.997
Additional controls	No	Yes	No	Yes	No	Yes

NOTES: All columns include strata-fixed effects, standard errors clustered at the school level are in parentheses. Additional controls include student gender, the potential share of mentees, an indicator for father completing high school or above, an indicator for mother completing high school or above, household standardized wealth index, and dummies for missing data on father education, mother education, and household wealth. Missing data are imputed as the median. \* p-value < 0.1, \*\* p-value < 0.05, \*\*\* p-value < 0.01.

Source: Authors.

To complement our survey data, we also use administrative data on enrollment in middle or higher secondary schools and TVET institutes. The secondary school data sets are managed by the Ministry of Education, while the TVET data sets are managed by the Ministry of Labour and Human Resources. They cover all students enrolled in both public and private institutes, allowing us to identify the final educational decisions made by students in the following academic year.<sup>10</sup> In addition, we analyzed administrative data on test scores from the grade 10 secondary school graduation exam (BSEC) and grade 12 secondary school graduation exam (BHSEC) to assess whether the mentoring program has an impact on test performance. Remarkably, we were able to locate almost all our study subjects in the administrative data—specifically, 97% of the 10th grade students at baseline and 98% of 12th grade students at baseline (as shown in Table 1), with no statistical difference in the attrition rates between the treatment, spillover, and control groups.

<sup>10</sup> The administrative enrollment data however is not without its drawbacks. In particular, the TVET administrative database is not necessarily comprehensive. For example, all public TVET institutions are required to report data to the government, but it is possible that some private TVET institutions do not report their data to the government. At the time of the study, the data of some public TVET institutions had not yet been integrated into the central database. As a result, the results on the final educational decisions of the baseline 12th graders should be interpreted with caution.

### 3.2 Variable Constructions

The primary objective of the two career mentoring programs is to increase the application and enrollment rates of grade 10 students for the science stream and grade 12 students for the TVET program. To assess the achievement of this goal, we evaluate the effectiveness of the mentoring program based on two main outcomes: stated preferences and actual educational decisions. For the baseline 10th graders, stated preferences are measured using students' self-reported ranking of six educational options, which include the arts, commerce, science, and *Rigzhung* streams at the high school level (grades 11–12), as well as TVET and the decision to discontinue education after grade 10. Similarly, we measure stated preferences for the baseline grade 12 students by considering students' self-reported ranking of educational choices, including the six university degree options, TVET, and the choice to discontinue education after grade 12.

Our second primary outcome focuses on the actual educational decisions made by students in grades 10 and 12. To measure this outcome, we create an indicator variable to determine whether a baseline 10th grade student in the science stream at secondary school and whether a baseline 12th grade student applied to and was enrolled in a TVET institute in the following academic year. Since the science stream is more competitive and requires better academic performance than other academic streams, we also examine whether the mentoring program encourages students to take relevant subjects such as math and science for the national graduation exam. We use an indicator of whether a baseline 10th grader passed the BSEC exam and their test scores as a proxy for student effort.

To understand the link between mentoring programs, students' stated preferences, and actual educational decisions, we examine different intermediate outcomes. These include students' perceptions of science and technology, gender norms in STEM, bias toward blue-collar jobs, perceived and objective knowledge of the entry requirements and application process for the two fields of study, expected satisfaction conditional on enrollment, self-assessment of their ability to complete the study, and beliefs about parental, peer, and societal approval if they choose to enroll in the science stream or TVET program. For each of these intermediate outcomes, we report the results in a respective composite index in the main text.

### 3.3 Summary Statistics and Balancing of Baseline Characteristics

Table 2 presents baseline summary statistics for the grade 10 sample. The average age of the students is 16.7 years, and 45.7% of the students identify as male. Of these students, 38.4% express a preference for the science stream after grade 10, and 74.0% consider a STEM-related major as their first or second choice after grade 12. On a 5-point Likert scale (where 1 indicates “strongly disagree” and 5 indicates “strongly agree”), students scored an average of 4.0 points when expressing their opinions on the statements about the importance of science and technology. Students also agree that they would receive approval from parents, peers, and society if they chose the science stream (3.9 out of 5). The average control student tends to somewhat disagree with the biased statements about women in STEM fields and professional careers (2.2 out of 5).

**Table 2: Balance of Baseline Variables Across Treatment Groups, Grade 10**

	Observations	Control Mean [SD]	Difference (std. err)		
			Treatment Control	Spillover Control	Treatment Spillover
	(1)	(2)	(3)	(4)	(5)
Age	6,458	16.728	-0.013	0.021	-0.034
		[1.320]	(0.091)	(0.092)	(0.066)
Male	6,458	0.457	-0.000	-0.022	0.022
		[0.498]	(0.020)	(0.014)	(0.022)
Father with high school diploma (0/1)	5,878	0.208	-0.006	-0.010	0.004
		[0.406]	(0.025)	(0.036)	(0.023)
Mother with high school diploma (0/1)	6,105	0.135	-0.015	-0.030	0.015
		[0.342]	(0.017)	(0.024)	(0.014)
z-score wealth (PCA)	6,438	-0.008	0.032	0.004	0.028
		[0.985]	(0.070)	(0.066)	(0.051)
Potential share of mentees	6,458	0.277	0.003	0.002	0.001
		[0.204]	(0.002)	(0.002)	(0.001)
z-score like Math	6,430	-0.001	-0.009	0.007	-0.015
		[0.999]	(0.053)	(0.054)	(0.044)
z-score like Science	6,451	0.005	-0.085	-0.001	-0.084*
		[0.994]	(0.053)	(0.054)	(0.043)
z-score Math performance	6,395	-0.015	-0.033	0.061	-0.095*
		[0.994]	(0.073)	(0.076)	(0.052)
z-score Science performance	6,416	0.035	-0.150**	-0.067	-0.083*
		[0.993]	(0.059)	(0.050)	(0.045)
Science as top 1 choice after middle school (0/1)	6,458	0.384	-0.033	-0.019	-0.013
		[0.486]	(0.020)	(0.021)	(0.022)
STEM-related college majors as top 2 choice (0/1)	6,458	0.740	-0.007	0.016	-0.023
		[0.439]	(0.020)	(0.014)	(0.019)
Index raw attitude to science and technology	6,442	3.971	0.013	0.024	-0.012
		[0.852]	(0.040)	(0.030)	(0.039)
Index raw gender bias	6,451	2.240	-0.020	-0.029	0.008
		[0.815]	(0.058)	(0.051)	(0.036)
Index raw subjective knowledge about Science	6,345	3.773	0.007	-0.035	0.042
		[0.924]	(0.049)	(0.040)	(0.038)
Index raw ability to enroll and complete Science	6,383	2.621	-0.048	-0.045	-0.004
		[0.892]	(0.050)	(0.047)	(0.043)

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Table 2 continued

	Observations	Control Mean [SD]	Difference (std. err)		
			Treatment Control	Spillover Control	Treatment Spillover
	(1)	(2)	(3)	(4)	(5)
Index raw approval if choosing Science	6,397	3.915	0.015	-0.014	0.029
		[0.833]	(0.032)	(0.031)	(0.027)
Belief about peers preferences (percent)	6,119	22.048	-1.177	-0.677	-0.500
		[15.746]	(1.058)	(0.942)	(0.617)

PCA = principal component analysis; SD = standard deviation; STEM = science, technology, engineering, and mathematics.

NOTES: Column (1) shows the number of observations for each variable. Column (2) shows the control group's means and standard deviations. Columns (3)–(4) indicate mean differences with the control group, after controlling for strata-fixed effects, with cluster-robust standard errors at the school level in parentheses. Mean differences are coefficients on TREAT and SPILL in regressions of the variable on the left-hand side on TREAT and SPILL, controlling for strata-fixed effects. Column (5) indicates the mean difference between the treatment and spillover groups, after controlling for school-fixed effects, with robust standard errors in parentheses. This mean difference is the coefficient on TREAT in regressions of the variable of the left-hand side on TREAT using the sample of students in treatment schools, controlling for school-fixed effects. \* p-value < 0.1, \*\* p-value < 0.05, \*\*\* p-value < 0.01.

Source: Authors.

Turning to the sample of 12th graders, students are 18.8 years old on average, and 42.4% of them are male (Table 3). Among the eight educational options, including six tertiary degrees, TVET, and discontinuing education after grade 12, students in the control group gave TVET a rank of 3.6 by genuine interest and 3.5 if they were to make a final decision at the time of the survey. In other words, for approximately 20.3% of students, TVET is among the top three choices based on their genuine interest. In addition, 17.0% of students would select TVET as one of their top three choices if they had to make a final decision at the time of the survey.

Table 3: Balance of Baseline Variables Across Treatment Groups, Grade 12

	Observations	Control Mean [SD]	Difference (std. err)		
			Treatment Control	Spillover Control	Treatment Spillover
	(1)	(2)	(3)	(4)	(5)
Age	5,540	18.810	0.055	0.109	-0.053
		[1.436]	(0.159)	(0.181)	(0.083)
Male	5,540	0.424	0.011	0.022	-0.011
		[0.494]	(0.020)	(0.015)	(0.016)
Father with high school diploma (0/1)	4,874	0.220	-0.015	-0.014	-0.001
		[0.414]	(0.034)	(0.049)	(0.023)
Mother with high school diploma (0/1)	5,527	0.044	0.005	0.003	0.001
		[0.206]	(0.016)	(0.006)	(0.016)
z-score wealth (PCA)	5,500	0.029	-0.003	-0.053	0.050
		[1.000]	(0.104)	(0.110)	(0.061)
Potential share of mentees	5,540	0.204	-0.002	-0.001	-0.001
		[0.155]	(0.005)	(0.003)	(0.002)
z-score overall performance	5,100	0.004	-0.044	0.004	-0.048
		[0.996]	(0.107)	(0.081)	(0.080)

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Table 3 *continued*

	Observations	Control Mean [SD]	Difference (std. err)		
			Treatment Control	Spillover Control	Treatment Spillover
	(1)	(2)	(3)	(4)	(5)
Raw ranking of TTI/IZC by genuine interest	5,540	3.613 [1.876]	-0.040 (0.132)	0.080 (0.143)	-0.121* (0.070)
Raw ranking of TTI/IZC if decide today	5,540	3.452 [1.816]	0.047 (0.124)	0.087 (0.144)	-0.040 (0.092)
TTI/IZC as top 3 choice after HS by interest (0/1)	5,540	0.203 [0.402]	-0.010 (0.025)	0.021 (0.025)	-0.031** (0.013)
TTI/IZC as top 3 choice after HS if decide today (0/1)	5,540	0.170 [0.376]	0.017 (0.024)	0.025 (0.023)	-0.008 (0.017)
Index raw attitude to science and technology	5,515	4.120 [0.887]	-0.046 (0.042)	-0.018 (0.032)	-0.028 (0.036)
Index raw bias against blue-collar jobs	5,303	3.265 [0.799]	0.026 (0.047)	0.028 (0.037)	-0.002 (0.039)
Index raw subjective knowledge about TTI/IZC	5,415	3.115 [0.884]	-0.028 (0.055)	0.040 (0.072)	-0.068 (0.057)
Index raw ability to enroll and complete TTI/IZC	4,988	2.962 [0.881]	-0.122** (0.046)	-0.050 (0.037)	-0.073** (0.035)
Index raw approval if choosing TTI/IZC	4,708	50.091 [21.000]	0.357 (1.101)	0.608 (1.005)	-0.251 (0.939)
Belief about peers preferences (percent)	5,297	9.773 [6.167]	-0.081 (0.465)	0.255 (0.445)	-0.336 (0.390)
Index raw expected satisfaction on TTI/IZC	5,022	3.307 [0.883]	0.006 (0.054)	-0.005 (0.056)	0.011 (0.045)
Belief on own employment (percent) with TTI/IZC	4,878	46.369 [20.876]	0.339 (1.034)	-0.814 (0.869)	1.153 (1.018)
Belief on own earnings (Nu 000) with TTI/IZC	5,208	22.160 [13.924]	0.856 (0.941)	-0.216 (0.603)	1.073 (0.965)

IZC = Institute of Zorig Chusum; PCA = principal component analysis; SD = standard deviation; STEM = science, technology, engineering, and mathematics; TTI = technical training institute.

NOTES: Column (1) shows the number of observations for each variable. Column (2) shows the control group's means and standard deviations. Columns (3)–(4) indicate mean differences with the control group, after controlling for strata-fixed effects, with cluster-robust standard errors at the school level in parentheses. Mean differences are coefficients on TREAT and SPILL in regressions of the variable on the left-hand side on TREAT and SPILL, controlling for strata-fixed effects. Column (5) indicates the mean difference between the treatment and spillover groups, after controlling for school-fixed effects, with robust standard errors in parentheses. This mean difference is the coefficient on TREAT in regressions of the variable of the left-hand side on TREAT using the sample of students in treatment schools, controlling for school-fixed effects. \* p-value < 0.1, \*\* p-value < 0.05, \*\*\* p-value < 0.01.

Source: Authors.

In contrast to 10th graders' perceptions of STEM/Science, 12th graders, on average, believe that there is only a 50% chance that their decision to enroll in a TVET institute will be approved by their parents, peers, and society. On a 5-point Likert scale (where 1 indicates "strongly disagree" and 5 indicates "strongly agree"), this cohort of students generally has a positive view about science and technology (4.1 out of 5). However, they also express a slight bias against blue-collar jobs (3.3 out of 5).

**Balance of baseline characteristics.** The completion of the first surveys before randomization allowed us to analyze the balance of variables in the two samples at baseline. For grade 10 students, columns (3)–(5) in Table 2 show that we found no meaningful differences between the treatment, spillover, and control groups in terms of included demographic characteristics, educational preferences, perceived knowledge of the field of study, and beliefs about others' approval before the program began. The only differences that emerge between the treatment and spillover groups are students' self-reported preferences for science subjects and academic performance, although these are barely significant at the 10% level. Only self-reported performance in science subjects differed between the treatment and control groups at the 5% level. Among 12th graders, we observe a small difference in the ranking of TVET by students' genuine interest between the treatment and spillover groups (columns (3)–(5) in Table 3). Significant differences at the 5% level emerge in the self-reported ability to enroll at TTIs or the IZC and complete TVET between the student groups. However, these differences are not unexpected given the extensive pairwise comparison of the baseline variables across the three groups. To ensure that our estimation results are not driven by these differences, we control for these baseline variables when they are available.

It is worth noting that across the two cohort samples, some variables have a considerable number of missing values. For example, students generally did not report their parents' highest level of education. Completion rates for the questions on beliefs about peer approval and preferences and self-assessment of ability to study the respective fields remain low, suggesting a lack of information to help students make informed decisions. To maintain the number of observations, we impute missing values of the baseline variables with the medians in the main analysis and include missing indicators in all regressions. However, all index measures are based on unimputed data only.



## 4. EMPIRICAL STRATEGY

The randomization of students into the treatment, spillover, and control groups allows us to identify the causal impact of educational career mentoring on student outcomes as well as spillover effects. We define  $y_{isz}$  as the post-treatment outcome of student mentee  $i$  in school  $s$  of strata  $z$  and estimate the following equation:

$$y_{isz} = \beta_0 + \beta_1 TREAT_{is} + \beta_2 SPILL_{is} + \gamma X_{is} + \delta_z + \epsilon_{isz} \quad (1)$$

In equation (1),  $TREAT_{is}$  is a binary variable that takes the value of one if a student is assigned to the mentoring program in the treatment schools, and zero otherwise.  $SPILL_{is}$  is also a binary variable that takes the value of one if a student in the treatment schools is not assigned to the mentoring program, and zero otherwise. If both  $TREAT_{is}$  and  $SPILL_{is}$  take the value zero, this means that the students are in the control schools. The  $\delta_z$  term denotes the fixed effect for the school randomization strata based on school geographic location, school size (total enrollment), and public/private status. The vector  $X_{is}$  represents student characteristics, including gender, an outcome variable at baseline if available, household socioeconomic status, and the share of potential mentees among the target group of students in school  $s$ . We cluster the error term,  $\epsilon_{isz}$ , at the school level. The coefficient  $\beta_1$  represents the intent-to-treat effect of the mentoring program, whereas  $\beta_2$  represents the spillover effects from participants to nonparticipants within the same treatment schools.

To address the issue of statistical inference given the small number of clusters in the analysis of TVET mentoring programs, we use the wild-cluster bootstrapped standard errors (Cameron, Gelbach, and Miller 2008). In estimating equation (1), we also report the p-values computed using the wild-bootstrap cluster procedure, in addition to the school-level clustered standard errors.

If no spillover effect can be detected, we improve the statistical power by estimating the within-school effects of the program. In particular, we compare students who were assigned to the mentoring program (i.e., treatment students) with those who did not participate in the program (spillover students) within each school by estimating the following equation:

$$y_{is} = \mu_0 + \mu_1 TREAT_{is} + \gamma X_{is} + \delta_s + \epsilon_{is} \quad (2)$$

Here,  $\delta_s$  represents the school fixed effect. All other terms are the same as above. Since the randomization of students within the treatment schools is done at the individual level, we report robust standard errors without clustering.

## 5. EMPIRICAL RESULTS

### 5.1 Stated Preferences and Actual Decisions

Table 4 presents the regression results obtained from estimating equation (1), using stated preferences and actual decisions as dependent variables. In all regressions, we control for the baseline value of the outcomes if available, and the key baseline characteristics specified above. Our findings show statistically significant and economically meaningful impacts of STEM and TVET mentoring programs on students' interest in their respective fields of study. Specifically, we observe in column (1) that the likelihood of grade 10 treatment students selecting science as their first educational preference increases by 16.2 percentage points, on average, compared to the control group mean of 43.6%. This effect is statistically significant at the 1% level, as confirmed by both methods of clustering standard errors. Notably, this increased preference for the science stream is accompanied by a lower preference for other general education streams, including arts and commerce, as well as for vocational training (Table 5). In addition, we find a smaller but statistically significant effect for non-treated students in treatment schools: spillover students are 4.3 percentage points more likely to choose science as their top field of study compared to control students. A large part of this effect is due to students who are less likely to choose the arts stream as their preferred educational path (Table 5).

**Table 4: Career Mentoring, Stated Preferences, and Actual Decisions**

	Grade 10		Grade 12					
	Preference (Survey Data)	Decision (Admin Data)	Preference (Survey Data)		Decision (Admin Data)		Decision (Survey Data)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Science as Top 1 (0/1)	Enrolled Science (0/1)	TTI/IZC as Top 3 genuine interest (0/1)	TTI/IZC as Top 3 if decide today (0/1)	Applied TVET (0/1)	Admitted TVET (0/1)	Applied TTI/IZC (0/1)	Admitted TTI/IZC (0/1)
Treatment Student (TREAT)	0.162***	0.010	0.059**	0.041**	0.017	0.005	-0.009	-0.007
	(0.022)	(0.029)	(0.022)	(0.019)	(0.017)	(0.014)	(0.020)	(0.011)
	[0.000]	[0.733]	[0.019]	[0.038]	[0.384]	[0.739]	[0.721]	[0.592]
Spillover Student (SPILL)	0.043***	0.007	0.042**	0.053***	0.024*	0.011	0.002	-0.001
	(0.015)	(0.030)	(0.017)	(0.014)	(0.013)	(0.012)	(0.013)	(0.008)
	[0.011]	[0.835]	[0.048]	[0.004]	[0.144]	[0.456]	[0.873]	[0.913]
Observations	6,189	6,458	5,433	5,433	5,540	5,540	4,742	4,742
Adjusted R-squared	0.323	0.304	0.062	0.067	0.012	0.030	0.024	0.018

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	Grade 10		Grade 12					
	Preference (Survey Data)	Decision (Admin Data)	Preference (Survey Data)		Decision (Admin Data)		Decision (Survey Data)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Science as Top 1 (0/1)	Enrolled Science (0/1)	TTI/IZC as Top 3 genuine interest (0/1)	TTI/IZC as Top 3 if decide today (0/1)	Applied TVET (0/1)	Admitted TVET (0/1)	Applied TTI/IZC (0/1)	Admitted TTI/IZC (0/1)
Control group mean	0.436	0.281	0.186	0.159	0.127	0.077	0.071	0.033
p-value (TREAT)- (SPILL)=0	0.000	0.897	0.498	0.619	0.609	0.620	0.492	0.633
Control for baseline outcome	Yes	N/A	Yes	Yes	N/A	N/A	N/A	N/A
Additional controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

IZC = Institute of Zorig Chusum; N/A = not applicable; STEM = science, technology, engineering, and mathematics; TTI = technical training institute; TVET = technical and vocational education and training.

NOTES: In Column (1), the dependent variable is whether studying Science in grade 11 is the top 1 choice by grade 10 students. In Columns (3)-(4), the dependent variable is whether studying TTI/IZC is among the top 3 choices by grade 12 students. All regressions include strata-fixed effects. Additional controls include student gender, the potential share of mentees, an indicator for father completing high school or above, an indicator for mother completing high school or above, household standardized wealth index, dummies for missing data on father education, mother education, household wealth, as well as baseline science academic performance for grade 10 students. Missing data are imputed as the median. Standard errors clustered at the school level are in parentheses. Bootstrap p-values are in brackets. \* p-value < 0.1, \*\* p-value < 0.05, \*\*\* p-value < 0.01.

Source: Authors.

**Table 5: Career Mentoring and Academic Stream Preferences, Grade 10**

	Preferences (Survey Data)				
	(1) Science (0/1)	(2) Arts (0/1)	(3) Commerce (0/1)	(4) Rigzhung (0/1)	(5) TTI/IZC (0/1)
Treatment Student (TREAT)	0.162*** (0.022) [0.000]	-0.102*** (0.021) [0.000]	-0.036*** (0.011) [0.003]	-0.002 (0.012) [0.862]	-0.015** (0.006) [0.038]
Spillover Student (SPILL)	0.043*** (0.015) [0.011]	-0.031** (0.015) [0.059]	-0.008 (0.013) [0.596]	-0.001 (0.009) [0.942]	-0.007 (0.005) [0.231]
Observations	6,189	6,189	6,189	6,189	6,189
Adjusted R-squared	0.323	0.219	0.192	0.152	0.054

*continued on next page*

Table 5 continued

	Preferences (Survey Data)				
	(1) Science (0/1)	(2) Arts (0/1)	(3) Commerce (0/1)	(4) Rigzhung (0/1)	(5) TTI/IZC (0/1)
Control group mean	0.436	0.294	0.161	0.065	0.032
p-value (TREAT)–(SPILL)=0	0.000	0.000	0.028	0.881	0.207
Control for baseline outcome	Yes	Yes	Yes	Yes	Yes
Additional controls	Yes	Yes	Yes	Yes	Yes

IZC = Institute of Zorig Chusum, TTI = technical training institute.

NOTES: The dependent variable is whether the academic stream specified in each column is the top 1 choice by grade 10 students after lower secondary school. All regressions include strata-fixed effects. Additional controls include student gender, the potential share of mentees, an indicator for father completing high school or above, an indicator for mother completing high school or above, household standardized wealth index, dummies for missing data on father education, mother education, household wealth, and baseline science academic performance. Missing data are imputed as the median. Standard errors clustered at the school level are in parentheses. Bootstrap p-values are in brackets. \* p-value < 0.1, \*\* p-value < 0.05,

\*\*\* p-value < 0.01

Source: Authors.

For 12th grade students, we continue to observe significant effects of the mentoring program on students' stated preferences. Compared to the control group mean of 18.6%, treatment students are 5.9 percentage points more likely to choose TTIs or the IZC among their top three educational choices based on their genuine interest. We do not find any statistically differential effects on preferences between treatment and spillover students.

Although the mentoring effects on students' preferences are significant, there is no evidence that the programs influence students' final decisions. In column (2) of Table 4, the dependent variable is whether a baseline 10th grade student ultimately enrolled in the science stream for grade 11 in the following school year. In columns (5) and (6), we use administrative data to examine whether grade 12 students applied to and were admitted to a TVET institute. It is important to note that TVET institutes include not only the standard 2-year courses at TTIs or the IZC, but also short training courses at private institutes, such as driving schools. To focus exclusively on TTIs or the IZC and exclude nondegree short training courses, columns (7) and (8) use this specific subset of data from the second follow-up survey.<sup>11</sup> In all these outcomes on final decisions, we find no statistically significant impact of the mentoring program.

## 5.2 Intermediate Outcomes

In this subsection, we analyze the intermediate outcomes to examine the mechanisms underlying the significant effects on students' stated preferences but the lack of impacts on actual decisions presented in the previous section.

**Grade 10.** We find statistically significant and economically meaningful effects of mentoring on most of the intermediate outcomes for grade 10 students measured by our indexes. These include attitudes toward science and technology; knowledge of the field of study; approval from parents, friends, and

<sup>11</sup> In discussions with the representative of the software firm responsible for the TVET database, we have discovered instances where schools have applied for vocational training courses on behalf of students without their knowledge. In addition, data from certain TTIs or the IZC have not yet been integrated into the central database, leading to discrepancies between administrative and survey data.

society; peer preferences; expected satisfaction; and subjective assessment of one's ability to study the science stream (Table 6, panel A).<sup>12</sup> Overall, the joint significance of the treatment effects on the intermediate outcomes, obtained by estimating the system of equations jointly using seemingly unrelated regression, has a p-value of less than 0.01.

**Table 6: Career Mentoring and Intermediate Outcomes**

	Attitude to Science Technology	Bias against Female (G10)/ Blue-Collar Jobs (G12)	Subjective Knowledge on Field of Study	Objective Knowledge on Field of Study	Approval of Parents Friends Society	Beliefs about Peers Preferences	Expected Satisfaction with Field of Study	Ability to Enroll Complete Study
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b>Panel A: Grade 10 students</b>								
Treatment Student (TREAT)	0.085**	-0.030	0.268***	0.011	0.162***	0.117**	0.236***	0.115***
	(0.040)	(0.049)	(0.046)	(0.050)	(0.044)	(0.052)	(0.056)	(0.040)
	[0.059]	[0.568]	[0.000]	[0.856]	[0.001]	[0.040]	[0.000]	[0.011]
Spillover Student (SPILL)	0.001	0.008	0.058	0.002	0.022	0.056	0.057	0.040
	(0.041)	(0.037)	(0.041)	(0.037)	(0.035)	(0.050)	(0.050)	(0.041)
	[0.985]	[0.849]	[0.226]	[0.954]	[0.582]	[0.366]	[0.332]	[0.382]
Observations	6,147	6,171	6,036	6,183	6,076	5,682	5,958	6,055
Adjusted R-squared	0.049	0.307	0.125	0.014	0.186	0.116	0.175	0.264
Control group mean	-0.009	0.003	-0.050	0.003	-0.027	-0.027	-0.030	-0.011
p-value (TREAT)- (SPILL)=0	0.064	0.411	0.000	0.836	0.003	0.190	0.000	0.057
<b>Panel B: Grade 12 students</b>								
Treatment Student (TREAT)	0.018	-0.034	0.184**	0.100*	-0.015	0.032	0.030	0.032
	(0.047)	(0.053)	(0.073)	(0.053)	(0.045)	(0.063)	(0.074)	(0.075)
	[0.736]	[0.571]	[0.029]	[0.104]	[0.783]	[0.666]	[0.717]	[0.735]

*continued on next page*

<sup>12</sup> The effects on each element of these constructed indexes are available upon request.

Table 6 continued

	Attitude to Science Technology	Bias against Female (G10)/ Blue-Collar Jobs (G12)	Subjective Knowledge on Field of Study	Objective Knowledge on Field of Study	Approval of Parents Friends Society	Beliefs about Peers Preferences	Expected Satisfaction with Field of Study	Ability to Enroll Complete Study
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Spillover Student (SPILL)	-0.048 (0.034) [0.227]	-0.024 (0.043) [0.632]	-0.025 (0.059) [0.699]	-0.020 (0.037) [0.663]	-0.037 (0.056) [0.622]	0.001 (0.067) [0.989]	-0.023 (0.051) [0.701]	-0.091 (0.076) [0.416]
Observations	5,396	5,075	5,248	5,422	4,141	4,948	4,662	4,652
Adjusted R-squared	0.030	0.090	0.216	0.005	0.168	0.044	0.118	0.123
Control group mean	0.017	0.004	-0.035	-0.009	0.012	-0.011	-0.004	0.026
p-value (TREAT)- (SPILL)=0	0.142	0.862	0.004	0.019	0.687	0.587	0.462	0.010
Control for baseline outcome	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes
Additional controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

N/A = not applicable.

NOTES: Dependent variables are standardized. In Column (2), the dependent variable is an index of bias against female workers for grade 10 students, and bias against blue-collar jobs for grade 12 students. A higher value means more bias against these subjects. All columns include strata-fixed effects. Standard errors clustered at the school level are in parentheses. Bootstrap p-values are in brackets. Additional controls include student gender, the potential share of mentees, an indicator for father completing high school or above, an indicator for mother completing high school or above, household standardized wealth index, and dummies for missing data on father education, mother education, and household wealth. Additional controls also include baseline science academic performance for grade 10 students. Missing data are imputed as the median. \* p-value < 0.1, \*\* p-value < 0.05, \*\*\* p-value < 0.01.

Source: Authors.

Attitudes toward science and technology are significantly more positive in the treatment group than in the control group after starting the mentoring program (0.085 standard deviation, Table 6, column 1), with students more likely to agree with the two statements: “Science makes lives healthier,” and “Science makes the world better off.” This effect is statistically significant at the 5% level when standard errors are clustered at the school level and at the 10% level with bootstrapping. Similarly, we observe a significant increase in students’ perceived knowledge of the admissions procedure and the career path of science stream students (0.27 standard deviation) and this effect is significant at the 1% level according to both school-level clustered and bootstrap p-values (column 3). Through the mentoring program, students are more likely to feel recognized by their parents, friends, and society when they study science (0.16 standard deviation, p-value is less than 0.01, column 5), and they are more likely to believe that their peers also have science as their preferred educational choice (0.12 standard deviation, p-value is less than 0.05, column 6). Treatment students are more likely to feel satisfied with studying science (0.24 standard deviation) and more likely to enroll in and complete this field of study (0.12 standard deviation). These effects are all significant at the 1% level (columns 7–8). We see little evidence of a

reduction in students' bias against women in STEM subjects (column 2) or an improvement in their objective knowledge of admissions eligibility and processes (column 4). The positive but statistically insignificant and negligible point estimate for objective knowledge could be attributed to the fact that the details of the admissions procedure can change from year to year, and our questions designed to test students' knowledge did not take this into account.

Given that application to science requires higher academic performance relative to other academic streams such as arts and commerce, we test whether our program has an impact on students' study effort as proxied by their graduation exam outcomes. In Table 7, we find some suggestive evidence of positive effects on grade 10 students' science test scores and on their graduation status, although these effects are not significant at conventional levels when estimating the school-wide sample. For grade 12 students, only English and Dzongkha (national language) test scores are examined because these are common tests that students are required to take regardless of their stream choice (e.g., arts, commerce, and science). The test scores of other subjects are available, but the number of elective subjects varies widely and the sample size is not enough to conduct a meaningful analysis. Since we also find no evidence of a significant spillover effect, we estimate equation (2) by comparing these outcomes between treatment and spillover students within treatment schools. Table 8 shows that the program significantly increases the probability that a student passes the graduation exam. Specifically, the likelihood that treatment students obtain a BCSE Pass Certificate increases by 5.2 percentage points from a mean pass rate of 70% of spillover students.

**Table 7: Career Mentoring, Test Scores, and Graduation Exams**

	Exam Pass		Exam Score				
	(1) (0/1)	(2) English	(3) Dzongkha	(4) Math	(5) Physics	(6) Chemistry	(7) Biology
<b>Panel A: Grade 10 students</b>							
Treatment Student (TREAT)	0.034 (0.028) [0.279]	-0.027 (0.090) [0.780]	0.005 (0.084) [0.960]	0.051 (0.089) [0.586]	0.123 (0.079) [0.178]	0.007 (0.109) [0.956]	0.059 (0.097) [0.588]
Spillover Student (SPILL)	-0.002 (0.027) [0.944]	-0.015 (0.093) [0.870]	-0.033 (0.089) [0.722]	0.084 (0.088) [0.440]	0.101 (0.096) [0.384]	0.000 (0.127) [0.999]	0.030 (0.109) [0.802]
Observations	6,285	6,231	6,223	6,228	6,228	6,228	6,228
Adjusted R-squared	0.193	0.422	0.342	0.408	0.477	0.457	0.440
Control group mean	0.729	0.037	0.064	0.011	0.002	0.064	0.019
p-value (TREAT)-(SPILL)=0	0.121	0.826	0.484	0.523	0.687	0.924	0.622
<b>Panel B: Grade 12 students</b>							
Treatment Student (TREAT)	0.029 (0.030) [0.461]	0.008 (0.131) [0.948]	0.058 (0.155) [0.777]				
Spillover Student (SPILL)	0.029 (0.038) [0.570]	-0.121 (0.148) [0.555]	-0.018 (0.177) [0.930]				

*continued on next page*

Table 7 continued

	Exam Pass	Exam Score					
	(1) (0/1)	(2) English	(3) Dzongkha	(4) Math	(5) Physics	(6) Chemistry	(7) Biology
Observations	5,420	5,386	5,381				
Adjusted R-squared	0.041	0.133	0.155				
Control group mean	0.806	0.051	-0.031				
p-value (TREAT)-(SPILL)=0	0.999	0.046	0.293				
Control for baseline outcome	N/A	N/A	N/A				
Additional controls	Yes	Yes	Yes				

NA = not applicable.

NOTES: In Column (1), the dependent variable is whether a student passes the Bhutan Certificate of Secondary Education (BCSE, grade 10) or the Bhutan Higher Secondary Education Certificate (BHSEC, grade 12). In Columns (2)-(6), dependent variables are standardized test scores in corresponding subjects. All regressions include strata-fixed effects. Additional controls include student gender, the potential share of mentees, an indicator for father completing high school or above, an indicator for mother completing high school or above, household standardized wealth index, dummies for missing data on father education, mother education, household wealth, as well as baseline subjective science performance for grade 10. Missing data are imputed as the median. Standard errors clustered at the school level are in parentheses. Bootstrap p-values are in brackets. \* p-value < 0.1, \*\* p-value < 0.05, \*\*\* p-value < 0.01.

Source: Authors.

**Table 8: Career Mentoring, Test Scores, and Graduation Exams, Grade 10  
(Within-School Estimation)**

	Exam Pass	Exam Score					
	(1) (0/1)	(2) English	(3) Dzongkha	(4) Math	(5) Physics	(6) Chemistry	(7) Biology
Treatment Student (TREAT)	0.052*** (0.017)	0.018 (0.030)	0.009 (0.033)	0.014 (0.029)	0.037 (0.028)	0.027 (0.027)	0.019 (0.027)
Observations	3,336	3,303	3,298	3,300	3,300	3,300	3,300
Adjusted R-squared	0.232	0.519	0.424	0.512	0.605	0.656	0.597
Spillover group mean	0.697	0.051	-0.117	0.014	0.012	-0.038	0.003
Control for baseline outcome	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Additional controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

NA = not applicable.

NOTES: In Column (1), the dependent variable is whether a student passed the Bhutan Certificate of Secondary Education (BCSE, grade 10). In Columns (2)-(6), dependent variables are standardized test scores in corresponding subjects. All regressions include school-fixed effects. Additional controls include student gender, the potential share of mentees, an indicator for father completing high school or above, an indicator for mother completing high school or above, household standardized wealth index, dummies for missing data on father education, mother education, household wealth, as well as baseline subjective science performance for grade 10. Missing data are imputed as the median. Robust standard errors are in parentheses. \* p-value < 0.1, \*\* p-value < 0.05, \*\*\* p-value < 0.01

Source: Authors.



**Grade 12.** Table 6 panel B presents the findings for the sample of baseline grade 12 students. As can be seen, there is some evidence of mentoring effects on the intermediate outcomes among 12th graders. The joint significance of the treatment effects for all outcomes has a p-value of less than 0.05. Treatment students believe that they know more about TTIs or the IZC, an increase of 0.18 standard deviations compared to the control group. This effect is statistically significant at the 5% level, according to both clustered and bootstrapped p-values. In addition, we find that treatment students are 0.1 standard deviations more likely to give correct answers to our designed questions on the TTIs or the IZC. This effect is statistically significant at the 10% level when the standard errors are clustered at the school level, but becomes insignificant at the conventional levels with bootstrap. When we analyze each element of this objective knowledge index, we see a large improvement in the treatment students' understanding of the application eligibility and entry criteria for this field of study (both significant at the 5% level), but no evidence for the admissions procedure (Table 9).

**Table 9: Career Mentoring and Objective Knowledge**

	Index	1/0 Indicator			
	(1)	(2)	(3)	(4)	(5)
	Science (G10)/ TVET (G12)	Admission Eligibility	Admission Procedure	Entry Criteria (G10)/ Interview Criteria (G12)	Merit Ordering
<b>Panel A: Grade 10 students</b>					
Treatment Student (TREAT)	0.011	0.003	-0.013	0.025	-0.006
	(0.050)	(0.019)	(0.020)	(0.026)	(0.024)
	[0.856]	[0.889]	[0.578]	[0.382]	[0.839]
Spillover Student (SPILL)	0.002	0.014	0.016	-0.009	-0.018
	(0.037)	(0.016)	(0.016)	(0.020)	(0.020)
	[0.954]	[0.405]	[0.403]	[0.696]	[0.393]
Observations	6,183	6,183	6,181	6,182	6,182
Adjusted R-squared	0.014	0.005	0.025	0.002	0.010
Control group mean	0.003	0.227	0.705	0.320	0.407
p-value (TREAT)-(SPILL)=0	0.836	0.579	0.114	0.117	0.581
<b>Panel B: Grade 12 students</b>					
Treatment Student (TREAT)	0.100*	0.055**	-0.020	0.064**	
	(0.053)	(0.027)	(0.025)	(0.024)	
	[0.104]	[0.071]	[0.472]	[0.014]	
Spillover Student (SPILL)	-0.020	-0.001	-0.003	-0.015	
	(0.037)	(0.017)	(0.018)	(0.018)	
	[0.663]	[0.963]	[0.913]	[0.483]	

*continued on next page*

Table 9 *continued*

	Index	1/0 Indicator			
	(1)	(2)	(3)	(4)	(5)
	Science (G10)/ TVET (G12)	Admission Eligibility	Admission Procedure	Entry Criteria (G10)/ Interview Criteria (G12)	Merit Ordering
Observations	5,422	5,422	5,422	5,422	
Adjusted R-squared	0.005	0.008	0.000	0.004	
Control group mean	-0.009	0.357	0.485	0.397	
p-value (TREAT)-(SPILL)=0	0.019	0.034	0.445	0.000	
Control for baseline outcome	N/A	N/A	N/A	N/A	
Additional controls	Yes	Yes	Yes	Yes	

N/A = not applicable, TVET = technical and vocational education and training.

NOTES: All regressions include strata-fixed effects. Additional controls include student gender, the potential share of mentees, an indicator for father completing high school or above, an indicator for mother completing high school or above, household standardized wealth index, dummies for missing data on father education, mother education, household wealth, as well as baseline subjective science performance for grade 10. Missing data are imputed as the median. Standard errors clustered at the school level are in parentheses. Bootstrap p-values are in brackets. \* p-value < 0.1, \*\* p-value < 0.05, \*\*\* p-value < 0.01.

Source: Authors.

We observe no significant evidence of other outcomes, although the point estimates indicate a decrease in students' bias toward blue-collar jobs, an improvement in their attitudes toward science and technology, an increase in students' expected satisfaction with their own assessment of their ability to complete TVET, and their beliefs about peer preference in TTIs or the IZC.

### 5.3 Heterogeneity Analysis by Gender

In theory, the randomization nature of the matching process between mentors and mentees allows us to investigate the effects of gender on mentoring. Using the sample of treatment and control students, we estimate the following equation:

$$y_{isz} = \delta_z + \alpha_0 + \sum_{j=1}^4 \alpha_j TREAT_{is} \times I\{G_j\} + \beta_2 SPILL_{is} + \gamma X_{is} + \epsilon_{isz} \quad (3)$$

where  $I\{G_j\}$  is an indicator that takes the value of one if student  $i$  belongs to the male mentor-male mentee group, male mentor-female mentee group, female mentor-male mentee group, and female mentor-female mentee group, and zero otherwise. All other terms are the same as in equation (1). The coefficient  $\alpha_j$  represents the effect of participation in the mentoring program on the students of a particular mentor-mentee gender pair  $j$ , relative to the students of the control schools.

In practice, however, we found significant differences in several pretreatment characteristics between each mentor-mentee group and the control group (Table 10 and Table 11). Specifically, 10th grade female (male) mentees exhibit, on average, less (more) bias against women in STEM compared to the control group at baseline. Female mentees in grade 10 show a lower preference for science subjects compared to the control group, while male mentees show a greater preference for math. Female mentees in grade 12 likewise show a lower preference for the TVET system. An important caveat to the analysis by gender of the mentor-mentee group is the low statistical power to disentangle the differential effects across gender pairs. Therefore, the following results should be interpreted with caution, and null effects should not be overinterpreted.

**Table 10: Balance of Baseline Variables Across Mentor-Mentee Groups, Grade 10**

	Observations	Control Mean [SD]	Difference (std. err)			
			FF – Control	MF – Control	MM – Control	FM – Control
	(1)	(2)	(3)	(4)	(5)	(6)
Age	6,458	16.728 [1.320]	–0.048 (0.108)	–0.167 (0.108)	0.156 (0.112)	0.074 (0.126)
Male	6,458	0.457 [0.498]	–0.445*** (0.011)	–0.445*** (0.010)	0.554*** (0.010)	0.556*** (0.011)
Father with high school diploma (0/1)	5,878	0.208 [0.406]	–0.041 (0.029)	–0.044 (0.031)	0.045 (0.028)	0.034 (0.037)
Mother with high school diploma (0/1)	6,105	0.135 [0.342]	–0.030 (0.022)	–0.034 (0.020)	0.007 (0.023)	0.008 (0.030)
z-score wealth (PCA)	6,438	–0.008 [0.985]	0.085 (0.098)	0.092 (0.081)	–0.036 (0.081)	–0.041 (0.098)
Potential share of mentees	6,458	0.277 [0.204]	0.003 (0.002)	0.004 (0.003)	0.004* (0.002)	0.001 (0.003)
z-score like Math	6,430	–0.001 [0.999]	–0.094 (0.086)	–0.220*** (0.059)	0.182*** (0.068)	0.207** (0.095)
z-score like Science	6,451	0.005 [0.994]	–0.067 (0.071)	–0.256*** (0.060)	–0.006 (0.075)	0.087 (0.089)
z-score Math performance	6,395	–0.015 [0.994]	–0.031 (0.095)	–0.136 (0.090)	0.071 (0.095)	0.007 (0.095)
z-score Science performance	6,416	0.035 [0.993]	–0.133 (0.089)	–0.214*** (0.067)	–0.136 (0.086)	–0.077 (0.076)
Science as top 1 choice after middle school (0/1)	6,458	0.384 [0.486]	–0.027 (0.035)	–0.083*** (0.027)	–0.014 (0.038)	0.025 (0.036)
STEM-related college majors as top 2 choice (0/1)	6,458	0.740 [0.439]	0.022 (0.030)	–0.033 (0.034)	–0.019 (0.031)	0.022 (0.036)
Index raw attitude to science and technology	6,442	3.971 [0.852]	0.094* (0.056)	–0.011 (0.051)	–0.013 (0.058)	–0.007 (0.069)
Index raw gender bias	6,451	2.240 [0.815]	–0.263*** (0.070)	–0.154* (0.078)	0.190** (0.078)	0.214** (0.092)
Index raw subjective knowledge about Science	6,345	3.773 [0.924]	0.056 (0.068)	–0.057 (0.057)	0.014 (0.068)	0.054 (0.076)
Index raw ability to enroll and complete Science	6,383	2.621 [0.892]	–0.059 (0.083)	–0.196*** (0.057)	0.042 (0.076)	0.102 (0.078)
Index raw approval if choosing TTI/IZC	6,397	3.915 [0.833]	0.032 (0.059)	0.039 (0.051)	–0.034 (0.053)	0.018 (0.060)
Belief about peers preferences (percent)	6,119	22.048 [15.746]	–2.290* (1.337)	–2.456** (1.084)	–0.825 (1.501)	1.826 (1.789)

IZM = Institute of Zorig Chusum, N/A = not applicable, TTI = technical training institute.

Source: Authors.

**Table 11: Balance of Baseline Variables Across Mentor-Mentee Groups, Grade 12**

	Observations	Control Mean	Difference (std. err)			
		[SD]	FF – Control	MF – Control	MM – Control	FM – Control
	(1)	(2)	(3)	(4)	(5)	(6)
Age	5,540	18.810 [1.436]	0.044 (0.211)	–0.073 (0.166)	0.206 (0.178)	0.140 (0.230)
Male	5,540	0.424 [0.494]	–0.419*** (0.014)	–0.417*** (0.014)	0.584*** (0.014)	0.578*** (0.015)
Father with high school diploma (0/1)	4,874	0.220 [0.414]	–0.039 (0.040)	–0.001 (0.037)	–0.012 (0.048)	–0.036 (0.045)
Mother with high school diploma (0/1)	5,527	0.044 [0.206]	–0.027* (0.014)	0.006 (0.019)	0.014 (0.025)	0.013 (0.028)
z-score wealth (PCA)	5,500	0.029 [1.000]	0.009 (0.150)	0.055 (0.120)	0.011 (0.096)	–0.260 (0.188)
Potential share of mentees	5,540	0.204 [0.155]	–0.001 (0.004)	–0.003 (0.005)	–0.002 (0.005)	–0.002 (0.004)
z-score overall performance	5,100	0.004 [0.996]	0.103 (0.144)	–0.035 (0.103)	–0.055 (0.130)	–0.225 (0.150)
Raw ranking of TTI/IZC by genuine interest	5,540	3.613 [1.876]	–0.270 (0.219)	–0.077 (0.133)	–0.060 (0.154)	0.408 (0.288)
Raw ranking of TTI/IZC if decide today	5,540	3.452 [1.816]	–0.139 (0.172)	0.002 (0.120)	0.112 (0.193)	0.264 (0.234)
TTI/IZC as top 3 choice after HS by interest (0/1)	5,540	0.203 [0.402]	–0.106** (0.039)	–0.030 (0.024)	0.022 (0.033)	0.095 (0.071)
TTI/IZC as top 3 choice after HS if decide today (0/1)	5,540	0.170 [0.376]	–0.090** (0.039)	0.013 (0.027)	0.056 (0.037)	0.061 (0.045)
Index raw attitude to science and technology	5,515	4.120 [0.887]	0.019 (0.076)	–0.021 (0.052)	–0.014 (0.069)	–0.293* (0.164)
Index raw bias against blue-collar jobs	5,303	3.265 [0.799]	–0.044 (0.052)	0.095* (0.049)	–0.086 (0.106)	0.158** (0.073)
Index raw subjective knowledge about TTI/IZC	5,415	3.115 [0.884]	–0.046 (0.109)	–0.061 (0.069)	–0.035 (0.055)	0.124 (0.095)
Index raw ability to enroll and complete TTI/IZC	4,988	2.962 [0.881]	–0.052 (0.094)	–0.207*** (0.048)	–0.043 (0.052)	–0.101 (0.123)
Index raw approval if choosing TTI/IZC	4,708	50.091 [21.000]	0.082 (2.447)	–0.299 (1.065)	0.163 (1.715)	3.547 (2.895)
Belief about peers preferences (percent)	5,297	9.773 [6.167]	–1.160 (0.829)	0.153 (0.606)	0.074 (0.532)	–0.031 (0.613)

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Table 11 *continued*

	Observations	Control Mean	Difference (std. err)			
		[SD]	FF – Control	MF – Control	MM – Control	FM – Control
	(1)	(2)	(3)	(4)	(5)	(6)
Index raw expected satisfaction on TTI/IZC	5,022	3.307 [0.883]	–0.034 (0.114)	0.020 (0.071)	0.017 (0.068)	–0.019 (0.087)
Belief on own employment (percent) with TTI/IZC	4,878	46.369 [20.876]	0.738 (2.343)	–0.874 (1.302)	1.993 (1.623)	0.104 (2.633)
Belief on own earnings (Nu 000) with TTI/IZC	5,208	22.160 [13.924]	–2.000* (1.154)	–0.383 (1.028)	3.824** (1.465)	1.374 (1.496)

FF = female mentor–female mentee group; FM = female mentor–male mentee group; IZC = Institute of Zorig Chusum; MF = male mentor–female mentee group; MM = male mentor–male mentee group; PCA = principal component analysis; SD = standard deviation; STEM = science, technology, engineering, and mathematics; TTI = technical training institute.

NOTE: \* p-value < 0.1, \*\* p-value < 0.05, \*\*\* p-value < 0.01.

Source: Authors.

**Stated preferences and actual decisions.** We find no significant evidence of differences between same and across-gender mentoring relationships for students in either grade 10 or 12 (Table 12). The effect for male students is not statistically significantly different between male and female mentors, as shown by the p-values for the differences between male mentor–male mentee group and female mentor–male mentee group. The effect for female students also does not differ between male and female mentors, as can be seen from the p-values for the differences between male mentor–female mentee group and female mentor–female mentee group. For grade 10 students, we observe a trend in the point estimates, suggesting that male mentees are more responsive than female mentees in updating their preferences and their actual choice of the science stream (columns 1–2). Mentoring in male–male pairs increases the likelihood of students having science as their first choice by 21.6 percentage points, relative to a 13.2 percentage point increase among male–female pairs (p-value of the difference is 0.088). For 12th graders, there is little evidence of differential effects across pairing on these outcomes (columns 3–8).

**Table 12: Career Mentoring, Stated Preferences, and Actual Decisions, by Mentor-Mentee Group**

	Grade 10		Grade 12					
	Preference (Survey Data)	Decision (Admin Data)	Preference (Survey Data)	Decision (Admin Data)	Decision (Survey Data)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Science as Top 1 (0/1)	Enrolled Science (0/1)	TTI/IZC as Top 3 genuine interest (0/1)	TTI/IZC as Top 3 if decide today (0/1)	Applied TVET (0/1)	Admitted TVET (0/1)	Applied TTI/IZC (0/1)	Admitted TTI/IZC (0/1)
Male Mentor–Male Mentee (MM)	0.216*** (0.032) [0.000]	0.030 (0.036) [0.455]	–0.009 (0.033) [0.808]	0.007 (0.031) [0.843]	0.040 (0.025) [0.152]	0.025 (0.022) [0.344]	–0.011 (0.027) [0.723]	–0.014 (0.014) [0.372]
Female Mentor– Female Mentee (FF)	0.140*** (0.037) [0.000]	–0.005 (0.037) [0.901]	0.058 (0.057) [0.341]	0.062 (0.046) [0.223]	–0.020 (0.026) [0.429]	–0.008 (0.025) [0.761]	–0.002 (0.025) [0.923]	0.005 (0.018) [0.800]

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Table 12 continued

	Grade 10		Grade 12					
	Preference (Survey Data)	Decision (Admin Data)	Preference (Survey Data)	Decision (Admin Data)	Decision (Survey Data)			
	(1) Science as Top 1 (0/1)	(2) Enrolled Science (0/1)	(3) TTI/IZC as Top 3 genuine interest (0/1)	(4) TTI/IZC as Top 3 if decide today (0/1)	(5) Applied TVET (0/1)	(6) Admitted TVET (0/1)	(7) Applied TTI/IZC (0/1)	(8) Admitted TTI/IZC (0/1)
Male Mentor– Female Mentee (MF)	0.132*** (0.038) [0.005]	-0.009 (0.035) [0.782]	0.089*** (0.022) [0.003]	0.049** (0.021) [0.039]	0.028 (0.027) [0.404]	0.007 (0.021) [0.764]	-0.017 (0.022) [0.492]	-0.008 (0.010) [0.455]
Female Mentor– Male Mentee (FM)	0.171*** (0.027) [0.000]	0.032 (0.043) [0.499]	0.124*** (0.042) [0.015]	0.076 (0.074) [0.410]	-0.037 (0.035) [0.314]	-0.037* (0.021) [0.110]	0.021 (0.049) [0.697]	0.002 (0.043) [0.980]
Spillover Student (SPILL)	0.043*** (0.015)	0.007 (0.030)	0.041** (0.017)	0.053*** (0.014)	0.024* (0.013)	0.011 (0.012)	0.002 (0.013)	-0.001 (0.008)
Observations	6,189	6,458	5,433	5,433	5,540	5,540	4,742	4,742
Adjusted R-squared	0.324	0.304	0.063	0.066	0.013	0.030	0.024	0.017
Control group mean	0.436	0.281	0.186	0.159	0.127	0.077	0.071	0.033
p-value MM - FF =0	0.134	0.279	0.171	0.351	0.094	0.370	0.772	0.261
p-value MM - MF =0	0.088	0.315	0.023	0.254	0.744	0.518	0.788	0.684
p-value MM - FM =0	0.220	0.964	0.005	0.331	0.079	0.021	0.516	0.680
p-value FF - MF =0	0.866	0.898	0.604	0.818	0.192	0.652	0.557	0.538
p-value FF - FM =0	0.403	0.365	0.195	0.882	0.680	0.326	0.656	0.966
p-value MF - FM =0	0.334	0.308	0.333	0.699	0.145	0.135	0.472	0.799
Control for baseline outcome	Yes	N/A	Yes	Yes	N/A	N/A	N/A	N/A
Additional controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

IZC = Institute of Zorig Chusum, N/A = not applicable, TTI = technical training institute.

NOTES: In Column (1), the dependent variable is whether studying Science in grade 11 is the top 1 choice by grade 10 students. In Columns (3)–(4), the dependent variable is whether studying TTI/IZC is among the top 3 choices by grade 12 students. All regressions include strata-fixed effects. Additional controls include student gender, the potential share of mentees, an indicator for father completing high school or above, an indicator for mother completing high school or above, household standardized wealth index, dummies for missing data on father education, mother education, household wealth, as well as baseline science academic performance for grade 10 students. Missing data are imputed as the median. Standard errors clustered at the school level are in parentheses. Bootstrap p-values are in brackets. \* p-value < 0.1, \*\* p-value < 0.05, \*\*\* p-value < 0.01.

Source: Authors.

**Intermediate outcomes.** Consistent with the observation that male mentees are more likely than female mentees to update their preferences for the science stream, we see relatively greater effects of mentoring on male mentee groups on several intermediate outcomes, including attitudes toward science and technology, subjective knowledge, approval of others if studying science, belief that their peers also have science as a top choice, and expected satisfaction with the field of study (Table 13).

**Table 13: Career Mentoring and Intermediate Outcomes, by Mentor-Mentee Group, Grade 10**

	Attitude to Science Technology	Bias against Female (G10)/ Blue-Collar Jobs (G12)	Subjective Knowledge on Field of Study	Objective Knowledge on Field of Study	Approval of Parents Friends Society	Beliefs about Peers Preferences	Expected Satisfaction with Field of Study	Ability to Enroll Complete Study
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Male Mentor– Male Mentee (MM)	0.209*** (0.071) [0.009]	-0.033 (0.083) [0.698]	0.369*** (0.067) [0.000]	-0.049 (0.060) [0.442]	0.279*** (0.068) [0.001]	0.163** (0.074) [0.050]	0.301*** (0.073) [0.000]	0.153*** (0.049) [0.007]
Female Men- tor–Female Mentee (FF)	0.003 (0.062) [0.954]	0.012 (0.049) [0.815]	0.235*** (0.065) [0.005]	0.063 (0.104) [0.576]	0.126* (0.068) [0.096]	0.097 (0.087) [0.305]	0.248*** (0.068) [0.002]	0.170*** (0.050) [0.005]
Male Men- tor–Female Mentee (MF)	0.096 (0.059) [0.128]	-0.068 (0.057) [0.250]	0.237*** (0.065) [0.002]	-0.002 (0.066) [0.977]	0.100* (0.059) [0.109]	0.015 (0.074) [0.858]	0.138* (0.079) [0.101]	0.072 (0.062) [0.303]
Female Men- tor–Male Mentee (FM)	0.006 (0.083) [0.945]	-0.012 (0.095) [0.914]	0.231*** (0.083) [0.010]	0.048 (0.080) [0.576]	0.161** (0.069) [0.033]	0.252*** (0.075) [0.006]	0.304*** (0.080) [0.000]	0.072 (0.068) [0.342]
Spillover Student (SPILL)	0.000 (0.041)	0.008 (0.037)	0.057 (0.041)	0.002 (0.037)	0.022 (0.035)	0.055 (0.050)	0.056 (0.050)	0.040 (0.041)
Observations	6,147	6,171	6,036	6,183	6,076	5,682	5,958	6,055
Adjusted R-squared	0.050	0.307	0.125	0.014	0.186	0.116	0.175	0.264
Control group mean	-0.009	0.003	-0.050	0.003	-0.027	-0.027	-0.030	-0.011
p-value MM - FF = 0	0.018	0.581	0.107	0.286	0.106	0.445	0.524	0.778
p-value MM - MF = 0	0.160	0.699	0.102	0.502	0.030	0.131	0.060	0.162
p-value MM - FM = 0	0.063	0.786	0.143	0.222	0.103	0.358	0.971	0.324

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Table 13 continued

	Attitude to Science Technology	Bias against Female (G10)/ Blue-Collar Jobs (G12)	Subjective Knowledge on Field of Study	Objective Knowledge on Field of Study	Approval of Parents Friends Society	Beliefs about Peers Preferences	Expected Satisfaction with Field of Study	Ability to Enroll Complete Study
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
p-value FF - MF =0	0.192	0.172	0.982	0.594	0.723	0.435	0.153	0.100
p-value FF - FM =0	0.982	0.792	0.958	0.914	0.665	0.146	0.484	0.224
p-value MF - FM =0	0.379	0.590	0.947	0.481	0.449	0.008	0.090	0.998
Control for baseline outcome	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes
Additional controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

N/A = not applicable.

NOTE: \* p-value &lt; 0.1, \*\* p-value &lt; 0.05, \*\*\* p-value &lt; 0.01.

Source: Authors.

## 5.4 Local Average Treatment Effects

Since not all students assigned to the treatment group actually participated in the program, it is important to ask whether our intention-to-treat (ITT) effects differ from the actual treatment effects. We focus on the local average treatment effects (LATE) by using the initial assignment of the mentoring program to students as an instrumental variable for their actual participation in the program. Data on actual treatment come from the mentor reports. The results can be found in Table 14.

Table 14: Career Mentoring, Stated Preferences, and Actual Decisions (IV Estimates)

	Grade 10		Grade 12					
	Preference (Survey Data)	Decision (Admin Data)	Preference (Survey Data)		Decision (Admin Data)		Decision (Survey Data)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Science as Top 1 (0/1)	Enrolled Science (0/1)	TTI/IZC as Top 3 genuine interest (0/1)	TTI/IZC as Top 3 if decide today (0/1)	Applied TVET (0/1)	Admitted TVET (0/1)	Applied TTI/IZC (0/1)	Admitted TTI/IZC (0/1)
Participation	0.169*** (0.022) [0.000]	0.010 (0.031) [0.733]	0.088*** (0.031) [0.016]	0.061** (0.028) [0.039]	0.025 (0.025) [0.379]	0.007 (0.021) [0.739]	-0.013 (0.029) [0.721]	-0.010 (0.016) [0.593]
Observations	6,189	6,458	5,433	5,433	5,540	5,540	4,742	4,742
Adjusted R-squared	0.324	0.304	0.062	0.067	0.012	0.029	0.023	0.017
Control group mean	0.436	0.281	0.186	0.159	0.127	0.077	0.071	0.033

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Table 14 *continued*

	Grade 10		Grade 12					
	Preference (Survey Data)	Decision (Admin Data)	Preference (Survey Data)		Decision (Admin Data)		Decision (Survey Data)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Science as Top 1 (0/1)	Enrolled Science (0/1)	TTI/IZC as Top 3 genuine interest (0/1)	TTI/IZC as Top 3 if decide today (0/1)	Applied TVET (0/1)	Admitted TVET (0/1)	Applied TTI/IZC (0/1)	Admitted TTI/IZC (0/1)
Control for baseline outcome	Yes	N/A	Yes	Yes	N/A	N/A	N/A	N/A
Additional controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

IZC = Institute of Zorig Chusum, N/A = not applicable, TTI = technical training institute, TVET = technical and vocational education and training.

NOTES: In Column (1), the dependent variable is whether studying Science in grade 11 is the top 1 choice by grade 10 students. In Columns (3)-(4), the dependent variable is whether studying TTI/IZC is among the top 3 choices by grade 12 students. All regressions include strata-fixed effects. Additional controls include student gender, the potential share of mentees, an indicator for father completing high school or above, an indicator for mother completing high school or above, household standardized wealth index, dummies for missing data on father education, mother education, household wealth, as well as baseline science academic performance for grade 10 students. Missing data are imputed as the median. Standard errors clustered at the school level are in parentheses. Bootstrap p-values are in brackets. \* p-value < 0.1, \*\* p-value < 0.05, \*\*\* p-value < 0.01

Source: Authors.

We find qualitatively similar effects when comparing the LATE effect with the ITT effect of the mentoring program. The magnitudes are similar for grade 10 students but expectedly larger for grade 12 students due to low take-up rates. However, we find no significant evidence for students' educational decisions.

## 5.5 Discussion

In section 5.1, we show that the mentoring program resulted in a significant increase in students' preferences for the science stream among 10th graders and TVET among 12th graders. While these positive changes are encouraging, we find no conclusive evidence that the program influenced students' actual application and enrollment choices. In this section, we discuss our findings further.

For the sample of grade 10 students, both the main analysis and the heterogeneity analysis indicate that the effects are most pronounced for male mentees. The results on updated preferences are consistent with a combination of positive changes in various intermediate outcomes. These include shifts in attitudes toward science and technology, greater parental and peer approval, and a stronger belief that more of their peers will choose this field of study. Among grade 12 students, the increased interest in TTIs or the IZC is likely due to an improved subjective and objective understanding of the various facets of the field, ranging from admission eligibility and entry criteria to students' everyday lives. These findings underscore the important role of nonpecuniary factors in students' educational decisions, as already documented in various studies (e.g., Delavande and Zafar 2019).

We consider several explanations for the lack of effects in grade 10 students' final decisions regarding enrollment in the science stream and in grade 12 students' TVET application and admission outcomes. First, insufficient improvement in 10th grade students' performance in math and science could hinder their competitiveness in this academic stream. Although we observe significant impacts on mentees'

graduation outcomes through a within-school estimate, we find no evidence of increased test scores in core subjects. These results could be counterintuitive. However, to receive a pass certificate, students must not only have an exam score that is above a certain cutoff (often referred to as theory), but also satisfy school requirements (e.g., attendance and study attitude, which are evaluated and reported by the school's teachers). Students may be more motivated to pursue the science stream, but may not have enough time to prepare for the high-stakes BCSE examinations in science and math that are important for admission to the science stream. For example, students need a minimum of 40% in math, 55% in science, and a grade C in physics, biology, and chemistry. These requirements may vary from year to year.

In the case of grade 12 students, one possible explanation is the lack of reduced bias against vocational education and training. Unlike the science stream, vocational programs often carry a social stigma and are not a preferred option compared to other professions. Of the 700 randomly selected grade 12 mentees, only 455 students participated fully in the program (a participation rate of 65.0%). In contrast, the take-up rate for grade 10 students was approximately 94.6%. However, we cannot rule out the possibility that another potential factor contributing to the lack of impact is the low-intensity nature of the intervention. Student mentees and mentors were expected to meet at least four times within a month before their final exams, with additional encouragement to maintain communication through other means. However, the mentor reports indicate that more than 50% of the official meetings took place within 2 weeks and 90% of the mentoring was completed within 18 days. Furthermore, only 45% of mentors reported that they communicated regularly with their mentees on a weekly basis via text messaging, phone calls, or email during the program. This low intensity of career mentoring has been identified as a major reason for the limited evidence on the impact of a French mentoring program on students' academic plans, despite its significant effect on academic ambitions (Behaghel, Chiodi, and Gurgand 2017). Similarly, low-intensity mentoring in Argentina has shown limited effects on students' academic mindsets, perseverance, and learning strategies among students (Ganimian et al. 2020).

Conversely, it is also possible that grade 12 mentored students may apply and enroll in TTIs or the IZC after completing our second follow-up survey. This is because actual enrollment could be influenced by many other factors beyond students' control, such as labor market conditions, parental preferences, and the level and options of training course offerings. The data from our follow-up survey suggest that male students and students from low socioeconomic backgrounds—such as students with fathers who have lower levels of education or limited wealth—are more likely to apply at TTIs or the IZC. It is important to conduct a further follow-up survey to see the medium- to long-term impacts.

## 6 CONCLUSION AND FUTURE AREAS OF RESEARCH

In this study, we present the findings of two field experiments investigating the impact of mentoring support on the educational preferences and decision-making of Bhutanese secondary school students in grades 10 and 12. These mentoring programs aim to inform students about the TVET system for grade 12 students and the STEM education system for grade 10 students, as well as opportunities in the labor market, while allowing students to learn from their mentors' real-life experiences in these respective fields. Despite the different levels of recognition and stigma associated with these study areas, both programs are generating increased interest from students, as reflected in their stated preferences. This is an important step, but this increased interest does not translate directly into higher application rates or actual enrollments.

Our findings also suggest that STEM career mentoring positively influences students' attitudes toward science; beliefs about parental, peer, and societal approval; and peer preferences. In addition, students anticipate greater satisfaction and self-assess their ability to pursue STEM subjects. However, evidence on students' learning efforts remains limited, perhaps due to the lack of time for exam preparation and the low intensity of mentoring support. In the future, it is suggested that similar research be conducted in earlier grades, so that students who are motivated to pursue a science stream have more time to prepare for the high-stakes examinations and have a higher level of interaction with mentors. Conversely, the TVET mentoring program improves students' knowledge of admission eligibility and entry criteria, but does not significantly affect other outcomes, nor does it significantly reduce bias against blue-collar jobs. Again, the short-term mentoring intervention just before choosing an educational career may not be sufficient. Given that tutoring by teachers in earlier grades has a greater impact on learning outcomes (Nickow, Oreopoulos, and Quan 2024), future research should consider the timing and intensity of providing educational career counseling through the use of school mentors. It is important to conduct a follow-up survey to see the potential medium- to long-term impacts because final and intermediate outcomes of enrollment, mindset, and attitudes toward TVET depend on several factors that are beyond the students' control. Overall, our findings underscore the importance of nonmonetary factors in shaping educational preferences and decision-making.

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## **Mentoring, Educational Preferences, and Career Choice**

*Evidence from Two Field Experiments in Bhutan*

Two separate field experiments were conducted to examine whether mentoring impacts the educational preferences and career choices of Bhutanese students in grades 10 and 12. The mentoring programs focus on technical and vocational education and training (TVET) for grade 12 students and science, technology, engineering, and mathematics (STEM) for grade 10 students, providing information on labor market outcomes and mentors' experiences. Despite different levels of stigma toward TVET and STEM, both programs generate greater interest and positive shifts in attitudes. However, this increased interest does not lead to higher applications or enrollments, highlighting the importance of nonmonetary factors in educational decision-making.

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