

# What Cambodian Students Need: Parachutes Before and During a Global Pandemic

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## Abstract

Education remains one of the main tools to fight poverty, rendering it a pivotal part of policy in developing countries. Nonetheless, education in developing countries is often underfinanced, resulting in a lack of schooling facilities and a low quality of the education provided. Cambodia, the country of interest in this dissertation, lags behind its neighbors due to the echo from the dictatorial rule of the Khmer Rouge and their offensive against the education sector in the 1970s. The education sector in Cambodia feels the consequences even today.

Particularly rural students face limited access to career guidance, which prevents them from engaging with their interests. To explore this further, this dissertation is based on an educational Randomized Control Trial (RCT) which combines a personality test with personalized career paths in an electronic application and provides detailed information about high school and vocational training. The focus of the analysis is set on the application and the overall impact of the RCT to see whether students look differently at career information once it is made self-relevant and whether the intervention can encourage students to transition to high school. Survey data is complemented with rich administrative data.

The implementation of the RCT took place at the beginning of 2020 and was interrupted by the nation-wide school closure due to the spread of the COVID-19 virus. In an effort to speak to students directly after they were told to stay home, our team managed to reach 67% of our initial sample of 3,261 students over the phone. We asked about their studying routine, how they kept up with the curriculum and used their time apart from studying, how they perceived the crisis, and collected background information on their family's situation. Again, we put the survey answers in the context of administrative data which was collected before and after school closure.

The analysis of the application in chapter 2 reveals that most of the students maneuver the application with ease and indeed look at different career paths once these paths are linked to students' own interest and are personalized. The low-cost application could easily be replicated and used to fill in the gap in the Cambodian curriculum with respect to career guidance. When looking at the impact of the entire intervention in chapter 3, however, we see on average no effects. A heterogeneous analysis highlights unintended effects for low-performing students. While high-performing students seem to be unaffected by the intervention, low-performing students report less often to have studied and are at higher risk to be working during school closures. Finally, chapter 4 analyzes the impact of the COVID-19 crisis on students. The majority of students communicate that they keep studying and also return to school to write their final exam at the end of 2020. Nevertheless, students experience differential impacts stemming from income losses from

either the father or the mother. Paternal income losses decrease the likelihood of studying and of participation in the final exam but maternal income losses increase the likelihood. We discuss different mechanisms and find supportive evidence for a scenario wherein the mother spends the newly acquired free time to encourage her child(ren) to learn for school.

**Keywords:** Aspirations, Cambodia, Career Guidance, COVID-19, Education, School Closure



## Kurzzusammenfassung

Bildung ist nach wie vor eines der wichtigsten Instrumente zur Bekämpfung der Armut und damit ein zentraler Bestandteil der Politik in Entwicklungsländern. Dennoch ist das Bildungswesen in den Entwicklungsländern häufig unterfinanziert, was zu einem Mangel an schulischen Einrichtungen und einer geringen Qualität des Bildungsangebots führt. Kambodscha, um das es in dieser Dissertation geht, hinkt im Vergleich zu seinen Nachbarländern hinterher, was auf die Folgen der diktatorischen Herrschaft der Khmer Rouge und deren Offensive gegen den Bildungssektor in den 1970er Jahren zurückzuführen ist. Der Bildungssektor in Kambodscha hat auch heute noch unter den Konsequenzen zu leiden.

Vor allem Schüler:innen in ländlichen Gebieten haben nur begrenzten Zugang zur Berufsberatung, was sie daran hindert, sich mit ihren Interessen zu befassen. Um dies näher zu untersuchen, basiert diese Dissertation auf einem bildungsbezogenen Randomized Control Trial (RCT), das einen Persönlichkeitstest mit personalisierten Karrierewegen in einer elektronischen App kombiniert und detaillierte Informationen über weiterführende Schulen und Berufsausbildungen liefert. Der Schwerpunkt der Analyse liegt auf der App und der Gesamtwirkung des RCTs, um herauszufinden, ob Schüler:innen Berufsinformationen anders aufnehmen, wenn sie für sie selbst relevant sind, und ob die Intervention Schüler:innen dazu ermutigen kann, den Übertritt zur High School zu schaffen. Die aus dem RCT erhobenen Daten werden um umfangreichen administrativen Daten ergänzt.

Die Durchführung des RCTs fand Anfang 2020 statt und wurde durch die landesweite Schulschließung aufgrund der Ausbreitung des COVID-19-Virus unterbrochen. In dem Bemühen mit Schüler:innen direkt zu sprechen, nachdem sie aufgefordert worden waren, zu Hause zu bleiben, gelang es unserem Team, 67% unserer ursprünglichen Stichprobe von 3.261 Schüler:innen telefonisch zu erreichen. Wir erkundigten uns nach ihrem Lernalltag, wie sie mit dem Lehrplan Schritt hielten und die Zeit neben dem Lernen nutzten, wie sie die Krise wahrnahmen und sammelten Hintergrundinformationen über die Situation ihrer Familie. Auch hier stellten wir die Antworten der Befragten in den Kontext der administrativen Daten, die vor und nach der Schulschließung erhoben wurden.

Die Analyse der App in Kapitel 2 zeigt, dass die meisten Schüler:innen die App mit Leichtigkeit handhaben und tatsächlich verschiedene Karrierewege in Betracht ziehen, wenn diese Wege mit den eigenen Interessen der Schüler:innen verknüpft und personalisiert sind. Die kostengünstige App könnte leicht repliziert und angewendet werden, um die Lücke im kambodschanischen Lehrplan bezüglich Berufsberatung zu schließen. Bei der Betrachtung der Auswirkungen der gesamten Intervention in Kapitel 3 sehen wir jedoch im Durchschnitt keine Effekte. Eine heterogene Analyse zeigt unbeabsichtigte Effekte für leistungsschwache Schüler:innen auf. Während leistungsfähige Schüler:innen offenbar nicht von der Intervention betroffen sind, geben leistungsschwache Schüler:innen

an, seltener zu lernen und haben ein höheres Risiko, während der Schulschließungen zu arbeiten. Schließlich werden in Kapitel 4 die Auswirkungen der COVID-19-Krise auf die Schüler:innen analysiert. Die Mehrheit der Schüler:innen teilt mit, dass sie weiter lernen und auch in die Schule zurückkehren, um Ende 2020 ihre Abschlussprüfung zu schreiben. Allerdings sind die Auswirkungen der Einkommensverluste des Vaters oder der Mutter für die Schüler:innenn unterschiedlich. Die Einkommensverluste des Vaters verringern die Wahrscheinlichkeit des Lernens und der Teilnahme an der Abschlussprüfung, während die Einkommensverluste der Mutter diese Wahrscheinlichkeit erhöhen. Wir erörtern verschiedene Mechanismen und finden Anhaltspunkte für ein Szenario, in dem die Mutter die neu gewonnene freie Zeit nutzt, um ihr(e) Kind(er) zum Lernen für die Schule zu ermutigen.

**Schlagwörter:** Aspirationen, Berufsberatung, Bildung, COVID-19, Kambodscha, Schulschließungen

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# List of Abbreviations

<b>CET</b>	Career Exploration Tool
<b>GP</b>	General Practitioner
<b>ICET</b>	Interest and Career Exploration Tool
<b>IET</b>	Interest Exploration Tool
<b>LMIC</b>	Lower Middle Income Country
<b>NEA</b>	National Employment Agency (Cambodia)
<b>NGO</b>	Non-Governmental Organization
<b>O*NET</b>	Occupation and Information Network
<b>OECD</b>	Organisation for Economic Co-operation and Development
<b>RCT</b>	Randomized Control Trial
<b>RIASEC</b>	Hexagonal model based on six personality types
<b>SDG</b>	Sustainable Development Goals

# 1. Introduction

ចំណេះដឹងជាអាហារ ប្រាជ្ញាជាអាវុធ

*Translation: Knowledge is food, wisdom is a weapon.*

– Author unknown, *Khmer proverb*

## 1.1. Motivation

The ongoing COVID-19 crisis is reversing substantial progress made in eradicating poverty across the globe. The first sustainable development goal (SDG), with its target to eliminate poverty, has become ever more pressing since the beginning of the pandemic. A report from the United Nations (2021) contains statistics which highlight that additional to the high death toll, there are between 119 and 124 million lives in 2020 alone which are left in extreme poverty. The report emphasizes that measures to fight COVID-19 also simultaneously feed into the fight against poverty. Making vaccination, sanitation, and hygiene services accessible to everyone can reduce the spread of the virus and the risk of remaining in or slipping into poverty. In the longer run, other factors such as education play a crucial role in poverty eradication.

Educational attainment is often used in a symbolic manner to describe progress and development. Nevertheless, attainment alone is not key to development. SDG 4 refers to the quality of education, highlighting the fact that education as a promoter of development and tool against poverty is not only about quantity but also quality. The objective of quality education is to improve schooling conditions and to enhance the content taught at school. Beyond teaching hard skills, transferable skill are increasingly recognized as an important educational tool. If transferable skills such as forming goals in and outside of the classroom as well as reflecting about different opportunities and (career) paths are taught at school, they can support the sustainable

development of each individual and can positively contribute to a nation's progress (UNICEF, 2019).

Countries suffering from instability caused not only by the current pandemic but by additional factors such as violent past, corruption, or natural disasters are in particular need to rebuild themselves and improve their education system. The educational sector of Cambodia, a lower middle income country (LMIC) and country of interest in this dissertation, for instance, has suffered tremendously in the past century. The entire value of education was not only questioned but undermined during the dictatorial reign of the Khmer Rouge (Chandler, 2007). A UNESCO (2011) report argues that education is crucial for Cambodia's sustainable and stable development, and for overcoming instability and low educational attainment.

In order to achieve the desired development in Cambodia, the country must, among other factors, enhance the skills of its workforce. This was addressed in a skill development action plan from 2012 with its first objective to improve access to information. It was highlighted that career guidance should be available for job seekers on- and offline and the National Employment Agency (NEA) of Cambodia as the responsible institution needed to further strengthen its capacities to be able to deliver career guidance services (The World Bank, 2012). Career counseling is often provided at the time of a job search (and potentially during unemployment). Yet, its provision at the time of schooling might be more effective. Students who lack knowledge and awareness about the multitude of available career paths, and how to further decide between the same, might make uninformed choices and thus drop out earlier than they should.

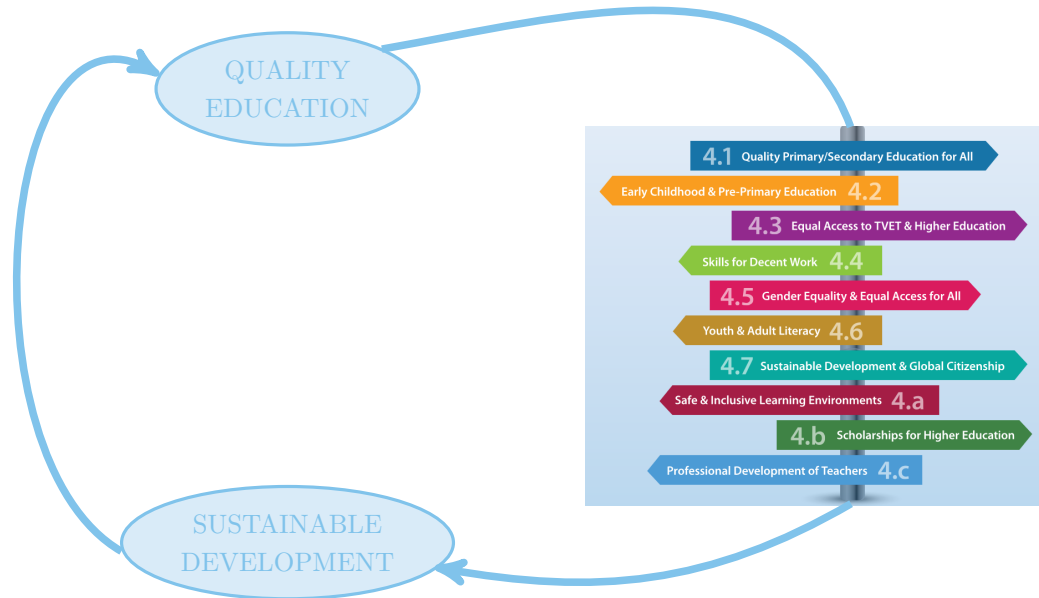
Taken all these elements together, several dimensions of quality education must be addressed to promote sustainable development. Figure 1.1 shows how education and development mutually influence each other: by devoting a country's resources to each of the targets of SDG 4, the national (and international) development is stimulated which in turn boosts the quality of education further. Finally, this thesis speaks particularly to target 4.4 of SDG 4 which addresses skills as an engine for decent employment and entrepreneurship. These skills need to encompass transferable skills such as forming goals to prepare school graduates and job seekers for the navigation through the jungle of learning, training, and job opportunities.

## 1.2. Project Development and Challenges

The starting point of this research was a puzzling asymmetry between high dropout rates between lower and higher secondary schools in Northwest Cambodia (Ministry



Figure 1.1.: Interplay of Education and Development



*Notes:* Own illustration based on SDG 4. Signpost is extracted from UNESCO (2018).

of Education, Youth and Sport, 2017) on the one hand and students' wishes to pursue a career which requires at least higher secondary school on the other hand. We documented these wishes during a field trip to Cambodia in 2019 and examined the data to determine which of the following factors most likely contributed to this asymmetry: Do students lack the capacity to visualize their future (Hershfield et al., 2011), to plan ahead or form goals (Webb and Sheeran, 2004), to engage with their vocational personalities (Holland, 1997), or do they lack information about careers and returns to education (Jensen, 2010)?

The analysis of surveys with almost 200 students and several focus group discussions brought us to conclude that the most pressing factors are connected to students not knowing what their own interests look like and not being taught about careers nor how they could reach them. In accordance with efforts of the NEA to provide a career tool for students in secondary school, I took the lead in designing and developing an app-based Interest and Career Exploration Tool (ICET).

Research on aspirations has shown that they are linked with poverty: the lower the aspirations, the higher the risk of poverty (World Bank Group, 2015). Mullainathan and Shafir (2013) analyze how a mindset confronted with daily scarcity is barely capable of aspiring for something other than making it through the day, inhibiting its

owner from disrupting the scarcity. The ICET addresses aspirations by making students aware of their own interests which are connected to specific vocations. Engaging with one's (vocational) interests should translate into more specific aspirations, leading in turn to more suitable career paths. In the case of students whose interests map into careers which require higher education, the tool could raise aspirations and make students consider the transition to high school.

This thesis includes the analysis of the tool's performance and compares results to a placebo application. Both applications were developed at a low cost together with a Cambodian consultant and programmer. For the ICET, we used the hexagonal model of Holland (1997) to map different interests into six specific personality types. Based on national classifications from the NEA, we associated these personality types with specific careers. The aim of the ICET is to be replicated and to serve a greater sample of students.

The tool was embedded in an educational Randomized Control Trial (RCT) for Cambodian ninth-graders who are about to decide whether to transition to high school or not. Our initial plan was to target 60 schools in rural Northwest Cambodia. Half of these schools were randomly assigned to treatment, the other half to control status. Students of treatment schools were invited to participate in a half-day intervention we designed to encourage rural ninth-graders to transition to high school with two main features: 1) the ICET which only a subset of students experienced, and 2) a school information session providing detailed information on high and vocational schools which all students attended.

We pre-registered two studies: "personal mindset and information processing in education" (Gehrke et al., 2020b) and "career goals and investments in education" (Gehrke et al., 2020a). The first one targeted the effects within the intervention. To this end, we included three different treatment arms to analyze whether students process career-related information differently once it is made self-relevant to them. The second registry addressed middle- to long-term effects with respect to educational investments after the intervention took place. We wanted to investigate whether the intervention motivated students to continue with high school among other outcomes.

The intervention started on February 17, 2020 and it was supposed to be finished roughly six weeks later, by April 2. When visiting the 18<sup>th</sup> school on March 16, the government announced the immediate and national school closure due to the COVID-19 outbreak, leaving us with only slightly over half of the sample we initially planned to visit. We mirrored these 18 schools with 18 control schools from the same districts. From the remaining 24 schools, six schools were not cooperating and had

to be dropped. This left us with a sample of 54 schools, out of which 18 cannot be included in the analysis of the intervention.

After schools were closed, we thought of alternative ways how to complement our data as we had to deviate from our original pre-analysis plans as 1) schools were closed which in the short-run hindered additional administrative data collection<sup>1</sup>, 2) the intervention was interrupted half-way, and 3) randomization into treatment arms was unsuccessful. The latter is likely connected to the fact that we have substantially fewer observations than originally planned and it impeded us from moving forward with the firstly mentioned RCT registry. We decided to contact students over the phone to ask them about their daily activities, their expectations, and aspirations, given the ongoing school closure and economic downturn in their country.<sup>2</sup> Without a pre-existing infrastructure, we managed to reach 67% of students across the 54 schools. Using both phone and administrative data, we are able to shed light on how students and their families are coping with the global crisis.

Figure 1.2 shows the exact timeline for the full sample highlighting the three strands of targeted schools: treatment, control, and remaining schools. In terms of administrative data, we collected monthly grades and absences before the onset of school closure. At the end of August, the government announced that schools would reopen for grade 9 such that students were able to write their exit exams at the end of 2020. This allowed us to complement our administrative data with the results of the final exam and scholarship applications.

The methodological approach applied in the first two chapters is based on field experiments. Chapter 2 uses the random assignment of students to either the ICET or placebo application and chapter 3 relies on the analysis of the RCT. When evaluating the effect of the COVID-19 pandemic on student learning, we exploit the quasi-random nature of the intensity by which students experienced the economic downturn. All survey and administrative data are novel, collected, and assembled by ourselves.

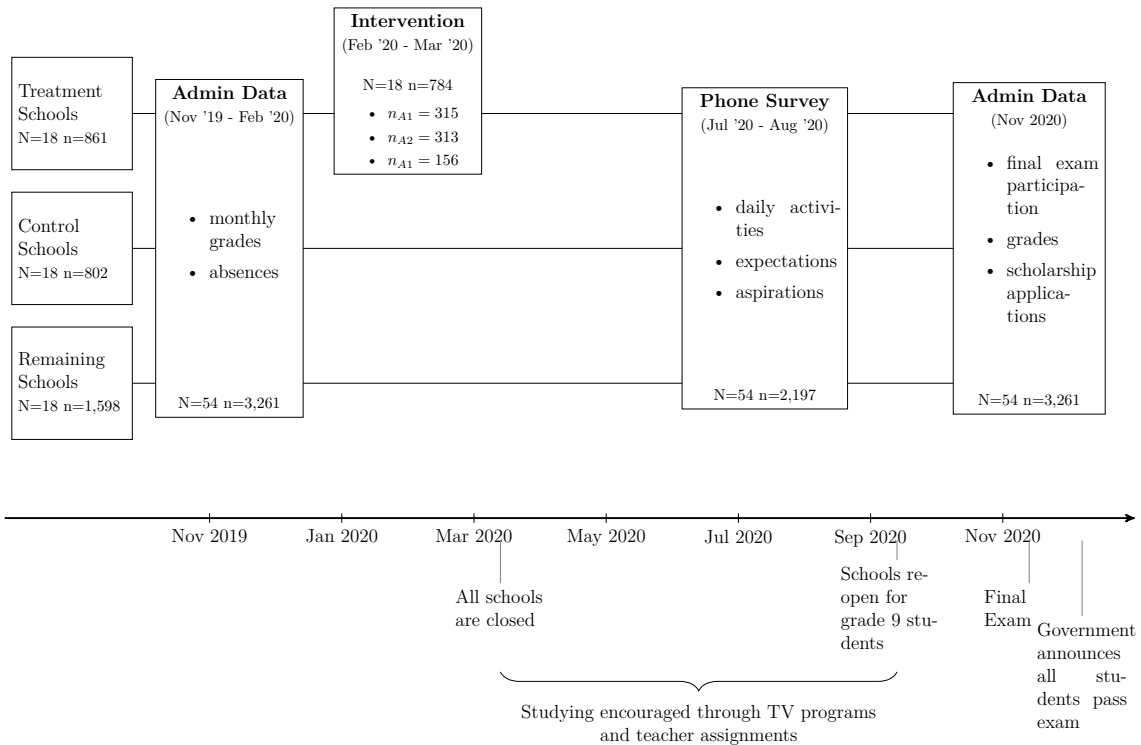
The analysis of schooling outcomes in an unprecedented period of long-lasting school closures has drawn major attention across research areas and will be of enormous importance over the next years. This dissertation adds to this research strand by

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<sup>1</sup> We wanted to collect administrative data for the months before and after the intervention, in particular the monthly grades from November to March, two mid-term exams – called Semester 1 and Semester 2 exam – at the end of March and July respectively, and the nation-wide standardized final exam for grade 9. Due to the school closure, many schools were not able to conduct any exam in March, including the Semester 1 exam.

<sup>2</sup> We wrote a policy brief containing descriptive outcomes of the phone survey. For more details, see Gehrke et al. (2021). The policy brief is currently under revision at the Journal *Educational Researcher*.

Figure 1.2.: Timeline of the Data Collection for Full Sample



analyzing the impact of an educational intervention just before schools closed and by documenting how students were coping with the crisis during school closure.

### 1.3. Summary of Chapters

The thesis consists of three main chapters (chapters 2 to 4) which are based on specific data sets from the superordinate data collection realized in Cambodia. Chapter 2 focuses on the application which was designed for the intervention. Chapter 3 sets a broader focus and analyzes short- and middle-term effects of the intervention. Chapter 4 mainly builds upon the data obtained from the phone survey and highlights the consequences of the outbreak of the global pandemic. The final chapter 5 summarizes all findings, concludes and gives recommendations for the way forward. In what follows, I briefly summarize chapters 2 to 4.

In **chapter 2**, I evaluate the performance of the electronic application called ICET. I investigate whether the accessibility is equally given for all students and whether students look for career-related information differently once this information is made self-relevant. Its design and implementation speaks to two strands in the educational literature – the use of digital solutions in the educational sector (Kalolo, 2019) ver-

sus nudging intervention based on career-related information (Abbiati et al., 2018; Avitabile and de Hoyos, 2018; Jensen, 2010; Nguyen, 2008) and interventions highlighting the importance of self-relevant information (Ertac, 2011; Wiswall and Zafir, 2015). Further, it addresses a broad literature on interest-based personality tests and the pioneering work of Holland (1997). I combine individual-level administrative data from students across 18 treatment schools with precise data collected by the application and further compare results to a placebo application which was also designed for the intervention. This allows me to analyze information-seeking behavior of students for whom information was individualized (ICET) and for whom information was shown in random order (placebo). Results suggest that the ICET is accessible for a broad set of students. Nevertheless, it could be made more accessible once the application is usable on smartphones and includes an audio-taped version for students with reading difficulties. The analysis also shows that students indeed prefer different career-related information in the ICET compared to the placebo as students focus on career paths about which they have heard little or nothing beforehand. As career information is not integrated in the Cambodian curriculum, the ICET has the potential of closing this gap and helping students make informed career-related decisions.

**Chapter 3** is joint work with Esther Gehrke and Friederike Lenel and analyzes the short- and mid-term effects of the RCT and whether the intervention helps to retain students in school. This research contributes to the literature on nudging interventions targeting either the provision of information or behavioral barriers (see Damgaard and Nielsen (2018) for a recent review of nudging interventions). We focus on the 18 visited treatment schools, compare them to control schools in the same districts, and use self-collected survey and individual-level administrative data to analyze schooling decisions during and after school closure. The intervention seems to have on average no effects on high-performing students. The analysis further reveals that there are unintended effects on low-performing students as the likelihood of both studying and applying for a high school scholarship decreases for treated low-performing students while the likelihood of working for pay increases.

**Chapter 4** is also co-authored by Esther Gehrke and Friederike Lenel and we examine how the economic shock induced by the pandemic affects schooling outcomes. We again combine survey with administrative data and are the first ones to do so in the context of COVID-19, education, and developing countries. We speak to an emerging literature addressing the effects of the pandemic on students in three ways: 1) using administrative data to determine learning losses and dropout (Lichand and Christen, 2021); 2) speaking to students directly to capture more precise answers

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about the schooling situation (Asanov et al., 2021; Favara et al., 2021); and 3) examining not only the effects of school closures but also the effects of the economic downturn on studying. Although most students kept studying and returned to school after school closure in our setting, there are severe and differential effects of parental income shocks on learning outcomes. The paternal shock worsened these outcomes, but a negative income shock experienced by the mother increases the likelihood of studying and participating in the final exam. We find suggestive evidence that mothers use their freed up time differently than fathers and seem to invest this time in the encouragement of their children to continue studying.

## **2. An Interest and Career Exploration Tool: the Potentials and Pitfalls of an Electronic Application for Adolescents in an LMIC Setting\***

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\* This project benefited from discussions with Sin Nita. Furthermore, I would like to thank Aiko Schmeisser, Chhern Sreyneang, Chhly Chaktokrong, Khann Rada, Kouth Sochampawatd, Phon Loem Bobon, and Teung Seila for excellent fieldwork and research assistance. Helpful comments from Krisztina Kis-Katos as well as seminar participants at an internal Freiburg-Göttingen Seminar, particularly Mara Rebaudo, and seminar participants at a brownbag held at the Macro Institute of Hannover, particularly Lisa Rogge, helped improve this paper. I also thank Franziska Dorn and Viviana Urueña for their feedback on the interpretation of the results. This research was financed by the Deutsche Forschungsgemeinschaft through the Research Training Group 1723. It is part of a larger project conducted in Cambodia together with Esther Gehrke and Friederike Lenel to whom the author is indebted for contributions and comments. This study obtained ethical approval from the Ethics Committee at the University of Göttingen (IRB approval date February 11, 2020).

## 2.1. Abstract

Career guidance supports students in making informed career choices based on their own interests with the prospect of leading to better living conditions. I evaluate an app-based ICET that I designed to address missing career information and guidance for Cambodian students in their last year of compulsory schooling. The tool is embedded in an educational RCT which was conducted at rural schools in the beginning of 2020. To evaluate its performance, I analyze its accessibility and compare the clicking and reading behavior of students working with the ICET to a placebo group. Although both groups received the same content about career paths, the information was personalized for ICET students, highlighting jobs that fit their interests. The results suggest no differential accessibility but it is slightly easier to navigate for students with better reading skills and who own a smartphone. Students in the ICET group spend relatively more time than placebo students reading about occupations with which they are not familiar and focus on occupations without a university degree. It seems that the ICET makes students reflect alternative career paths which are more suitable to their interests, potentially translating into better career choices.

**Keywords:** Career Guidance, Electronic Application, Education, Cambodia

**JEL:** I25, O12, O33



## 2.2. Introduction

Career guidance is of utmost importance but inaccessible for many students and school graduates. Students see themselves growing up in a world with innovations and technological changes steadily increasing the diversity of job positions. In contrast to this trend, adolescents' occupational aspirations have not undergone any such substantial changes. A study from the Organisation for Economic Co-operation and Development (OECD) (Mann et al., 2020) shows that job expectations of adolescents have changed comparably little to preceding decades during which employment opportunities were more limited. Notably vulnerable students in OECD countries are prone to having a limited number of jobs in which they see themselves working. Career guidance can prepare students for a constantly changing labor market, also by setting more adequate aspirations.

Despite the multitude of career guidance tools available online, their potential to improve career choices, and consequently living standards, has yet to be fully acknowledged and integrated into school curricula. These tools are based on personality tests combined with best fits to specific occupations. Adapting them to different (and other than Western) contexts is a very fast and cost-effective measure to support students engaging with their personality, making them reflect on future employment opportunities, and eventually finding suitable career paths.

The access to career guidance is particularly restricted in Cambodia and has long-lasting effects on past and present generations. The country is still suffering from belligerent occupations and a civil war in the 20<sup>th</sup> century. The latter almost destroyed the entire educational sector (UNESCO, 2011). Educational attainment levels are only slowly recovering from this shock, meaning that parents have little knowledge about schooling or career choices and low capacities to serve as role models for their offspring (Eng et al., 2014). This in turn leads to high dropout rates in lower secondary school (Ministry of Education, Youth and Sport, 2019).

During two pre-studies across five districts in Northwest Cambodia in December 2018 and July 2019, various stakeholders were interviewed with the aim of better understanding education, work-related goals of adolescents, and the constraints they are facing. These visits resulted in three main take-aways: 1) there is a lack of information and guidance for students of lower secondary school, 2) stated goals do not necessarily reflect true career goals, and 3) students engage only little (or not at all) with their own strengths and interests. Further, the range of different jobs mentioned in student surveys is very limited with over 85% of the students stating that they would like to

become either a teacher, doctor, or police officer.

There is an apparent mismatch between labor demand and supply in Cambodia. Comparing preferences for two of the most prominent occupations from the pre-studies to the employment shares of specific occupations throughout the country, only 0.18% and 0.36% of employees in the age-group 20-30 are secondary-level teacher and police officer, respectively (National Institute of Statistics, 2017). Additional anecdotal evidence supports this mismatch: in one province, there were over 2000 applications for only two teaching positions. Sam (2018a) analyzes the education-job mismatches in Cambodia and highlights their impact on job satisfaction. The author concludes that lower job satisfaction can further increase absenteeism and turnover which seems to be relatively high in the Cambodian landscape of employees.

I developed an ICET<sup>1</sup> for ninth-graders in rural Cambodia to tackle the limited career knowledge of Cambodian students translating into education-job mismatches. The tool speaks to students' interests, reveals their strongest personality types, and links these to specific career choices.<sup>2</sup> These students are in their last year of compulsory schooling and need to decide between high school or a grade 9 diploma. This is why it is crucial for them to know at this point in time what their interests look like and into which career paths they might translate, in order to make an informed decision about higher education. The tool is replicable and can be disseminated to a larger set of students at a low cost.

I examine whether the ICET has differential accessibility for students who have little or no experience working with an electronic application, whether there are differential effects with respect to age, gender, smartphone ownership, their school performance, and family background, and whether additional assistance becomes necessary for a subset of students. If accessibility is the same across sub-groups, it allows me to investigate in a subsequent step if students look differently into career-related information when this information is linked to their own interests. Hence, information is personalized and made self-relevant. In particular, I am interested in whether students are willing to deviate from reading descriptions of occupations on which they normally focus and which were elicited during the pre-studies.

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<sup>1</sup> The design, content, and translation of the tool was supported by the Cambodian consultant Sin Nita while the Cambodian programmer Touch Hean was responsible for the technical implementation.

<sup>2</sup> Even though interest profiles begin to stabilize at about 18 years of age (Du Toit et al., 1993), meaning that students' strongest personality types still can change, they are better equipped by reflecting on their own interests, knowing that these interests can guide them to a better career choice than without considering these interests.

To evaluate the ICET, an RCT was conducted in February and March 2020.<sup>3</sup> The ICET consists of two main parts – the Interest Exploration Tool (IET) and the Career Exploration Tool (CET), further divided into two components each: 1a) three interest-based personality tests, 1b) a personalized result page that shows and describes the strongest personality types, 2a) an unframed job page where students are asked to choose up to three jobs that are interesting to them, and 2b) a personalized page with job suggestions. The last component contains detailed descriptions of 18 jobs, highlighted and ordered by the students’ strongest personality types. Three occupations are allocated to each personality type and each one of three occupations requires a specific educational level: a grade 9 diploma, a high school degree, or a university degree. Three of these 18 occupations also relate to the three most common jobs found in the pre-studies: teacher as “secondary-level teacher”, doctor as “general practitioner” (GP), and “police officer”. Students are allowed to spend up to 17 minutes on this page but can log out at any time.

The collected data comprises of 315 students using the ICET and another 313 students using a placebo application across 20 grade 9 classes in 18 rural schools. Individual randomization into either group took place at each school. The placebo application has a similar structure as the ICET but the tests in 1a are not interest-related and consequently students are not shown any test results (1b is missing). The content and display of 2a remain unchanged for the placebo group. The same career options as in the ICET are shown in 2b but displayed in random order without any relation to students’ interests or personality types. The comparison with the placebo group allows me to analyze whether students react differently to career information once it is personalized.

I find that students maneuver the ICET well and that there are significant differences between both applications. Even though there is no specific group of students who have difficulties in understanding what they are supposed to do while going through the application, it seems that students with a smartphone are able to navigate easier through the personality tests while students with greater high school ability spend more time reading job descriptions. Adding then the information from the placebo group and comparing choosing and reading patterns with respect to career paths between the two applications, the results show that treated students are interested in more occupations when they are asked to choose between zero and three jobs

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<sup>3</sup> Its implementation, which is analyzed in chapter 3, had to be interrupted as schools were closed on March 16 due to the COVID-19 pandemic. The impact of the economic downturn on schooling outcomes in Cambodia is discussed in chapter 4.

plus they allocate their time between different job descriptions than placebo students do. More specifically, students in the ICET look for new information as they spend less relative reading time on the three most common jobs. They are also interested in different jobs with respect to the educational requirement. It seems that occupations with a high school degree become more salient to these students as they spend less time on occupations which require a university degree.

I contribute to three strands of literature by developing and implementing a culturally sensitive and context-relevant personality tool respecting the specific needs of the targeted group: 1) using digital solutions for the transfer of educational content, 2) career-related information and its impact on educational investments, and 3) interest-based personality tests. Kalolo (2019) critically reviews the digital revolution in the educational sector of developing countries. While highlighting the benefits of new technologies used in education, he claims that the implementation needs to be carefully examined to avoid counter-intuitive outcomes. This is also what Amrose et al. (2021) demand for engineering solutions in developing countries, calling for an inclusive process that considers various stakeholders and key implementation factors. The focus is still set on engineering-specific details but country, market, consumer, and other characteristics need to be taken into account to provide sustainable solutions. Consequently, designing a career guidance tool in an LMIC setting needs a thorough examination of its impact before making it accessible to a broader share of consumers.

The second strand of literature relates to the importance of providing career information and how this information is sought and processed differently when made self-relevant. Information on returns to education is broadly discussed in the literature. Avitabile and de Hoyos (2018) detect positive impacts on test scores, Nguyen (2008) on test scores and school attendance. A study from the Dominican Republic finds significant increases in schooling years (Jensen, 2010). Abbiati et al. (2018) look at outcomes after school and see adjustments in favor of vocational training instead of less favorable study fields with weak remuneration prospects. Nevertheless, information about different career paths alone often fails to make a difference as research on information processing has shown. Once information is transformed such that it is perceived as self-relevant, belief updates are larger (Wiswall and Zafir, 2015) or deviations from Bayesian benchmarks are even more asymmetrical (Ertac, 2011). Hence it is crucial to fashion material about career paths in a way such that students deem it self-relevant.

The design and impact of interest-based personality tests is the third strand of

literature to which this research speaks. These tests rely on the pioneer work of Holland (1997). He developed a hexagonal model which consists of six personality types, namely realistic, investigative, artistic, social, enterprising, and conventional.<sup>4</sup> Research on this hexagonal model has proven its generalizability as well as cross-cultural transportability beyond the North-American and European context (Aljojo and Saifuddin, 2017; Meireles and Primi, 2015; Morgan and de Bruin, 2018), plus it has established a positive association between vocational identity and work-related outcomes such as performance or full-time employment.

A meta-analysis by van Iddekinge et al. (2011) incorporates data from 74 different studies, covering a 70-years time period and investigating criterion-related validity of vocational interests (i.e. how well the measure of vocational interests predicts other interest-related outcomes) and the predictive power of the latter on employee performance and turnover. They find that vocational interests are positively related to job performance (validity estimate of 0.14) and to training performance (validity estimate of 0.26), and negatively related to turnover intentions (validity estimate of -0.19) and actual turnover (validity estimate of -0.15). Other studies have focused on further outcomes such as full-time employment or unemployment, gross income, partnership status, offspring, and perceived health status (Stoll et al., 2017); employment status and employment nature (de Fruyt and Mervielde, 1999), or the stability of interests over 15 years for a sub-group of intellectually gifted adolescents (Lubinski et al., 1995). All studies provide evidence for the predictive power of vocational interests making a case for the provision of early-on career counseling to students who normally do not benefit from these interest-based personality tests and who often take uninformed decisions about their career trajectory, potentially resulting in a mismatch of their skills and requirements in the labor market.

The remainder of chapter 2 is organized as follows. Section 2.3 explains the structure as well as content of the application and provides information on its implementation, empirical approach, and data. Results are shown in section 2.4 before turning to a discussion of practical insights for further development of the application in section 2.5. Section 2.6 concludes.

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<sup>4</sup> Taking the first letters together, the model is also known as RIASEC model.

## 2.3. Intervention

In this section, I describe the application, the empirical approach, and the sample. The description of the application relates to the ICET only. Its difference to the placebo application is highlighted within the explanation of both applications' implementation.

### 2.3.1. Structure, Content, and Implementation of the ICET

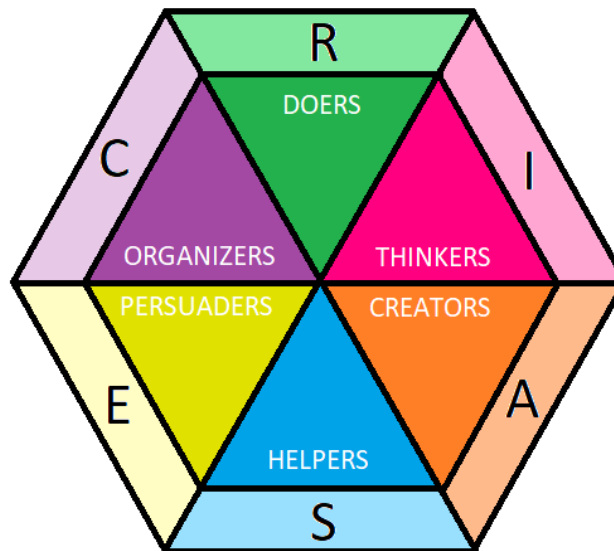
Table 2.1.: Structure of the ICET and Placebo Application

			ICET	Placebo
IET	Component 1a	Test 1	Related to interests	Related to environmental and gender issues
		Test 2		
		Test 3		
	Component 1b	Results of tests	Personality types	None
CET	Component 2a	Job selection	Unframed	Unframed
	Component 2b	Career options	Personalized	Not personalized

The application consists of four components as shown in Table 2.1 divided into two parts: the IET and CET (an in-depth description of the application's structure can be found in Appendix A.3). The IET consists of components 1a and 1b. Component 1a contains three individual tests which are all based on the hexagonal model from Holland (1997) visualized in Figure 2.1. According to this model, people's interests can be mapped into six different personality types, namely realistic (also referred to as doers), investigative (thinkers), artistic (creators), social (helpers), enterprising (persuaders), and conventional (organizers). The three strongest personality types form the Holland Code and can vary across individuals. Different occupations can be associated with one, two, or three personality types.

I include three different tests to make students engage with their interests with different methods such that the outcome of the tests is not depending on the format and to limit any fatigue. The first and second test are based on Athanasou (2000, 2007) and on a cooperation between the Hawaii Department of Education and the Occupation Information Network (O\*NET) (Hawaii Department of Education, 2020) respectively. The third test is designed by myself. The chosen statements include a broad range of interests, are context-specific, relevant for ninth-graders, and exclusively activity-based (e.g. "negotiating prices at a local market", the exact wording

Figure 2.1.: Holland's Hexagonal Model



*Notes:* Own illustration based on common visualizations of the Holland model found online. R stands for realistic, I for investigative, A for artistic, S for social, E for enterprising, and C for conventional.

of all statements can be found in Appendix A.4). They were piloted several times to ensure students' understanding of the statements plus a local artist drew pictures to further improve comprehension. Component 1b shows a personalized score of each personality type which is calculated based on the answering scheme across all statements as well as tests and the types are displayed respecting the order of the scores.

Component 2a and 2b are both dedicated to career options (CET). There are 18 occupations in total which are again context-specific, relevant for ninth-graders in rural Cambodia, and hand-made pictures by the same artist are added to improve the comprehension of the occupations. They are grouped by personality type and divided by three educational levels: finishing with grade 9, high school, or a university degree. Table 2.2 contains all 18 jobs and is organized with respect to the occupations' allocation to personality types and educational requirements. In one pre-study, it was found that the 85<sup>th</sup> percentile of occupations which are interesting to students in the target region are the three following jobs: teacher, doctor, and police officer (see Table A.2.1). I also include these three most common jobs to analyze whether students still prefer to inform themselves about these jobs or they focus on jobs which are related to their interests. Teacher is integrated as "lower-secondary teacher", doctor as "general practitioner", while police officer stays the same.



Table 2.2.: Job Categorization in the CET

Type	Required educational degree		
	grade 9	grade 12	university
Realistic	police officer	agric. technician	civil engineer
Investigative	carpenter	journalist	general practitioner
Artistic	photographer	clothes designer	architect
Social	tour guide	social worker	sec.-level teacher
Enterprising	chef	real-estate agent	sales manager
Conventional	receptionist	office administrator	software developer

*Notes:* Each occupation is assigned to one of the six personality types and to one of three educational degrees. The former categorization relies on the classification by the NEA, the latter is categorized by the research team.

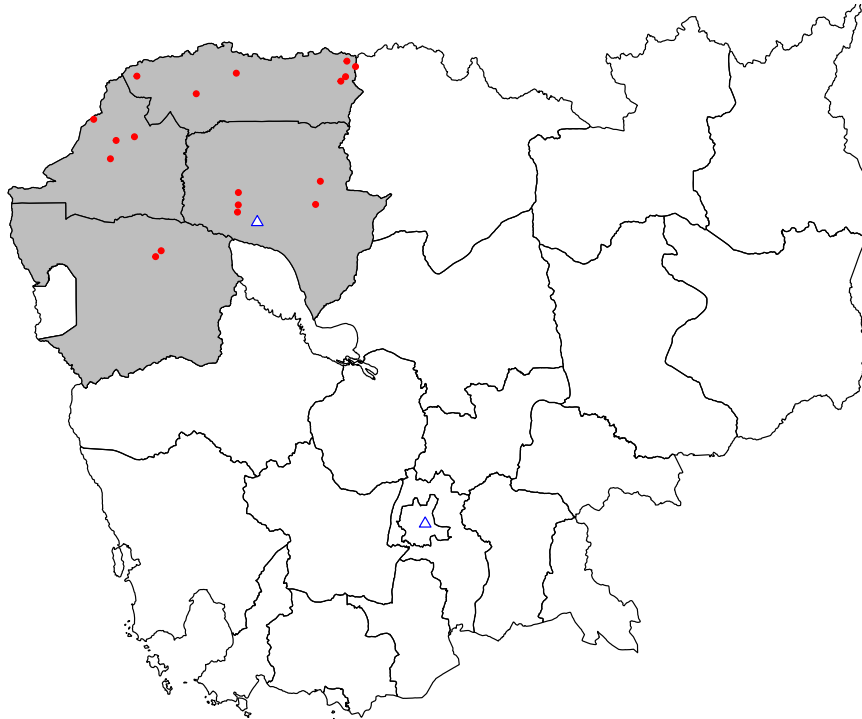
Although both components are based on career options, they differ in styles. Component 2a, called job selection, only lets students choose occupations and the last component 2b, called career options, provides detailed information about the occupations. The job selection is unframed, hence job titles are shown in random order and students can select between zero and three jobs which are interesting to them. The final component presents again all 18 career options, this time ordered by the score of the personality types and educational level. Ergo, all nine occupations relating to students' three strongest personality types are shown in the first row of the screen and the remaining ones are shown in the second row. Each occupation is equipped with a detailed description which focuses on the most important tasks, responsibilities, as well as their societal value (the exact wording of all job descriptions can be found again in Appendix A.4). The descriptions have on average five full sentences, three bullet points, plus the information on the required educational level. Students are able to decide how much time they want to invest for the job descriptions. They could log out immediately or spend up to 17 minutes on this last component. Based on the trial runs within the pilots, I calculated with the conservative measure of requiring around two minutes for one description and hence being able to read at least eight descriptions if wanted.

The application is part of an educational RCT which started on February 17, 2020 and had to be interrupted as schools were closed on March 16, 2020 due to the COVID-19 pandemic. It was administered in 18 schools (20 classes) during a one-day intervention. The schools are distributed across four provinces, namely Banteay Meanchey, Battambang, Oddar Meanchey, and Siem Reap, are from 8 different districts, and 15



(out of 18) schools are targeted by the local non-governmental organization (NGO) Child's Dream which provides high school scholarships for selected students. The map and location of the schools are shown in Figure 2.2.

Figure 2.2.: Map of Cambodia



*Notes:* This maps highlights the locations of all 18 intervention schools in red. The four provinces of interest are colored in gray. The capital Phnom Penh is represented by the blue triangle in the South, Siem Reap is the blue triangle in the North.

The RCT included a placebo group of 313 students who went through a placebo application which has a very similar structure to the ICET. Its purpose is to relate any differences between the applications to the fact that career options are personalized and made self-relevant only within the ICET application, not the placebo application. The latter differs in the following aspects from the former (see Table 2.1). The tests in component 1a) are related to gender and environmental issues.<sup>5</sup> This is why students are not shown any results of the tests in 2b) as there are no outcomes with respect to personality types. The unframed job selection 2a) is again the same for students in the placebo group. The last component 2b) contains the same career options as the ICET but they are not personalized and shown in random order to students.

<sup>5</sup> An interpretation of any gender effect between applications is not feasible as placebo students are framed toward gender topics within the tests.

The random assignment to either the ICET or placebo application was realized at each school on the morning of the intervention day. Once students arrived at the school, they drew unique identifiers from an opaque box. Each student was then working mainly on her own and on tablets brought to the schools by our research team<sup>6</sup> and was guided through the applications by research assistants<sup>7</sup>. They made students start together, pause after each test and each component, and finish together such that all students were working on the same app pages at the same time.

### 2.3.2. Empirical Approach

The application is used in an LMIC setting with the potential threat that only a sub-group of students benefits from the application while others cannot follow even in the presence of research assistants for different reasons. Hence, I first examine if the tool offers equal accessibility and can be implemented in the targeted setting. I estimate OLS using the following equation:

$$Y_{ics} = \beta_0 + \beta_1'X_i + \beta_2'Z_c + \lambda_s + \varepsilon_{ics}. \quad (2.1)$$

$Y_{ics}$  in eq. (2.1) relates to three outcome variables for student  $i$  in class  $c$  and school  $s$ , and studies whether specific students have difficulties in interacting with the application: the reading time for all three tests<sup>8</sup>, the reading time for career options and an indicator for students which encountered issues throughout the application. The latter equals 1 when students' answering scheme for the tests was inconsistent, if research assistants noted that they were unengaged or needed extra time to catch up during the tests, if they asked many questions, and if they did not read any job descriptions when they were shown the career options. In total, these are 17% of students working with the ICET.

$X_i$  is a vector of student and family characteristics. It subsequently includes a) gender, age, and smartphone ownership, b) school performance, and finally c) parental occupation. School performance is measured by the average Khmer grade, standardized literacy level within each class, and standardized high school ability within each class. Parental occupation is captured by one dummy which equals 1 when at least

<sup>6</sup> The tablets were generously provided by the local NGO GoAhead: <http://www.goahead-ngo.org/>.

<sup>7</sup> Research assistants knew beforehand which group they would be working with for each school but did not know which students would end up in their group before students drew their unique identifiers.

<sup>8</sup> The time measure for the first and second test are imperfect as there is no time stamp for the last page of each test, hence the reading time is even longer than what is summed up.

one parent has an occupation which requires at least a grade 9 diploma and another dummy which equals 1 when both parents worked in Thailand in the past 12 months. This vector further includes the location of the student, measured by the distance of the students' village to the school as well as to the district town.  $Z_c$  is a vector of class characteristics including the gender, age, experience of the class teacher, whether she has a university degree, the distance of her home address to the school, and the class size.  $\lambda_s$  are school fixed effects.  $\varepsilon_{ics}$  is the error term clustered at the school level.

I also estimate eq. (2.1) for specific outcomes of the job selection (2a) and career options (2b) to check whether there are differential effects of the socio-demographics for information-seeking behavior. The outcomes of interest are the number of choices on the job selection, the relative reading time spent on other than the three most common jobs, and the relative reading time spent on job descriptions which require at least a high school diploma.

To investigate whether the tool makes students select and read about specific occupations (and leave out others), I compare results of the job selection and career options with the placebo application. Differences for the former component can be related to students' interaction with the tests, differences for the latter can come from both the interaction with the tests and the personalized order for ICET students. Ertac (2011) and Wiswall and Zafir (2015) show that the perception of the self-relevance of information is important for belief updating. Hence I hypothesize that engaging with one's own interests affects answering and information-seeking behavior and that information is sought differently when it is made self-relevant through the order of the personalized score. I again estimate OLS using the following equation:

$$Y_{ics} = \beta_0 + \beta_1 ICET_i + \beta_2 W_i + \beta_3 Z_c + \lambda_s + \varepsilon_{ics}. \quad (2.2)$$

Outcomes of interest  $Y_{ics}$  in eq. (2.2) for student  $i$  in class  $c$  and school  $s$  are for the unframed job selection how many jobs students selected, more than 0, 1, and 2 respectively and how many of these selections are dedicated to other than the three most common jobs<sup>9</sup> and to occupations which require at least a high school diploma. For the career options, I examine relative reading time with respect to the three most common jobs versus the remaining occupations and with respect to the educational requirement, namely at least a high school or a university degree.  $ICET_i$  is a dummy

<sup>9</sup> These two outcomes were pre-specified in a pre-analysis plan (Gehrke et al., 2020b) to analyze the relevance of making information self-relevant to students and its consequences for seeking and processing information about higher education.

indicating whether the student worked with the ICET application (=1) or the placebo application (=0).

$W_i$  is the same vector of student and family characteristics as  $X_i$  in eq. (2.1) but I additionally control for the most common personality types which are linked to the three most common jobs, in order to compare both applications for the career options. The most common types are displayed in the first row of career options for ICET students. Figure A.1.1 shows the distribution of the Holland Code. The first and second most common combinations are conventional-investigative-social and social-investigative-conventional (3.2% and 2.9% respectively). I add a dummy which equals 1 whenever students have both investigative and social in their Holland Code as two of the most common jobs are allocated to these two personality types: general practitioner belongs to the investigative type and secondary-level teacher belongs to the social type.  $Z_c$  is the same vector of class characteristics as for eq. (2.1).  $\lambda_s$  are school fixed effects.  $\varepsilon_{ics}$  is the error term clustered at the school level.

Individual, household, and school characteristics are included as controls based on the assumption that the outcomes of interest are uncorrelated with the error term after controlling for  $X_i$  or  $W_i$  respectively,  $Z_c$ , and  $\lambda_s$ . Smartphone ownership and particularly reading skills can influence the accessibility of and intensity of engagement with the application. As parents often serve as main advisers when it comes to career choices, their occupation and working site also might play a role how students interact with the application. The larger the distance to school and smaller the distance to the next district town, the higher is the likelihood of the distance being a push factor out of school and pull factor into work. Growing up in remote areas could also decrease the likelihood of having access to a smartphone or a similar device which in turn could decrease the application's accessibility. Finally, the quality of school, measured by teacher's characteristics and class size, is also likely to influence students' ability to engage with an innovative tool and students' perception of what they want and also are able to do in the future.

### 2.3.3. Sample

Schools were targeted through the collaboration with the local NGO Child's Dream and the sample was expanded by schools which are in the same district and with similar characteristics as the initial schools. Although these schools are a selected sample of rural lower secondary schools in Cambodia, a comparison with all rural schools does not yield important differences (Ministry of Education, Youth and Sport,

2019). The size of grade 9 in the selected sample compared to the average rural school is almost the same: there are 89 students distributed over 1.89 classes in the selected sample and 90 students distributed over 1.99 classes in rural schools. Looking at class size and composition, the average number of students (47) and the percentage of female students (54%) per class are close to indistinguishable across the selected sample and the rural average.

Information about students working with the ICET, their school performance, and family characteristics is provided in Table 2.3 (a balance table for both the ICET and placebo group is available in Table A.2.2). The sample consists of slightly more female than male students and they are on average 15 years old. Almost half of the students (45%) own a smartphone. In terms of parental occupations, the most common occupation is farmer with 78% of the students having at least one parent working as a farmer. The educational requirements of parental occupations are on average low: less than ten percent of households have one or two parent(s) whose occupations require a grade 9 or even a higher diploma. Seventeen percent of students are taken care of by other family members since both parents work and live in Thailand. Roughly half of the sample (46%) has members in the extended family who migrated within the last twelve months.

Table 2.3 also contains information on location of students, their school performance, and school characteristics. The mean distance between a student's home and the school equals almost four kilometers and the distance between her home and the district town equals almost ten kilometers. The Khmer grade is students' average grades from November 2019 to January 2020 just before the start of the intervention. The maximum score that can be reached in Khmer equals 100 and students reach on average slightly over half of the maximum points for Khmer (54). The grade is the only characteristic which is not balanced between ICET and placebo (see Table A.2.2), hence I control for it in the subsequent analysis. The teacher assessments are based on a five-point Likert scale with 1 relating to "very poor" and 5 "very good".<sup>10</sup> Both indicators vary considerably over schools and students. Finally, information on the class teacher and size reveals that there are roughly thirty percent of female teachers, that teachers are on average around thirty years old, and have worked at the selected school for over seven years. Further, they live around ten kilometers from the schools, over half of them have a university degree (55%), and they teach in classes with on average 48 students.

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<sup>10</sup> The information was collected while students were employed in the intervention, hence they did not know about the assessment.

Table 2.3.: Student and Family Characteristics for Students in the ICET Group

	(1)	(2)	(3)	(4)	(5)
	Mean	SD	Min	Max	Count
Female student (=1)	0.530	0.500	0	1	315
Age	15.114	1.319	12	19	315
Student owns smartphone (=1)	0.454	0.499	0	1	315
At least one parent is a farmer	0.781	0.414	0	1	315
At least one parent has job with high educ. level	0.092	0.290	0	1	315
Both parents work in Thailand	0.165	0.372	0	1	315
Any family member migrated in past 12 months	0.463	0.499	0	1	315
Dist. betw. student's village and school (km)	3.981	3.856	0	18	315
Dist. betw. students' village and district town (km)	9.955	6.468	0	34	315
Av. Khmer	54.171	17.529	16	93	315
Literacy level	3.225	0.883	1	5	315
High school ability	3.162	0.800	1	5	315
Teacher: female	0.286	0.452	0	1	315
Teacher: age	29.797	5.359	20	40	315
Teacher: years of school experience	7.159	5.247	2	19	315
Teacher: has university degree	0.552	0.498	0	1	315
Teacher: distance to school (km)	10.091	9.039	1	31	315
Class Size	48.730	11.626	28	68	315

*Notes:* This table shows the sample means, standard deviations, minimum, maximum, and count of student, family, and class characteristics. Gender, age, distances, average Khmer grade (averaged over three pre-intervention months November, December, and January whenever available), information about the teacher, and class size were collected separately. Information on literacy level and high school ability are provided by the class teacher and collected on the day of the intervention. All remaining variables are self-reported by the student.

In order to assess if students seek information differently once they engaged with their own interests, different measures of how students used the application are summarized in Table 2.4 (a balance table for both the ICET and placebo group is available in Table A.2.3).<sup>11</sup> Students spend around 80 minutes going through the entire application including the breaks they had in between. They choose on average two jobs within the job selection: more precisely, most students select three jobs (61%), a roughly equal share of 16% and 15% choose two or one job(s) respectively, and the rest (8%) do not settle on any job (see Figure A.1.2). Regarding the career options, the average student logs out after roughly eight minutes and she needs less than two minutes to read one description. Students are therefore faster than the two minutes I expected them to require for one description, giving them the possibility to read more descriptions in total.

Looking at the reading time measure for specific occupations, namely the three most

<sup>11</sup> Five students from the ICET are excluded from the subsequent analyses as they encountered technical problems with the application at this stage.

Table 2.4.: Summary Statistics for ICET Usage

	(1)	(2)	(3)	(4)	(5)
	Mean	SD	Min	Max	Count
Total time spent in application	78.934	7.494	61	93	310
No. of choices between 0-3	2.300	0.994	0	3	310
Total time spent for career options	8.330	4.892	0	17	310
Average time spent for a single career option	1.712	1.130	0	8	278
Rel. time spent for three most common jobs	0.377	0.306	0	1	296
Rel. time spent for jobs with $\geq$ high school degree	0.597	0.273	0	1	296

*Notes:* This table shows the sample means, standard deviations, minimum, maximum, and count of time and click measures of the ICET. Time measures are in minutes. The total time includes the time spent on the overview page and the time for a single description is calculated based on the time stamps between two individual descriptions. The statistic for average reading time per descriptions is limited to students reading at least two descriptions. Relative reading time is restricted to students reading at least one description.

common occupations (out of 18) and the ones which require at least a high school degree (12 out of 18), the time investment for the three most common occupations is considerably large. Students spend on average 38% of their relative reading time for secondary-level teacher, general practitioner, and police officer (see Figure A.1.3a) while they spend less than two thirds of the time for the share of occupations with medium and high educational requirements (see Figure A.1.3b). Finally, students in the ICET also spent their time respecting the order of the types as intended: the largest share of their reading time is dedicated to their strongest type, lesser time on their second strongest type, and so on (box plots are provided in Figure A.1.4).

## 2.4. Results

I first analyze if there is any differential accessibility for students working with the ICET in terms of socio-demographic characteristics. As I do not find any systematic exclusion, I compare results for the ICET with results for the placebo application in a second step. I look at choices for the job selection, more precisely the number of choices, to see whether the interaction with the tests alone already has an impact on ICET students. Further, I compare relative reading time with respect to the three most common jobs – police officer, secondary-level teacher, and general practitioner – and the educational requirement to analyze a potential effect of the ICET on how students look for career-related information.

### 2.4.1. Accessibility of the ICET

Table 2.5 shows the results for students with potential difficulties in accessing the application. There are two time measures each (in minutes) for personality tests and career options, and one indicator variable collecting all the cases of students with difficulties. Older students and the ones without a smartphone seem to need more time to go through the interest-based personality tests (columns 1-3). The total reading time for the career options is decided by the students themselves. The higher the teacher's assessment of them being able to continue with high school (columns 4-6), the more time they invest on job descriptions. Longer choosing and reading time for tests and career options can relate to one of the following scenarios: either the student encountered difficulties and hence needed more time than her peers or she was uncommonly interested in the tests and career options and took her time to precisely answer the tests and read thoroughly within the job descriptions.

Table 2.5.: Accessibility: Reading Time Spent for Tests and for Career Options as well as Students with Difficulties

	Time spent for tests			Time spent for career options			Students with difficulties		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Female student (=1)	0.531 (0.646)	0.961 (0.554)	0.916 (0.544)	0.088 (0.609)	-0.330 (0.467)	-0.360 (0.467)	-0.000 (0.048)	0.016 (0.055)	0.020 (0.055)
Age	0.745*** (0.193)	0.716*** (0.188)	0.719*** (0.201)	0.401 (0.234)	0.396* (0.227)	0.397 (0.230)	0.021 (0.020)	0.022 (0.019)	0.024 (0.019)
Student owns smartphone (=1)	-1.278* (0.655)	-1.346* (0.646)	-1.348* (0.651)	-0.017 (0.398)	0.153 (0.443)	0.153 (0.475)	0.000 (0.057)	-0.009 (0.052)	-0.018 (0.052)
Av. Khmer		-0.035 (0.027)	-0.035 (0.026)		0.017 (0.011)	0.018 (0.011)		0.001 (0.002)	0.001 (0.001)
Literacy level (standardized)		-0.333 (0.391)	-0.332 (0.404)		-0.326 (0.330)	-0.327 (0.347)		-0.036 (0.042)	-0.030 (0.040)
High school ability (standardized)		0.179 (0.313)	0.204 (0.297)		0.857** (0.319)	0.874** (0.335)		-0.012 (0.049)	-0.014 (0.047)
At least one parent has job with high educ. level			-0.709 (0.924)			-0.475 (0.986)			0.120 (0.094)
Both parents work in Thailand			0.771 (0.621)			0.476 (0.739)			0.048 (0.077)
Observations	310	310	310	310	310	310	310	310	310
Adjusted $R^2$	0.206	0.210	0.207	0.306	0.321	0.318	0.010	0.009	0.011

Notes: Dependent variables are in the column header (time spent for test 1-3 and for career options in minutes, students with difficulties is a dummy). All regressions include controls for students' distances (namely the distance between their home village and school as well as district town), for class characteristics (namely gender, age, experience of the teacher, whether she has a university degree, the distance between her home and the school, and the class size), and control for school fixed effects. Standard errors (clustered at the school level) are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

In order to find evidence for either scenario, I pool all observations that encountered difficulties in an indicator variable for which age, smartphone ownership, and high school ability are insignificant (columns 7-9). These insignificant results of the three previously significant variables suggest that the second explanation in favor of more enthusiasm becomes more plausible. Especially older students might consciously take



more time to answer the statements in the tests and students with a greater high school ability might enjoy the job descriptions more than other students. Experiences with the navigation of a smartphone might in turn motivate students to maneuver faster through component 1a filled with personality tests.

Nevertheless, smartphone ownership and high school ability could play an important role for the accessibility of the application in the future. Even though the tool's format is new for all students, smartphones seem to give them an advantage in navigating through the tests. Students with a greater high school ability are willing to invest more reading time for career jobs after spending a substantial amount of time with the application and potentially getting tired of reading. As of now, the design of the application is unlikely to exclude any specific group of students but it seems that accessibility to the application is increased by owning a smartphone and with a greater high school ability. This will be further discussed in section 2.5.

### 2.4.2. Information-seeking Behavior

Before comparing choosing and reading behavior between applications, I verify if specific socio-demographics of the students matter for explaining information-seeking behavior. Table 2.6 reveals that almost all characteristics are irrelevant as they are insignificant. Only the literacy level results in marginally significant coefficients for the number of choices (columns 2-3) within the unframed job selection (2a). This means that students' interaction with the personality tests has a positive effect on more literate students finding more jobs interesting within the unframed job selection. However, this effect does not translate into a different reading behavior with respect to individual job descriptions for career options.

Next, I turn to the comparison of results between the ICET and placebo application and start with looking again at component 2a, namely the job selection. Students in the ICET choose more jobs that appear interesting to them than placebo students. Figure A.1.2 shows that fewer students (13 percentage points less than placebo students) choose one job and more students (13 percentage points more than placebo students) choose three jobs. The regression results in Table 2.7 underpin this descriptive finding by showing that this difference is significant: the ICET induces students to choose more jobs than in the placebo as the likelihood of choosing more than or equal to two (columns 4-6) or exactly three jobs (columns 7-9) is increased by 12.0 (11.7) and 12.3 (11.8) percentage points without student controls (with all controls) respectively.

Table 2.6.: Information-seeking Behavior: Socio-demographics of Students

	No. of choices			Other than 3 jobs			≥ HS diploma		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Female student (=1)	0.085 (0.131)	0.041 (0.147)	0.033 (0.148)	-0.037 (0.040)	-0.012 (0.045)	-0.012 (0.045)	0.001 (0.034)	-0.025 (0.038)	-0.026 (0.038)
Age	0.018 (0.029)	0.018 (0.030)	0.017 (0.029)	-0.019 (0.017)	-0.021 (0.018)	-0.022 (0.017)	-0.004 (0.009)	-0.005 (0.010)	-0.005 (0.010)
Student owns smartphone (=1)	0.035 (0.093)	0.057 (0.084)	0.060 (0.088)	0.039 (0.031)	0.034 (0.031)	0.037 (0.033)	0.005 (0.030)	0.020 (0.028)	0.020 (0.027)
Av. Khmer		-0.003 (0.004)	-0.003 (0.004)		-0.002 (0.001)	-0.002 (0.001)		-0.001 (0.001)	-0.001 (0.001)
Literacy level (standardized)		0.146* (0.076)	0.144* (0.076)		-0.026 (0.026)	-0.029 (0.026)		0.017 (0.025)	0.016 (0.026)
High school ability (standardized)		-0.022 (0.090)	-0.017 (0.089)		0.015 (0.026)	0.015 (0.027)		0.046 (0.027)	0.046 (0.027)
At least one parent has job with high educ. level			-0.153 (0.268)			-0.035 (0.066)			-0.017 (0.060)
Both parents work in Thailand			0.087 (0.198)			-0.038 (0.026)			0.014 (0.056)
Observations	310	310	310	296	296	296	296	296	296
Adjusted $R^2$	0.114	0.117	0.114	0.052	0.056	0.052	-0.010	0.012	0.005

Notes: Dependent variable are in the column header (number of choices for the job selection, relative reading time for other than the 3 most common jobs and relative reading time for jobs which require at least a high school degree). 14 students do not read any job descriptions and are excluded for the last two outcomes. All regressions include controls for students' distances (namely the distance between their home village and school as well as district town), for class characteristics (namely gender, age, experience of the teacher, whether she has a university degree, the distance between her home and the school, and the class size), and control for school fixed effects. Standard errors (clustered at the school level) are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table 2.7.: Information-seeking Behavior: Number of Choices for Job Selection

	Choices ≥ 1			Choices ≥ 2			Choices = 3		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ICET (=1)	-0.002 (0.029)	-0.004 (0.029)	-0.006 (0.030)	0.120** (0.044)	0.119** (0.043)	0.117** (0.044)	0.123** (0.046)	0.123** (0.046)	0.118** (0.045)
Female student (=1)		0.014 (0.024)	0.014 (0.024)		0.038 (0.045)	0.027 (0.049)		0.032 (0.052)	0.019 (0.056)
Age		0.008 (0.007)	0.008 (0.007)		0.019 (0.012)	0.020 (0.012)		0.031 (0.018)	0.031 (0.018)
Student owns smartphone (=1)		0.020 (0.017)	0.020 (0.017)		0.011 (0.030)	0.013 (0.029)		-0.051 (0.036)	-0.050 (0.037)
Av. Khmer			-0.001** (0.001)			-0.001 (0.001)			-0.003*** (0.001)
Literacy level (standardized)			0.017 (0.012)			0.048 (0.033)			0.085*** (0.024)
High school ability (standardized)			0.008 (0.014)			-0.010 (0.039)			-0.016 (0.034)
Observations	623	623	623	623	623	623	623	623	623
Adjusted $R^2$	0.029	0.027	0.028	0.044	0.044	0.044	0.042	0.045	0.056

Notes: Dependent variable is in the column header ((No. of) Choices ≥ 1, ≥ 2, and = 3). All regressions include controls for students' distances (namely the distance between their home village and school as well as district town), for parental occupation (namely whether at least one parent has job with high education level and whether both parents work in Thailand), for class characteristics (namely gender, age, experience of the teacher, whether she has a university degree, the distance between her home and the school, and the class size), and control for school fixed effects. Standard errors (clustered at the school level) are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Analyzing the job selection across applications with respect to the content of choices (instead of the number), a chi-square test reveals a significant difference at the five-percent level between ICET and placebo regarding the jobs collected within the first click (choices within the second and third click are not significantly different).<sup>12</sup> Nevertheless, there are no significant differences between preferences for the three most common jobs and the rest, as well as between occupations which only require a grade 9 diploma and jobs which require at least a high school diploma once all student controls are included (see Figure A.1.5 and Table A.2.4).

In sum, students in the ICET make different choices already within the unframed job selection, as hypothesized beforehand. Although they are only revealed their personality types without putting them in relation with different careers, ICET students tend to find more and different jobs interesting than students in the placebo. Already at this stage, there is weak evidence in favor of the ICET making students seek information differently than placebo students. This difference stems from the interaction with individual interests not from any personalized display of career options.

Turning to the last component 2b, I expect the largest difference between both applications as information is personalized for students working with the ICET but is shown in random order for students in the placebo group. I find that the overall reading time for career options is not significantly different (see its distribution in Figure A.1.6). Yet, I can look at relative reading time, the more accurate measure than overall reading time, which is normalized between 0 and 1, and compare two specific outcomes for the career options: the three most common jobs versus the remaining jobs and the educational level (grade 9 diploma only or high school diploma and higher). Figure A.1.3 shows the distribution of the relative reading time for the two outcomes of interest and for both applications.

The ICET significantly increases relative reading time for occupations other than the three most common jobs (see columns 10-12 in Table 2.8). This is largely driven by a decreased reading time for secondary-level teacher (columns 7-9).<sup>13</sup> Whenever students have the social type as one of their strongest personality types, the negative effect on relative reading time for teacher is almost entirely offset by the guidance through the types for ICET students. This means that students, who should read

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<sup>12</sup> Clicks refers to the choices collected in the first, second, and third entry. As choices could be undone by clicking on the job again, the preference order of choices is unclear and jobs collected in the first click are not automatically the first preference of students.

<sup>13</sup> The three most common jobs already occupy more than a third of the total reading time for the ICET and almost half of the reading time for the placebo while they only represent a sixth of all jobs.

about teacher as it is associated with one of their strongest types, still read this specific description.

Table 2.8.: Information-seeking Behavior: Relative Reading Time for Three Most Common Jobs and the Rest

	Police			GP			Teacher			Rest		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
ICET (=1)	-0.012 (0.020)	-0.013 (0.020)	-0.012 (0.022)	-0.024 (0.020)	-0.022 (0.020)	-0.021 (0.021)	-0.095*** (0.014)	-0.094*** (0.014)	-0.088*** (0.016)	0.131*** (0.027)	0.130*** (0.028)	0.121*** (0.030)
Teacher and GP in Holland Code	-0.018 (0.023)	-0.018 (0.024)	-0.015 (0.024)	0.049** (0.023)	0.048** (0.022)	0.047** (0.022)	0.093*** (0.019)	0.093*** (0.019)	0.086*** (0.020)	-0.123*** (0.035)	-0.123*** (0.034)	-0.118*** (0.035)
Female student (=1)		-0.037 (0.022)	-0.027 (0.024)		0.037** (0.016)	0.036* (0.021)		0.045* (0.024)	0.023 (0.023)		-0.045 (0.028)	-0.033 (0.027)
Age		-0.005 (0.004)	-0.005 (0.005)		-0.004 (0.007)	-0.005 (0.007)		0.009 (0.008)	0.009 (0.007)		0.001 (0.012)	0.001 (0.012)
Student owns smartphone (=1)		0.006 (0.020)	0.003 (0.019)		-0.010 (0.012)	-0.009 (0.012)		-0.005 (0.016)	0.003 (0.016)		0.009 (0.019)	0.003 (0.019)
Av. Khmer			0.002** (0.001)			-0.000 (0.001)			0.001 (0.001)			-0.002** (0.001)
Literacy level (standardized)			-0.037** (0.015)			-0.007 (0.009)			0.023 (0.016)			0.021 (0.020)
High school ability (standardized)			-0.013 (0.017)			0.014* (0.008)			0.014 (0.019)			-0.016 (0.023)
Observations	599	599	599	599	599	599	599	599	599	599	599	599
Adjusted R <sup>2</sup>	-0.009	-0.008	0.010	0.033	0.042	0.040	0.043	0.047	0.070	0.059	0.059	0.067

Notes: Dependent variable is in the column header (relative reading time for police officer, general practitioner, secondary-level teacher, and remaining occupations). 14 students in the ICET and 11 students in the placebo do not read any job descriptions and are excluded here. All regressions include controls for students' distances (namely the distance between their home village and school as well as district town), for parental occupation (namely whether at least one parent has job with high education level and whether both parents work in Thailand), for class characteristics (namely gender, age, experience of the teacher, whether she has a university degree, the distance between her home and the school, and the class size), and control for school fixed effects. Standard errors (clustered at the school level) are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table 2.9.: Information-seeking Behavior: Relative Reading Time with respect to Educational Requirements

	$\geq$ High school			University		
	(1)	(2)	(3)	(4)	(5)	(6)
ICET (=1)	-0.055** (0.020)	-0.054** (0.020)	-0.051** (0.023)	-0.124*** (0.029)	-0.124*** (0.029)	-0.119*** (0.031)
Teacher and GP in Holland Code	0.100*** (0.033)	0.100*** (0.034)	0.093** (0.034)	0.135*** (0.030)	0.135*** (0.030)	0.127*** (0.030)
Female student (=1)		0.031 (0.030)	0.011 (0.033)		-0.022 (0.029)	-0.042 (0.032)
Age		0.004 (0.009)	0.003 (0.010)		-0.004 (0.010)	-0.005 (0.011)
Student owns smartphone (=1)		-0.006 (0.022)	0.002 (0.023)		-0.001 (0.026)	0.009 (0.025)
Av. Khmer			-0.001 (0.001)			-0.000 (0.001)
Literacy level (standardized)			0.028 (0.020)			0.012 (0.016)
High school ability (standardized)			0.038* (0.019)			0.048** (0.018)
Observations	599	599	599	599	599	599
Adjusted $R^2$	-0.002	-0.004	0.022	0.025	0.021	0.045

*Notes:* Dependent variable is in the column header (relative reading time for occupation which require at least a high school degree and which require a university degree). 14 students in the ICET and 11 students in the placebo do not read any job descriptions and are excluded here. All regressions include controls for students' distances (namely the distance between their home village and school as well as district town), for parental occupation (namely whether at least one parent has job with high education level and whether both parents work in Thailand), for class characteristics (namely gender, age, experience of the teacher, whether she has a university degree, the distance between her home and the school, and the class size), and control for school fixed effects. Standard errors (clustered at the school level) are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table 2.9 shows that ICET students tend to spend less time on occupations which require at least a high school degree (columns 1-3). This is in fact mostly driven by occupations with the highest educational requirement (columns 4-6), as for example secondary-level teacher and general practitioner. Occupations, which require a university degree, are still the group that gets most attention in the placebo group as Figure A.1.3b indicates. However, the average relative reading time is larger for jobs with a high school degree in the ICET than in the placebo. The analysis for the three most common jobs has shown that ICET students spend less relative reading time on the description for teacher but not for general practitioner which could be suggestive that the ICET does not make high-skilled jobs less appealing in general. Instead, they

spend less time on a job of which they already know and reinvest their reading time in jobs with the second highest educational requirements. This reading behavior could still translate into the consideration of continuing with high school.

In sum, there is evidence that the ICET makes students search for information on career options differently than placebo students do. First of all, they are choosing different jobs on the unframed job selection and also tend to find more occupations interesting than placebo students. Second of all, there are significant differences with respect to relative reading time for the three most common jobs and for the educational requirements. Students in the ICET spend less relative reading time for occupations about which they have heard beforehand and it seems that occupations which require only a high school certificate – as opposed to a university degree – become more interesting for ICET students.

## 2.5. Practical Insights

Using an electronic interest-based personality test in an LMIC setting has a lot of potential to make students engage with their own interests and reflect differently about potential career paths (and consequently higher education). Nevertheless, the design of the application can be further enhanced to avoid any counter-intuitive effects when making use of it. In the following section, I discuss how improvements of the applications could help in making sure that the implementation of the application results in its intended purpose.

There is substantial heterogeneity in reading time for all tests (see Table A.2.5). I suggest two improvements to potentially make reading time more homogeneous. First, time measures in component 1a must be further developed such that all pages are included.<sup>14</sup> This ensures precise information on which pages students might encounter difficulties.

Second, the design of the individual tests can also be improved by adding warning messages if there are clear inconsistencies in the answering scheme. In the first personality test for example, students were asked to choose one out of two statements per item. There were several items per page. Choosing all statements on the same side (either all left or all right) could be an indicator that these students either did not understand the instructions well or did not take the test seriously. Sixteen students in the sample chose only one-sided statements on more than one page. The biggest

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<sup>14</sup> This development should also entail the time stamps on career options. They should be calculated whenever a student enters and exits a specific description.

issue with test 2 is that both pages could be skipped voluntarily or by accident. From anecdotal evidence I know that some students skipped it by accident and would have liked to choose several statements on the skipped page. There is one student choosing zero statements and one student choosing all 42. It is likely that these two students did not understand the instructions.<sup>15</sup>

Consequently, guidance needs to be improved for each individual test to avoid these above-mentioned cases. This could be done by adding a warning message for the first and second test whenever the student chose all right- or left-handed statements on any page in the first test and chose no or all statements within one page for the second test. This message could ask students if they are sure about their answers, and explain again what they are asked to do.

The analysis has also shown that students owning a smartphone seem to have easier access to the personality tests. From a different study, I have anecdotal evidence for an increased availability of smartphones even in rural households. The application should be transformed such that it can be used also on a smartphone, not only on tablets. It could still be implemented in a supervised setting in which students share their smartphones. This way more students can try it out instead of restricting the implementation to a small sample to which tablets are brought.

Internal validity of the personality tests needs to be further developed as the statements across tests might not perfectly capture the allocation to specific types. I provide a correlation table across statements reflecting a specific type and across tests in Table A.2.6. The artistic type seems to be most consistently correlated across all three tests whereas the enterprising type has even negative correlation coefficients. Hence I refrain from arguing that the mechanism through which students are seeking information about career paths comes from the precise capture of a specific Holland Code. What I argue is that giving students the chance and creating the room and time for reflection on their interests matter. As they are involved in the process of determining their personality type, they also pay attention to the specific order of the jobs displayed on the framed career options.

Students with reading difficulties should have easier access to the tool through an audio-taped version of all texts. The individual job descriptions in particular could be less accessible for low-performing students. The implementation of this add-on is challenging on two levels. First, the application has had no technical requirements to do so until now, and will thus involve substantial reprogramming of it. Secondly and

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<sup>15</sup> These cases in test 1 and 2 are not excluded from the analysis as I cannot determine for sure whether the students' choice was intentional or not.

once it is equipped with this function, one has to think about how to further test the application with students as they will not only need the device (either tablet or if further developed a smartphone) but also headphones.

Although the current version of the application allows for modular changes, new coding would be needed to implement its usage on smartphones and include an audio-taped version of the tests and descriptions. The initial costs for reprogramming it are still relatively small given that the basic structure already exists and comparable to the potential outreach the application could have once it is adapted for smartphones. This in turn also simplifies its distribution. Different NGOs have already signaled their interest in the ICET, such that it could be developed and tested further until it is made available for a broader set of students with the potential to close the gap in the school curriculum regarding information on career options.

## 2.6. Conclusion

Lack of role models and of guidance for career choices are the consequences of a country dealing with the aftermath of a civil war and persecution of the intellectual elite. Surveys and focus group discussions with eighth-graders which preceded the main study revealed that students do not engage with their own interests. Consequently, the only available career guidance is what they see in their daily life or what their family suggests they do.

To make students engage more with their own interests which in turn map into different career paths, I designed an ICET for ninth-graders in Cambodia who are about to decide to continue with high school or finish schooling after grade 9. The structure of the tool allows students to decide between statements which reflect specific interests and the chosen statements are evaluated for each student to reveal her own strongest personality types. After selecting jobs that appear interesting to the student on her own, the ICET displays those jobs that best reflect the student's personality type(s).

The ICET was implemented as an integral part of an educational RCT in the beginning of 2020 and the analysis reveals that the application seems to be accessible for all students. Still, it appears that the common usage of a smartphone eases the process of going through the personality tests. In addition, a greater high school ability lets students spend more time on the job descriptions. As smartphones become more and more common even in the most remote areas, I suggest making the application



compatible for smartphones and including an audio-taped version as a support for low-performing students.

The comparison with the results of a placebo application also show that students look for career-related information differently between the two groups. The ICET students are more open toward exploring other than the most common occupations and also inform themselves about occupations which only require a high school degree (instead of a university degree). This could mean that students are now aware of jobs that they deem more interesting and have a lower educational requirement at the same time potentially resulting in a better match of skills and open positions.

Future research should focus on a repetition of the ICET with the same sample of students after a couple of months. It should be tested for the stickiness of the career options students have on their minds and select on the unframed part of the application. A repetition would help to see if the ICET can induce actual change by making students consider and read different occupations than they originally chose. Do their answers on the unframed job selection change toward the ones they were shown on the framed career options or do they remain the same? In line with this, tracking students would help to analyze middle- and long-term outcomes of the interaction with the ICET to analyze which students made the transition to high school and potentially even observe actual career choices. Once the application is adapted to smartphones, sample sizes can also be increased by counting on a specific percentage of students who have access to a smartphone such that less devices need to be brought to the field.

The strong suit of the ICET is not finding the exact personality type of each student, but rather to make them engage with oneself and reflect what they enjoy doing now and what they potentially enjoy in the future as well. The application is relatively low-cost with the potential to close the gap in the Cambodian school curriculum that does not include career guidance. Making the tool accessible for a broader student population could make a real difference in a setting where many students lack knowledge about both career options and about where to get the relevant information.

# 3. Career Goals and Investments in Education: Experimental Evidence from Cambodia\*

*with:*

*Esther Gehrke &*

*Friederike Lenel*

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### **3.1. Abstract**

We analyze whether an interest exploration tool – combined with information about potential careers, paths to higher education and financing options – can provide guidance to students in rural Cambodia, help them develop long-term career goals and thereby motivate them to continue with school. We target the intervention to adolescents in grade 9, who are about to decide whether to enroll in high school. The intervention was conducted just before schools were closed for a period of six months due to COVID-19. We use survey data, as well as individual-level administrative data obtained from treatment and control schools to track educational decisions during and after school closure. Our findings suggest that the intervention had no effects on average on high-performing students and unintended effects on low-performing students. Treated low-performing students are less likely to study during school closure and more likely to work for pay; they are also less likely to apply for high school scholarships. It seems our intervention made low-performing students more realistic in their expectations and aware of alternative career paths.

**Keywords:** Aspirations; Career guidance; Education; Cambodia

## 3.2. Introduction

Increasing educational attainment is pivotal for countries to benefit from globalization and the rapid diffusion of technological innovations. As such, education features prominently among the SDGs and forms an important component of international development assistance. While in most low and middle income countries access to education has improved substantially over the last decade, a large proportion of the students still drop out pre-maturely and few continue with higher education (UNESCO, 2020). Indeed, education-related decisions are not easy. They need to be taken at relatively young ages and require guidance and information.

Nudging interventions can help children make more informed decisions on their educational pathways and can increase educational attainment (Damgaard and Nielsen, 2018). They can be broadly classified into two categories: information and behavioral interventions. Information interventions aim at improving the quality of decision making. They often focus on the economic return to education (Nguyen, 2008; Jensen, 2010) but can also cover financing options (Bettinger et al., 2012; Dinkelman and Martínez A., 2014) or include more detailed information about alternative educational tracks, such as vocational training options (Goux et al., 2017). Behavioral interventions aim at reducing (psychological) barriers to decision-making and to action. They address a wide range of constraints, from a lack of social belonging (Yeager et al., 2014), to low self-control (Ariely and Wertenbroch, 2002), limited motivation (Clark et al., 2020), or impatience (Alan and Ertac, 2018).<sup>1</sup>

In this paper, we study the impact of a behavioral information intervention targeting adolescents in their final year of compulsory schooling. We investigate whether providing self-relevant information about potential careers, paths to higher education and financing options can help retain students in school. As part of a half-day workshop, students first work through an interest and career exploration tool – an app that helps students reflect about their preferences and interests and allows them to explore information about jobs that fit with their interests. They then participate in an information session that presents paths to higher education or vocational training as well as financing options. The intervention, which is low-cost and can be easily replicated, aims to boost motivation and aspirations among students, while providing the information necessary to take the next steps in their educational path (i.e. transition to high school or into vocational training).

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<sup>1</sup> This list is by no means complete. For a recent review of various nudging interventions in education, see Damgaard and Nielsen (2018).

The workshop was implemented as part of an RCT conducted with grade 9 students in Cambodia in early 2020, shortly before schools were closed due to the COVID-19 pandemic. Cambodia is a particularly interesting context to study educational investments. During Cambodia's long period of internal conflict, the educational sector was systematically destroyed: schools and universities were closed, educated people fled the country or were persecuted (UNESCO, 2011). As a consequence, education levels of adults are extremely low today. This has severe repercussions on younger generations: Students lack information and guidance about career paths, and educational aspirations are often set very low (Eng et al., 2014). Dropout rates are high and the transition rate to high school is low, especially in rural areas (Ministry of Education, Youth and Sport, 2017).

Results from a pilot survey in summer 2019 suggest that students have very little knowledge about career paths, and that few of them have developed 'true' career goals. When asked about their career aspirations, 90% of the students mention one of four jobs (teacher, doctor, police officer, and soldier), but know very little about how to achieve these goals. It seems that the lack of a true personal career goal results in low motivation in pursuing higher education. The intervention is designed to address these constraints.

We evaluate the effect of the intervention by exploiting the randomized assignment of 36 schools to either treatment or control status. We hypothesize that the intervention helps students develop career goals that are better matched to their interests, and encourages them to pursue higher education. However, we find that on average the intervention did not have the expected positive effect. Students in treatment schools are not more likely to study during the period of school closure than their peers at control schools. We also do not find them to be less likely to drop out before the end of the academic year. If at all, it seems treated students are more likely to work during school closure and less likely to apply for high school scholarships. This unintended negative effect of the intervention is driven by low-performing students (measured in terms of pre-intervention performance of a student relative to the median student in a given class): treated low-performing students are less likely to apply for a high school scholarship, less likely to study and more likely to work during school closure. These results are overall very robust to a number of alternative specifications. We study potential channels that might explain these unintended effects. We find suggestive evidence that our intervention made low-performing students aware of alternative career paths that do not include higher education and more realistic in terms of what they are able to achieve.

We contribute to the literature assessing the value of information in educational settings. The impact of providing information about the returns to education in low income settings has been discussed in numerous studies. Such information has been shown to lead to an increase in school attendance, an improvement in test scores, and a change in educational trajectories (Nguyen, 2008; Jensen, 2010; Abbiati et al., 2018; Avitabile and de Hoyos, 2018). We deviate from these works by focusing on pathways to higher education instead of its economic returns, and by focusing on self-relevant information (i.e. information that is tailored to students' own interests).

We also contribute to the literature that investigates the role of goal setting and aspirations in motivating educational investments. A number of studies have shown that role model interventions can increase aspirations and investments (Dinkelman and Martínez A., 2014; Riley, 2019). In contrast to those interventions, our intervention seeks to facilitate goal setting among students by encouraging students to explore their personal interests and by providing them with personalized information on career paths.

The remainder of this paper proceeds as follows: In section 3.3 we describe the setting. The design of the intervention is described in section 3.4 and the implementation and collected data in section 3.5. Section 3.6 presents the empirical approach and results, and section 3.7 concludes.

### 3.3. Setting

The educational sector in Cambodia was systematically destroyed by the regime of the Khmer Rouge in the 1970s during which the vast majority of teachers and academics fled the country or were killed (Chandler, 2007). The reconstruction of the educational sector did not start before the 1990s. The consequences are still visible today: The vast majority of the parental generation has not completed primary education. And while school completion rates have increased at the primary and lower-secondary level, higher-secondary school completion rates still lag behind (Huang et al., 2017).<sup>2</sup> Enrollment in lower secondary schools is 56.5% and decreases to 28.1% in higher secondary schools. The few students that manage to transition to high school, are often not able to finish with a diploma. Dropout rates of grade 10, grade 11, and grade 12 are 14.1%, 7.2%, and 30.9% respectively (Ministry of Education, Youth and Sport, 2019).

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<sup>2</sup> The education system in Cambodia consists of six years of primary, three years of lower secondary, and three years of high school; the first nine years of schooling are compulsory.

One of the potential reasons for the low educational attainment could be that students lack the necessary information and guidance from their parents and teachers to make informed educational decisions. Parents can provide little support to their children in terms of homework or schooling decisions more generally. Furthermore, parents often have a pessimistic view on the returns to education, notably in low-income households (UNESCO, 2011). Overall, the involvement of parents or other family members in students' schooling life is very rare (Benveniste et al., 2008), although a healthy connection between the school and the family could prevent a substantial amount of dropouts (Edwards et al., 2014).

Teachers, on the other side, are not sufficiently compensated and lack adequate training. Due to low salaries, high-performing graduates are typically not interested in becoming a teacher, and training centers report difficulties in recruiting qualified candidates (Tandon and Fukao, 2015). Furthermore, teachers often pursue side-employments to supplement their income. In particular, most teachers offer private tutoring classes to their students. These classes are considered necessary for the completion of the school curriculum; yet only a share of students can afford them resulting in increasing inequality (Bray et al., 2019; Marshall and Fukao, 2019). In addition, aspiring teachers receive insufficient training, especially when it comes to student-centered pedagogy (Tandon and Fukao, 2015). The skill set taught at school largely does not match the sectoral demands and there is little focus on critical and creative thinking (UNESCO, 2011).

As a result, students have little knowledge of potential career paths. In a pilot study in 2019, we surveyed students about their aspirations, knowledge on career paths, and their beliefs about costs associated with higher education.<sup>3</sup> While all students are able to name a specific job they would like to do in the future, the range of different jobs mentioned is very limited with over 90% of the students stating that they would like to become either a teacher, doctor, police officer, or soldier (see Table A.2.1). Very few students have a clear understanding on how to reach their career goal. In the pilot study, we asked students how they would achieve their stated career goal. The most common response was: "studying hard". In focus group discussions we had the impression that few students were passionate about their career goal. Talking to principals and teachers, it became apparent that future career options are not taught at school. Teachers admitted that they find it difficult to talk about career paths other than becoming a teacher as they have little knowledge about alternatives.

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<sup>3</sup> We conducted surveys with roughly 200 students and focus group discussions with 32 students in grade 8 and also held interviews with teachers, parents, and education experts.

### 3.4. Intervention Design

The intervention was designed as a half-day workshop targeting grade 9 students. The workshop consists of three main parts: First, students work through an IET which allows them to reflect on their interests and preferences; second, students go through an CET, where they are provided detailed information on a number of different jobs they might find interesting; third, students receive information on high schools and vocational schools nearby. While the first two parts are done by each student individually on a tablet (with the support of a research assistant if needed), the third part is conducted in small groups in person.

As we are interested in whether information take-up and processing differs when it is made self-relevant, we randomly allocate students into one of three treatment arms according to the participant number that students draw upon arriving to the intervention: the main treatment arm (A1), placebo arm (A2), and information-only (A3), with the respective chances of 2:2:1. While students in A1 participate in all three parts of the intervention, students in A2 only receive the job information and attend the school information session, and students in A3 participate in the information session only. The outline of the intervention for each of these groups is described in Table 3.1.

In the first part, students go through an electronic application, the IET, that has been designed by the project team together with a Cambodian consultant. It is based on an internationally used personality model, RIASEC, and was adapted to the Cambodian context.<sup>4</sup> In the IET, students are presented with statements on activities they might like and interests they might have and are asked to select the ones most applicable to them. Small pictures serve as further illustration. There are three different parts that differ in the way how statements are presented and how students can select them. It takes approximately 45 minutes to complete the tool. In the end, the strongest personality types are revealed for each student based on her answers.<sup>5</sup>

In the second part, the CET, students are shown a list of 18 jobs (ordered according to the students' strongest personality types in arm A1 and randomly in arm A2). By clicking on a job, an extra window pops up, providing a detailed description (job content, societal value, and education requirements) for each job. The featured list contains jobs that require at least lower-secondary, at least higher-secondary, or university education. We ensured that the tool featured jobs with which students are

<sup>4</sup> The origin of the RIASEC typology and model dates back to 1959 (Holland, 1959) and was adapted until 1997 (Holland, 1997).

<sup>5</sup> For more detail on the IET, see Appendix B.3.1 and chapter 2.



Table 3.1.: Outline of Intervention at Treatment Schools

	A1	A2	A3
Baseline survey	Background information on student('s family); beliefs about costs of attending high school		
IET	TREATMENT (a) three tests on personal interests and preferences (b) personality types	PLACEBO (a) three tests on gender attitudes and climate change (b) —	NO TOOL game outside
CET	(a) list of 18 jobs; students indicate most interesting ones(s) (b) list of 18 jobs (ordered by personality types), students can click on each job to read more detail	(a) list of 18 jobs; students indicate most interesting one(s) (b) list of 18 jobs (ordered randomly), students can click on each job to read more detail	game outside
Midline survey	Perceived constraints of attending high school; quizz: interpreting graph with costs of education		
SCHOOL INFORMATION SESSION	Detailed information on high schools and vocational training, including costs involved and available scholarships		
Endline survey	Questions capturing information retention; aspirations and expectations on education and career path		

familiar (such as teacher, police officer or doctor) as well as jobs that might be outside the usual reference window but still relevant in the context (such as agricultural technician, chef, or architect). Students can decide how much time to spend reading about each job. They have a total of 17 minutes to read through the job descriptions that they are interested in, but can also log out earlier.<sup>6</sup>

The last part, the information session, provides detailed information on high schools and vocational training centers in the area, about the requirements and costs of attending either institution, as well as scholarship possibilities. This session is conducted in person and interactively.<sup>7</sup>

In addition, three surveys are conducted with all students at the beginning, the middle, and the end of the workshop and capture the socio-economic background, believed costs, and constraints to attend high school as well as education- and work-related aspirations. At the end of the workshop, all students receive a leaflet with the jobs featured in the CET. Furthermore teachers receive a poster on educational

<sup>6</sup> For more detail on the CET, see Appendix B.3.2 and chapter 2.

<sup>7</sup> For more detail on the information session, see Appendix B.3.3.

pathways that was discussed during the information session and are encouraged to hang it up in the students' class room.

## 3.5. Implementation and Data

### 3.5.1. Timeline and Sample Composition

We collaborated with a local NGO called Child's Dream (CD) that offers high school scholarships, for which students in grade 9 can apply. Child's Dream partners with 51 lower secondary schools in eight districts across four provinces (Battambang, Banteay Meanchey, Oddar Meanchey, and Siem Reap) in Northwest Cambodia. For our study, we sampled all 39 schools that had a partnership with Child's Dream and a class size in grade 9 above 30.<sup>8</sup> We expanded the sample by including 21 additional schools from different districts in the same provinces that were similar in characteristics to the Child's Dream partner schools. From these sixty schools, thirty were randomly assigned to receive the treatment (i.e. the half-day workshop), the remaining thirty served as control.<sup>9</sup> The randomization was stratified by district. Figure 3.1a depicts the location of the initial sample of treatment and control schools.

The implementation of the intervention started mid-February 2020. By the beginning of April, the intervention was supposed to have been implemented in all thirty treatment schools.<sup>10</sup> However, on March 16, 2020, the Cambodian government announced to close all schools as a measure to prevent the spread of COVID-19. By that time we had conducted the intervention in 18 schools across eight districts.

Figure 3.2 depicts the timeline of the data collection and the sample composition.<sup>11</sup> We focus on the 18 treatment schools, where the intervention had been implemented, and the 18 control schools that are located in the same districts (see Figure 3.1b for the geographical location of these schools). In November 2019, there were in total 861 students in the treatment and 802 students in the control schools in the selected grade 9 classes. We collected administrative data for all students, in particular gender, age,

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<sup>8</sup> In very few cases, the class size was below 30 but there was more than one class in grade 9. We combined two classes with each less than 30 students in these cases.

<sup>9</sup> For those schools that had more than one class in grade 9, we randomized the class that would receive the treatment in case of treatment schools (or serve as control in case of control schools).

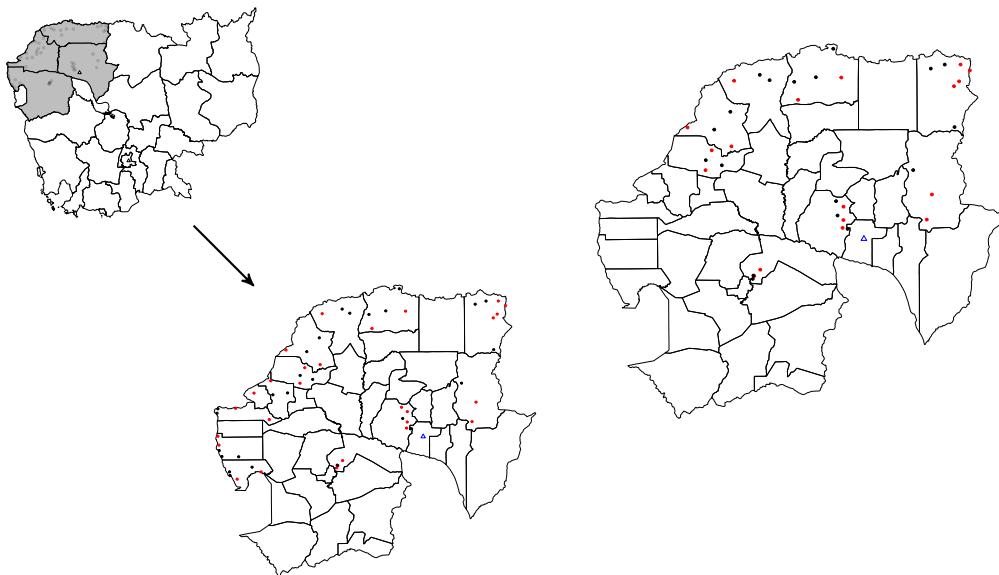
<sup>10</sup> As we were interested in the impact of the intervention on scholarship applications, the intervention was timed such that it would take place before the application deadline for the Child's Dream scholarships.

<sup>11</sup> There is one fewer observation for the intervention in  $n_{A2}$  than in Figure 1.2 and in chapter 2 because one student changed from a treated to a non-treated class after the intervention.

Figure 3.1.: Location of Treatment and Control Schools (Marked Red and Black Respectively)

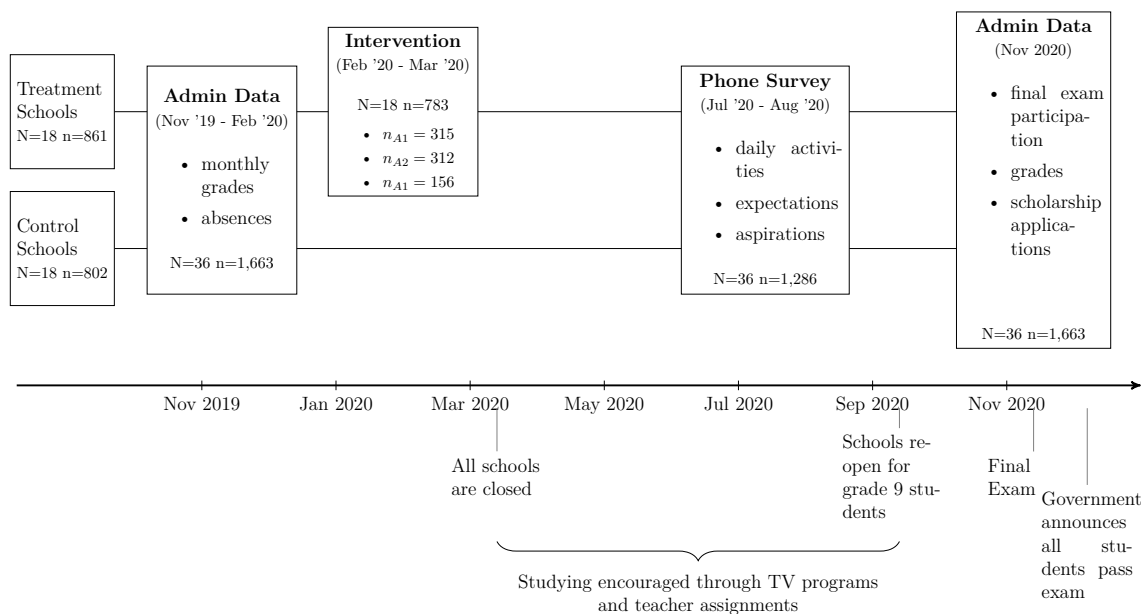
(a) Selected Sample

(b) Final Sample



*Notes:* Panel (a) shows the entire map of Cambodia in the upper left, highlighting the four provinces of interest in gray. The lower right map zooms into the four provinces, shows the border of the districts, and contains the initial treatment and control schools marked in red and black respectively. Panel (b) is again the same map extract this time highlighting the treatment and control schools in red and black respectively for the final sample.

Figure 3.2.: Timeline of the Data Collection



*Notes:* This timeline is based on Figure 1.2, excluding the 18 remaining schools which are not relevant for the analysis of the intervention.

village of residence, as well as grades and absences for the months before the intervention was conducted.<sup>12</sup> Furthermore, we collected teacher and school characteristics. Student and school characteristics are overall well balanced between treatment and control schools with the exception of one subject specific grade as well as the teacher's age and number of years working at the school (see Tables B.2.1.1 and B.2.1.2). We therefore control for grade information and teacher characteristics in the analysis.

For the 18 treatment schools, 783 students took part in the intervention out of the 861 invited students.<sup>13</sup> Randomization into the treatment arms was unfortunately not successful (see Table B.2.1.3). Students in the treatment arm A3 (i.e. students that participated in the information session only) are more likely to be female, were performing overall better and were less likely to be absent prior to the intervention

<sup>12</sup> In the analysis, we focus on subject-specific and total grades for the months December 2019 and January 2020, as grade information for November 2019 (when the school year started) was not available from all schools.

<sup>13</sup> Students were informed about the workshop several days beforehand and they were told that they were free to participate or not. Students that did not show up on the day of the workshop had overall worse school performance and were more days absent in the months before the intervention. During the workshop, in total five students left before the end. In the following analyses, we keep these five students as 'treated'; results do not change if these students are excluded.

as compared to students in the treatment arms A1 or A2.<sup>14</sup> In the following, we will therefore refrain from any analyses comparing the different treatment arms but only investigate the impact of the intervention overall.

In July to August 2020, we conducted a follow-up survey on the phone. We reached 77% of the students (n= 1,286). At that time, schools were still closed in Cambodia due to COVID-19. In the phone survey, we asked students about their daily activities, their expectations and aspirations in terms of education and future careers. Participation in the phone survey was not random; in particular, female students and students who performed better in school are more likely to have participated in the phone survey. We therefore reweight all survey-based outcomes in our analysis by the inverse of the probability of participating in the phone-survey (see Appendix B.4 for more details).

Schools remained closed for ninth-graders until September. Throughout school closure, students were encouraged to study on their own with grade-specific TV programs. Furthermore, teachers were responsible for providing students with additional content and assignments.<sup>15</sup> Schools reopened in September so that students could prepare for their final exam, which would determine whether students are able to continue to go to high school. The final exam was conducted end of November 2020. After the final exams were graded, unexpectedly, the government announced in December that all students who had registered for the final exam obtained the status of having passed the exam independent of their grade, also meaning that they were allowed to transition to high school.

We collected information on participation in the final exam and performance. Furthermore, we collected data on scholarship applications from those schools that partner with Child's Dream.

### 3.5.2. Descriptive Statistics

Table 3.2 presents students' background characteristics as well as the main outcome variables. This information is based on our three main data sources: administrative data collected for all students in our sample before and after the intervention (n=1,663), information from a baseline survey that was only administered to the stu-

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<sup>14</sup> It is not clear why randomization was unsuccessful. Neither students nor research assistants were able to manipulate students' treatment status. Participants had blindly drawn from a box the participant badge with a number that determined treatment status, the number was directly recorded and could not be changed during the workshop. Likely it was just bad luck.

<sup>15</sup> In a separate study, we show that learning activities varied greatly across students (see chapter 4).

dents participating in the intervention (n=783), as well as information from the phone survey that was conducted with students in treatment and control schools (n=1,286).

Table 3.2.: Summary Statistics

Variable	(1) Mean	(2) Median	(3) SD	(4) Min	(5) Max	(6) Obs.
ADMIN CHARACTERISTICS (PRE) - COMPLETE SAMPLE						
Female	0.53	1.00	0.50	0.00	1.00	1663
Age	15.07	15.00	1.33	11.00	22.00	1663
Distance to school (km)	3.56	2.19	3.83	0.00	24.53	1663
Distance to district town (km)	11.29	9.28	7.57	0.11	33.74	1663
Distance to high school (km)	9.60	7.94	6.90	0.06	31.42	1663
BASELINE CHARACTERISTICS - TREATED STUDENTS						
Num siblings	2.58	2.00	1.88	0.00	22.00	777
Owns smartphone	0.43	0.00	0.50	0.00	1.00	778
Owns bicycle	0.71	1.00	0.46	0.00	1.00	778
Owns moto	0.41	0.00	0.49	0.00	1.00	778
Can use family moto	0.82	1.00	0.39	0.00	1.00	778
Parents are farmers	0.78	1.00	0.42	0.00	1.00	783
Mother or father high educ job	0.09	0.00	0.28	0.00	1.00	783
FOLLOW-UP CHARACTERISTICS - PHONE SURVEY						
Father education < primary	0.69	1.00	0.46	0.00	1.00	1133
Mother education < primary	0.82	1.00	0.39	0.00	1.00	1206
Worked last 7 days	0.58	1.00	0.49	0.00	1.00	1283
Keep studying	0.44	0.00	0.50	0.00	1.00	1258
Application for scholarship	0.23	0.00	0.42	0.00	1.00	1258
Wants to return to school	0.98	1.00	0.13	0.00	1.00	1284
Aspires at least higher secondary	0.96	1.00	0.19	0.00	1.00	1275
Believes to reach preferred educ level	0.42	0.00	0.49	0.00	1.00	1252
Aspires job with high school requirement	0.92	1.00	0.27	0.00	1.00	1250
Believes to reach preferred job	0.39	0.00	0.49	0.00	1.00	1247
ADMIN CHARACTERISTICS (POST) - COMPLETE SAMPLE						
Application for CD scholarship	0.16	0.00	0.37	0.00	1.00	1266
Dropout by October (teacher report)	0.04	0.00	0.20	0.00	1.00	1663
Dropout grade 9 (not participating in final exam)	0.13	0.00	0.34	0.00	1.00	1663
Final total grade	321.10	310.00	65.46	122.00	520.00	1444

*Notes:* Population means, median, standard deviation, minimum and maximum, as well as the number of observations are provided for each characteristic. The final total grade excludes students who scored 0 or did not write the exam.

Students in our sample are on average 15 years old at the time of the intervention. They live in rural areas – approximately eleven kilometers away from the district town. Students need to travel on average 3.5 kilometers to their school; the high school that they would attend is, however, further away: on average about ten kilometers. Less than half of the students owned a smartphone at baseline, an important pre-requisite for remote learning. The vast majority of parents are farmers (78%), less than 10% of the children have a mother or a father who works in a job that would require higher education. In the follow-up survey we asked students explicitly about their parents’

education. From those students that knew their parents' education level, 69% (82%) report that their father (mother) had less than primary education.

In terms of students' activities during school closure, 44% of the students strongly agreed with the statement "I kept studying during school closure" and 58% report to have worked for pay in the last 7 days. Of the surveyed students, 23% reported to have applied for any high school related scholarship. This could be either the one from Child's Dream, which was available at 75% of the schools in our sample, a scholarship provided by the Cambodian government, or other scholarships from locally operating NGOs. From the administrative records of Child's Dream, we can infer that, of all the students who had access to a CD scholarship (n=1,266), only 16% applied for it.

Nearly all students were planning to return to school once they reopened and the vast majority (96%) reported to aspire to complete higher secondary education. However, a considerably smaller proportion (42%) stated that they expect to actually reach the aspired education level. Similarly, while a very large proportion aspires a job that would require higher secondary education (92%), only two out of five believe it to be likely that they would reach their preferred job.

Students' aspirations and expectations are likely negatively impacted by school closure as students did not know if and when schools would reopen by the time of the phone survey. To analyze this, we can compare aspirations and expectations of treated students before and after school closure, which were elicited both at the end of the workshop as well as in the phone survey. Indeed, there is a clear shift (see Figure B.1.1.1). While, interestingly, the proportion of students that aspire to complete at least high school increased during school closure, the share of students who expects to reach the preferred education level fell from 77% to 42%. Similarly, the share of students that expects to obtain their most preferred job reduced by nearly half (from 79% to 41%). The COVID-19 crisis thus seems to have drastically reduced students' expectations both in terms of educational attainment and in terms of career opportunities.

We have two sources of information on students' dropout. First, teachers reported whether students had returned to school by October 2020. According to these reports, only 4% of the students had not returned to school. However, teachers likely under-report dropout during the school year due to worries that this might impact school resources. We therefore use as the main indicator of dropout whether students participated in the final exam and thus completed the academic year. Of our targeted students, 13% did not show up for the exam. For those that participated in the exam, most students did surprisingly well. Students normally need 260 points to pass the

exam and the vast majority is above this threshold. However, when looking at the distribution of the final exam grades (see Figure B.1.2.1), it becomes apparent that there was likely considerable manipulation by the teachers, as a large proportion of students received just above 260 points.

### 3.5.3. Information Retention

During the school information session, we provided detailed facts about schooling, in particular the information on costs of schooling and jobs. Did students retain the information?

We can analyze (updating in) cost beliefs both in the short and the long run. Before and immediately after the information session we asked treated students about the estimated distance to the next high school and the estimated costs associated with high school, both in terms of overall costs as well as in terms of costs associated with different items, such as material, transportation and extra classes.<sup>16</sup> We find that, in the short-run, students indeed seem to adjust their beliefs towards the true costs after having participated in the workshop (see Figure B.1.3.1).

We find however less information retention in the long-run. In the follow-up survey, four to five months after the intervention, students were asked to provide an estimate for the total costs of attending high school. Furthermore, they were asked which cost item of attending high school was most costly, and to provide an estimate for this specific item (materials, transportation, extra classes). We find that treated students are not more accurate in their estimates of the costs of high school or of extra classes (which most students believed to be the most expensive item) than students in control school (Table B.2.2.1, columns 1-4). However, treated students are more likely to provide a cost estimate at all and they are more likely to correctly state the most expensive cost item of attending high school (Table B.2.2.1, columns 5-8).<sup>17</sup>

It is more difficult to assess whether students retained information on the jobs they were presented with. In the follow-up survey, we asked students only about their most favorite job which might not necessarily capture the range of different jobs students

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<sup>16</sup> Note that regarding transportation we only provided students with information on average costs based on the distance from the lower secondary school to the high school. We also did not provide them with information on total high school costs as this might differ from student to student, depending on how far away a student lives from high school and whether she would attend extra classes. In the following analysis, we calculate the ‘true’ total costs of high school as the sum of costs for material, extra classes, as well as for transportation based on the distance from the student’s village of residence to the next high school. In the analysis, we control for students’ individual distance to high-school as well as school performance.

<sup>17</sup> Depending on the student’s location this could be transportation or costs of extra classes.



are aware of. We do not find that treated students are more likely to aspire to a job that has been featured in the intervention (Table B.2.2.2, columns 1-2). Indeed, most of the treated and control students mention lower-secondary teacher, military/soldier, primary teacher, or police officer which are also the jobs mentioned by most students in the pilot study (see Figure B.1.3.2). However, we find that treated student assess the chances higher that they would be able to get the job they prefer, potentially as they are now more familiar with the job requirements (Table B.2.2.2, columns 3-4).<sup>18</sup>

Thus overall, the results are mixed. There has been an update in cost beliefs, but only in the short- not in the long-run. Treated students, however, feel more comfortable in providing a cost estimate and seem to have a better sense of what is the most expensive cost item related to attending high school. Similarly, while the intervention did not make students change their most preferred jobs, it seems to have made treated students more confident in being able to reach their preferred job. However, even with little information retention, the workshop might still have affected schooling decisions, as it aimed to boost motivation more generally.

## 3.6. Empirical Analysis

### 3.6.1. Empirical Approach

In order to analyze whether our intervention affected schooling decisions, we focus on four main outcomes and link these to the treatment status of students. First, we analyze whether students continued to study during school closure. Second, we study if students worked during school closure, as this has been shown to be one of the main determinants of later dropout (Chhaing, 2021). Both outcomes are based on the students' reports in the phone survey. Third, we examine students' high school scholarships applications using the administrative records of Child's Dream. Finally, we study whether students dropped out of school using information on students' participation in the final exam.<sup>19</sup>

For the main analyses, we estimate the following specification:

$$Y_{ijd} = \beta_0 + \beta_1 T_j + \beta_2' X_{ijd} + \xi_d + \epsilon_{ijd} \quad (3.1)$$

<sup>18</sup> Note that both lower-secondary teacher and police officer were featured in the CET.

<sup>19</sup> In a pre-analysis plan, we have pre-specified to analyze studying during school closure, dropout and final exam performance (Gehrke et al., 2020a). Given the apparent manipulation in the grading, final exam performance is not further analyzed.

where  $Y_{ijd}$  is each of the outcomes of interest for student  $i$  in school  $j$  in district  $d$ .  $T_j$  is a dummy equal to one if the intervention was implemented in school  $j$  and zero otherwise.  $X_{ijd}$  is a vector of student and school characteristics prior to the intervention. Student characteristics include gender, age, distance from home village to the school, distance to the district town as well as total grades averaged over the months before the intervention. School characteristics include the teacher's age, gender, years of experience, educational degree and distance to the school, as well as class size, subject-specific grades prior to the intervention averaged over all grade 9 students and an indicator on whether the school is partnering with Child's Dream.  $\xi_d$  are district fixed effects.  $\epsilon_{ijd}$  is the idiosyncratic error term. Standard errors are corrected for clustering within schools. All survey based outcomes in our analysis are reweighted using the inverse probability of participating in the survey.<sup>20</sup>

As not all students in treatment schools did participate in the intervention (in total 78 of the 861 students that were targeted did not show up), we estimate the treatment effects in two-stage least squares and instrument treatment with the assigned treatment status.

### 3.6.2. Results

Results are presented in Tables 3.3 and 3.4. In column (1) we present the effect of the intervention without controlling for any additional characteristics. In the remaining columns, district fixed effects (2), school (3) and student controls (4) are added stepwise.

We find that our intervention had no effect on any of our outcome variables on average. Students who participated in our intervention are not more likely to have studied during school closure nor are they more likely to have participated in the final exam. If at all, our intervention seems to have increased the likelihood that students are working for pay (Table 3.3, Panel B) and reduced scholarship applications (Table 3.4, Panel A). Tables B.2.3.1-B.2.3.2 report the intention to treat effects, *i.e.* the impact of our intervention on those assigned to the treatment, which confirm our main results.

Previous research has shown that the effectiveness of information intervention can depend on students' school performance (Damgaard and Nielsen, 2018). Indeed, information about higher education and related career paths might only motivate students that already perform well in school. Table 3.5 reports results of interacting treat-

<sup>20</sup> See Appendix B.4 for a description of the weighting procedure.

Table 3.3.: Impact of the Intervention on Activities during School Closure

	PANEL A				PANEL B			
	Studying during school closure				Working during school closure			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Treated	-0.011 (0.043)	-0.015 (0.040)	-0.034 (0.029)	-0.038 (0.037)	0.009 (0.046)	-0.013 (0.032)	0.042 (0.029)	0.062 (0.024)**
Observations	1258	1258	1258	1258	1283	1283	1283	1283
Control Mean	0.4347	0.4347	0.4347	0.4347	0.5712	0.5712	0.5712	0.5712
District FE		✓	✓	✓		✓	✓	✓
School Controls			✓	✓			✓	✓
Individual Controls				✓				✓

Notes: 2SLS Estimators. Standard errors are depicted in parentheses and clustered at the school level. Estimations of survey-based outcomes weighted with inverse probability weights. *Treated* (i.e. participation in the intervention) instrumented by assigned treatment status. School Controls include teacher characteristics (age, gender, experience, and educational degree); Child’s Dream partnership; class size; Khmer, English, and Math grades prior to intervention averaged over all grade 9 students per school. Individual Controls include gender, age, distance to school, distance to district town, and average total grades prior to intervention. \*/\*\*/\*\* denote significance levels at 10/5/1 percent respectively.

Table 3.4.: Impact of the Intervention on Scholarship Application and Dropout

	PANEL A				PANEL B			
	Scholarship application (admin)				Dropout final (admin)			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Treated	-0.078 (0.071)	-0.102 (0.054)*	-0.059 (0.042)	-0.057 (0.043)	0.015 (0.034)	0.012 (0.028)	0.009 (0.028)	-0.006 (0.034)
Observations	1266	1266	1266	1266	1663	1663	1663	1663
Control Mean	0.2023	0.2023	0.2023	0.2023	0.1247	0.1247	0.1247	0.1247
District FE		✓	✓	✓		✓	✓	✓
School Controls			✓	✓			✓	✓
Individual Controls				✓				✓

Notes: 2SLS Estimators. Standard errors are depicted in parentheses and clustered at the school level. Estimations of survey-based outcomes weighted with inverse probability weights. *Treated* (i.e. participation in the intervention) instrumented by assigned treatment status. School Controls include teacher characteristics (age, gender, experience, and educational degree); Child’s Dream partnership; class size; Khmer, English, and Math grades prior to intervention averaged over all grade 9 students per school. Individual Controls include gender, age, distance to school, distance to district town, and average total grades prior to intervention. \*/\*\*/\*\* denote significance levels at 10/5/1 percent respectively.

ment status with a student’s performance prior to the intervention, for which we create a dummy that equals one if the student is in the top-half of her class based on her performance before the intervention. Again, we control for school and student characteristics as well as district fixed effects. We find clear differential effects. Low-performing students who took part in our intervention are 12 percentage points less likely to study during school closure, 10 percentage points more likely to work and 8 percentage points less likely to apply for a scholarship compared to low-performing students that did not take part in the intervention. The overall null effect thus masks

an unintended negative effect of the intervention on low-performing students.<sup>21</sup>

Table 3.5.: Impact of the Intervention by School Performance

	Studying during school closure		Working during school closure		Scholarship application		Dropout final	
Treated	-0.038 (0.037)	-0.122 (0.042)***	0.062 (0.024)**	0.101 (0.044)**	-0.057 (0.043)	-0.080 (0.041)*	-0.006 (0.034)	-0.020 (0.046)
Good Student		0.041 (0.034)		0.029 (0.042)		0.030 (0.051)		-0.087 (0.035)**
Treated x Good Student		0.154 (0.056)***		-0.076 (0.059)		0.046 (0.064)		0.033 (0.043)
Observations	1258	1258	1283	1283	1266	1266	1663	1663
Control Mean	0.4347	0.4347	0.5712	0.5712	0.2023	0.2023	0.1247	0.1247
District FE	✓	✓	✓	✓	✓	✓	✓	✓
School Controls	✓	✓	✓	✓	✓	✓	✓	✓
Individual Controls	✓	✓	✓	✓	✓	✓	✓	✓

*Notes:* 2SLS Estimators. Standard errors are depicted in parentheses and clustered at the school level. Estimations of survey-based outcomes weighted with inverse probability weights. *Good Student*: student was better than median student in her class prior to intervention. *Treated* (i.e. participation in the intervention) instrumented by assigned treatment status. School Controls include teacher characteristics (age, gender, experience, and educational degree); Child's Dream partnership; class size; Khmer, English, and Math grades prior to intervention averaged over all grade 9 students per school. Individual Controls include gender, age, distance to school, distance to district town, and average total grades prior to intervention. \*/\*\*/\*\* denote significance levels at 10/5/1 percent respectively.

We conduct a number of robustness checks. First, we study whether the average null effect might be driven by spillovers to control students. In particular, as randomization was stratified by district, students attending control schools could in principle live relatively close to treatment schools and thus be in contact with treated students. If students that attended our workshop shared the findings and the experiences they made with students attending control schools, our intervention might have affected students from treatment and control schools, thus muting any major differences in outcomes between treatment and control schools. In order to analyze potential spillovers, we regress our main outcome variables on the distance between control students' home village and the next treatment school. Results are reported in Tables B.2.4.1 and B.2.4.2, mimicking the structure of Tables 3.3 and 3.4 but using the (logarithmized) distance to the next treatment school instead of treatment status as explanatory variable. While there is a positive correlation between distance to the next treatment school and studying or working during school closure without controlling for any other school or student related variables, this correlation disappears once additional controls are included. Overall, the results suggest that it is rather unlikely that spillovers can explain the average null effect.

Second, we use two alternative measures that we have available for scholarship application and drop out, namely whether students reported in the survey that they

<sup>21</sup> Table B.2.3.3 report the intention to treat effects; coefficients are slightly smaller but remain significant.

had applied for a high school scholarship and whether they came back to school in October according to the teachers' reports. Our results hold and become considerably more pronounced for the self-reported scholarship applications (see Table B.2.4.3). Students that took part in the intervention are, depending on the specification, between 23% and 39% less likely to have applied for a high school scholarship, confirming the suggestive negative effect we find when using the administrative data from Child's Dream. Again the effect is driven by low-performing students (Table B.2.4.4, Panel A). There is no effect on dropout (Panel B).

Third, we analyze the survey outcomes without survey weights to ensure that our results are not driven by the weighting procedure. We can replicate the main findings, the interaction effects become more pronounced (see Table B.2.4.5). In addition, we can control for interviewer and survey date by including interviewer and survey-week fixed effects for all survey outcomes. Our results remain unchanged (see Table B.2.4.6).

Fourth, as the number of clusters is relatively small ( $N=36$ ), we conduct wild bootstrap clustered at the school level using Rademacher weights with 999 replications (Roodman et al., 2019). Results are reported in Tables B.2.4.7 - B.2.4.9. The significance levels on all coefficients remain unchanged, with the exception of the heterogeneous treatment effect on scholarship application, which turns insignificant.

Finally, we study whether our findings on the heterogeneous effects by school performance are just spurious correlations driven by confounding variables. For instance, parental education rather than school performance, which is likely correlated with parental education, might drive our results. First, we analyze potential correlates of school performance by regressing a number of relevant variables on school performance while controlling for student's age, gender and district fixed effects. Results are shown in Table B.2.4.10. Neither remoteness of the student's village (in terms of distance to the school or next district town) nor occupation of the parents, smartphone availability in the household or the extent to which parents were affected by COVID-19 are significantly correlated with school performance. However, we find that students who belong to the bottom half of the grade distribution in their class are more likely to have parents with less than primary education. We therefore repeat our analysis by also including the interaction between parental education and treatment. Note that we can only carry out this analysis for the students who participated in the phone survey and reported information on their parents' education; it is thus a selected sample. Results are reported in Table B.2.4.11. All our results that include interaction effects are robust to controlling for parental education and its interaction with treatment status. In general, parental education does not seem to explain any additional varia-

tion in treatment effects with the exception of scholarship application: students whose parents have less than primary education are less likely to apply for a scholarship if they participated in the workshop. This comes in addition to the negative treatment effect for low-performing students.

### 3.6.3. Discussion

In summary, we find that our intervention had little effect on schooling decision and, if at all, it reduced scholarship applications and increased the likelihood that a student worked for pay. We show that these negative effects are driven by low-performing students, who are less likely to study during school closure, less likely to apply for scholarships and more likely to work. In the following, we briefly discuss what could drive these results.

Our intervention seems to have changed the perceived net benefits of higher secondary versus lower secondary education for low-performing students. Given the design of our workshop there are two potential channels.

First, the information on costs associated with high schools might have discouraged low-performing students. This effect could be particularly pronounced if low-performing students systematically underestimate the costs of higher education. Learning about the true costs of attending high school, low-performing students would then have needed to adjust their beliefs upwards. As a consequence, attending high school might seem less attractive to low-performing students, in particular given the substantial amount of effort they would need to put into schooling. Indeed, we find that low-performing students are more likely to estimate lower costs of schooling at baseline (see Table B.2.5.1). However, there seems to have been only limited cost updating. Cost estimates in the follow-up do not differ by treatment status nor by school performance, neither for the total costs nor for the costs of extra classes, which most students mention as most expensive part of attending high school (see Table B.2.5.2). Thus, it is unlikely that (solely) the cost information that we provided is driving our results.

Second, the provision of information on jobs that do not require high school as well as on vocational schools might have made the alternatives to pursuing high school and the associated benefits more salient. These alternatives could be perceived as particularly relevant by low-performing students. Indeed, when analyzing reading behavior in the CET, we see that there is a strong correlation between school performance and types of jobs at which students look (see Table B.2.5.3). In particular, low-performing

students spend more time reading about jobs that only require lower-secondary education. In the follow-up survey, low-performing treated students are not more likely to aspire lower education or jobs that require less than high school education than their low-performing peers in control schools. Still, they are more likely to expect that they will only be able to complete lower secondary school (see Table B.2.5.4).

It thus seems that by allowing students to engage with their own interests and by providing them with information about jobs that can be pursued without a high school degree, we might have made low-performing students aware of alternative career paths. While these jobs might not be the students' most preferred ones, they might be potentially a better match in terms of skill requirements.

### 3.7. Conclusion

We examine how providing students with information – about their own personality, potential careers and educational pathways – affects their educational decisions. We find that our intervention had no effects for high-performing students, yet negative effects for low-performing students. Treated low-performing students are less likely to apply for a high school scholarship, less likely to study and more likely to work during school closure. We find suggestive evidence that our intervention made low-performing students aware of alternative career paths and more realistic in terms of what they can achieve.

While our intervention was designed to retain students at school, it had the opposite effect for low-performing students. Even though this was not intended, it could have positive implications in the long-run. First, low-performing students, who took part in our intervention and adjusted their expectations with respect to higher education, are potentially less frustrated in the future. The negative implications of a too large gap between aspirations and expectations and of the resulting frustration has been pointed out theoretically in Genicot and Ray (2017). In the context of schooling, Goux et al. (2017) show that helping low-performing students forming more adequate objectives can increase motivation and reduce dropout. Second, interventions like ours might be able to reduce the skill miss-match that has been documented recently in the context of Cambodia. In particular, skill supply is often not adequate to meet the labor demand (Sam, 2018b). Not being adequately skilled in a more demanding environment does not only have economic consequences but can similarly lead to frustration and dis-engagement (Stinebrickner and Stinebrickner, 2014). Providing information about

alternative career paths that might be a better match to students' individual skills can prepare them for the labor market and reduce frustration in the long run.

Our study comes with a number of caveats. First, due to the school closure our sample size is very small and we are thus potentially under-powered to detect average treatment effects. Second, the study was (unintentionally) conducted during a very specific time period. Just as the intervention was interrupted midway, schools were closed for half a year and students had to study on their own with little external support. Although there were very few reported cases of COVID-19 infections in Cambodia in 2020, the global economic recession and travel disruptions had severe repercussions on the households. Many students reported that their parents lost income or even their job due to the crisis (see chapter 4). Students were thus facing severe financial constraints. This might have likely undermined a potential positive effect of the intervention. Finally, we are looking at short-term effects only, collected 5-9 months after the intervention was conducted. We do not observe what students are doing in the long run, whether they continue to work, what type of jobs they pursue, which students actually transition to high school, and (even more importantly) which students stay in high school despite a repeated school closure in 2021. This is an avenue for future research.



# 4. COVID-19 crisis, Economic Hardships, and Schooling Outcomes\*

*with:*

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## 4.1. Abstract

We combine phone-survey data from 2,200 students collected in July-August of 2020 with student-level administrative data from 54 schools in four Northwestern provinces of Cambodia to investigate the implications of the COVID-19 pandemic for grade 9 students. These students were particularly vulnerable to dropping out of school prematurely due to the crisis. We find that most students kept studying during the crisis, and returned to school to participate in the lower-secondary graduation exam after schools reopened. However, we also find that the parental exposure to the economic downturn had substantial effects on students: Paternal income shocks had a negative effect on studying during the crisis, as well as on participation and performance in the final exam. Maternal income shocks, in contrast, seem to have benefited studying during the crisis and participation in the final exam, potentially because mothers used the time at home to encourage their children to study.

**Keywords:** COVID-19; Schooling; Cambodia

**JEL:** I18; I25; O12

## 4.2. Introduction

The COVID-19 pandemic has forced governments around the globe to adopt severe measures to slow down the spread of the virus. In March 2020, schooling was put to an abrupt halt in almost every country of the world, forcing roughly 1.6 billion students out of school and into remote learning (United Nations, 2020).

For students from developing countries, the implications of the COVID-19 pandemic are expected to be particularly severe. On the one hand, students face more difficulties in accessing learning material. Schools are less likely to offer online education, and students often do not own the equipment or have the internet connection necessary to participate in remote learning activities (United Nations Children's Fund and International Telecommunication Union, 2020). On the other hand, the economic hardships these children are exposed to are more taxing: Globally, the pandemic is threatening to push between 71 and 117 million people into extreme poverty (Lakner et al., 2020). In many developing countries, the economic fallout of the crisis is immense (Egger et al., 2021). And as poverty deepens, parents lack the financial resources to finance education, while more and more children have to enter the labor force in order to support their families financially (Jacoby and Skoufias, 1997; Jensen, 2000; Beegle et al., 2006; Duryea et al., 2007; Bjorkman-Nyqvist, 2013).

The situation in Cambodia, the context of our study, is similar to the COVID-19 related developments in many other countries of the Global South. Cambodia was only moderately affected by the virus itself in 2020. By the end of the year, 366 cases of COVID-19 had been registered in the entire country (Roser et al., 2020).<sup>1</sup> Nonetheless, schools remained largely closed between March and November 2020 in order to contain the outbreak. Similar to other countries, the government of Cambodia set up a system of remote learning for the period of school closure, consisting mainly of educational programs on television. Meanwhile, the global economic recession and travel disruptions due to COVID-19 have had drastic repercussions for the economic situation of many households in the country, as the economy relies heavily on small-scale manufacturing, international tourism and remittances from Cambodians working abroad (Takenaka et al., 2020; World Bank Group, 2020b). Whether students who were confronted with increasing poverty continued their studies during school closure and were able to return to school once these reopened remains largely unknown.

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<sup>1</sup> Our empirical analysis focuses on the first school closure between March 2020 and November 2020. In 2021, the country has been hit by a severe second wave with much higher infection rates. Schools have been closed again in early 2021 and remain closed at the time of writing.

In this paper, we investigate the implications of the COVID-19 pandemic for schooling outcomes of grade 9 students in Northwest Cambodia, focusing on the impact of the economic downturn. Grade 9 students were particularly vulnerable to dropping out of school because of the pandemic, as grade 9 is the final grade of lower-secondary school and the last year of compulsory schooling in Cambodia. Furthermore, during grade 9 most students turn 15, which is the official minimum working age in Cambodia. The performance in the final exam of grade 9, the lower-secondary diploma examination, determines admission to the subsequent education level (high school).

We combine student-level administrative data that cover the entire (prolonged) school year (November 2019 to November 2020) – obtained from 54 schools across four provinces in Northwest Cambodia – with phone-survey data collected during July–August 2020. Our final sample consists of 2,197 grade 9 students. In the phone survey, we collected information on students’ study behavior, the type of remote learning activities in which students were engaged, time-use, COVID-19 perceptions, as well as some family characteristics (parental education and occupation before the COVID-19 outbreak and migration history in the family). The administrative data contain student characteristics, subject-specific monthly grades for the months December 2019 to February 2020 (pre-crisis), as well as participation and performance in the final exam, which was conducted in person in November 2020.

In our empirical analysis, we examine whether parental exposure to the economic repercussions of COVID-19 (measured by the fraction of adults in a specific economic sector for whom students reported COVID-19 related income losses) affected child schooling. In terms of outcomes, we focus on learning incidence during the period of school closure (student studied in the last 7 days), on participation in the final exam (which indicates that the student did not dropout before the end of the academic year), and on performance in the final exam (if the student belonged to the group of best performing students). We find that parental exposure to the economic downturn associated with COVID-19 had important effects on schooling outcomes. A higher probability that the father experienced an income shock (weakly) reduced studying during school closure, and reduced participation in the final exam and the likelihood that a student ranked among the top students in the final exam. On the other hand, a higher probability that the mother experienced an income shock increased studying during school closure and participation in the final exam, yet had a (statistically not significant) negative effect on performance in the final exam.

These findings suggest that income losses experienced by fathers had severe financial implications for households, forcing students to drop out of school prematurely.

Indeed, students whose father worked in a sector that was more severely hit by the crisis were more likely to report COVID-19 related financial worries and were more likely to work for pay as their main activity. In contrast, income shocks experienced by the mother seem to have benefited students' schooling. We examine three different mechanisms that could explain a positive effect of the maternal shock but cannot conclusively determine which one is driving the observed pattern. The most plausible explanation seems to be that mothers who experienced an income shock spent more time at home and used this time to encourage their children to invest in their education.

Our study contributes to the emerging literature that seeks to understand the impact of the COVID-19 pandemic on student learning in three important aspects. *First*, to the best of our knowledge we are the first to combine survey data with administrative data. This allows us to compare reported behavior with recorded learning outcomes and to control for pre-crisis school performance. Administrative data is so far mostly available from high-income countries, and is used to shed light on learning losses and dropout during school closures.<sup>2</sup> The only evidence available so far from low- or middle-income countries that makes use of administrative data is from Brazil; it suggests that the rate of student dropout among high-school students is about two and a half times higher than in pre-crisis years (Lichand and Christen, 2021).

*Second*, our survey data is based on students' accounts directly, while most of the existing survey evidence is based on information collected from parents or other adult household members which is inherently imprecise and needs to be interpreted with caution.<sup>3</sup> The few research teams that were able to speak with students directly focus on high school students exclusively. Asanov et al. (2021) document that a vast majority of surveyed high school students in Ecuador were actively engaged in learning activities during school closure, yet students from lower socio-economic backgrounds faced more difficulties in accessing learning material and were more likely to be working for a

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<sup>2</sup> Engzell et al. (2021) estimate substantial learning losses among primary school children after a short school closure (8 weeks) in the Netherlands, with students from low-income backgrounds and with lower initial performance having experienced the largest learning losses. Similar patterns of learning losses are documented for England, Belgium and the United States (Rose et al., 2021; Maldonado and De Witte, 2020; Bielinski et al., 2020).

<sup>3</sup> For example, Furbush et al. (2021) and Koos et al. (2020) use data from World Bank High-Frequency Phone Surveys to document large variation in learning during the lockdown across Sub-Saharan African countries, with learning incidence varying between 17% and 62% at the country level. Similarly, IPA's RECOVR surveys also unveil substantial variability across countries, with just 35% of secondary-school aged children having engaged in any learning activity between March and May 2020 in Zambia, as compared to 96% of secondary-school aged children in Colombia (Warren, 2020).

substantial part of the day. In a comparative study across four developing countries, Favara et al. (2021) show substantial variation in learning activities among 19-year olds who were still enrolled in school before the crisis. Learning incidence during the lockdown was at 80% in Vietnam and Peru, but only at 10% in Ethiopia. The same data also indicate that a considerable share of students was not intending to continue their education after the lockdown period.

*Third*, the existing literature on the implications of COVID-19 for student learning focuses exclusively on the effect of the school closures. Our data allows us to assess the impact of the economic shock associated with COVID-19 on learning outcomes, and to document the severe fallout school-aged children had to face due to the economic downturn.

Beyond advancing the understanding of the COVID-19 related consequences for students, this paper also contributes to the rich literature that investigates the implications of economic shocks for child schooling more generally. Previous work has highlighted that such shocks reduce resources available to finance education (Jensen, 2000; Skoufias and Parker, 2006; Gubert and Robilliard, 2008; Bjorkman-Nyqvist, 2013) and increase pressure that children start working (Jacoby and Skoufias, 1997; Beegle et al., 2006; Duryea et al., 2007). We add to this literature by separately investigating the effects of paternal and maternal income shocks, which becomes increasingly important given the growing rate of female labor-force participation in most societies. We find that effects of paternal and maternal shocks operate through different mechanisms, which could be explained by differences in gender-roles that prevail within the household.

The remainder of the paper is structured as follows. In section 2 we provide background information about the COVID-19 related developments in Cambodia, describe the data and present descriptive evidence of learning activities during the first lockdown. Section 3 presents results on the impact of the economic shock experienced at the household level on schooling outcomes. Section 4 concludes.

## **4.3. Context and Data**

### **4.3.1. Setting**

Educational attainment among adults is very low in Cambodia due to the systematic destruction of the educational sector by the Khmer Rouge in the 1970s and the following period of civil unrest until the early 1990s (UNESCO, 2011). While higher

education has seen a rapid expansion in recent years, the low levels of education of the parental generation still have strong implications for the younger generation – particularly in rural areas – as students often lack the necessary support and guidance to access higher education (Eng et al., 2014). Many students drop out of school early, *i.e.* during lower-secondary school (grades 7-9), and do not manage the transition to high school (grades 10-12), which is typically farther away and more expensive in terms of transportation, schooling material and fees.

The COVID-19 crisis likely aggravated this situation. Firstly, students were directly affected by the preventive measures the Cambodian government has put in place. Mid of March 2020, all schools were closed and largely remained closed until November 2020. For the period of school closure, the government set up a system of remote learning, consisting primarily of subject-specific television programs, and encouraged teachers to deliver assignments and new content to their students (World Bank Group, 2020c). In September 2020, only students of grade 9 and grade 12 were allowed to return to school in order to prepare for their final exams, which determine graduation from lower secondary and high school, respectively. The final exam of grade 9 took place in November 2020. In December 2020 (after the exams were graded), the Prime Minister announced that in response to the COVID-19 crisis all students of grade 9 who participated in the final exam would automatically pass and could thus transition to high school irrespective of their actual performance (Khmer Times, 2020). However, in January 2021 (high) schools only reopened for a few weeks; they were closed again in February 2021.

In addition, the measures that were adapted globally in response to COVID-19 had severe effects on the economic situation of many households in Cambodia and thereby likely also affected the educational outcomes of children. Survey evidence suggests that between 25% and 80% of households experienced income or job losses as a result of the crisis (Morgan and Trinh, 2021; Karamba et al., 2021). The losses are expected to be particularly prevalent among households working in the tourism, garment or construction sector (International Labour Organization, 2020; World Bank Group, 2020b). Without any additional interventions, the poverty rate is projected to increase by over 80% to 17.6% (United Nations Development Programme, 2020).<sup>4</sup>

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<sup>4</sup> While the Government of Cambodia quickly expanded access to the country's cash transfer program, targeting of this program was based on the existing IDpoor database and could not take into account differential impacts of the economic downturn by economic sector (World Bank Group, 2021).

### 4.3.2. Sample

Our sample consists of grade 9 students from 54 schools in Northwest Cambodia, thus students who were in the final year of lower-secondary school and who had to decide whether to continue with high school. The schools are distributed across four provinces: Banteay Meanchey, Battambang, Oddar Meanchey, and Siem Reap, provinces that experience particularly high dropout rates during lower-secondary education (Ministry of Education, Youth and Sport, 2017). The geographical distribution of the 54 schools is displayed in Figure C.1.1 (Figures C.1.1-C.1.4 and Tables C.2.1-C.2.8 are available in the Appendix).

The selected schools are a non-random sub-sample of the universe of lower-secondary schools in rural Cambodia.<sup>5</sup> Nevertheless, they are broadly comparable to rural schools along a number of dimensions (Ministry of Education, Youth and Sport, 2019). Schools in our sample are only slightly smaller than the average school in rural Cambodia (80 students in grade 9 across 1.74 classes on average, as compared to 90 students across 1.99 classes in rural areas). Also, the class size (46 students per class) and the share of female students in the class (54%) is roughly identical to the rural average.

Our main dataset combines student-level administrative data that cover the entire (prolonged) school year (November 2019 to November 2020), and data from a phone survey that was conducted between July and August 2020. In the phone survey, we attempted to reach all students that were still enrolled in grade 9 just before the onset of the COVID-19 crisis (February 2020), which gives a target sample of 3,261 students.

As is common in phone surveys, we were able to reach and conduct the interview with only a selected group of students. Overall, we reached 2,197 students, which resulted in a response rate of 67%. Students who participated in the phone survey have substantially better grades than their peers who did not participate in the phone survey (see Figure C.1.1 and Table C.2.1). In order to minimize concerns about selection bias in our phone-survey data, we reweight all observations with the inverse of the probability of participating in the phone survey. The probabilities are calculated from

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<sup>5</sup> For our study, we collaborated with the NGO Child's Dream that provides scholarships to high school students in Northwest Cambodia. We initially sampled 39 lower-secondary schools that had a partnership with Child's Dream, and which had more than 30 students in grade 9 each. We then added 21 lower-secondary schools from other districts in the same provinces to our sample, that are similar in characteristics to the partner schools of Child's Dream. Over the course of the study, we had to drop six schools from the sample as school principals were not cooperating. Within the selected schools, we either targeted all grade 9 students of the school (when there was only one grade 9 class), or randomly selected one to two classes of grade 9 (and all students in these classes) to be part of our sample.



a logistic regression that flexibly incorporates age, gender, pre-crisis grades, as well as teacher and school characteristics. The regression results are displayed in Table C.2.2 and the resulting weights in Figure C.1.1. The reweighted sample is well balanced in terms of student and school characteristics that are available from administrative data, as shown in Table C.2.1. The correction for selection bias allows us to compute estimates that are broadly representative of the targeted student population.

Table 4.1 shows that there are slightly more female than male students in this sample, and students are on average about 15 years old. Student performance pre-crisis is satisfactory at best, with the average student obtaining only 57/100 points in Khmer, 48/100 in Math and 17/50 in English (grades are assigned monthly, and were averaged by the researchers across the months December, January and February). Absence is relatively low in this sample, with students only missing 1.5 days of school per month on average.

Information about students' family background that was collected in the phone survey is also summarized in Table 4.1. As can be seen, 85% of students have access to a smartphone (either their own or of someone else in the family). For almost two thirds of the students, neither parent completed primary school. And more than a third of the households have at least one family member who migrated in the past 12 months.

The economic repercussions of the crisis are well reflected in the students' responses to the phone survey. Seventy-three percent of students reported that at least one of their parents experienced income losses due to the COVID-19 crisis. Furthermore, about 15% of students reported that at least one parent changed their job(s) due to the COVID-19 pandemic.

The extent to which parents were affected by the crisis varies substantially across occupational sectors. To show this more systematically, we report the sector of occupation of parents in Table 4.2, ordered by popularity. As can be seen, the most important sectors are agriculture, construction and trade (buying and selling).<sup>6</sup> Column (5) shows the probability of experiencing a negative income shock due to COVID-19 by sector, calculated as the fraction of parents in that particular sector for whom students reported COVID-19 related income losses in the phone survey. Column (6) reports the sector-specific probability of income loss as calculated from the Cambodia

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<sup>6</sup> These sectors are obtained from an open-ended question that elicits the occupation/activity of each parent. Answers were subsequently coded by the interviewers and researchers and follow the ISIC, Rev.4 classification (United Nations, 2008). A few sectors (such as education and health, manufacturing and mining, financial, real estate and professional activities) were merged to increase power.

Table 4.1.: Summary Statistics

	(1)	(2)	(3)	(4)	(5)
	Mean	SD	Min	Max	Count
<b>Administrative data</b>					
Age (adm. data)	15.048	1.309	11	20	2197
Female student (adm. data)	0.534	0.499	0	1	2197
Pre-crisis Khmer	56.770	19.016	0	98	2197
Pre-crisis Math	47.884	22.406	0	100	2197
Pre-crisis English	17.023	12.475	0	50	2197
Pre-crisis Total (std. within class)	0.019	0.896	-3	3	2197
Pre-crisis Absence	1.483	2.036	0	14	2011
Participated in final exam	0.917	0.276	0	1	2197
Ranks in top 15% in final exam	0.134	0.341	0	1	2197
<b>Survey data</b>					
Owns smartphone	0.850	0.358	0	1	2197
At least one parent $\geq$ primary	0.357	0.479	0	1	2197
Any member migrated	0.363	0.481	0	1	2196
Studied in last 7 days	0.881	0.324	0	1	2197
Main activity in last 7 days: study	0.236	0.424	0	1	2193
Main activity in last 7 days: paid work	0.114	0.318	0	1	2193
Main activity in last 7 days: hh work	0.625	0.484	0	1	2193
Main activity in last 7 days: leisure	0.024	0.152	0	1	2193
Father experienced income loss	0.634	0.482	0	1	2194
Mother experienced income loss	0.654	0.476	0	1	2194
Father changed job(s)	0.109	0.311	0	1	2192
Mother changed job(s)	0.095	0.293	0	1	2192
Probability of income loss (father)	0.654	0.099	0	1	2033
Probability of income loss (mother)	0.677	0.076	0	1	1918

*Notes:* This table shows the population means and standard deviations of student and family characteristics collected from administrative data and in the phone survey. Pre-crisis Khmer, English and Math are the students' monthly grade in the subject averaged over the months December, January and February. The maximum points achievable per subject are 100, 50 and 100, respectively. Pre-crisis Total (std.) is the 3-month average total grade (sum over all subjects) with each month being standardized within class to account for differences in the number of subjects across schools/classes. Pre-crisis absence is the average number of days absent per month over the months December, January, February. Participated in final exam equals 1 if the student participated in the final exam on November 30, 2020. The statistics for job changes for mother and father include net job losses due to the crisis (status changed to stay-at-home). Roughly 17% of mothers and 6% of fathers who changed their jobs, *de facto* lost their jobs. Probability of income loss is the parental sector of occupation specific probability of experiencing income losses due to COVID-19, as calculated in Table 4.2.

Table 4.2.: Parental Occupation before COVID-19

	Father		Mother		Prob. of income loss	
	N (1)	pct. (2)	N (3)	pct. (4)	Survey (5)	World Bank (6)
Agriculture, Forestry and Fishery	1,164	57.26	1,166	60.79	0.629	0.812
Construction	281	13.82	151	7.87	0.764	0.804
Buying & selling goods, Repair of vehicles, Hotels & restaurants	204	10.03	430	22.42	0.778	0.884
Public administration (gov. empl., police, soldier)	169	8.31	15	0.78	0.440	0.546
Manufacturing and Mining	71	3.49	88	4.59	0.758	0.760
Transportation	50	2.46	2	0.10	0.882	1.000
Education and Health	43	2.12	23	1.20	0.522	.
Other services	18	0.89	25	1.30	0.636	0.852
Electricity, Gas, Water, Waste, Demining	11	0.54	2	0.10	0.750	.
Administrative and support services	9	0.44	5	0.26	0.714	.
Arts, Entertainment, Tourism, Recreation	7	0.34	10	0.52	0.944	.
Professional activities	6	0.30	1	0.05	0.714	0.900
Total	2,032		1,918			

Notes: Columns (1)-(4) show the frequency and percentage share of parental sectors of occupation by gender, and ordered by frequency of the father's occupation. For each parent, students could list up to three occupations. If multiple occupations were listed, we report the first entry for each parent (main occupation) in this table. Sectors follow the ISIC Rev.4 classification (United Nations, 2008). Some sectors were merged for reasons of power. Columns (5) and (6) show the probability of experiencing income losses (fraction of individuals in the sector for which COVID-19 related income losses were reported) by sector, as calculated in the phone survey (col. 5) and in the Cambodia High-Frequency Phone Survey – LSMS – Round 1, conducted by the World Bank (col. 6). To calculate these probabilities in the phone survey, we restrict the sample to parents for which students only reported one job, such that the reported income losses could be linked to a specific sector. In the World Bank survey, respondents report only the main job. We restrict the LSMS sample to rural households to make it comparable to our setting.

High-Frequency Phone Survey – LSMS – Round 1, which was conducted by the World Bank in May 2020 (World Bank Group, 2020a).<sup>7</sup> In line with evidence from other developing countries (Egger et al., 2021), experiences of income losses due to COVID-19 are widespread and can be observed in most economic sectors. As can be seen in Table 4.2, the probability of experiencing income losses is slightly lower in the public sector (military, government, police) and in the education and health sector. Parents who were working in transportation, trade, construction and in manufacturing and mining have the highest probability of experiencing income losses.<sup>8</sup> The average probability (across all sectors) of an income loss of the father (mother) is 0.65 (0.68) with a standard deviation of 0.10 (0.08) (see Table 4.1).

### 4.3.3. Learning During and After the COVID-19 School Closure

The phone-survey data allows us to assess the extent to which learning activities continued during the period of school closure, in which form, and how students used their time more generally. We find substantial variation in the frequency of teacher contact across students. While the majority of students (70%) were in contact with the teacher in the last 7 days, a sizable share of students (30%) had much less or no contact at all since school closure (see Figure C.1.2). Nevertheless, a large majority of students (88%) reportedly studied in the last 7 days, which is similar to the study incidence observed in many upper middle-income countries (Warren, 2020; Favara et al., 2021). In terms of types of education or learning activities students engaged in, we find that 57% of students interacted live with a teacher (in-person meeting with teacher or online session/meeting with teacher).<sup>9</sup> About three-quarters (74%) of all students also reported having worked on assignments provided by the teacher. These assignments could be distributed by the teacher individually, by class leaders, or through online messengers such as Telegram, Facebook or WhatsApp. Overall, only 9% of students were exclusively engaged in learning activities that were not guided by the teacher (such as studying without assignment, with a tutor or watching educational TV). This indicates that a substantial share of teachers indeed kept engaged with their

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<sup>7</sup> In the World Bank survey, one household member (mostly the household head) was asked about the sector of activity of the main pre-crisis job, and whether the household experienced income losses due to COVID-19. The correlation coefficients between the shock measures calculated from our phone survey and from the World Bank survey are 0.80 for fathers and 0.63 for mothers.

<sup>8</sup> Workers in electricity, gas, water, waste, mining, in tourism and arts, and in professional activities were also strongly affected by the crisis, but are quantitatively less important in this sample.

<sup>9</sup> The question was open ended, and students could give multiple answers, which were then categorized by the interviewer.

students even 4 months after schools were closed and compares favorably with other lower-middle income countries (Warren, 2020). The broadcast learning environment provided by the government was only used by about 25% of the students (*cf.* Figure C.1.2).

Learning activities thus seem to have continued even months after schools were closed. Yet, students seem to have been subject to severe time constraints too, with only 21% of students reporting that studying was their main activity during the last 7 days, while 74% reportedly worked for pay, for the family or in the household as their main activity (*cf.* Table 4.1 and Figure C.1.2).

Based on the administrative data, we can examine schooling outcomes after students were allowed to return to school. We find that by far most students returned to school once they reopened: eighty-eight percent participated in the final exam (92% in the weighted phone survey sample, see Table C.2.1).<sup>10</sup> The lower-secondary exit exam is a nationally standardized examination, which students take at their own school and is corrected by their own teachers (Maeda, 2021). Nearly all students who participated in the final exam (95%) obtained a total grade of 260 points or higher, which is the threshold for obtaining the lower-secondary degree and for being admitted to high school (*cf.* Table C.2.1). The distribution of the final exam grade displays a stark discontinuity at 260 points, which indicates a substantial amount of manipulation (see Figure B.1.2.1). The top 15% of students (a threshold that is commonly used to distinguish the best performing students) achieved a score higher than 397 points.

We find some clear patterns with respect to the characteristics that predict studying during school closure (*i.e.* whether students reported to have studied in the last 7 days) as well as participation and performance in the final exam (see Table 4.3). Older students were less likely to continue studying during school closure and were also weakly less likely to participate in the final exam and to rank in the top 15%. Female students were more likely to continue studying but were less likely to participate in the final exam, especially when accounting for differences in pre-crisis grades. Female students seem to have performed better than male students in the final exam, but this can be largely explained by better pre-crisis grades. Parental education seems to have mattered somewhat for schooling outcomes: the education of the father positively contributed to student learning and to final exam participation, and the education of the mother increased students' self-reported studying during the lockdown. Students,

<sup>10</sup>The fact that the dropout rate is significantly lower in the phone survey sample than in the overall sample after weighting the data could indicate two things. First, some differences between the phone-survey sample and our full sample remain even after correcting for sample selection. Second, the phone survey could have had a positive effect on students' schooling itself.

who were performing better before the crisis, were also more likely to study during the school closure and to participate in the final exam, suggesting that the COVID-19 pandemic increased learning inequalities in this context.

Table 4.3.: Correlates of Schooling during COVID-19

	Studied in last 7d		Part. in final exam		Ranks in top 15%	
	(1)	(2)	(3)	(4)	(5)	(6)
Age (adm. data)	-0.018*** (0.006)	-0.019*** (0.006)	-0.011* (0.006)	-0.011* (0.006)	-0.010 (0.006)	-0.009* (0.005)
Female student (adm. data)	0.073*** (0.017)	0.044*** (0.016)	-0.001 (0.012)	-0.024** (0.011)	0.068*** (0.017)	-0.010 (0.013)
Father education $\geq$ primary	0.035** (0.015)	0.026 (0.016)	0.035*** (0.012)	0.026** (0.012)	0.043** (0.018)	0.010 (0.014)
Mother education $\geq$ primary	0.044** (0.020)	0.040** (0.020)	0.018 (0.018)	0.014 (0.018)	0.023 (0.020)	0.007 (0.017)
Any member migrated	-0.008 (0.015)	-0.001 (0.014)	-0.016 (0.015)	-0.010 (0.014)	-0.024 (0.019)	-0.003 (0.015)
Pre-crisis Total (std. within class)		0.041*** (0.015)		0.035* (0.020)		0.088*** (0.021)
Pre-crisis Khmer		0.001* (0.001)		0.000 (0.001)		0.001 (0.001)
Pre-crisis English		-0.001 (0.001)		0.000 (0.001)		0.006*** (0.002)
Pre-crisis Math		0.001 (0.001)		0.001 (0.001)		0.003*** (0.001)
Observations	2196	2196	2196	2196	2196	2196
Adjusted $R^2$	0.066	0.099	0.029	0.063	0.089	0.354
Dep. var. mean	0.881	0.881	0.917	0.917	0.134	0.134

Notes: Dependent variables are in the column header (Studied in last 7d (phone survey), Part. in final exam (adm. data), Ranks in top 15% (adm. data)). Weighted Least Squares (weights are inverse probability weights calculated from Table C.2.2) reported throughout. All regressions control for school and interviewer fixed effects. Standard errors (clustered at the school level) are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

## 4.4. Parental Income Shocks and Schooling Outcomes

To investigate whether students' schooling outcomes are affected by the global economic downturn, we leverage information about the sector in which parents were occupied before the onset of the COVID-19 crisis as well as variation across sectors in

the impact of the crisis, and relate this to the students' reported studying behavior during the crisis as well as to participation and performance in the final exam.

#### 4.4.1. Empirical Approach

We determine a student's exposure to the economic downturn by the sector of occupation (pre-crisis) of each parent and the associated probability of experiencing income losses. If more than one sector was provided per parent (each student could list up to three occupations per parent), we use the minimum of all probabilities, assuming that parents with multiple occupations could switch somewhat flexibly between them. We use this predicted measure rather than self-reported assessments of parental income losses in order to reduce reporting bias. The main concern would be that more pessimistic students were more likely to report that their parents experienced income losses, while also performing worse in school during the crisis. We also restrict the sample to students with two working parents and with non-missing parental sector of initial activity.<sup>11</sup> We estimate:

$$Y_{ij} = \beta_0 + \beta_1 Shock_i^{fa} + \beta_2 Shock_i^{mo} + \beta_3' X_i + \mu_j + \varepsilon_{ij}. \quad (4.1)$$

In eq. (4.1),  $Y_{ij}$  is the outcome of interest of student  $i$  in school  $j$ , *i.e.* whether the student studied in the last 7 days (phone-survey response), participated in final exam (administrative records), and ranks in top 15% of students in final exam (administrative records).  $Shock_i^{fa}$  is the income shock of the father (probability of income loss), and  $Shock_i^{mo}$  the income shock of the mother.<sup>12</sup>  $X_i$  is a vector of student, family, and interview characteristics, namely age, gender, pre-crisis grades, migration in the family, education of each parent, and interviewer fixed effects.  $\mu_j$  are school fixed effects.  $\varepsilon_{ij}$  is the error term. We account for non-random survey-response by estimating eq. (4.1) in weighted least squares (using the inverse probability weights discussed in section 4.3.2). Because study outcomes likely correlate within class, we cluster our standard errors at the school level throughout. We additionally perform a wild cluster bootstrap of the t-statistic (4,999 replications, Rademacher weights) at the level of

<sup>11</sup> Note, that we do not observe the sector of all parents. A total of 31 fathers are not in the labor force (stay-at-home or retired), as well as 235 mothers. In addition, 102 fathers and 31 mothers are either deceased or divorced (with no activity being reported). Finally, students did not know or refused to name the occupation of 31 fathers and 13 mothers. As households with only one working parent are likely to be very different from the households with two working parents, we exclude these in the main analysis (238 students in total). We show results that include students with only one working parent (mostly the father) in Table C.2.7.

<sup>12</sup> The correlation coefficient between  $Shock_i^{fa}$  and  $Shock_i^{mo}$  is 0.41.



each parent's (combination of) occupation(s) and report the calculated p-values to account for potential correlation in outcomes within occupation.

The identifying assumption is that the parental income shocks are uncorrelated with the error term after controlling for  $X_i$  and  $\mu_j$ . These controls are important as we have good reasons to suspect that parental characteristics are correlated with the probability of experiencing income losses during the COVID-19 crisis. In general, less educated parents and families with migrating household members seem to have been more severely affected by the crisis. Reassuringly, our shock measures do not seem to correlate systematically with pre-crisis grades, family structure and wealth (observed in a baseline survey for a sub-sample of students) or consumption levels (as observed in the 2017 Cambodia Socio-Economic Survey), see Tables C.2.3-C.2.4.<sup>13</sup>

#### 4.4.2. Results

We find that paternal income shocks had opposing effects on student learning during school closure and on final exam participation (see Table 4.4). Students whose fathers were more exposed to COVID-19 related income losses were (weakly) less likely to report that they studied in the last 7 days and were less likely to participate in the final exam. However, students whose mothers were more exposed to COVID-19 related income losses were more likely to study during the school closure, and were more likely to participate in the final exam. In terms of performance in the final exam, both parents' shocks seem to have had a negative effect, though the effect of the maternal shock is not statistically significant.<sup>14</sup> The estimated effects are largely robust to inference based on the wild cluster bootstrap-t procedure, except for the negative effect of the paternal shock on child studying during the school closure. In terms of magnitudes, these coefficients suggest that a 10 percentage point increase in the probability that the father experienced an income loss reduced the incidence of studying during the lockdown by 1.1 percentage points, the probability of participating in the final exam by 1.7 percentage points, and the probability of ranking among the top 15% of students by 1.6 percentage points. An increase of the same magnitude in the probability that the mother experienced an income loss increased the incidence of studying during lockdown by 1.9 percentage points and the participation in the final

<sup>13</sup> This baseline survey was administered in 18 schools as part of an educational RCT, which had to be interrupted as schools were closed on March 16 due to the COVID-19 pandemic. More information can be found in chapter 3.

<sup>14</sup> We show results for different grade thresholds in table C.2.5. Coefficients are negative across all thresholds and for both parents.



exam by 3.0 percentage points, yet reduced the probability of ranking among the top 15% of students by 0.9 percentage points.

Table 4.4.: Effect of COVID-19 Economic Downturn on Schooling

	Studied in last 7d		Part. in final exam		Ranks in top 15%	
	(1)	(2)	(3)	(4)	(5)	(6)
Probability of income loss (father)	-0.124*	-0.110	-0.182**	-0.166**	-0.230***	-0.162**
	(0.070)	(0.066)	(0.070)	(0.066)	(0.080)	(0.075)
Probability of income loss (mother)	0.182*	0.191*	0.300**	0.299**	-0.081	-0.085
	(0.104)	(0.100)	(0.120)	(0.120)	(0.088)	(0.082)
Age (adm. data)	-0.021***	-0.021***	-0.013**	-0.013**	-0.010	-0.006
	(0.007)	(0.007)	(0.006)	(0.006)	(0.007)	(0.006)
Female student (adm. data)	0.087***	0.055***	0.001	-0.023*	0.081***	-0.003
	(0.018)	(0.018)	(0.014)	(0.013)	(0.018)	(0.015)
Pre-crisis Total (std. within class)		0.050**		0.047**		0.098***
		(0.019)		(0.019)		(0.024)
Pre-crisis Khmer		0.001		0.000		0.001
		(0.001)		(0.001)		(0.001)
Pre-crisis English		-0.001		-0.001		0.005***
		(0.001)		(0.001)		(0.002)
Pre-crisis Math		0.001		0.001		0.004***
		(0.001)		(0.001)		(0.001)
Observations	1789	1789	1789	1789	1789	1789
Adjusted $R^2$	0.076	0.109	0.033	0.068	0.089	0.355
Dep. var. mean	0.882	0.882	0.918	0.918	0.138	0.138
Wild cluster bootstrap p-value (father shock)	0.529	0.508	0.028	0.024	0.074	0.064
Wild cluster bootstrap p-value (mother shock)	0.147	0.054	0.025	0.027	0.120	0.133

Notes: Dependent variables are in the column header (Studied in last 7d (phone survey), Part. in final exam (adm. data), Ranks in top 15% (adm. data)). Weighted Least Squares (weights are inverse probability weights calculated from Table C.2.2) reported throughout. All regressions control for school, parental education, migration and interviewer fixed effects. Standard errors (clustered at the school level) are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

The results are highly robust: we find no changes in our findings if we base our income shock measure on the main (first-mentioned) occupation or if we use the average of up to three probabilities (*cf.* Table C.2.6, Panels A and B). The results are also qualitatively similar if we use the shock measures calculated from the Cambodia High-Frequency Phone Survey, and if we use the student-reported parental income loss as explanatory variables rather than the predicted values (Panels C and D of Table C.2.6).<sup>15</sup> Our results are also not driven by the empirical approach: controlling for district and Child’s Dream partnership fixed effects instead of school fixed effects does not change the results, nor does omitting the sampling weights (*cf.* Table C.2.7, Panels A and B). As smartphone ownership is positively correlated with the maternal

<sup>15</sup> Note, that the Cambodia High-Frequency Phone Survey has a considerably smaller sample size: only 700 households are interviewed in total.

shock in the baseline sub-sample, we also control for smartphone ownership (Panel C of Table C.2.7); our results are unchanged. Finally, we expand the sample to students for whom we observe only one working parent (Panel D of Table C.2.7). In this sample, the negative effect of a paternal shock prevails while the positive effect of the maternal shock disappears.

In terms of within-sample heterogeneity, we find that effects of parental shocks on studying during school closure and on participation in the final exam are fairly similar for both genders (see Figure C.1.3, Panel A). Interestingly, while the maternal shock had a positive effect on participation in the final exam both for boys and girls, it had a positive effect on boys' but a negative effect on girls' performance (probability of ranking in the top 15%). Splitting the sample by students' pre-crisis grades (above median student in class vs. below) reveals that the negative paternal and positive maternal effects on studying and on participation in the final exam are predominantly driven by low-performing students (see Figure C.1.3, Panel B). We find no differential effects on final exam performance.

### 4.4.3. Mechanisms

The result that parental shocks had opposing effects on studying during lockdown and participation in the final exam is highly surprising. The negative effect of the paternal income shock is likely related to financial aspects: paternal income shocks reduced the financial resources available for schooling and increased pressure on students to take up remunerative work. Indeed, we find that students exposed to paternal income shocks were more likely to report working for pay as their main activity during school closure (Table C.2.8). Furthermore, they were more likely to agree with statements which indicate that the COVID-19 pandemic increased their financial worries (*cf.* Table 4.5, columns 1-2), and reportedly expect to achieve fewer years of education by the age of 25 (Table 4.5, columns 11-12).<sup>16</sup>

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<sup>16</sup> In the phone survey, students were asked for their agreement with different statements related to COVID-19. Figure C.1.4 depicts an overview of all statements and responses.

Table 4.5.: Mechanisms of COVID-19 Effect

	Finan. worries			Benefits of educ.			Motiv. for school			Aspired years			Prob. of achv. lvl			Expected years		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)						
Probability of income loss (father)	0.692*** (0.217)	0.676*** (0.222)	0.073 (0.116)	0.089 (0.119)	-0.114 (0.152)	-0.093 (0.152)	-0.120 (0.492)	0.049 (0.533)	-0.753* (0.404)	-0.720* (0.404)	-1.332** (0.594)	-1.175* (0.630)						
Probability of income loss (mother)	-0.406 (0.275)	-0.412 (0.278)	0.041 (0.191)	0.054 (0.190)	0.058 (0.256)	0.065 (0.238)	0.482 (0.700)	0.475 (0.726)	0.991* (0.544)	1.061** (0.524)	0.866 (0.741)	0.770 (0.774)						
Age (adm. data)	0.053*** (0.015)	0.052*** (0.015)	0.002 (0.009)	0.002 (0.009)	-0.032*** (0.010)	-0.032*** (0.010)	-0.119*** (0.032)	-0.108*** (0.033)	-0.078** (0.033)	-0.083** (0.032)	-0.156*** (0.039)	-0.146*** (0.040)						
Female student (adm. data)	0.077** (0.031)	0.094** (0.037)	0.031 (0.021)	0.000 (0.023)	0.047 (0.029)	0.005 (0.027)	0.463*** (0.097)	0.286*** (0.107)	-0.097 (0.073)	-0.225** (0.084)	0.094 (0.092)	-0.010 (0.090)						
Pre-crisis Total (std. within class)	0.039 (0.041)	0.039 (0.041)	0.055* (0.029)	0.055* (0.029)	0.056 (0.037)	0.056 (0.037)	0.066 (0.099)	0.066 (0.099)	0.179*** (0.067)	0.179*** (0.067)	0.241** (0.100)	0.241** (0.100)						
Pre-crisis Khmer	-0.002 (0.002)	-0.002 (0.002)	0.001 (0.001)	0.001 (0.001)	0.001 (0.002)	0.001 (0.002)	0.006 (0.006)	0.006 (0.006)	0.008* (0.004)	0.008* (0.004)	-0.008** (0.004)	-0.008** (0.004)						
Pre-crisis English	-0.000 (0.003)	-0.000 (0.003)	-0.000 (0.002)	-0.000 (0.002)	-0.001 (0.002)	-0.001 (0.002)	0.013 (0.008)	0.013 (0.008)	-0.006 (0.006)	-0.006 (0.006)	0.003 (0.008)	0.003 (0.008)						
Pre-crisis Math	-0.002* (0.001)	-0.002* (0.001)	0.000 (0.001)	0.000 (0.001)	0.001 (0.001)	0.001 (0.001)	0.013*** (0.004)	0.013*** (0.004)	-0.001 (0.003)	-0.001 (0.003)	0.015*** (0.004)	0.015*** (0.004)						
Observations	1785	1785	1767	1767	1758	1758	1772	1772	1771	1771	1771	1771						
Adjusted R <sup>2</sup>	0.098	0.100	0.034	0.047	0.072	0.091	0.118	0.157	0.034	0.053	0.121	0.154						
Dep. var. mean	2.751	2.751	2.795	2.795	2.769	2.769	13.474	13.474	5.821	5.821	12.540	12.540						
Wild cluster bootstrap p-value (father shock)	0.001	0.000	0.535	0.397	0.586	0.653	0.803	0.918	0.110	0.085	0.028	0.034						
Wild cluster bootstrap p-value (mother shock)	0.373	0.369	0.855	0.827	0.706	0.648	0.409	0.307	0.346	0.255	0.654	0.651						

Notes: Dependent variable is in the column header. *Financial worries* is an index representing the level of student agreement (on a 4-point Likert scale) with statements that the COVID-19 crisis increased financial worries. The index is calculated as the average of three statements: a) "The COVID-19 crisis worsened the financial situation of my family."; b) "Because of the COVID-19 crisis, my family will not have the financial resources to allow me to go to high school."; c) "Because of the COVID-19 crisis, I had to start working in order to support my family financially." *Benefits of education* is the average of three statements: a) "The COVID-19 crisis reduces the economic benefit of having a high school degree." (reversed); b) "There are no more well-paid jobs for lower-secondary graduates (such as in tourism or garment) due to the COVID-19 crisis."; c) "Migrating for work is difficult due to the COVID-19 crisis." *Motivation for school* is the average of three statements: a) "During the COVID-19 school closure I keep studying for school."; b) "My motivation to go to high school increased due to COVID-19."; c) "I am worried I will not be able to continue to grade 10 because of the COVID-19 crisis." *Aspired years* represents the aspired educational level of the student at age 25 (expressed in years of schooling). *Probability of achieving level* is the self-reported likelihood (between 0-10) of achieving the aspired educational level. *Expected years* represents the educational level (in schooling years) the student expects to achieve at age 25. Weighted Least Squares (weights are inverse probability weights calculated from Table C.2.2) reported throughout. All regressions control for school, parental education, migration and interviewer fixed effects. Standard errors (clustered at the school level) are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

The positive effect of the maternal income shock, on the other hand, is more difficult to explain. The income shares of mothers and fathers are typically not widely different among households in which both parents are working: survey evidence from 2017 suggests that 45% of couples' income is earned by the wife and 55% by the husband (National Institute of Statistics, 2017).<sup>17</sup> We also find no evidence that mothers are more likely to report switching jobs than fathers (*cf.* Table 4.1). Nevertheless, even if fathers earned a higher share of household income or mothers were more flexible in finding a new occupation in order to compensate for income losses, such evidence could only explain a null effect of the maternal income shock on study time and dropout, yet hardly a positive effect, if the main mechanism was financial.

There are at least three alternative mechanisms that could explain why the maternal shock had a positive effect on child schooling. *First*, COVID-19 related job losses might have signaled the benefits of (higher) education attainment to parents and children if low-education occupations were more severely affected by the economic downturn. If the positive signaling effect was outweighed by the negative income effects for paternal shocks but not for maternal shocks, this could explain the observed pattern. Indeed, jobs with lower educational requirements seem to have been affected by the crisis more severely: The probability of income losses is negatively correlated with the average educational attainment of parents in a given sector (correlation coefficient of -0.47). However, we find no evidence that children exposed to parental income shocks were more likely to agree to statements that imply that the COVID-19 pandemic increased the benefits of higher education (see Table 4.5, columns 3-4), nor were the aspired years of education differentially affected by the economic shock (columns 7-8).

*Second*, income losses could have been associated with more free time for both parents, which mothers might have used differently than fathers. Mothers might have responded to the income shock by spending more time in the household or on the family farm, thus allowing their children to reduce the time they spent on these activities and instead increase study time. While we cannot look at parental time-use directly, we can look at students' time use. However, students whose mother faced an income shock were not less likely to report to be working (in paid work or on household chores) as their main activity, nor were they more likely to report that studying was their main activity (see Table C.2.8). Unfortunately, time use is only available in terms of main activity, and we cannot rule out meaningful adjustments

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<sup>17</sup> This exercise is limited to couples in which both are working and to income sources that can be clearly attributed to one household member such as wage income and business earnings, and is necessarily imprecise as it omits farm income and other income sources (such as remittances).

in terms of hours studied.

*Third*, related to the mechanism above, mothers who were spending more time at home could have used this time to encourage their children to study more continuously during the school closure and to participate in the final exam, or even have supervised their learning activities. While maternal income shocks do not seem to increase motivation and continuity in learning (see Table 4.5, columns 5-6), we do find evidence that the maternal shock positively affected the probability at which students rated that they would achieve their aspired level of education (columns 9-10). Also consistent with an encouragement-related explanation is the finding that the positive effect of the maternal shock is driven by low-performing students (see Figure C.1.3).

Taken together, these results imply that paternal income shocks (weakly) reduced child studying during school closure, and reduced participation and performance in the final exam. Maternal income shocks increased students' studying during school closure and participation in the final exam, but did not necessarily imply better performance. While we cannot conclusively determine why maternal shocks had a positive effect on child schooling (in terms of continuation of studies during school closure and lower-secondary completion rate), we do find some evidence that is supportive of an encouragement-related explanation.

## 4.5. Conclusion

The COVID-19 pandemic forced 1.6 billion students worldwide into remote learning. Administrative data combined with phone-survey data from Northwest Cambodia reveals that the vast majority of grade 9 students continued to study during the first lockdown period, returned to school when schools reopened and participated in the final exam. However, studying was the main activity during school closure only for a minority of students, suggesting that very few students maintained high study hours and that learning losses were likely substantial.

While almost all students were given the opportunity to transition to high school, it is unclear whether students were able to catch up with the material they missed in the first lockdown and to succeed in high school. As some (if not all) of these students enrolled in high school, these classes risk being very full. This also raises the peril of low-performing students being left behind even further. It seems unlikely that these students will be able to graduate high school without intensive support in form of remedial classes and activities, which are expensive.

At the time of writing, schools in Cambodia were closed again in response to a second COVID-19 wave. With no indication how long this current school closure will last, the necessity of providing adequate responses to the disruption in education (from targeting remedial education to those in need, to continued engagement with those who are most vulnerable to dropping out) becomes ever more urgent.

Our results also show that part of the variation in schooling outcomes across students can be attributed to the extent to which a student's family was exposed to the economic downturn. Students whose fathers worked in sectors particularly affected by the crisis were less likely to study during school closure, more likely to drop out, and performed less well in the final exam. We find that this is likely driven by economic hardships which forced students to take up paid work. Income shocks faced by the mother, on the other hand, seem to have had a positive effect on studying during lockdown and participation in the final exam. Potentially, mothers who experienced income losses had more time to support their children in such a difficult situation and to encourage them to invest in their education. Such encouragement seems to have been crucial, particularly for low-performing students.

By documenting that gender-roles shape the effects of economic shocks, our findings contribute to the rich literature that investigates the implications of economic shocks for schooling outcomes. More research is needed to understand the differential roles parents play in influencing studying behavior in times of economic crisis and the underlying mechanisms.

## 5. Conclusion and Way Forward

This thesis is based on a multi-faceted project targeting ninth-graders in rural Cambodia. The core of the project is an educational intervention, which was designed to encourage students to make the transition to high school, in a context where dropout rates are relatively high, and one where students lack career guidance. The intervention has two main elements: 1) the electronic application called ICET and 2) the school information session. The former tries to coalesce students with their interests, by showing them which career paths might be of relevance to them. The second element contains relevant information regarding high and vocational schools, their associated costs, and scholarship opportunities.

The analysis in chapter 2 reveals that the application seems accessible for a broad set of students and that they look for different career paths compared to students going through a placebo application. The ICET provides information on career paths personalized to each student, while the placebo application does not include personalized guidance. Students using the ICET spend more relative reading time on occupations novel for them, and those that they had not been familiar with at the time of using the ICET. They also inform themselves more about jobs that do not require a university degree. The ICET is analyzed separately and in the context of the RCT in the subsequent chapter 3. Together with the school information session, the ICET was delivered to 18 schools while another 18 schools served as control schools.

Comparing treated to non-treated students across these 36 schools, we find that the intervention has, on average, no effect on high-performing students in terms of studying and working during school closure, scholarship application, and dropout. Effects on low-performing students are visible but go in an unintended direction: they are less likely to study and to apply for a scholarship as well as more likely to work during school closure. The timing of our intervention is very peculiar as the RCT was put to a halt half-way through our schedule due to the nation-wide school closure induced by the COVID-19 crisis. This might have nullified any potential effect of the intervention.

In order to document how students dealt with the school closure, we conducted an additional phone survey with the aim of reaching all initially targeted students. Results are summarized in chapter 4. As a first step, we examine whether students are able to study during school closure and if they return once schools were reopened. Even though most of the students confirm both, we find heterogeneous effects with respect to parental income shocks. An income shock experienced by the father negatively impacts a student's schooling outcomes in terms of studying during school closure, taking part in the final exam, and ranking in the top 15% after the school closure. A shock experienced by the mother, on the other hand, seems to have counterbalanced negative effects on studying and participating in the final exam as mothers might encourage students to keep on studying even when they do not benefit from in-person supervision by their teacher.

As the analysis of the phone survey reveals, closed schools and remote learning were not the only fallout of the pandemic for these students. In parallel, they also had to cope with reduced household income and consequent financial constraints. At the time of writing this thesis, Cambodian students are in a second period of school closure. The academic school year is expected to only resume in 2022. Rural students were disadvantaged long before the pandemic, and this situation has only become exacerbated in light of the events of the pandemic.

On the basis of these circumstances, policy measures should target the two following predicaments: 1) access to career guidance for students in lower secondary school and 2) possibility of high school graduation with remedial education. First, chapter 2 shows that the ICET has the potential to close the gap in the Cambodian curriculum when it comes to career information and guidance. It is a low-cost and easy-to-replicate tool for which different NGOs have already signaled their interest. Improving the tool and making it accessible to a larger sample of students could complement efforts of the government to expand vocational training and increase the quality of education.

Second, the reversal of governmental efforts to improve the educational system over the last decades will become a real threat if no additional policy measures will be set in motion in a timely manner. These measures need to counterbalance learning losses due to school closure and differential effects of the economic downturn on students. Schools are still closed at the moment and a substantial share of students might drop out before they reopen again in 2022. Within a difficult situation for students, it is likely that even motivated and previously high-performing students fall behind. It is thus necessary to offset learning losses and dropouts of students caused by school closures with academic support for students who may fall behind. In order to help students inclusively and



efficiently, remedial classes must be comprehensive and holistic. Students who had to start working could be offered alternative paths to obtain a high school degree, for example by providing online courses in the evenings or during weekends.

Finally, future research should focus on the apparent mismatch of skilled labor supply and demand. In chapter 3, we see that low-performing students have the most significant reaction to our intervention such that they are less likely to study and more likely to start working during school closure. By making students aware of career paths that do not entail higher education and which are potentially more suitable to them, the chances of committing to these careers, and subsequently, job satisfaction, becomes higher. Thus aiding students to have a fulfilling career has positive implications both for the students as well as the labor market, which benefits from more efficient skill matches.

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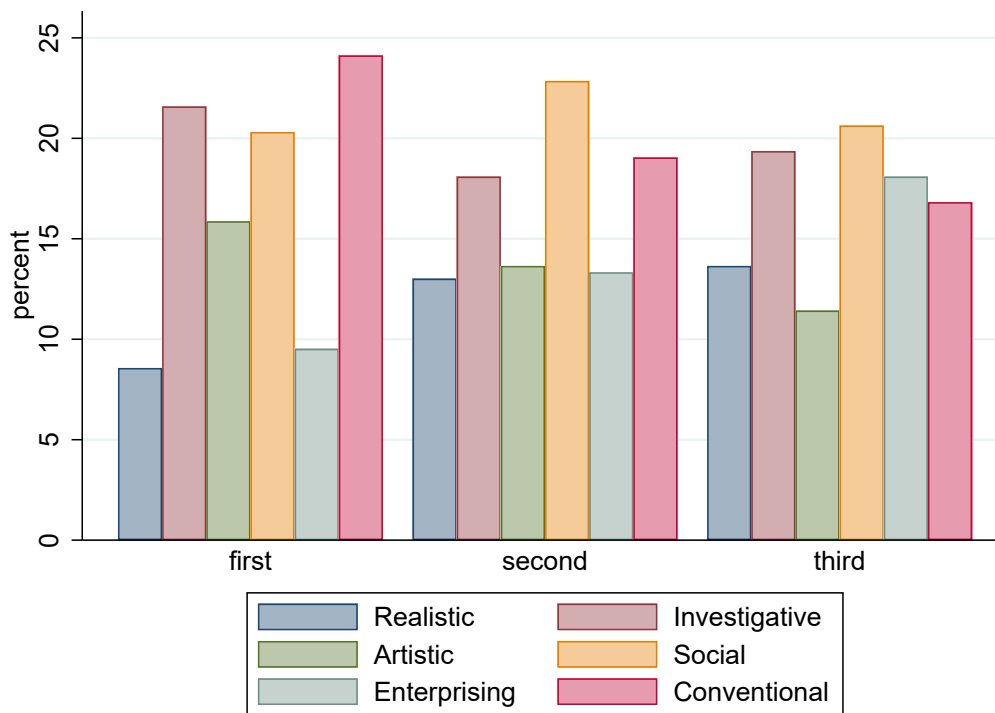
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# A. Appendix for Chapter 2

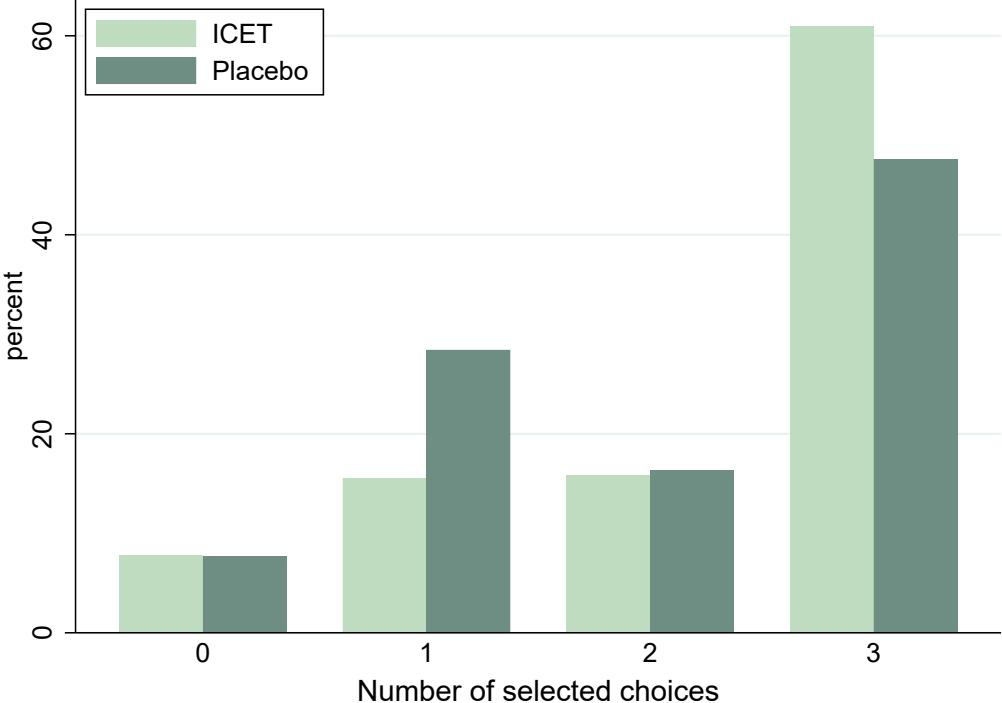
## A.1. Supplementary Figures

Figure A.1.1.: Distribution of Holland Code for ICET students



*Notes:* The Holland Code consists of the three strongest personality types out of six, namely realistic, investigative, artistic, social, enterprising, and conventional. It is calculated for each student individually based on her answering scheme in the tests.

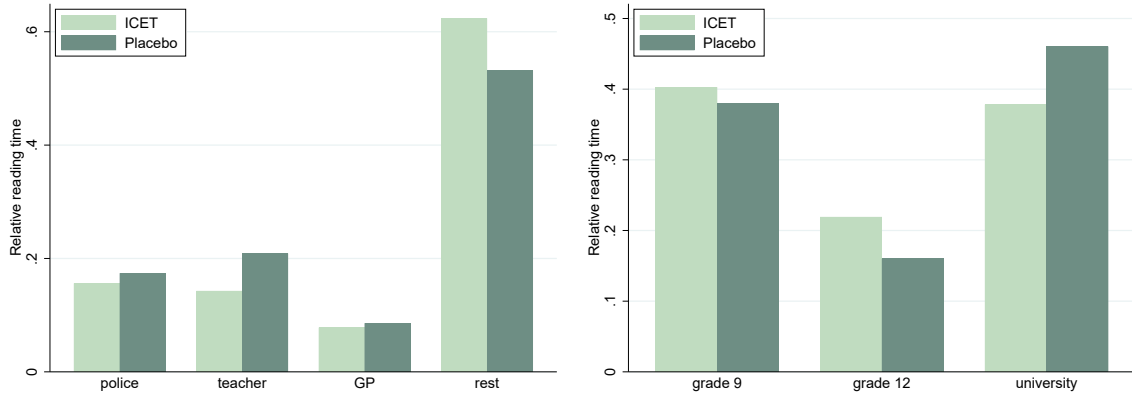
Figure A.1.2.: Distribution of Choices for Unframed Job Selection



Notes: This graph shows how many students in the ICET and placebo group chose 0, 1, 2, or 3 jobs within the unframed job selection of the CET (component 2a).

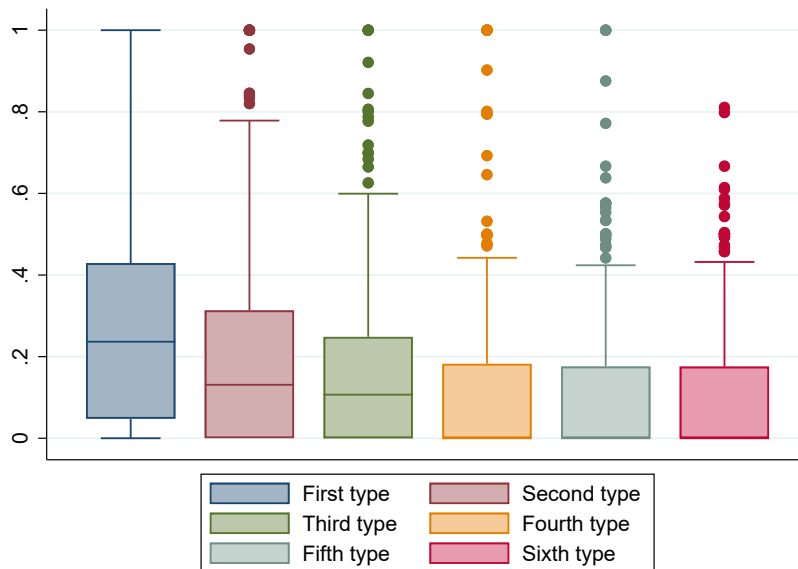
Figure A.1.3.: Information-seeking Behavior: Relative Reading Time for Career Options

(a) Ordered by Three Most Common Jobs (b) Ordered by Educational Requirement



Notes: Panel (a) shows the distribution of the relative reading time for the three most common job descriptions, namely police officer, secondary-level teacher, and general practitioner as well as for all remaining occupations (rest). Panel (b) shows the distribution of the relative reading time for job descriptions ordered by their educational requirements, namely a grade 9 diploma, a grade 12 diploma, and a university degree.

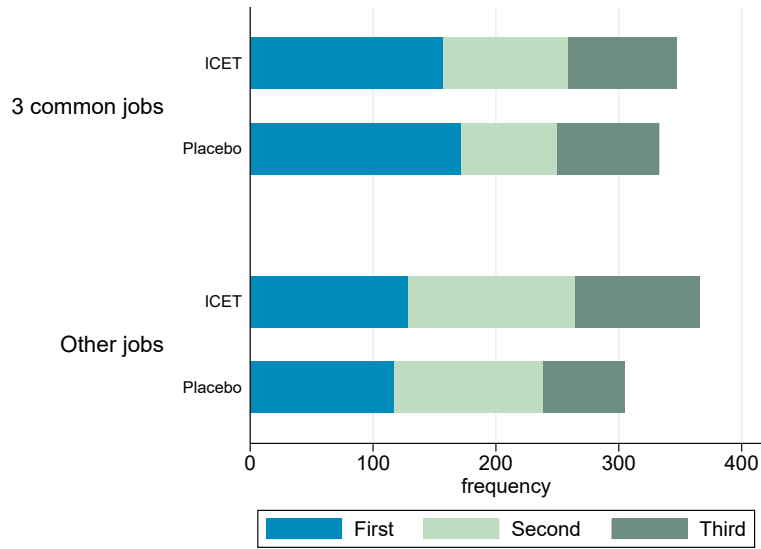
Figure A.1.4.: Relative Reading Time per Order of Type for ICET Students



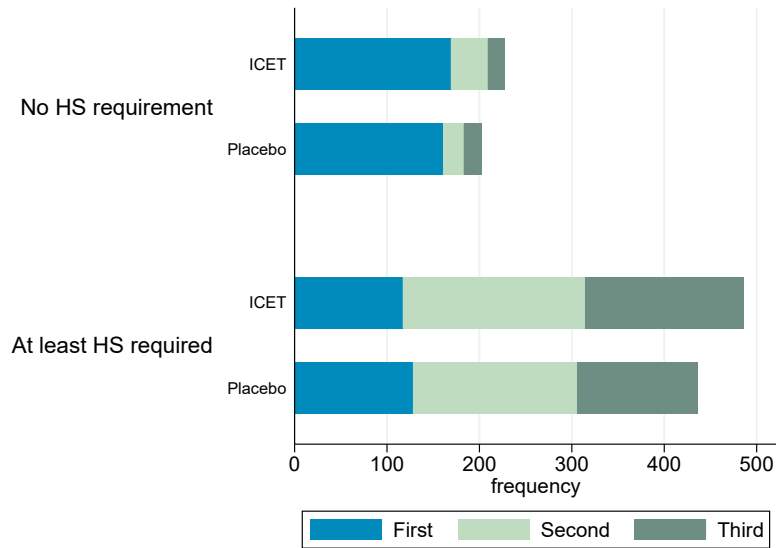
Notes: The reading time per job descriptions associated with one personality type (in total three per type) is divided by the overall reading time of each student who reads at least one description.

Figure A.1.5.: Information-seeking Behavior: Job Selection

(a) Ordered by Three Most Common Jobs

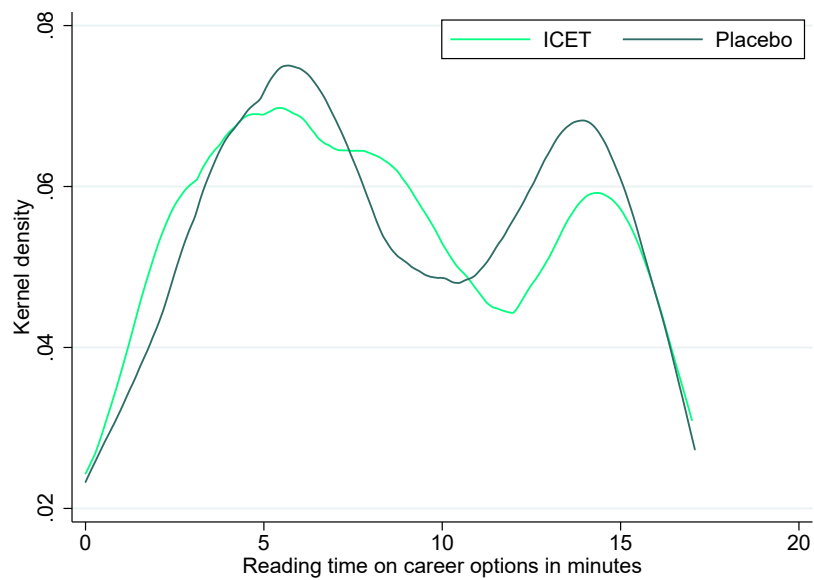


(b) Ordered by Educational Requirement



Notes: Panel (a) shows how often students working with the ICET versus placebo application select the three most common jobs, namely general practitioner, police officer, and secondary-level teacher compared to all other jobs within the job selection (component 2a). Panel (b) shows how often students working with the ICET versus placebo application select jobs which require no high school (HS) degree compared to those that require one within the job selection (component 2a).

Figure A.1.6.: Information-seeking Behavior: Distribution of the Total Reading time for Career Options



*Notes:* Students have in total 17 minutes to spend on career options of the CET (component 2b) in both the ICET and placebo application. They also can log out sooner.

## A.2. Supplementary Tables

Table A.2.1.: Six Most Frequently Mentioned Jobs from Pre-study in 2019

Job	Freq.	Percent
Teacher	102	57.95
Doctor	31	17.61
Police officer	19	10.80
Soldier	8	4.55
Farmer	3	1.70
Government staff	3	1.70
Other	10	5.68
Total	176	100.00

*Notes:* Students are asked in an open-ended question what job they would like to be doing when they are about 25 years old. Answers were categorized by the researchers.

Table A.2.2.: Balance Table of Summary Statistics

Variable	(1)	(2)	(3)	(4)	(5)	(6)
	ICET		Placebo		Difference	
	Mean	SD	Mean	SD	Diff	p-value
Female student (=1)	0.530	(0.500)	0.537	(0.499)	0.007	(0.869)
Age	15.114	(1.319)	15.058	(1.312)	-0.057	(0.589)
Student owns smartphone (=1)	0.454	(0.499)	0.396	(0.490)	-0.058	(0.143)
At least one parent is a farmer	0.781	(0.414)	0.776	(0.417)	-0.005	(0.890)
At least one parent has job with high educ. level	0.092	(0.290)	0.077	(0.267)	-0.015	(0.489)
Both parents work in Thailand	0.165	(0.372)	0.128	(0.334)	-0.037	(0.187)
Any family member migrated in past 12 months	0.463	(0.499)	0.422	(0.495)	-0.042	(0.293)
Dist. betw. student's village and school (km)	3.981	(3.856)	3.987	(4.014)	0.005	(0.987)
Dist. betw. students' village and district town (km)	9.955	(6.468)	9.733	(6.428)	-0.223	(0.665)
Av. Khmer	54.171	(17.529)	56.810	(18.348)	2.640*	(0.066)
Literacy level	3.225	(0.883)	3.260	(0.837)	0.034	(0.619)
High school ability	3.162	(0.800)	3.215	(0.846)	0.053	(0.422)
Teacher: female	0.286	(0.452)	0.294	(0.456)	0.008	(0.821)
Teacher: age	29.797	(5.359)	29.974	(5.284)	0.178	(0.676)
Teacher: years of school experience	7.159	(5.247)	7.256	(5.335)	0.097	(0.819)
Teacher: has university degree	0.552	(0.498)	0.546	(0.499)	-0.006	(0.879)
Teacher: distance to school (km)	10.091	(9.039)	10.263	(9.165)	0.172	(0.813)
Class Size	48.730	(11.626)	48.981	(11.562)	0.251	(0.787)
Observations	315		313		628	

*Notes:* This table shows the sample means, standard deviations, minimum, maximum, and count of student, family, and characteristics for both ICET and placebo students. Gender, age, distances, Khmer grade (averaged over three pre-intervention months November, December, and January whenever available), information about the teacher, and class size were collected separately. Information on literacy level and high school ability are provided by the class teacher and collected on the day of the intervention. All remaining variables are self-reported by the student. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table A.2.3.: Balance Table of Application Usage

Variable	(1)	(2)	(3)	(4)	(5)	(6)
	ICET		Placebo		Difference	
	Mean	SD	Mean	SD	Diff	p-value
Total time spent in application	78.934	(7.494)	79.879	(8.716)	0.946	(0.147)
No. of choices between 0-3	2.300	(0.994)	2.038	(1.034)	-0.262***	(0.001)
Total time spent for career options	8.330	(4.892)	8.632	(4.803)	0.303	(0.436)
Average time spent for a single career option	1.712	(1.130)	1.961	(1.833)	0.249*	(0.056)
Rel. time spent for three most common jobs	0.377	(0.306)	0.468	(0.330)	0.092***	(0.000)
Rel. time spent for jobs with $\geq$ high school degree	0.597	(0.273)	0.620	(0.310)	0.023	(0.335)
Observations	310		313		623	

*Notes:* This table shows the sample means, standard deviations, minimum, maximum, and count of time and click measures for both ICET and placebo students. Time measures are shown in minutes. The total time includes the time spent on the overview page and the time for a single description is calculated based on the time stamps between two individual descriptions. The statistic for average reading time per descriptions is limited to students reading at least two descriptions. Relative reading time is restricted to students reading at least one description. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table A.2.4.: Information-seeking Behavior: Content of Choices for Job Selection

	$\geq 1$ uncommon job			$\geq 1$ HS requir.		
	(1)	(2)	(3)	(4)	(5)	(6)
ICET (=1)	0.055*	0.056*	0.043	0.034	0.035	0.036
	(0.030)	(0.030)	(0.030)	(0.023)	(0.023)	(0.023)
Female student (=1)		-0.084**	-0.062		0.037	0.020
		(0.040)	(0.039)		(0.034)	(0.032)
Age		0.003	0.003		0.006	0.007
		(0.014)	(0.014)		(0.009)	(0.010)
Student owns smartphone (=1)		-0.012	-0.019		-0.012	-0.008
		(0.030)	(0.032)		(0.030)	(0.028)
Av. Khmer			-0.005***			-0.000
			(0.001)			(0.001)
Literacy level (standardized)			0.045			0.038**
			(0.047)			(0.017)
High school ability (standardized)			-0.027			-0.002
			(0.044)			(0.022)
Observations	575	575	575	575	575	575
Adjusted $R^2$	-0.000	0.004	0.024	0.007	0.005	0.011

*Notes:* Dependent variable is in the column header (at least one job is not one of the 3 common jobs and at least one job requires a high school degree). Observations are reduced by students not choosing any jobs. All regressions include controls for students' distances (namely the distance between their home village and school as well as district town), for parental occupation (namely whether at least one parent has job with high education level and whether both parents work in Thailand), for class characteristics (namely gender, age, experience of the teacher, whether she has a university degree, the distance between her home and the school, and the class size), and control for school fixed effects. Standard errors (clustered at the school level) are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table A.2.5.: Reading Time per Test and Page of Test

	(1)	(2)	(3)	(4)	(5)
	Mean	SD	Min	Max	Count
Test 1: time on page 1	6.514	2.238	1.583	21.083	315
Test 1: time on page 2	2.472	1.120	0.183	8.650	315
Test 1: time on page 3	2.407	0.911	0.317	5.683	315
Test 1: time on page 4	2.200	0.835	0.233	5.833	315
Test 2: time on page 1	5.017	2.055	0.583	20.917	315
Test 3: time on page 1	5.394	1.915	1.583	22.450	315
Test 3: time on page 2	1.391	0.538	0.300	3.550	315
Test 3: time on page 3	1.483	0.602	0.217	4.617	315
Test 3: time on page 4	1.237	0.432	0.217	2.733	315
Test 3: time on page 5	1.550	1.007	0.183	11.200	315

*Notes:* This table shows the sample means, standard deviations, minimum, maximum, and count of time spent on individual pages of all three interest-based personality tests. There are no time stamps available for the last page of the first and of the second test.



Table A.2.6.: Correlation of Statements Across Types and Tests

	R			I			A			S			E			C		
	Test1	Test2	Test3	Test1	Test2	Test3	Test1	Test2	Test3	Test1	Test2	Test3	Test1	Test2	Test3	Test1	Test2	Test3
R: Test1																		
R: Test2	0.122*	0.122*	0.131*	-0.230*	-0.114*	-0.108	-0.156*	-0.096	0.022	-0.218*	-0.215*	-0.014	-0.179*	-0.130*	0.038	-0.248*	-0.177*	-0.048
R: Test3	0.131*	0.101	0.101	-0.117*	0.435*	0.093	0.055	0.422*	0.072	-0.065	0.367*	-0.081	-0.021	0.315*	-0.135*	0.010	0.310*	-0.065
I: Test1				-0.121*	-0.124*	-0.221*	0.133*	-0.073	-0.003	-0.066	-0.197*	-0.204*	-0.072	-0.044	-0.249*	-0.033	-0.116*	-0.225*
I: Test2				0.064	0.108	0.108	-0.101	-0.030	-0.049	-0.205*	0.101	0.006	-0.158*	0.077	0.061	-0.245*	0.033	-0.021
I: Test3				0.064	0.124*	0.124*	0.059	0.448*	-0.013	-0.024	0.493*	0.005	0.009	0.362*	-0.046	0.010	0.459*	0.030
A: Test1				0.108	0.124*	0.124*	-0.001	0.016	-0.233*	-0.040	0.096	-0.257*	0.068	0.062	-0.259*	-0.014	0.099	-0.162*
A: Test2							0.208*	0.112*	0.112*	-0.234*	0.008	-0.058	-0.385*	0.103	-0.080	-0.237*	0.003	-0.114*
A: Test3							0.208*	0.167*	0.167*	-0.046	0.369*	-0.022	-0.111	0.362*	-0.049	0.053	0.322*	-0.063
S: Test1							0.112*	0.167*	0.167*	0.004	-0.012	-0.207*	-0.058	-0.008	-0.213*	-0.056	-0.053	-0.419*
S: Test2										0.036	0.036	0.010	-0.144*	-0.008	0.085	-0.230*	-0.014	0.007
S: Test3										0.010	0.002	0.002	0.012	0.471*	-0.014	0.070	0.537*	-0.097
E: Test1													0.062	0.010	-0.112*	0.007	0.050	-0.068
E: Test2														-0.080	-0.074	-0.012	0.086	0.070
E: Test3														-0.080	-0.030	0.028	0.439*	0.002
C: Test1														-0.074	-0.030	-0.028	-0.027	-0.143*
C: Test2																0.086	0.086	0.124*
C: Test3																0.124*	0.035	0.035

Notes: Each cell correlates one type within one test across all three tests. Gray cells show correlation coefficients between neighboring types. \*  $p < 0.05$ .

### A.3. Composition of ICET

The development of the application was realized with a Cambodian consultant, implemented with a Cambodian programmer and is based on the hexagonal model from Holland (1997) which is characterized by six personality types: the realistic (R) personality type is also called “doers”, investigative (I) type or “thinkers”, artistic (A) type or “creators”, social (S) type or “helpers”, enterprising (E) type or “persuaders”, and finally conventional (C) type or “organizers”. The model is visualized in Figure 2.1. Even though the amount of personality types differ in the subsequently developed models and personality tests, Tracey and Rounds (1995) argue to use between six and eight types while (Athanasou, 2007) uses ten types. Any set larger than six is mostly a combination of the six original ones. This is why we opted to use the initial set-up. The personality types are determined by a test varying in statements which stand in relation to a specific type. These different types map in turn into specific occupations. I will use the terms Holland test and RIASEC test interchangeably when referring to this method while the term Holland Code refers to the three strongest types only.

We use the hexagonal model, because it is applied in many different contexts including Cambodia. The NEA in Cambodia set up a paper-based booklet of six sections to be used by students for career counseling.<sup>1</sup> While particularly the fourth section of this booklet is based on RIASEC, the first and partly the second also rely on it. To our information, the booklet was limited in its outreach since it remained paper-based although there is substantial interest in digitizing it. We refrained from using the test already developed by the NEA since we detected the need to carefully develop context-adapted statements for the test. These statements are activity-based (e.g. “I like hiking”) and are related to students’ life in rural areas. We also tested their understandability through two pre-tests and two pilots to make sure students understood the statements as well as the link between their answers and the test results very well.

The NEA already allocated many occupations to their respective personality types of which we took advantage.<sup>2</sup> We added innovative and detailed descriptions for a total of 18 jobs. All of them were carefully selected to avoid any bias regarding gender or undesirable jobs. There are three jobs per type depending on the required educational level: finishing grade 9, finishing high school, or finishing a university degree. The selected jobs are shown in Table 2.2.

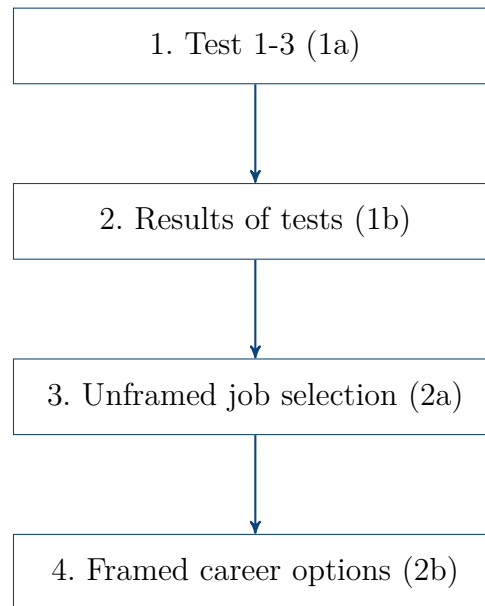
The overall structure of the ICET is visualized in Figure A.3.1. The application was only programmed in Khmer such that all following screenshots are also in Khmer.<sup>3</sup> The ICET starts with three tests while each test differs in its testing method to keep it interesting for students, hence limiting fatigue, and to make students engage with their interests through different methods. After finishing the tests, the personalized results are revealed to each student, showing her all six types but ordered based on her answering scheme. Each type can be clicked on one by one for further explanation. As we want to make sure that students understand that the results are based on what they selected in the tests on their own, hence reflecting their own interests, the subsequent display of the results after the tests is crucial. After the tests and their results (called IET), the 18 jobs from Table 2.2 are shown to students as unframed job selection, hence they are not set in relation to the Holland Code yet. In this final step before providing detailed career guidance, students were asked to

<sup>1</sup> The NEA Career Aptitude Test was developed at the Phnom Penh Job Centre.

<sup>2</sup> If there was no occupation categorization available for the chosen occupation we used international allocations to personality types.

<sup>3</sup> The English wording is available in Appendix A.4.

Figure A.3.1.: Structure of Application

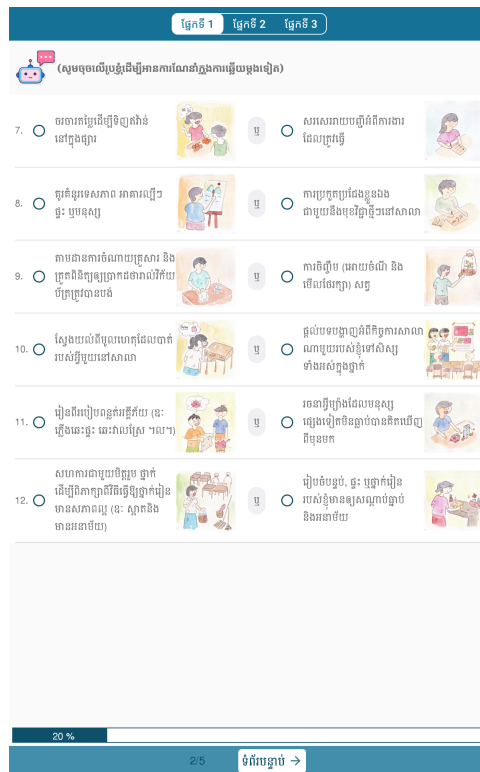


choose between zero and three jobs. Then they are directed to the final component of the application showing the same 18 jobs again but ordered in accordance with the Holland Code. Students could read in detail each job descriptions within or outside their strongest type on the last component called framed career options.

The exact procedure of the application starts with a proper login and a short introduction. Then students are shown the first page of test 1 (see Figure A.3.2). On the top of each relevant page, there is a robot icon which indicates students that they could read detailed instructions. There are five pages of the same kind with a total of 30 opposing items. Each opposing item consists of two statements and each statement is allocated to a specific personality type. Each type is contrasted to all other types twice across the opposing items. Students are forced to choose one statement over the other for every item by deciding which of the two they prefer or to which agree more. If they change their opinion they can undo their choice by clicking on the other statement as long as they do not proceed to the next page. This test procedure is based on the work of Athanasou (2000, 2007) but the statements are carefully adapted to our context plus hand-painted pictures from a local artist are included for better understanding. For example, when contrasting the artistic type with the social type the wording was “Designing an original or new equipment that my school needs such as new colorful rubbish bins or desks” versus “Tutoring students who have problems in their studies”.

After filling out all five pages and a short introduction to test 2, the next test format consists of 42 activity-based statements related again to the six types appearing seven times each. Statements are chosen by ticking them (and consequently not chosen by not ticking them) with a total of 21 choices on two pages each. The template for this test is drawn from a cooperation between Hawaii Department of Education and Occupation Information Network (O\*NET) (Hawaii Department of Education, 2020). It is included as a benchmark test with the following features. The test is at least a decade in use. Although its users are mainly located in Hawaii in particular and the United States in general, additional users are widespread throughout the globe. Since our tests are not validated beforehand,

Figure A.3.2.: Screenshot of Test 1

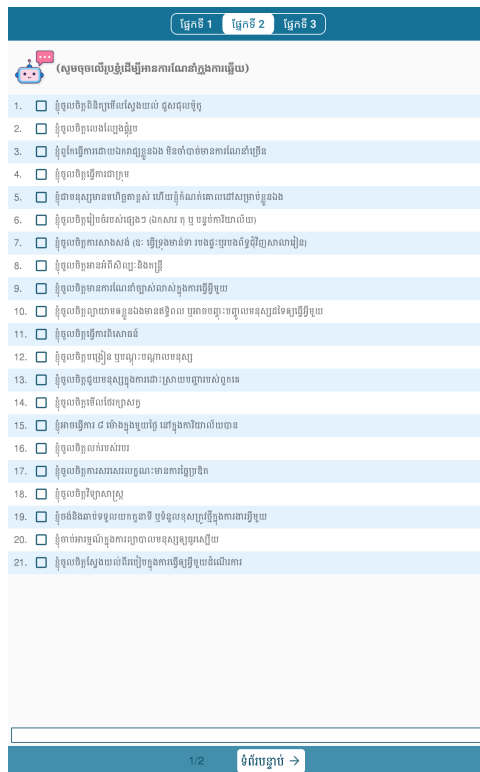


Notes: The application was programmed only in Khmer.  
 The English wording is available in Appendix A.4.

we opted to include one test which has been internationally validated (although Cambodia was not part of it). The literature has proven the transferability of Holland tests (Morgan and de Bruin, 2018; Aljojo and Saifuddin, 2017; Meireles and Primi, 2015) and such that the other two tests, which are designed by ourselves, can be compared to this test. The translations was mostly word-by-word and was only altered in very few cases to ensure students understanding of the statements. The first page of this test can be seen in Figure A.3.3.

To the best of our knowledge, the format of test 3 has not been implemented prior to this study. After discussing favorable formats for ninth-graders with local experts, it seemed fundamental to include it. This test consists of five different scenarios on five individual pages. Each scenario starts off with a half-sentence describing a particular situation. Students are then shown six different ways of how to finish the sentence. Each option is again related to a specific personality type. The challenging part is that students can give different weights to the statements in the following way. There are three empty balls in front of each statement such that students can 1) choose three different statements and consequently giving three statements one point each, 2) choose two statements such that one statement receives two points and the other only one point, or 3) choose a single statement by allocating three points to it. As before, choices can be undone by clicking on the points in front of the statements. Figure A.3.4 illustrates the first scenario and shows in addition that each scenario is supported by a hand-painted picture from a local artist.

Figure A.3.3.: Screenshot of Test 2

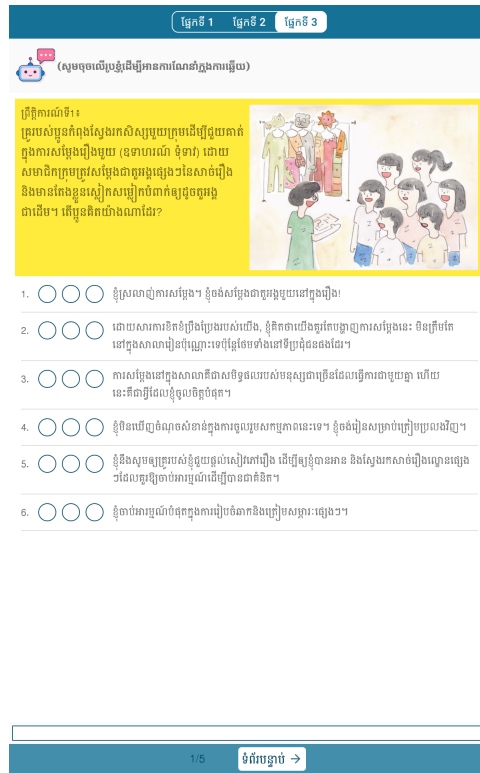


Notes: The application was programmed only in Khmer.  
The English wording is available in Appendix A.4.

Once the students went through all pages of the tests, they are forwarded to the results of their tests. As stated before, all interests can be mapped into the six personality types of RIASEC. For each type, the statements are counted for each test separately. One point is added to the sum for test 1 if the student chooses the statement related to the respective type over the other statement within an opposing item. Hence the maximum of points one type could get in test 1 equals 10. In test 2, the type was given points whenever its related statements are ticked with a maximum of seven points. Finally the points allocated in test 3 over five scenarios could sum up to a maximum amount of 15 points.

The three strongest types are shown from left to right in the first row and visually highlighted while the three weakest types were in the second row as depicted in Figure A.3.5. For all types, the keyword (such as “realistic”) was included as well as a very short description. Students have the option to click on every one of the six personality types to read more about each type’s description. The content is inspired by the The Delaware Departement of Labor (2019) and is again adapted to the rural Cambodian context. Students also are displayed their final score for each type. Based on data from two pilots, our goal was to increase variation across interests and tests as much as possible such that a preference for a few types became more distinguished, ergo we set the underlying algorithm as follows. Test 3 is given the highest weight, consequently it enters the formula with half of its score whereas test 2 is divided by a factor of 2.5 and test 1 by a factor of 20. The highest score for the

Figure A.3.4.: Screenshot of Test 3

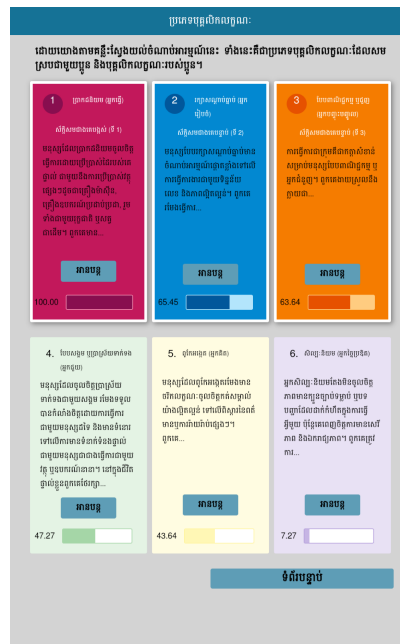


Notes: The application was programmed only in Khmer.  
 The English wording is available in Appendix A.4.

winning type is normalized to 100 for each student and the other scores were shown as percentages of the highest score. A bar additionally visualizes how much of the total score the other types reached.

The following component relates to the unframed job selection for which the 18 jobs from Table 2.2 are displayed in random order and visualized by pictures from which students can choose. As we knew from our field trips that students tend to aim high with respect to higher education, we include different educational levels to check if students are more likely to read descriptions associated with higher educational requirements. A grade 9 diploma is the lowest requirement and applies to all jobs. The next level requires a high school diploma and the highest level a university degree. Consequently, there are three jobs per personality type respecting the different educational levels. We also made sure to include the most common jobs students chose in our survey in July 2019: police officer is the job with the lowest educational requirement for the realistic type, secondary-level teacher is the job with the highest educational requirement for the social type, and general practitioner is also the job with the highest educational requirement for the investigative type. Figure A.3.6 shows an example of the randomized display. No information with respect to the types or educational level was disclosed at this stage but only in the following component since the focus here was set on the initial choice of students. They are told to choose up to three from this selection of jobs that students like themselves might find interesting. There was an opt-out option included whenever none of the displayed jobs was interesting for students.

Figure A.3.5.: Screenshot of the Test Results



Notes: The application was programmed only in Khmer.  
The English wording is available in Appendix A.4.

The app concludes with the framed career options. Students are shown again the very same jobs as described before but this time in the order of their personality types – the first row reveals from left to right their best fit to jobs according to their strongest types, starting with the job with the lowest educational requirement and finishing with the one with the highest educational requirement in each box referring to one specific type. All 18 jobs with student-specific order are displayed at once and students have 17 minutes in total to choose between descriptions they want to read. Once they click on an occupation, a pop-up window with a very detailed description of each occupation appears. A timer is visualized as a green bar diminishing as time runs by and eventually turning yellow and red in the last couple of minutes. Nevertheless, students have the possibility to log out at any time before the timer runs out, creating intentional heterogeneity in interaction with the career paths. The outlay of the overview page is presented in Figure A.3.7a. Each description is innovatively set up by our team and gives an overview of the activities related to the job, highlights the most important tasks and responsibilities as well its societal value, and finishes with explaining the educational requirements. An example of one job description, in this case agricultural technician, can also be seen in Figure A.3.7b.

Figure A.3.6.: Screenshot of the Job List



Notes: The application was programmed only in Khmer. The English wording is available in Appendix A.4.

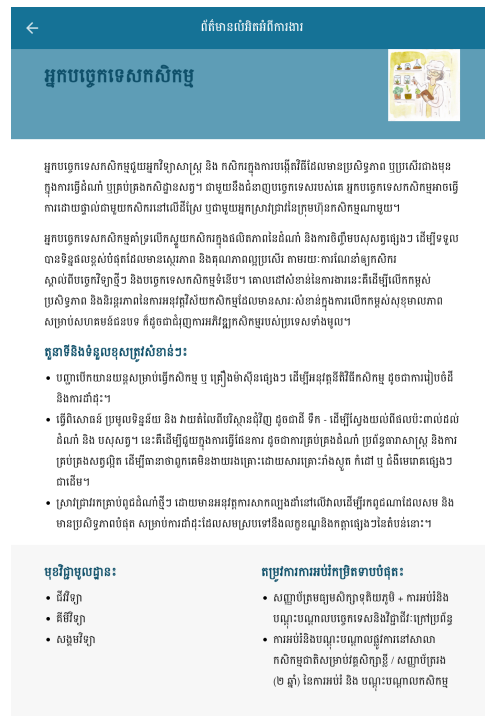


Figure A.3.7.: Screenshots of the Career Options

(a) Overall Job page



(b) Example of one Job Description



Notes: The application was programmed only in Khmer. The English wording is available in Appendix A.4.

## A.4. Wording of ICET

### Interest-based personality tests

Table A.4.1.: Wording of Test 1

Statement ID	Wording	Type
t1_q1_1	Designing an original or new equipment that my school needs such as new colorful rubbish bins or desks	A
t1_q1_2	Tutoring students who have problems in their studies	S
t1_q2_1	Selling goods or groceries to customers	E
t1_q2_2	Keeping records of income such as gift money from guests or expenses in events (e.g. a wedding, a religious ceremony such as "Bon Kathen")	C
t1_q3_1	Helping out a friend who is busy with lots of work to do for their family (e.g. by doing house chores, or helping with the family business)	S
t1_q3_2	Going to the library and reading about a topic I am interested in	I
t1_q4_1	Encouraging people with a positive attitude before an exam	E
t1_q4_2	Sharing something that happened to me with others to help them learn what I learned	S
t1_q5_1	Studying nature or people	I
t1_q5_2	Growing different types of trees, plants or vegetables	R
t1_q6_1	Gardening such as cutting grass or trimming bushes around my house or along the street	R
t1_q6_2	Designing a poster that is creative and eye-catching for my school	A
t1_q7_1	Negotiating prices at a local market	E
t1_q7_2	Writing to-do lists	C
t1_q8_1	Painting sceneries, buildings, houses or people	A
t1_q8_2	Challenging myself with new subjects at school	I
t1_q9_1	Keeping track of household expenditures and make sure bills are being paid	C
t1_q9_2	Raising (feeding and looking after) animals	R
t1_q10_1	Finding out why something went missing at school	I
t1_q10_2	Giving presentation about my school assignment to the class	E
t1_q11_1	Learning how to put out fires (e.g. houses/buildings or fields on fire)	R
t1_q11_2	Designing something that other people have not thought of before	A
t1_q12_1	Teaming up with classmates to discuss how to keep the classroom in a good shape (clean and tidy)	S
t1_q12_2	Keeping my room, house or classroom clean and tidy on my own	C
t1_q13_1	Entertaining my friends by telling an interesting story	E
t1_q13_2	Understanding how the sanitation system works at school	R
t1_q14_1	Solving exercises with clear instructions and ordered steps	C
t1_q14_2	Writing an open-topic essay which I can write about anything I'm interested in	A
t1_q15_1	Observing other people's behavior to understand their emotions and how they think	I
t1_q15_2	Convincing friends to join a social event	E
t1_q16_1	Figuring out how things work/operate (e.g. bikes) by taking them apart and putting them back together	R
t1_q16_2	Caring for people who are disabled	S
t1_q17_1	Determining the best routes to travel on to get to a specific destination	R
t1_q17_2	Collecting information into a notebook for future reference	C
t1_q18_1	Weaving baskets/bamboo balls or using grass or flowers to make bracelets	A
t1_q18_2	Explaining how a compass (instrument to draw circles) is used to convince my friends to use it, too	E
t1_q19_1	Investigating the reasons for a shortage in water supply	I
t1_q19_2	Following routines to avoid errors or mistakes	C
t1_q20_1	Checking my previous lessons or textbooks to learn from past errors	C
t1_q20_2	Learning about new topics by reading about them in school books provided by the teachers	I
t1_q21_1	Setting up a school garden such as adding the soil and grass, planting flowers, etc.	R
t1_q21_2	Connecting with my community by learning about their problems	S
t1_q22_1	Writing a song or a poem for someone I like	A
t1_q22_2	Promote tourist attraction sites to visitors	E
t1_q23_1	Understanding what happens during a lunar eclipse (e.g. by asking my teachers or older people about it)	I
t1_q23_2	Telling interesting stories to the elderly	S
t1_q24_1	Being in charge of looking after a relative's (grocery) store and serving customers in her absence	E
t1_q24_2	Going for a hike in the mountains/forests to collect firewood, pick fruits or find natural herbal medicine	R
t1_q25_1	Creating artistic advertisements for products sold in a store or sold by your parents	A
t1_q25_2	Recording other student test scores for the teacher after an exam or for Student Report Book	C
t1_q26_1	Making new friends during a social event in the neighboring village	S
t1_q26_2	Memorizing and performing a dance you saw on TV or during a social event	A
t1_q27_1	Organizing traveling arrangements such as food, accommodation, and places to visit	C
t1_q27_2	Listening to people sharing stories	S
t1_q28_1	Learning to play a musical instrument (e.g. a guitar, flute, drum)	A
t1_q28_2	Analyzing the reasons why a mobile phone, TV or radio is not working	I
t1_q29_1	Teaching children how to play sports	S
t1_q29_2	Taking up a leadership role in a group project	E
t1_q30_1	Collecting and analyzing natural resources such as fossils or minerals	I
t1_q30_2	Learning how to fix everyday items such as broken shoes, bags, fans, etc.	R

Table A.4.2.: Wording of Test 2 and 3

Statement ID	Wording	Type
t2_q1	I like studying and tinkering with motorbikes	R
t2_q2	I like to do puzzles	I
t2_q3	I am good at working independently	A
t2_q4	I like to work in teams	S
t2_q5	I am an ambitious person, I set goals for myself	E
t2_q6	I like to organize things, (files, desks/offices)	C
t2_q7	I like to build things (e.g. making chicken/duck coop, fences around the house or around the school)	R
t2_q8	I like to read about art and music	A
t2_q9	I like to have clear instructions to follow	C
t2_q10	I like to try to influence or persuade people	E
t2_q11	I like to do experiments	I
t2_q12	I like to teach or train people	S
t2_q13	I like trying to help people solve their problems	S
t2_q14	I like to take care of animals	R
t2_q15	I wouldn't mind working 8 hours per day in an office	C
t2_q16	I like selling things	E
t2_q17	I enjoy creative writing	A
t2_q18	I enjoy science	I
t2_q19	I am quick to take on new responsibilities	E
t2_q20	I am interested in healing people	S
t2_q21	I enjoy trying to figure out how things work	I
t2_q22	I like putting things together or assembling things	R
t2_q23	I am a creative person	A
t2_q24	I pay attention to details	C
t2_q25	I like filing / organizing previous lessons or teachers' handouts according to school subjects	C
t2_q26	I like to analyze things (problems/situations)	I
t2_q27	I like to play musical instruments or sing	A
t2_q28	I enjoy learning about other cultures	S
t2_q29	I would like to start my own business	E
t2_q30	I like to cook	R
t2_q31	I like acting in plays	A
t2_q32	I am a practical person	R
t2_q33	I like calculating numbers or drawing graphs to better understand a problem description in a lesson	I
t2_q34	I like to get into discussions about issues	S
t2_q35	I am good at keeping records of my work	C
t2_q36	I like to lead	E
t2_q37	I like to be and work outside in nature, fieldwork in different villages or work on different project sites	R
t2_q38	I would like to work in an office	C
t2_q39	I'm good at math	I
t2_q40	I like helping people	S
t2_q41	I like to draw	A
t2_q42	I like to talk in front of the villagers to explain solutions to problems we have in the village	E
t3_q1_1	I love plays. I would like to play a character in the story!	A
t3_q1_2	Given how much effort we put in, I think we should show the play not only in school but in the district town.	E
t3_q1_3	The school play is a product of many people working together, this is what I like most about it.	S
t3_q1_4	I do not see the point in doing the play; I would rather prepare for my exams.	C
t3_q1_5	I'll ask my teachers to provide story books, so that I could read and search for interesting plays.	I
t3_q1_6	I am most interested in setting up the stage and putting pieces together.	R
t3_q2_1	I can reduce stress by listening to music, singing, dancing, painting or drawing.	A
t3_q2_2	I would distract myself by helping my parents with the household, in the garden, or on the farm.	R
t3_q2_3	I usually find ways to overcome my problems, they help me grow.	I
t3_q2_4	I would talk to my friends or family. Talking to people always helps me.	S
t3_q2_5	I would not let myself down too much, usually things work out.	E
t3_q2_6	I would seek help and guidance from my teacher.	C
t3_q3_1	... well ordered and organized with clear information. I like to know which exercises I have to complete in a day in order to prepare for the lesson.	C
t3_q3_2	... unexpected. I need surprises to be happy and excited at school.	A
t3_q3_3	... conveyed through discussions and interactions with my friends and teachers.	S
t3_q3_4	... practical. I enjoy learning things that I can apply in my daily life.	R
t3_q3_5	... challenging. I like to find answers to complex questions.	I
t3_q3_6	... giving me the option to compete with others in group exercises.	E
t3_q4_1	I would set up the tent and tables, or help in the kitchen.	R
t3_q4_2	I would look up the best venue, caterer, or wedding dresser/make-up artist.	I
t3_q4_3	I would enjoy preparing the decoration or being the photographer of the day.	A
t3_q4_4	I would welcome everybody on arrival and make sure that the guests are comfortable.	S
t3_q4_5	I would contact my relatives and friends and convince them to come to the wedding.	E
t3_q4_6	I would be keeping record of who is coming, in order to plan the menu and seating.	C
t3_q5_1	I would like to learn how world maps/map of Cambodia are constructed.	I
t3_q5_2	I would like to learn about how to keep track of my expenditures and how to organize my homework.	C
t3_q5_3	I would like to learn games and activities that I could do with children from my village.	S
t3_q5_4	I would like to have a creative workshop that involves acting, singing, drawing, or writing.	A
t3_q5_5	I would like to learn more about how to motivate and guide my peers.	E
t3_q5_6	I would like to learn about using and repairing cellphones.	R

## **Wording of job descriptions**

### **Police officer**

A Police Officer (Policeman/Policewoman) is employed and trained under the government through Cambodian National Police, Department of Ministry of Interior. He/she has the duty to serve the general public and protect it against crimes, violence or any act of injustice. Another primary function is maintaining public order and peace through law enforcement and surveillance of the public to make sure they do not break the law.

Police Officers are trained to defend themselves and the victims, and are trained investigation techniques to prevent and detect crimes such as fraud, rape, murder, or drug trafficking. They have the legal authority to arrest or detain people for a limited time when those people have been suspected of committing a crime or if there is any assault. They are also skilled at de-escalation of stressful situations between different parties.

Main Roles and Responsibilities:

- Manage traffic flow to keep the roads free of congestion, enforce the Rules of the Road for every transport user, and prevent or protocol accidents in order to maintain traffic safety and efficiency on the roads.
- In maintaining public order, police officers may patrol on foot, in a car/motorbike or are often stationed next to the road to deal with traffic violations such as giving people warnings or issuing fines.
- Receive calls to investigate burglaries or other crimes.
- Help collect evidence to solve crimes such as by investigating or interrogating suspects/criminals and witnesses to make sure the evidence is accurate and reliable before making any arrest or release.

Foundation Subjects:

- Khmer Literature
- Sociology
- Law
- History
- Physical Education

Basic Education Requirement: Lower Secondary Education + Training at The Police Academy of Cambodia

### **Agricultural technician**

An Agricultural Technician helps scientists and farmers develop effective or better ways to manage plant and animal farms. With his/her technical expertise, an agricultural technician might work directly with farmers on the fields or with researchers of agricultural companies.

Agricultural technicians support farmers in improving productivity of different crops and livestock to maximize yields, in achieving better quality and stable production through the introduction of new

technologies and sophisticated farming techniques. A key goal of this job is to improve the efficacy and sustainability of agricultural practices, which is essential to promoting well-being for the rural communities as well as advancing the nation's agricultural development as a whole.

Main Roles and Responsibilities:

- Operate farming vehicles or other motorized equipment to carry out farming procedures such as land preparation and cultivation.
- Collect samples and evaluate how the surrounding environment - e.g. soil, water - affects crops and livestock. This is necessary to improve crop management, irrigation systems, and pest control to ensure crops and livestock are not vulnerable to drought, heat, diseases, etc.
- As the executive arm of researchers, they research new crop varieties by performing planting experiments on the field to find those that are most suitable and most effective for cultivation with the conditions of the area.

Foundation Subjects:

- Biology
- Chemistry
- Sociology

Basic Education Requirements: High School Diploma + Non-Formal Technical and Vocational Education and Training (TVET);

Formal education and training at National Agricultural schools for Short Courses / Associate Degree (2 years) of Agricultural Education and Training

## **Civil engineer**

A Civil Engineer is a person who designs, improves, and maintains construction projects such as roads, bridges, dams, water supply or sewage systems and works on structural components of buildings e.g. airports and hospitals. With the application of their scientific and environmental knowledge, he/she also oversees the operations and progress of the projects, making sure infrastructure meets basic human needs such as withstanding all weather conditions, to promote safety and improve quality of living of citizens benefiting from these constructions.

Civil Engineering is a versatile job because different projects can translate into working in different provinces/countries and during different working hours. Also, one can see the results at the end of their work - a completed bridge, a hydroelectric dam for the community to use, etc.

Main Roles and Responsibilities:

- Designing the structure of a project and planning the construction activities
- Before the implementation can begin, civil engineers have to organize and carry out logistical tasks to ensure the project site can be reached by heavy machinery and has access to water, electricity etc.
- Perform building inspections after the project has been completed

- Ensure each construction project complies with legal requirements, especially health and safety. This is by maintaining the quality of air, water, and land through sustainable practice and methods such as by implementing strategies to deal with pollution, waste management, etc.

Foundation Subjects:

- Maths
- Physics
- Drawing
- Social Science

Basic Education Requirement: Bachelor's Degree in Civil Engineering

## Carpenter

Carpenters are skilled craftsmen and women who create or adjust wooden objects and structures. In the construction industry, carpenters can work on different project sites from building homes and offices to bridges and roads. They need to start by reading and analyzing technical drawings or blueprints to understand the layouts and details of building plans and determine what they need to construct.

Their expertise in constructing wooden frames is fundamental to support building structures and ensure sustainability in each construction. This is why they need both training and physical practice to excel in making objects such as wardrobes, cabinets, chairs, and beds or structures such as houses or boats important and necessary for everyday use. In doing so, they need to be detail-oriented to be able to perform fine, intricate work accurately.

A carpenter may work independently or in teams based on the project contracts, but prefers little supervision as it is important that they make decisions and try out designs on their own.

Main Roles and Responsibilities:

- Make precise measurements of sizes and distances, calculate quantities and angles, triangulation, etc., before/while cutting or shaping wood, plastic or other materials.
- When facing unexpected situations or errors, carpenters need to think and come up with solutions quickly and accurately. They need to use logic to foresee problems/challenges in order to ensure effective time and budget management in a project.
- Communicate with clients and arrange what amount and type of materials and fitting plans according to the clients and building needs.

Foundation Subjects:

- Mathematics (Arithmetic, Algebra, Geometry)
- Drawing
- Physics
- Social Science

Basic Education Requirement: Lower Secondary Education + Technical and Vocational Education and Training (TVET) - Carpentry Training / Apprenticeship

## **Journalist**

The primary function of this profession is to investigate different social issues, which can be to provide insights into global events that can have impacts on people's lives or to uncover crimes, political corruption or corporate wrongdoing, etc. In this process, journalists then collect, write, and present information they manage to obtain as news stories. The news can be presented through newspapers, radio, magazines, television, and the internet.

A journalist can work with general issues, but the majority tends to specialize in certain topics of their highest interest or expertise such as politics, crime, business, health, or sports, etc. Regarding work setting, some journalists may be employed under national/international news organizations, or work as freelance to write news stories to different clients.

Serving to bring the truth to the general public, journalists sometimes have to expose themselves to danger with their access to sensitive information, especially when investigating and reporting in countries where freedom of the press is limited. However, through their essential role of being the eyes for the public, the world's citizens are informed about what they need to know - important issues that can help them make the best possible decisions about their lives, their communities, societies, and governments.

Main Roles and Responsibilities:

- Educate the public in an accurate, well-rounded, and objective manner about national and/or international events and issues and how they can affect lives of the citizens.
- Collect information for each news story, which can be by interviewing expert sources/witnesses on the topic, researching public/private records for facts and statistics to support their stories, visiting the sites of where the focal event/issue takes place, and documenting what they see, etc.
- Present the information they have collected in written or spoken form as news stories, documentaries or featured articles.

Foundation Subjects:

- Khmer Literature
- History
- Sociology
- Social Science
- Computer Skills
- Foreign Language (English)

Basic Education Requirement: High School Diploma + Media Training (e.g. Cambodian Center for Independent Media)

## General practitioner

A General Practitioner works in and for a particular community in public health facilities such as a referral hospital. He/she may also choose to work in provincial or major hospitals across the country.

In health care, general practitioners are primary-care physicians whom patients of all ages can go to for diagnoses, minor surgeries, and especially for treating ailments and chronic illnesses. They are the first contact when medical issues arise and consequently need to investigate in detail the type of illness and what treatment is needed. In case of serious diseases, they would need to refer those patients to the appropriate specialist doctor for medical advice and for higher-complexity surgeries or treatments.

Having the option to work close to rural communities, general practitioners can provide great convenience and comfort to remote villagers who wouldn't need to travel long distances to be admitted to healthcare. General practitioners are able to help those in need with their ability to conduct life-saving surgeries/treatments and heal people to good health and well-being.

Main Roles and Responsibilities:

- Provide patients interpretations of symptoms in identifying a certain illness, and consultations on the following course of action for treatment and medication, etc.
- Conduct physical examinations on patients to confirm a diagnosis.
- Provide pre-hospital treatment, surgeries, and other emergency care.
- Advise community members of preventive medicine and healthy lifestyles.

Foundation Subjects:

- Biology
- Chemistry
- Physics
- Mathematics
- Foreign Language (e.g. English, French)

Basic Education Requirement: Bachelor of Medicine Bachelor of Surgery

## Photographer

Taking pictures as a profession, a Photographer focuses on the art of making photographs with a digital or film camera.

Photographers can be employees of corporations such as newspaper/magazine companies, fashion publication or advertising agencies, who work full-time to take pictures for business websites and other promotional materials. However, many tend to work freelance, and can be hired by different clients for specific events such as weddings or graduations. Consequently, their social impact ranges from letting hosts and invitees refresh their memory of a private event to documenting historical, political or social milestones for the general public.

Depending on their specialization, some photographers work in studios, while others work outside, exploring and capturing nature, landscapes, places and things.

Main Roles and Responsibilities:



- Work with natural/artificial lighting or colors, and may also include different props to apply creativity and aesthetics when taking pictures of people, places and things.
- Choose their own subjects or materials that they want to take pictures of, and determine what beauty and style is for that setting.
- Have the pictures taken developed physically/digitally, usually after some editing of those pictures.

Foundation Subjects:

- Arts Education
- Chemistry
- Information and Communications Technology

Basic Education Requirement: Lower Secondary Education + Vocational Training - Photography

### **Clothes designer**

A clothes designer makes clothing for men, women and children such as suits, trousers, dresses, and other types of clothes. The clothes designed by a professional can be practical and useful for daily activities on the one hand while they can be as extravagant as wedding dresses on the other hand. The process of making clothes can involve customization to best fit each client's preferences and physique, which requires the clothes designer's talent in translating the wants of customers by using yarns and fabrics and by applying design and aesthetics to clothing.

Clothes designers can work full-time alone or part of a team for a fashion/design house. There are also those who work freelance for their own business at home or a shop.

Main Roles and Responsibilities:

- Measure customers before getting to sewing to make sure the clothing will fit and help customers select fabric and colors for their clothes. The designer communicates consistently with clients throughout the process in order to make sure all components from concept and design to materials are used to satisfy the clients.
- Sketch designs on paper/computer or drape fabric on a mannequin using different tools such as chinks, scissors, pins, and sewing machines. In designing, they also work with a wide range of materials, colors, patterns, and styles.
- Conduct research on current fashion trends to understand consumer tastes. This sets the foundation to creating designs.

Foundation Subjects:

- Drawing
- Sewing and Textile
- Arts Education
- Mathematics (Arithmetic, Algebra)

Basic Education Requirement: High School Diploma AND/OR Vocational Training - Tailoring / Dress Making

## Architect

An Architect's job is to plan, design, and review the construction of buildings for clients. He/she is responsible for the visual appearance of a building, focusing on the aesthetics and functionality of entire structures. An architect also oversees the project and is accountable for the public safety of the construction. As construction methods become more and more sophisticated, an Architect needs to ensure that s/he is up to date and offers cost-efficient and environment-friendly solutions to costumers.

With a variety of roles, architects usually work in a multitude of workplaces. During the designing stage, they may work from their office while having meetings with clients in different settings. Once the construction starts, architects need to do frequent site visits to oversee the project.

Main Roles and Responsibilities:

- Design proposals, featuring their creative ideas and visions of the clients on the structure and use of space, etc.
- Produce detailed drawings from the design and test the feasibility of the design with technology from a computer software.
- Translate the design into instructions and technical specifications for contractors and construction experts.
- Consult with engineers, construction surveyors, and other specialists about the design to ensure aspects such as structural supports and energy efficiency components e.g. ventilation system and natural lighting.

Foundation Subjects:

- Physics
- Mathematics (Algebra, Calculus, Geometry)
- Drawing
- Information and Communications Technology

Basic Education Requirement: Bachelor of Architecture

## Tour guide

A Tour Guide provides information and assistance to international individual clients or groups of visitors or tourists at different travel destinations such as nature attractions, landmarks, religious/historic sites, museums or other scenic locations.

Often employed under travel companies, tour guides may offer to lead walking tours, bus tours, and also river tours on boats. With their knowledge and expertise on the history of the target location, a tour guide normally provides interesting description and facts of the site - its history and its impacts on modern society, etc.

Main Roles and Responsibilities:

- Enlighten and engage the visitors with the site with the tour guide's knowledge of history and ability to interpret the cultural/natural heritage and provide answers to questions of interested visitors with ease

- Entertain the visitors
- Provide safety regulations and ensure that every visitor complies to the rules While also ensuring that the tour is as safe as possible for every member of the group tour.
- Plan, manage, and supervise itineraries, ensuring the program and its activities are adapted to the visitors' taste and are carried out according to schedule, arranging transportation between the traveling destinations, etc.

Foundation Subjects:

- Foreign Language (e.g. English, Chinese, Korean)
- History
- Social Sciences

Basic Education Requirement: Lower Secondary Education + Vocational Training (Post Grade 9)

### **Social worker (working with NGO)**

A social worker chooses as his/her profession to help and empower other people or communities (usually the marginalized/disadvantaged) to enhance their well-being and promote social change, development, and cohesion.

The structure and administration of organized social work usually aims to develop the beneficiaries' knowledge, skills and ability to utilize their own, the community or government's resources. This is often by ensuring the marginalized people access to quality education, counseling, health care services, and so forth, thereby jointly developing perspectives and qualifications to improve their own life and contribute to inclusive and sustainable development.

Through addressing challenges of individuals and communities, social workers may work to tackle broader issues of human rights, poverty, unemployment, inequality, etc.

Main Roles and Responsibilities:

- Travel to rural areas or marginalized communities where the Social Workers engage and listen to the community/beneficiaries in meetings and discussions to negotiate and formulate an action plan as program/project to tackle those challenges to secure funding and support for the project to take place.
- Carry out the project implementation, with close engagement and counseling with the beneficiaries and the NGO to maintain the right direction.
- Monitor and evaluate by conducting on-going documentation of short-term and/or long-term goal attainment.

Foundation Subjects:

- Sociology
- Social Sciences
- Mathematics (Statistics)

Basic Education Requirement: High School Diploma + Social Welfare Services Training

## Secondary-level teacher

Based in high schools (public/private), Secondary School Teachers help students of different age groups, typically from grades 7 - 12, to acquire knowledge, understanding and competence through teaching a particular subject of his/her expertise. The specialised subject can be academic, technical or vocational, which can be taught in a rotation of 3 - 6 classes per day and potentially to more than 100 students every day.

Through the educating process, a teacher is also integral in cultivating virtues, building a sense of moral framework and self-identity in students as they learn and grow into adulthood. Teaching can be a fulfilling career that can influence the future of young people and help prepare them into well-rounded individuals who can contribute to society.

Main Roles and Responsibilities:

- Share with students knowledge relevant to the focal subject in an understandable and interesting way
- Design lesson plans - guides which normally outline the objectives of what and how the students will learn/accomplish in a lesson, subject points to be covered, activities and learning materials to be used, etc.
- Grade students' examination papers, homework or assignments.
- Communicate with parents or guardians of the students of progress or challenges the students may have.

Foundation Subjects:

- Sociology
- Social Sciences
- Communication Skills
- (Depends on the focal subject one wishes to teach as featured in the National Curriculum, which can include Khmer Literature, Maths, Physics, Chemistry, Sociology, History, Geography, Foreign Language (English), etc.

Basic Education Requirement: Bachelor of Education

## Chef (restaurant owner)

Working as a professional cook, a chef prepares, cooks, and presents food to customers, usually specialized in a particular cuisine such as Khmer, Thai, Indian or Japanese. A chef is responsible for defining her/his own responsibilities which can vary widely depending on range of tasks and the size of the restaurant. The following tasks are either carry out by the chef or need to be delegated: cooking, leading staff, bookkeeping, cleaning, advertising etc.

Two of these tasks are often performed by the chef her-/himself: cooking and leading staff. Being the head of the kitchen, he/she may innovatively develop recipes to improve the tastes or presentation of traditional dishes, or be adventurous to create new and unique dishes to produce the best possible food and put together an attractive menu that fit the customers' tastes. A chef also needs to be a

leader who can supervise and delegate tasks to staff in the kitchen effectively in order to organize and achieve tasks as fast and efficient as possible to satisfy the client.

Main Roles and Responsibilities:

- Prepare, season, and decorate meals and dishes based on each customer's order.
- Work with multiple tasks, different ingredients for different dishes and various kitchen equipment
- Monitors and supervises the preparation and administration of cooking by other kitchen staff members.
- Ensure that the kitchen is well-organized and consists of a standardized level of hygiene to maintain food safety standards.

Foundation Subjects:

- Mathematics (Basic Numeracy Skills)
- Sociology
- Social Sciences

Basic Education Requirement: Lower Secondary Education + Vocational Training - Culinary

### **Real estate agent**

Purchasing a piece of property such as a house can be an important decision to make and may involve a complex procedure to follow to get the task sorted. Therefore, people usually seek assistance from a Real Estate Agent, whose job is to help clients buy or sell properties such as houses, offices or plots of land for the best possible price and/or conditions.

A real estate agent can choose to work as a listing agent to help clients sell properties, or as a buyer's agent to help clients buy properties. With their knowledge on local property law and expertise to market properties, real estate agents act as the middleman between the two parties who wish to buy and sell properties. Once the buyer and the seller came to an agreement and accepted a bid, the agents can still be involved in supporting the clients with paperwork, ensuring communication between the two parties runs smoothly and providing feedback on inspections and moving.

The workplace may vary across time spent in an office and time spent to visit properties and have meetings with clients in different places. Real estate agents also work irregular hours, which can be during the day, in the evening or also on weekends.

Main Roles and Responsibilities:

- Conduct research to be informed of the local property market trend and competitive prices
- Look for properties that suit clients' needs.
- Negotiate on client's behalf for the most reasonable price or favorable terms.
- Attend conferences and/or seminars to stay up to date with current trends and network with property owners, potential clients, and other real estate agents.

Foundation Subjects:

- Mathematics (Arithmetic, Statistics)
- Sociology
- Social Sciences

Basic Education Requirement: High School Diploma

### **Sales manager**

Usually employed at for-profit corporations, a sales manager leads and guides a team of sales staff to ensure effective sales processes and achievements. Sales management involves developing a sales plan which sets the strategy and identifies profit-based sales targets in order to achieve objectives through the sales of products and services in the organization. Their tasks often vary with the size of the organization they work for.

Sales managers listen and respond to customers' preferences to remain competitive and retain loyalty in the market. They also need to come up with new ideas to upgrade products and services to keep up to the evolving needs of consumers, to stay ahead and be able to expand the business's client base.

They play a key role contributing to the firm's success externally on the market but they also are a key player within the organization as a mentor and leader of employees in the sales team which are in constant exchange with the sales manager to improve their performance.

Main Roles and Responsibilities:

- Monitor and analyze customer preferences to determine the focus of sales efforts.
- Promote sales by determining discounts, special pricing plans or other rewards to capture consumers' interests.
- Evaluate sales staff performance to plan and coordinate training programs for sales staff.
- Manage and resolve customer complaints regarding sales and service.

Foundation Subjects:

- Mathematics (Arithmetic, Algebra, Statistics)
- Sociology
- Social Sciences
- Psychology
- Foreign Languages (e.g. English, Chinese)

Basic Education Requirement: Bachelor's Degree in Sales of Marketing; Bachelor's Degree in Business

### **Receptionist**

A Receptionist (sometimes referred to as administrative assistant) is someone who performs various administrative tasks, including answering telephones and giving information to the public and customers. The work is usually performed in the waiting area such as a lobby or front office desk of an organization or business.

Receptionists are often the first employee with whom the public or customer has contact. They are responsible for making a good first impression for the organization, which can affect the organization's success.

Main Roles and Responsibilities:

- Answer and forward telephone calls, obtain or send information or documents using a computer, mail, or a fax machine, and perform other administrative support tasks, such as keeping appointment calendars
- Greet walk-in customers and other visitors and escort them to specific destinations while contributing to the security of the office by helping to monitor visitors' access
- Copy, file, and maintain documents and records plus collect, sort, distribute, and prepare mail and courier deliveries.

Foundation Subjects:

- Sociology
- Social Sciences
- Foreign Languages (English, Chinese)

Basic Education Requirement: Lower Secondary Education + Vocational Training - Hospitality

### **Office administrator**

An office administrator works to ensure smooth flow of day-to-day operation and procedures of an office or an organization by supporting and organizing the administrative system. This includes financial arrangement and billing, personnel support, information and document records management, and logistics.

Having a key role in running various administrative activities effectively and efficiently, office administrators often need to provide and inform structures to other employees to follow such as budget management, procurement, correspondence procedure, etc. Consequently, they are good in multitasking managing various types of tasks at the same time.

Main Roles and Responsibilities:

- Coordinate office activities by implementing, managing and maintaining filing and labeling system of different categories of information records or invoices to ensure any required information is found easily and quickly when needed.
- Supervise administrative staff and assist fellow employees with meetings, conferences and other work events by scheduling appropriate times, booking rooms, and arranging refreshments, etc.
- Keep stock of office supplies and order stationery, furniture, and other office equipment when needed.

Foundation Subjects:

- Khmer Literature
- Mathematics (Arithmetics, Statistics)

- Computer Skills (e.g. Word, Excel, Access)
- Foreign Languages (English)

Basic Education Requirement: High School Diploma

### **Software developer**

Usually in a planned and structured process as discussed with clients, software developers have a keen interest in computer systems and the latest technology who write and maintain a chosen programming language (commonly known as a collection of code / source code) to carry information and implement a sequence of instructions which automate the performance of one or multiple tasks in a software. For example, a client can request to develop a program which controls electricity supply during the night such that light in public spaces are shut off automatically during times when nobody is present.

A software developer may work as an employee for an organization or as a freelancer and their work facilitates digital effectiveness in our daily use in a range of fields such as Health care, Education, Economics, Business, etc. He/she often works as a team with a number of computer programmers to write and implement the source code and also to find and fix errors in the system in order make changes and ensure proper function of the software.

Main Roles and Responsibilities:

- Communicate with clients to analyze their needs in order to design develop software/applications according to their requirements.
- Work with the client to create a conceptual design, and then have the developer's team of computer programmers create the programming code in order to run the software.
- Once the final manifestation and internal system of the program/software has been built, the developer continues to maintain and update the program to ensure all security problems are fixed and is well-operated in the database.

Foundation Subjects:

- Computer Skills
- Mathematics (Calculus, Statistics)
- Physics
- Social Sciences
- Foreign Languages (English)

Basic Education Requirement: Bachelor's Degree in Software Engineering; Bachelor's Degree in Computer Science; Bachelor's Degree in Information Technology

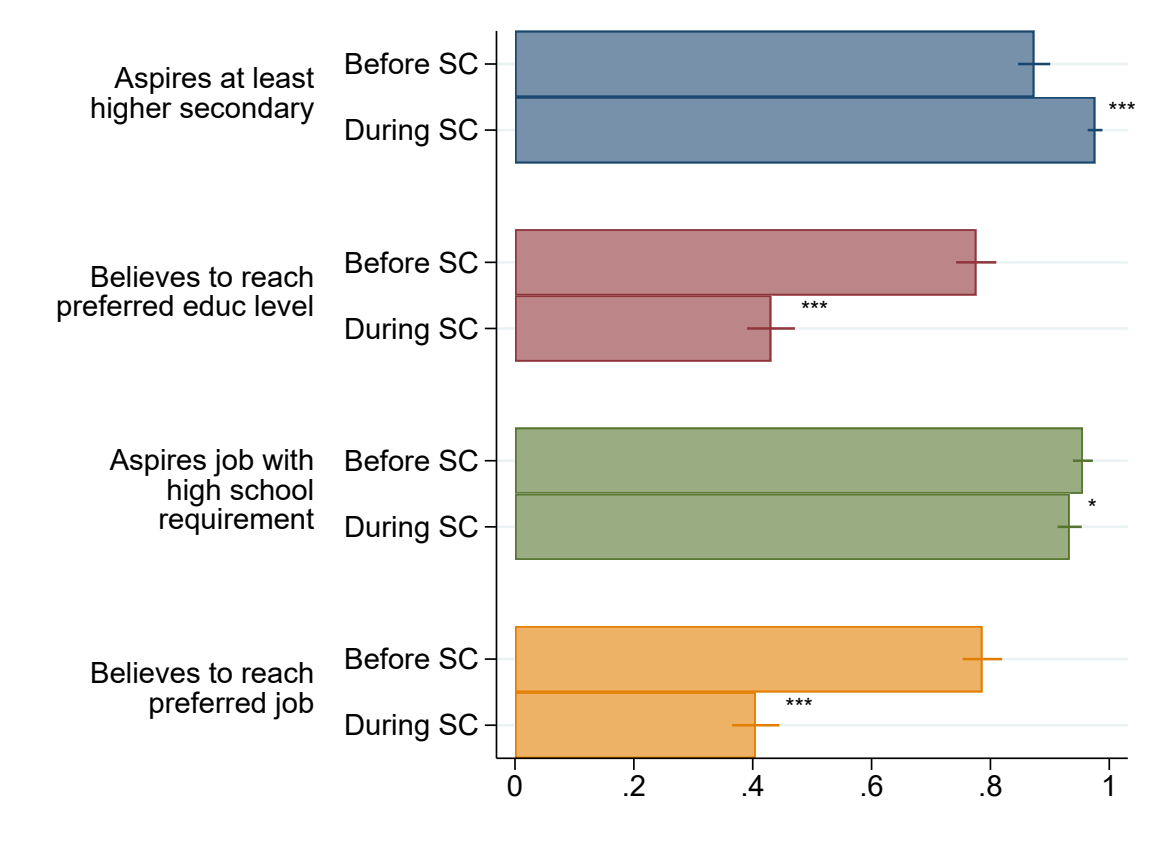


# B. Appendix for Chapter 3

## B.1. Supplementary Figures

### B.1.1. Impact of School Closure

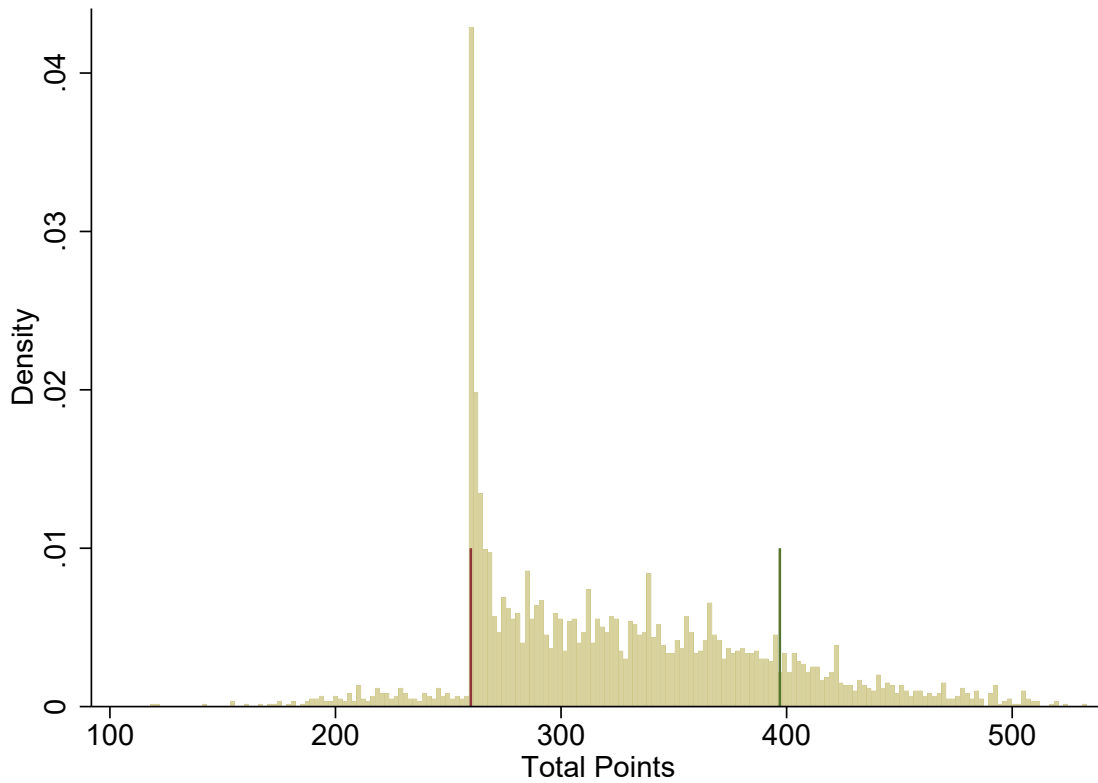
Figure B.1.1.1.: Preferred Job and Aspired Education Before and During School Closures



Notes: For treated students who also participated in the phone survey. All outcomes are dummies, SC denotes school closure. \*/\*\*/\*\* denote significance levels at 10/5/1 percent respectively.

## B.1.2. Grade Distribution

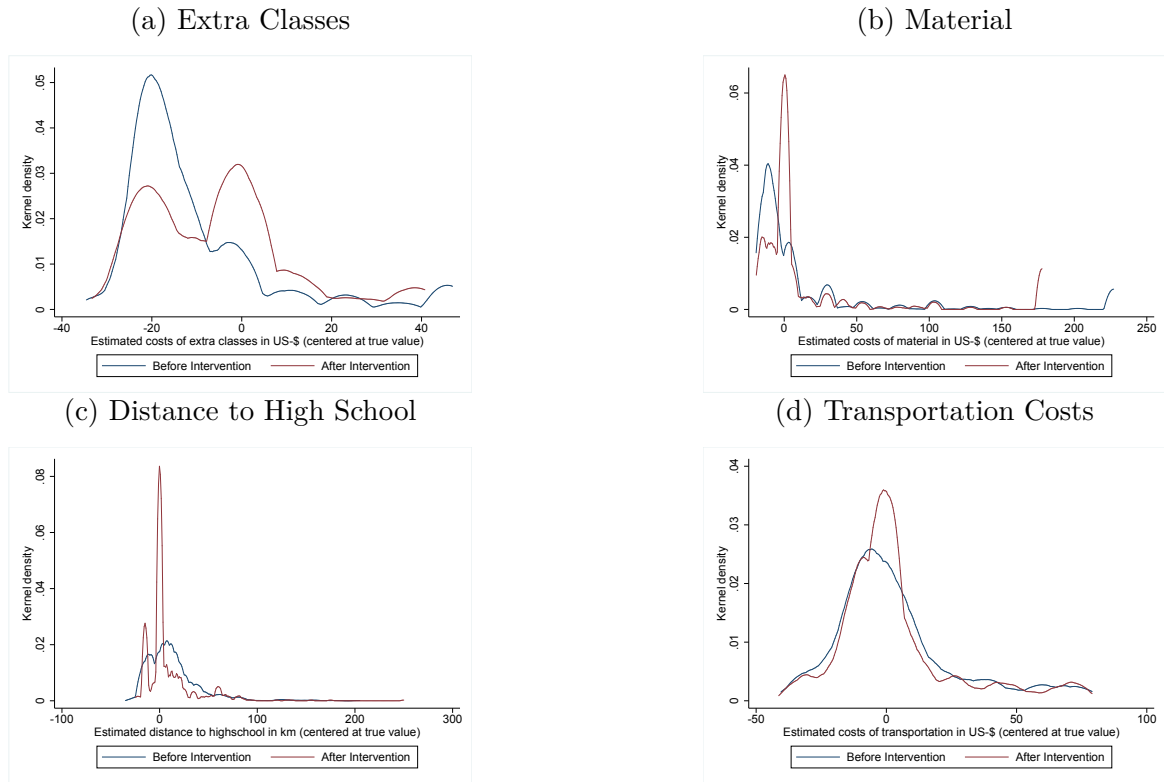
Figure B.1.2.1.: Distribution of Total Final Exam Grades



*Notes:* The graph shows the distribution of the total points students obtained in the final exam. Vertical lines represent cut-off points to pass final exam (red) and for belonging to the top 15% of students (green).

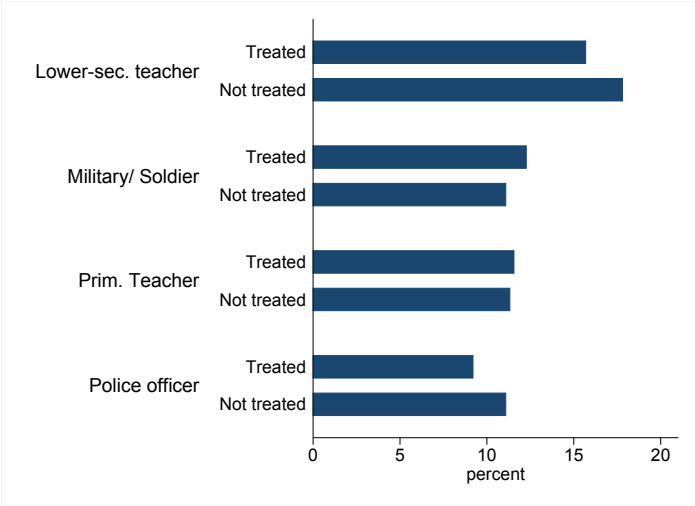
### B.1.3. Information Retention

Figure B.1.3.1.: High School Cost and Distance Estimates of Treated Students



Notes: Cost and distance estimates before and immediately after the intervention, in US-\$, centered at true value, winsorized at the 95<sup>th</sup> percentile.

Figure B.1.3.2.: Preferred Job of Treated and Not Treated Students, at Follow-up



Notes: Students are asked in an open-ended question what job they would like to be doing when they are about 25 years old. Answers were categorized by the interviewer and researchers.

## B.2. Supplementary Tables

### B.2.1. Student and School Characteristics

Table B.2.1.1.: Balance Table: Pre-Intervention Characteristics of Students in Treatment and Control Schools

Variable	(1) Mean Control	(2) Mean Treatment	(3) Cont. vs. Treat.
Female	0.52 (0.50)	0.54 (0.50)	0.02 (0.37)
Age	15.05 (1.30)	15.10 (1.35)	0.05 (0.74)
Distance to school (km)	3.07 (3.64)	4.00 (3.95)	0.93 (0.14)
Distance to district town (km)	12.89 (8.36)	9.80 (6.40)	-3.09 (0.18)
Distance to high school (km)	9.98 (7.35)	9.24 (6.44)	-0.74 (0.71)
Final Exam Grade 8	32.06 (5.67)	31.61 (6.38)	-0.46 (0.65)
Dec Khmer	62.93 (20.83)	55.29 (20.84)	-7.64** (0.05)
Dec Math	50.70 (26.62)	42.84 (24.42)	-7.86 (0.18)
Dec English	15.44 (13.99)	12.92 (12.52)	-2.52 (0.48)
Dec Total	349.03 (121.78)	303.32 (110.88)	-45.71 (0.16)
Jan Khmer	60.51 (21.33)	54.90 (21.05)	-5.62 (0.18)
Jan Math	47.43 (25.60)	47.02 (24.96)	-0.41 (0.94)
Jan English	16.63 (14.49)	13.32 (11.69)	-3.31 (0.35)
Jan Total	347.53 (120.44)	341.33 (135.39)	-6.20 (0.87)
Dec Absence	1.34 (2.28)	1.63 (2.25)	0.29 (0.36)
Jan Absence	1.40 (2.47)	1.69 (2.21)	0.30 (0.37)
Avg Total (Dec&Jan)	347.64 (114.63)	321.64 (117.19)	-25.99 (0.43)
Observations	802	861	1,663

Notes: (1) and (2): standard errors in parentheses (clustered at school level); (3): p-values in parentheses. \*/\*\*/\*\* denote significance levels at 10/5/1 percent respectively. The highest achievable points in Khmer, English, and Math are 100, 50 and 100, respectively. Absences are absent days per month. The Total grade is the sum of individual subjects and includes additional subjects than the ones reported here.

Table B.2.1.2.: Balance Table: Pre-Intervention Characteristics of Treatment and Control Schools

Variable	(1) Mean Control	(2) Mean Treatment	(3) Cont. vs. Treat.
Class Size	44.81 (9.22)	44.72 (11.25)	-0.09 (0.98)
Final Exam Grade 8 - Avg. Grade	30.84 (2.65)	31.37 (4.03)	0.53 (0.67)
Teacher: Female	0.28 (0.46)	0.28 (0.46)	-0.00 (1.00)
Teacher: Age	33.79 (5.49)	29.92 (4.35)	-3.87** (0.02)
Teacher: Years of Schoolexperience	9.99 (4.78)	7.26 (4.84)	-2.72* (0.10)
Teacher: Has University Degree	0.61 (0.50)	0.56 (0.51)	-0.06 (0.74)
Teacher: Distance to School (km)	8.20 (8.05)	9.55 (7.87)	1.35 (0.61)
Dropout grade 9 (2018)	0.14 (0.07)	0.12 (0.07)	-0.01 (0.55)
Transitionrate to High School (2017)	0.78 (0.16)	0.79 (0.11)	0.01 (0.86)
Transitionrate to High School (2018)	0.75 (0.17)	0.79 (0.10)	0.04 (0.46)
Observations	18	18	36

Notes: (1) and (2): standard errors in parentheses; (3): p-values in parentheses. \*/\*\*/\*\* denote significance levels at 10/5/1 percent respectively.

Table B.2.1.3.: Balance Table Experiment

Variable	(1) Mean A1	(2) Mean A2	(3) Mean A3	(4) A2 vs. A1	(5) A3 vs. A1	(6) A2 vs. A3
Female	0.53 (0.50)	0.54 (0.50)	0.66 (0.48)	-0.01 (0.90)	-0.13*** (0.00)	0.12*** (0.00)
Age	15.11 (1.32)	15.05 (1.31)	15.04 (1.36)	0.06 (0.63)	0.07 (0.59)	-0.01 (0.93)
Distance to school (km)	3.98 (3.86)	3.99 (4.02)	4.20 (4.29)	-0.01 (0.97)	-0.21 (0.49)	0.20 (0.55)
Distance to district town (km)	9.96 (6.47)	9.74 (6.44)	9.73 (6.47)	0.21 (0.35)	0.23 (0.53)	-0.01 (0.96)
Distance to high school (km)	9.33 (6.59)	9.27 (6.36)	9.15 (6.42)	0.06 (0.85)	0.18 (0.67)	-0.12 (0.70)
Dec Khmer (clstd)	-0.01 (0.97)	0.07 (0.96)	0.28 (0.87)	-0.08 (0.20)	-0.29*** (0.00)	0.21*** (0.01)
Dec Math (clstd)	-0.03 (0.98)	0.08 (0.93)	0.26 (1.04)	-0.10 (0.28)	-0.28*** (0.01)	0.18** (0.05)
Dec English (clstd)	-0.02 (0.96)	0.00 (0.97)	0.31 (1.09)	-0.02 (0.81)	-0.33*** (0.01)	0.31** (0.02)
Dec Total (clstd)	0.01 (0.93)	0.08 (0.92)	0.29 (0.97)	-0.07 (0.31)	-0.28*** (0.00)	0.21** (0.02)
Jan Khmer (clstd)	-0.05 (1.00)	0.13 (0.95)	0.19 (0.97)	-0.18*** (0.01)	-0.24** (0.01)	0.06 (0.60)
Jan Math (clstd)	-0.07 (0.93)	0.07 (0.95)	0.25 (1.10)	-0.14* (0.09)	-0.32*** (0.00)	0.19** (0.05)
Jan English (clstd)	-0.04 (0.92)	0.04 (1.01)	0.21 (1.07)	-0.08 (0.40)	-0.25** (0.03)	0.17 (0.17)
Jan Total (clstd)	-0.04 (0.94)	0.09 (0.96)	0.25 (1.00)	-0.13* (0.09)	-0.29*** (0.00)	0.16* (0.09)
Dec Absence	1.56 (2.24)	1.65 (2.20)	1.29 (1.96)	-0.09 (0.66)	0.28 (0.24)	-0.37 (0.11)
Jan Absence	1.75 (2.21)	1.60 (2.23)	1.27 (1.65)	0.15 (0.30)	0.48** (0.01)	-0.33** (0.04)
Final Exam Grade 8, class-std	-0.04 (1.02)	0.13 (0.91)	0.29 (0.99)	-0.17* (0.10)	-0.33*** (0.01)	0.15 (0.24)
Avg Grades (std.)	0.01 (0.89)	0.12 (0.91)	0.32 (0.97)	-0.10 (0.15)	-0.30*** (0.00)	0.20** (0.02)
Observations	315	312	150	627	465	462

Notes: (1)-(3): standard errors in parentheses (clustered at school level); (4) & (5): p-values in parentheses. \*/\*\*/\*\* denote significance levels at 10/5/1 percent respectively. The grades are standardized within class to adjust for differences with respect to the number of subjects across schools or classes.

## B.2.2. Information Retention

Table B.2.2.1.: Estimated Monthly Costs of Attending High School, at Follow-up

	Costs of highschool (in US-\$) ( <i>estimated – true</i> )		Costs of Extra Classes ( <i>estimated – true</i> )		Able to provide high school cost estimate		Believed highest cost correct	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treated	0.449 (3.452)	0.344 (1.662)	0.630 (2.427)	-0.479 (1.242)	0.048 (0.023)**	0.038 (0.027)	0.085 (0.076)	0.077 (0.041)*
Observations	1140	1140	701	701	1285	1285	1285	1285
Control Mean	20.1854	20.1854	-1.7723	-1.7723	0.8853	0.8853	0.4297	0.4297
District FE		✓		✓		✓		✓
School Controls		✓		✓		✓		✓
Individual Controls		✓		✓		✓		✓

*Notes:* 2SLS Estimators. Standard errors are depicted in parentheses and clustered at the school level. Estimations of survey-based outcomes weighted with inverse probability weights. Cost estimates in US-\$, winsorized at the 95<sup>th</sup> percentile. *Treated* (i.e. participation in the intervention) instrumented by assigned treatment status. School Controls include teacher characteristics (age, gender, experience, and educational degree); Child’s Dream partnership; class size; and Khmer, English, and Math grades prior to intervention averaged over all grade 9 students. Individual Controls include gender, age, distance to school, distance to district town, and average total grades prior to intervention. \*/\*\*/\*\* denote significance levels at 10/5/1 percent respectively.

Table B.2.2.2.: Preferred Job, at Follow-up

	Preferred job featured in intervention		High prob of reaching preferred job	
	(1)	(2)	(3)	(4)
Treated	-0.019 (0.039)	-0.030 (0.044)	0.053 (0.038)	0.072 (0.028)**
Observations	1250	1250	1247	1247
Control Mean	0.4942	0.4942	0.3665	0.3665
District FE		✓		✓
School Controls		✓		✓
Individual Controls		✓		✓

*Notes:* 2SLS Estimators. Standard errors are depicted in parentheses and clustered at the school level. Estimations weighted with inverse probability weights. Cost estimates in US-\$, winsorized at the 95<sup>th</sup> percentile. *Treated* (i.e. participation in the intervention) instrumented by assigned treatment status. School Controls include teacher characteristics (age, gender, experience, and educational degree); Child’s Dream partnership; class size; and Khmer, English, and Math grades prior to intervention averaged over all grade 9 students. Individual Controls include gender, age, distance to school, distance to district town, and average total grades prior to intervention. \*/\*\*/\*\* denote significance levels at 10/5/1 percent respectively.

### B.2.3. Intention to Treat Estimates

Table B.2.3.1.: Impact of the Intervention on Activities during School Closure  
(Intention to Treat Effect)

	PANEL A				PANEL B			
	Studying during school closure				Working during school closure			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Treatment Assigned	-0.011 (0.041)	-0.013 (0.037)	-0.032 (0.028)	-0.036 (0.035)	0.009 (0.042)	-0.012 (0.029)	0.039 (0.027)	0.058 (0.023)**
Observations	1258	1258	1258	1258	1283	1283	1283	1283
Control Mean	0.4347	0.4347	0.4347	0.4347	0.5712	0.5712	0.5712	0.5712
District FE		✓	✓	✓		✓	✓	✓
School Controls			✓	✓			✓	✓
Individual Controls				✓				✓

*Notes:* OLS Estimators. Standard errors are depicted in parentheses and clustered at the school level. Estimations of survey-based outcomes weighted with inverse probability weights. *Treatment Assigned* indicates whether student was assigned to the treatment. School Controls include teacher characteristics (age, gender, experience, and educational degree); Child's Dream partnership; class size; Khmer, English, and Math grades prior to intervention averaged over all grade 9 students per school. Individual Controls include gender, age, distance to school, distance to district town, and average total grades prior to intervention. \*/\*\*/\*\* denote significance levels at 10/5/1 percent respectively.

Table B.2.3.2.: Impact of the Intervention on Scholarship Application and Dropout  
(Intention to Treat Effect)

	PANEL A				PANEL B			
	Scholarship application (admin)				Dropout final			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Treatment Assigned	-0.072 (0.066)	-0.094 (0.051)*	-0.054 (0.040)	-0.052 (0.040)	0.014 (0.031)	0.011 (0.026)	0.008 (0.026)	-0.006 (0.032)
Observations	1266	1266	1266	1266	1663	1663	1663	1663
Control Mean	0.2023	0.2023	0.2023	0.2023	0.1247	0.1247	0.1247	0.1247
District FE		✓	✓	✓		✓	✓	✓
School Controls			✓	✓			✓	✓
Individual Controls				✓				✓

*Notes:* OLS Estimators. Standard errors are depicted in parentheses and clustered at the school level. Estimations of survey-based outcomes weighted with inverse probability weights. *Treatment Assigned* indicates whether student was assigned to the treatment. School Controls include teacher characteristics (age, gender, experience, and educational degree); Child's Dream partnership; class size; Khmer, English, and Math grades prior to intervention averaged over all grade 9 students per school. Individual Controls include gender, age, distance to school, distance to district town, and average total grades prior to intervention. \*/\*\*/\*\* denote significance levels at 10/5/1 percent respectively.



Table B.2.3.3.: Impact of the Intervention by School Performance (Intention to Treat Effect)

	Studying during school closure		Working during school closure		Scholarship application		Dropout final	
Treatment Assigned	-0.036 (0.035)	-0.109 (0.038)***	0.058 (0.023)**	0.090 (0.039)**	-0.052 (0.040)	-0.071 (0.038)*	-0.006 (0.032)	-0.017 (0.042)
Good Student		0.043 (0.035)		0.027 (0.043)		0.031 (0.053)		-0.087 (0.036)**
Treatment Assigned x Good Student		0.139 (0.054)**		-0.065 (0.054)		0.038 (0.061)		0.030 (0.039)
Observations	1258	1258	1283	1283	1266	1266	1663	1663
Control Mean	0.4347	0.4347	0.5712	0.5712	0.2023	0.2023	0.1247	0.1247
District FE	✓	✓	✓	✓	✓	✓	✓	✓
School Controls	✓	✓	✓	✓	✓	✓	✓	✓
Individual Controls	✓	✓	✓	✓	✓	✓	✓	✓

*Notes:* OLS Estimators. Standard errors are depicted in parentheses and clustered at the school level. Estimations of survey-based outcomes weighted with inverse probability weights. *Good Student:* student was better than median student in her class prior to intervention. *Treatment Assigned* indicates whether student was assigned to the treatment. School Controls include teacher characteristics (age, gender, experience, and educational degree); Child's Dream partnership; class size; Khmer, English, and Math grades prior to intervention averaged over all grade 9 students per school. Individual Controls include gender, age, distance to school, distance to district town, and average total grades prior to intervention. \*/\*\*/\*\* denote significance levels at 10/5/1 percent respectively.

## B.2.4. Robustness Checks

Table B.2.4.1.: Spillover Analysis using Distance Measures: Activities during School Closure

	PANEL A				PANEL B			
	Studying during school closure				Working during school closure			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Distance Treatment	-0.046 (0.030)	0.094 (0.041)**	0.113 (0.068)	0.104 (0.090)	0.092 (0.024)***	0.043 (0.040)	0.002 (0.057)	0.030 (0.072)
Observations	604	604	604	604	617	617	617	617
Mean	0.4354	0.4354	0.4354	0.4354	0.5721	0.5721	0.5721	0.5721
District FE		✓	✓	✓		✓	✓	✓
School Controls			✓	✓			✓	✓
Individual Controls				✓				✓

*Notes:* OLS Estimators. Standard errors are depicted in parentheses and clustered at the school level. Estimations of survey-based outcomes weighted with inverse probability weights. *Distance Treatment* - log distance between a student's home village and the next treatment school. School Controls include teacher characteristics (age, gender, experience, and educational degree); Child's Dream partnership; class size; and Khmer, English, and Math grades prior to intervention averaged over all grade 9 students per school. Individual Controls include gender, age, distance to school, distance to district town, and average total grades prior to intervention. \*/\*\*/\*\* denote significance levels at 10/5/1 percent respectively.

Table B.2.4.2.: Spillover Analysis using Distance Measures: Scholarship Application and Dropout

	PANEL A				PANEL B			
	Scholarship application (admin)				Dropout final (admin)			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Distance Treatment	0.085 (0.048)	-0.022 (0.037)	0.039 (0.047)	-0.045 (0.030)	0.034 (0.022)	-0.012 (0.026)	-0.045 (0.031)	-0.042 (0.028)
Observations	528	528	528	528	799	799	799	799
Mean	0.2008	0.2008	0.2008	0.2008	0.1239	0.1239	0.1239	0.1239
District FE		✓	✓	✓		✓	✓	✓
School Controls			✓	✓			✓	✓
Individual Controls				✓				✓

*Notes:* OLS Estimators. Standard errors are depicted in parentheses and clustered at the school level. Estimations of survey-based outcomes weighted with inverse probability weights. *Distance Treatment* - log distance between a student's home village and the next treatment school. School Controls include teacher characteristics (age, gender, experience, and educational degree); Child's Dream partnership; class size; and Khmer, English, and Math grades prior to intervention averaged over all grade 9 students per school. Individual Controls include gender, age, distance to school, distance to district town, and average total grades prior to intervention. \*/\*\*/\*\* denote significance levels at 10/5/1 percent respectively.

Table B.2.4.3.: Impact of the Intervention on Scholarship Application and Dropout, Alternative Measures

	PANEL A				PANEL B			
	Scholarship application (reported)				Dropout Oct (teacher report)			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Treated	-0.110 (0.049)**	-0.105 (0.034)***	-0.066 (0.032)**	-0.069 (0.033)**	-0.009 (0.018)	-0.011 (0.019)	0.005 (0.016)	-0.003 (0.019)
Observations	1258	1258	1258	1258	1663	1663	1663	1663
Control Mean	0.2831	0.2831	0.2831	0.2831	0.0461	0.0461	0.0461	0.0461
District FE		✓	✓	✓		✓	✓	✓
School Controls			✓	✓			✓	✓
Individual Controls				✓				✓

*Notes:* 2SLS Estimators. Standard errors are depicted in parentheses and clustered at the school level. Estimations of survey-based outcomes weighted with inverse probability weights. *Treated* (i.e. participation in the intervention) instrumented by assigned treatment status. School Controls include teacher characteristics (age, gender, experience, and educational degree); Child's Dream partnership; class size; Khmer, English, and Math grades prior to intervention averaged over all grade 9 students per school. Individual Controls include gender, age, distance to school, distance to district town, and average total grades prior to intervention. \*/\*\*/\*\* denote significance levels at 10/5/1 percent respectively.

Table B.2.4.4.: Impact of the Intervention by School Performance, Alternative Measures

	PANEL A		PANEL B	
	Scholarship application (reported)		Dropout Oct (teacher report)	
	(1)	(2)	(1)	(2)
Treated	-0.069 (0.033)**	-0.079 (0.034)**	-0.003 (0.019)	-0.003 (0.025)
Good Student		0.034 (0.036)		-0.028 (0.018)
Treated x Good Student		0.015 (0.049)		0.003 (0.021)
Observations	1258	1258	1663	1663
Control Mean	0.2831	0.2831	0.0461	0.0461
District FE	✓	✓	✓	✓
School Controls	✓	✓	✓	✓
Individual Controls	✓	✓	✓	✓

*Notes:* 2SLS Estimators. Standard errors are depicted in parentheses and clustered at the school level. *Treated* (i.e. participation in the intervention) instrumented by assigned treatment status. *Good Student*: student was better than median student in her class prior to intervention. *Treated* (i.e. participation in the intervention) instrumented by assigned treatment status. School Controls include teacher characteristics (age, gender, experience, educational degree, and distance to school); Child's Dream partnership; class size; and Khmer, English, and Math grades prior to intervention averaged over all grade 9 students per school. Individual Controls include gender, age, distance to school, distance to district town, and average total grades prior to intervention. \*/\*\*/\*\* denote significance levels at 10/5/1 percent respectively.

Table B.2.4.5.: Survey Outcomes, Without Survey Weights

	Studying during school closure			Working during school closure		
	(1)	(2)	(3)	(1)	(2)	(3)
Treated	0.002 (0.044)	-0.026 (0.038)	-0.121 (0.044)***	0.008 (0.045)	0.062 (0.023)***	0.114 (0.045)**
Good Student			0.039 (0.034)			0.027 (0.043)
Treated x Good Student			0.160 (0.057)***			-0.091 (0.060)
Observations	1258	1258	1258	1283	1283	1283
Control Mean	0.4347	0.4347	0.4347	0.5712	0.5712	0.5712
District FE		✓	✓		✓	✓
School Controls		✓	✓		✓	✓
Individual Controls		✓	✓		✓	✓

*Notes:* 2SLS Estimators. Standard errors are depicted in parentheses and clustered at the school level. *Treated* (i.e. participation in the intervention) instrumented by assigned treatment status. *Good Student*: student was better than median student in her class prior to intervention. *Treated* (i.e. participation in the intervention) instrumented by assigned treatment status. School Controls include teacher characteristics (age, gender, experience, educational degree, and distance to school); Child's Dream partnership; class size; and Khmer, English and Math grades prior to intervention averaged over all grade 9 students per school. Individual Controls include gender, age, distance to school, distance to district town, and average total grades prior to intervention. \*/\*\*/\*\* denote significance levels at 10/5/1 percent respectively.

Table B.2.4.6.: Survey Outcomes, Controlling for Survey Week and Interviewer Fixed Effects

	Studying during school closure		Working during school closure	
	(1)	(2)	(1)	(2)
Treated	-0.033 (0.040)	-0.138 (0.044)***	0.040 (0.021)*	0.093 (0.044)**
Good Student		0.046 (0.034)		0.033 (0.037)
Treated x Good Student		0.175 (0.055)***		-0.093 (0.059)
Observations	1258	1258	1283	1283
Control Mean	0.4347	0.4347	0.5712	0.5712
District FE	✓	✓	✓	✓
School Controls	✓	✓	✓	✓
Individual Controls	✓	✓	✓	✓
Survey Week FE	✓	✓	✓	✓
Interviewer FE	✓	✓	✓	✓

*Notes:* 2SLS Estimators. Standard errors are depicted in parentheses and clustered at the school level. *Treated* (i.e. participation in the intervention) instrumented by assigned treatment status. *Good Student*: student was better than median student in her class prior to intervention. *Treated* (i.e. participation in the intervention) instrumented by assigned treatment status. School Controls include teacher characteristics (age, gender, experience, educational degree, and distance to school); Child's Dream partnership; class size; and Khmer, English and Math grades prior to intervention averaged over all grade 9 students per school. Individual Controls include gender, age, distance to school, distance to district town, and average total grades prior to intervention. \*/\*\*/\*\* denote significance levels at 10/5/1 percent respectively.

Table B.2.4.7.: Impact of the Intervention on Activities during School Closure (Wild Cluster Bootstrap)

	PANEL A				PANEL B			
	Studying during school closure				Working during school closure			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Treated	-0.011 (0.803)	-0.015 (0.783)	-0.022 (0.326)	-0.023 (0.500)	0.009 (0.847)	-0.013 (0.729)	0.029 (0.248)	0.052 (0.096)*
Observations	1258	1258	1258	1258	1283	1283	1283	1283
Control Mean	0.4347	0.4347	0.4347	0.4347	0.5712	0.5712	0.5712	0.5712
District FE		✓	✓	✓		✓	✓	✓
School Controls			✓	✓			✓	✓
Individual Controls				✓				✓

*Notes:* 2SLS Estimators. P-values of wild bootstrap clustered at the school level using Rademacher weights with 999 replications (Roodman et al., 2019) depicted in parentheses. Estimations of survey-based outcomes weighted with inverse probability weights. *Treated* (i.e. participation in the intervention) instrumented by assigned treatment status. School Controls include teacher characteristics (age, gender, experience, educational degree, and distance to school); Child's Dream partnership; class size; Khmer, English, and Math grades prior to intervention averaged over all grade 9 students per school. Individual Controls include gender, age, distance to school, distance to district town, and average total grades prior to intervention. \*/\*\*/\*\* denote significance levels at 10/5/1 percent respectively.

Table B.2.4.8.: Impact of the Intervention on Scholarship Application and Dropout (Wild Cluster Bootstrap)

	PANEL A				PANEL B			
	Scholarship application (admin)				Dropout final (admin)			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Treated	-0.078 (0.330)	-0.102 (0.172)	-0.059 (0.446)	-0.057 (0.523)	0.015 (0.693)	0.012 (0.721)	0.009 (0.849)	-0.006 (0.937)
Observations	1266	1266	1266	1266	1663	1663	1663	1663
Control Mean	0.2023	0.2023	0.2023	0.2023	0.1247	0.1247	0.1247	0.1247
District FE		✓	✓	✓		✓	✓	✓
School Controls			✓	✓			✓	✓
Individual Controls				✓				✓

Notes: 2SLS Estimators. P-values of wild bootstrap clustered at the school level using Rademacher weights with 999 replications (Roodman et al., 2019) depicted in parentheses. Estimations of survey-based outcomes weighted with inverse probability weights. *Treated* (i.e. participation in the intervention) instrumented by assigned treatment status. School Controls include teacher characteristics (age, gender, experience, educational degree, and distance to school); Child's Dream partnership; class size; and Khmer, English, and Math grades prior to intervention averaged over all grade 9 students per school. Individual Controls include gender, age, distance to school, distance to district town, and average total grades prior to intervention. \*/\*\*/\*\* denote significance levels at 10/5/1 percent respectively.

Table B.2.4.9.: Impact of the Intervention by School Performance (Wild Cluster Bootstrap)

	Studying during school closure		Working during school closure		Scholarship application		Dropout final	
Treated	-0.038 (0.500)	-0.122 (0.018)**	0.062 (0.096)*	0.101 (0.056)*	-0.057 (0.523)	-0.080 (0.138)	-0.006 (0.937)	-0.020 (0.731)
Good Student		0.041 (0.000)***		0.029 (0.000)***		0.030 (0.000)***		-0.087 (0.000)***
Treated x Good Student		0.154 (0.008)***		-0.076 (0.220)		0.046 (0.526)		0.033 (0.444)
Observations	1258	1258	1283	1283	1266	1266	1663	1663
Control Mean	0.4347	0.4347	0.5712	0.5712	0.2023	0.2023	0.1247	0.1247
District FE	✓	✓	✓	✓	✓	✓	✓	✓
School Controls	✓	✓	✓	✓	✓	✓	✓	✓
Individual Controls	✓	✓	✓	✓	✓	✓	✓	✓

Notes: 2SLS Estimators. P-values of wild bootstrap clustered at the school level using Rademacher weights with 999 replications (Roodman et al., 2019) depicted in parentheses. Estimations of survey-based outcomes weighted with inverse probability weights. *Good Student*: student was better than median student in her class prior to intervention. *Treated* (i.e. participation in the intervention) instrumented by assigned treatment status. School Controls include teacher controls (age, gender, experience, and educational degree); Child's Dream partnership; class size; and Khmer, English, and Math grades prior to intervention averaged over all grade 9 students per school. Individual Controls include gender, age, distance to school, distance to district town, and average total grades prior to intervention. \*/\*\*/\*\* denote significance levels at 10/5/1 percent respectively.

Table B.2.4.10.: Correlates of School Performance

	Distance to to school	Distance to to district town	Both parents' educ < primary	Parents are farmers	Smartphone available	Parent lost income due to COVID-19	Parent lost job due to COVID-19
Good Student	0.005 (0.240)	-0.094 (0.224)	-0.059 (0.020)***	0.021 (0.025)	-0.016 (0.018)	-0.009 (0.026)	-0.036 (0.022)
Female	-0.128 (0.190)	0.550 (0.399)	0.025 (0.025)	-0.012 (0.024)	-0.083 (0.028)***	0.055 (0.026)**	0.033 (0.021)
Age	0.133 (0.105)	0.317 (0.174)*	0.036 (0.009)***	0.005 (0.012)	0.008 (0.008)	-0.008 (0.010)	0.014 (0.008)*
Observations	1663	1663	1235	1285	1285	1285	1285
Mean	3.5555	11.2882	0.2381	0.6918	0.8233	0.7035	0.1510
District FE	✓	✓	✓	✓	✓	✓	✓

Notes: OLS Estimators. Standard errors are depicted in parentheses and clustered at the school level. Estimations of survey-based outcomes weighted with inverse probability weights. *Good Student*: student was better than median student in her class prior to intervention. \*/\*\*/\*\* denote significance levels at 10/5/1 percent respectively.

Table B.2.4.11.: Impact of the Intervention by School Performance vs. Parental Education

	Studying during school closure	Working during school closure	Scholarship application	Dropout final
Treated	-0.124 (0.043)***	-0.132 (0.044)***	0.098 (0.047)**	0.083 (0.050)*
Good Student	0.041 (0.036)	0.042 (0.036)	0.028 (0.042)	0.026 (0.042)
Treated x Good Student	0.144 (0.056)***	0.147 (0.055)***	-0.065 (0.060)	-0.062 (0.061)
Parents low educ		0.022 (0.056)	-0.044 (0.048)	0.001 (0.030)
Treated x Parents low educ		0.027 (0.081)	0.064 (0.071)	-0.083 (0.042)**
Observations	1209	1209	1233	1233
Control Mean	0.4369	0.4369	0.5719	0.5719
District FE	✓	✓	✓	✓
School Controls	✓	✓	✓	✓
Individual Controls	✓	✓	✓	✓

Notes: 2SLS Estimators. Standard errors are depicted in parentheses and clustered at the school level. For students who participated in the phone survey and reported their parents' education. All outcomes weighted with inverse probability weights. *Good Student*: student was better than median student in her class prior to intervention. *Parents low educ*: both parents have less than primary education. *Treated* (i.e. participation in the intervention) instrumented by assigned treatment status. School Controls include teacher characteristics (age, gender, experience, and educational degree); Child's Dream partnership; class size; and Khmer, English, and Math grades prior to intervention averaged over all grade 9 students per school. Individual Controls include gender, age, distance to school, distance to district town, and average total grades prior to intervention. \*/\*\*/\*\* denote significance levels at 10/5/1 percent respectively.

## B.2.5. Mechanisms

Table B.2.5.1.: Estimated Monthly Costs of Attending High School, at Baseline

	Total costs		Extra classes		Transportation		Material	
Good Student	128.593 (21.830)***	132.903 (20.627)***	5.614 (1.225)***	5.748 (1.238)***	0.791 (4.293)	-0.357 (4.276)	3.324 (1.642)*	3.048 (1.854)
Constant	238.968 (27.858)***	222.191 (145.337)	14.230 (1.579)***	16.450 (11.279)	36.692 (3.816)***	49.542 (18.360)**	22.166 (2.390)***	26.558 (12.894)*
Observations	777	766	777	766	777	766	777	766
Individual Controls		✓		✓		✓		✓
School Fixed Effects		✓		✓		✓		✓

Notes: OLS Estimators. Standard errors are depicted in parentheses and clustered at the school level. Cost estimates in US-\$, winsorized at the 95<sup>th</sup> percentile. Individual controls include gender, age, number of siblings, distance to school, distance to next district town, ownership of smartphone, bicycle, moto, and whether parental job is high-educ job. \*/\*\*/\*\* denote significance levels at 10/5/1 percent respectively.

Table B.2.5.2.: Estimated Monthly Costs of Attending High School, at Follow-up

	Total Costs				Extra classes			
	<i>estimated</i>		<i>(estimated – true)</i>		<i>estimated</i>		<i>(estimated – true)</i>	
Treated	0.172 (1.652)	1.080 (2.834)	0.344 (1.662)	1.239 (2.865)	-0.647 (1.287)	0.992 (2.038)	-0.532 (1.262)	1.115 (2.024)
Good Student		-1.369 (3.523)		-1.459 (3.569)		2.225 (2.027)		2.237 (2.021)
Treated x Good Student		-1.572 (4.541)		-1.551 (4.565)		-2.651 (2.498)		-2.657 (2.494)
Observations	1141	1141	1140	1140	701	701	701	701
Control Mean	69.6438	69.6438	20.1854	20.1854	26.2152	26.2152	-1.7723	-1.7723
District FE	✓	✓	✓	✓	✓	✓	✓	✓
School Controls	✓	✓	✓	✓	✓	✓	✓	✓
Individual Controls	✓	✓	✓	✓	✓	✓	✓	✓

Notes: 2SLS Estimators; inverse probability weights included. Standard errors are depicted in parentheses and clustered at the school level. Cost estimates in US-\$, winsorized at the 95<sup>th</sup> percentile. *Good Student*: student was better than median student in her class prior to intervention. *Treated* (i.e. participation in the intervention) instrumented by assigned treatment status. School Controls include teacher characteristics (age, gender, experience, educational degree, and distance to school); Child's Dream partnership; class size; and Khmer, English, and Math grades prior to intervention averaged over all grade 9 students per school. Individual Controls include gender, age, distance to school, distance to district town, and average total grades prior to intervention. \*/\*\*/\*\* denote significance levels at 10/5/1 percent respectively.



Table B.2.5.3.: Information Seeking in CET

	Reading time of jobs requiring at least					
	lower secondary		high school		university	
	(1)	(2)	(3)	(4)	(5)	(6)
Good Student	-0.066 (0.027)**	-0.064 (0.027)**	0.066 (0.027)**	0.064 (0.027)**	0.041 (0.025)	0.051 (0.028)*
Constant	0.416 (0.020)***	0.533 (0.185)**	0.584 (0.020)***	0.467 (0.185)**	0.437 (0.023)***	0.368 (0.194)*
Observations	601	593	601	593	601	593
Individual Controls		✓		✓		✓
School Fixed Effects		✓		✓		✓

*Notes:* OLS Estimators. Standard errors are depicted in parentheses and clustered at the school level. Reading time measured proportional to total reading time. Individual controls include gender, age, number of siblings, distance to school, distance to next district town, ownership of smartphone, bicycle, moto, and whether parental job is high-educ job. \*/\*\*/\*\* denote significance levels at 10/5/1 percent respectively.

Table B.2.5.4.: Job and Education Aspiration and Expectation

	Aspires low-educ job		Aspires low educ		Expects low educ	
Treated	0.024 (0.045)	0.042 (0.055)	-0.006 (0.010)	-0.018 (0.019)	0.056 (0.019)***	0.084 (0.031)***
Good Student		-0.076 (0.047)		-0.046 (0.021)**		-0.015 (0.029)
Treated x Good Student		-0.028 (0.056)		0.025 (0.027)		-0.051 (0.042)
Observations	1252	1252	1275	1275	1253	1253
Control Mean	0.3828	0.3828	0.0376	0.0376	0.1032	0.1032
District FE	Yes	Yes	Yes	Yes	Yes	Yes
School Controls	Yes	Yes	Yes	Yes	Yes	Yes
School Grade Controls	Yes	Yes	Yes	Yes	Yes	Yes

*Notes:* 2SLS Estimators; inverse probability weights included. Standard errors are depicted in parentheses and clustered at the school level. *Treated* (i.e. participation in the intervention) instrumented by assigned treatment status. School Controls include teacher controls (age, gender, experience and educational degree) and class size. School Grade Controls include average Khmer, English and Math grades prior to intervention. \*/\*\*/\*\* denote significance levels at 10/5/1 percent respectively.

## B.3. Details on Intervention

### B.3.1. Interest Exploration Tool

The IET consists of two main components and starts off with interest-based personality tests. These tests make takers reflect on their interests which are in turn connected to specific personality types. This principle is based on the pioneer work of Holland (1997) who created a hexagonal model with six personality types, namely realistic, investigative, artistic, social, enterprising, and conventional. Taken the first letters together, the model is also referred to as RIASEC. Depending on the answering scheme in the tests, one person has one to three pronounced personality types.

The IET comprises of three different testing methods to reveal students' strongest personality types. The format of the first test is based on Athanasou (2000, 2007) and the second test is retrieved online from a cooperation between Hawaii Department of Education and the Occupation Information Network (O\*NET) (Hawaii Department of Education, 2020). The third test is our own creation. Figure B.3.1.1 provides examples for the design of the first and third test. All statements in the tests are adapted to our target population, meaning that all statements representing specific interests are activities to which adolescents in rural Cambodia are used or have access. Pictures drawn by a local artist contribute to the understanding of the statements. The testing format varies to ensure that the the outcome of the tests does not depend on a specific testing format. Research assistants guided students through all three tests, but students worked independently once they understood what to do. There were pauses between tests such that all students were able to follow in the same timely manner. If questions arose, students could ask them directly or select a pop-up window with written information about the testing method.

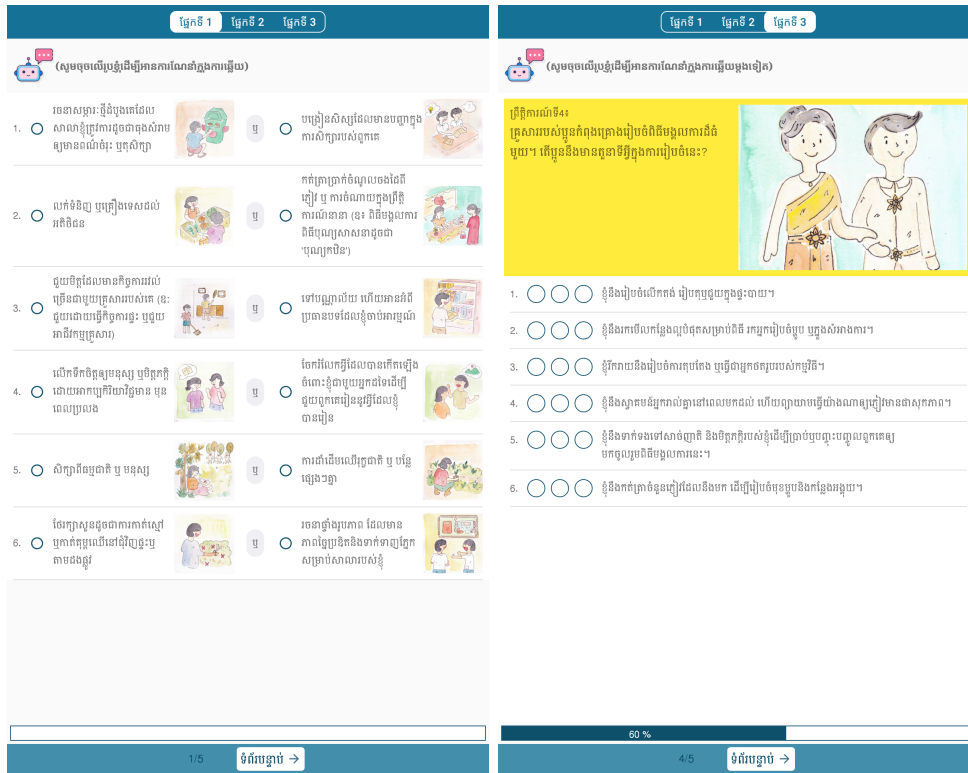
After the tests' completion, students see the results of their answers. This is the second component of the IET. Whenever a student agreed to statements allocated to a specific type, they are summed up across tests to show each student her personalized score. The highest score is set to 100, all other scores for the remaining types are normalized to it, and bars show the level of congruity with each type. The three personality types with the highest score are highlighted in the first row while the remaining three types are shown in the second row in less vivid colors (see Figure B.3.1.2 for an example of a personalized result). It was possible for students to click on each personality type and read a brief descriptions about its characteristics.

### B.3.2. Career Exploration Tool

There are again two components of the CET for students to go through. Both are based on a list of 18 occupations. Three occupations are allocated to one personality type each and they are further divided by educational level: grade 9 diploma, grade 12 diploma, or a university degree. Table 2.2 gives an overview of all 18 jobs respecting the allocation to personality types and educational levels. All occupations come along with pictures drawn by a local artist.

Although both components rely on the same list of jobs, their design and objective are very different. The third component shows this list in random order to each student and only provides the title and picture of the occupation. Students can choose between zero and three occupations which they find most interesting. Only the last component combines the results of the IET with the job list and orders each occupation respecting the strongest personality types of each student

Figure B.3.1.1.: Examples of Testing Method 1 and 3



and the educational level. The display is similar to the second component of the IET: the first row reveals occupations relating to the three strongest personality types and the second row shows all remaining occupations in less vivid colors. Students can then click on the icon of any job to inform themselves about it. There are detailed descriptions behind each icon containing the most important facts for each occupation such as its main tasks responsibilities, its societal value, and the required educational level. Students are given 17 minutes in total to read all descriptions they want to, but they can also log out sooner. Figure B.3.2.1 shows one example of the ordered display of all 18 jobs plus of one job description. At the end of the intervention day, each students receives a leaflet with all 18 jobs and a short descriptions of each occupations.

### B.3.3. School Information Session

For the school information session, students are allocated into two classrooms and are free to sit where they want but should remain close to the board. Two research assistants in each group highlight the most important facts about the Cambodian education system in general and then provide students with detailed information about high schools and vocational schools to which students can transition with a grade 9 diploma. Students can ask questions at any time during the presentation and research assistants also make sure students understand the content.

Each group starts off with a set of easy-to-answer questions about their own school (i.e. name of the school, inauguration, number of students and teachers). This introductory round is followed by a discussion of a poster which gives an overview of the complete Cambodian education system (see

Figure B.3.1.2.: Component 2: Result of the Personality Tests



Figure B.3.3.1) from primary school up to university and distinguishes between two paths after lower secondary school: either vocational school or upper secondary school (=high school). The poster also highlights which kind of professions one can pursue depending on the educational degree.

The focus is then set on high school and vocational school and they are presented subsequently. Both parts include information on the number of students, distance to the closest school and its associated time and travel costs, information about admission, living costs and school expenses, and available scholarships. The overall structure of the information stays the same across schools but is tailored to the location of the school. Figure B.3.3.2 provides an example of how information is displayed at schools. Information in green refers to high school and yellow to vocational school (cards in blue are related to the questions about the students' own lower secondary school). Teachers also receive two posters with a summary of the information tailored to each school and they are asked to hang it somewhere visible for the students.

Figure B.3.2.1.: Component 4: Overview of Job List (Left) and an Individual Example of a Job Description (Right)

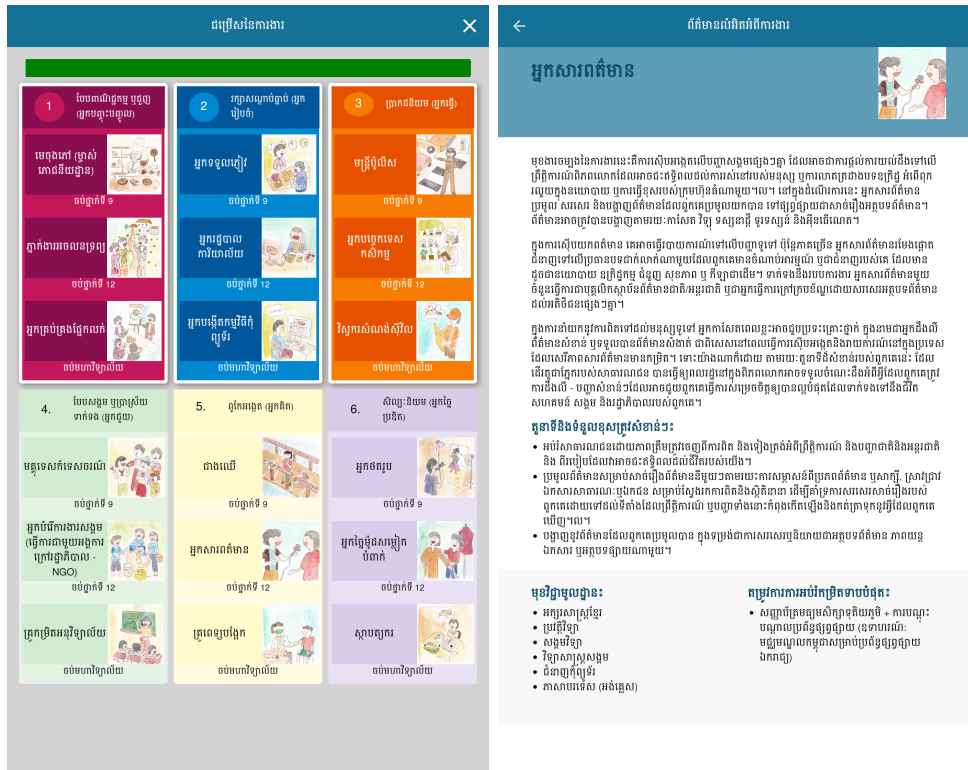
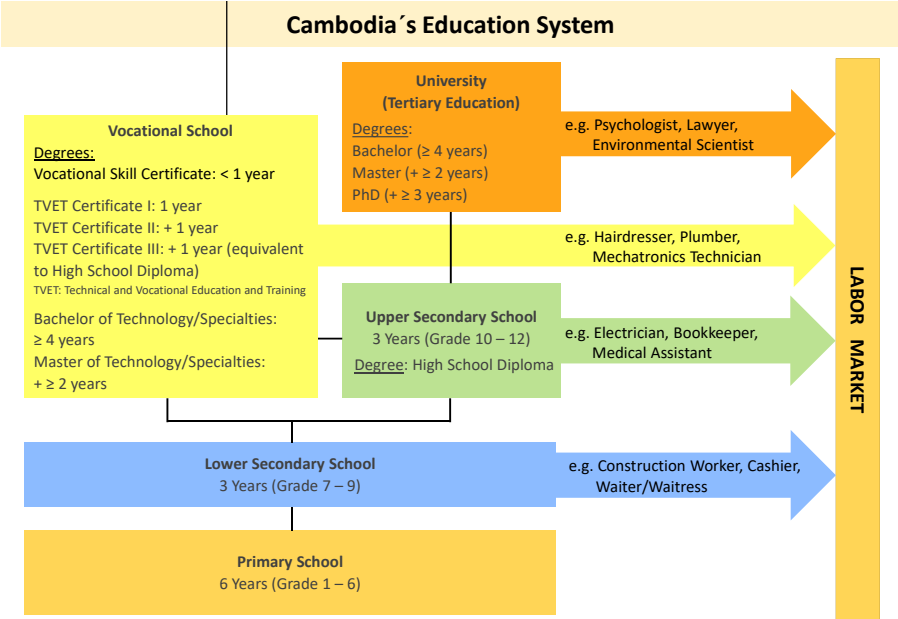


Figure B.3.3.1.: Poster Demonstrating Cambodian Education System





## B.4. Weighting of Survey Variables

Although we managed to reach a considerable share of the students calling them during school closure, Table B.4.1 reveals that female and better performing students were easier to reach via phone. We therefore construct survey weights to make the sample of interviewed students within the phone survey more comparable to the full sample.

Table B.4.1.: Balance before Weighting

Variable	(1) Mean Interviewed	(2) Mean All	(3) Difference
Female	0.57 (0.50)	0.53 (0.50)	0.04** (0.05)
Age	15.05 (1.28)	15.07 (1.33)	-0.03 (0.58)
Distance to school (km)	3.53 (3.80)	3.56 (3.83)	-0.02 (0.88)
Distance to district town (km)	11.34 (7.63)	11.29 (7.57)	0.05 (0.85)
Distance to high school (km)	9.69 (6.95)	9.60 (6.90)	0.09 (0.73)
Avg Math (Dec&Jan)	48.53 (23.83)	46.75 (23.37)	1.77** (0.04)
Avg Khmer (Dec&Jan)	59.51 (18.83)	58.26 (19.10)	1.25* (0.08)
Avg English (Dec&Jan)	15.02 (12.22)	14.45 (12.03)	0.58 (0.20)
Avg Total (Dec&Jan)	341.06 (116.63)	334.18 (116.66)	6.89 (0.11)
Avg Total (Dec&Jan), class-std	0.15 (0.93)	0.05 (0.93)	0.10*** (0.01)
Dec Absence	1.45 (2.29)	1.48 (2.27)	-0.04 (0.67)
Jan Absence	1.46 (2.29)	1.55 (2.35)	-0.08 (0.36)
Observations	1,285	1,663	

*Notes:* (1) and (2): standard errors in parentheses (clustered at school level); (3): p-values in parentheses. \*/\*\*/\*\* denote significance levels at 10/5/1 percent respectively. The highest achievable points in Khmer, English, and Math are 100, 50 and 100, respectively and individual subjects are averaged over the months December 2019 and January 2020. The total grade includes additional grades than the ones reported here. Both measures are averaged over December and January, the second measure is standardized within each class per month. Absences are absent days per month.

The weights are estimated by a logistic regression which includes student, school and teacher characteristics. The regression output is shown in Table B.4.2. The distribution of the resulting weights as inverse of its predicted values can be seen in Figure B.4.1 for both phone survey participants and remaining students.

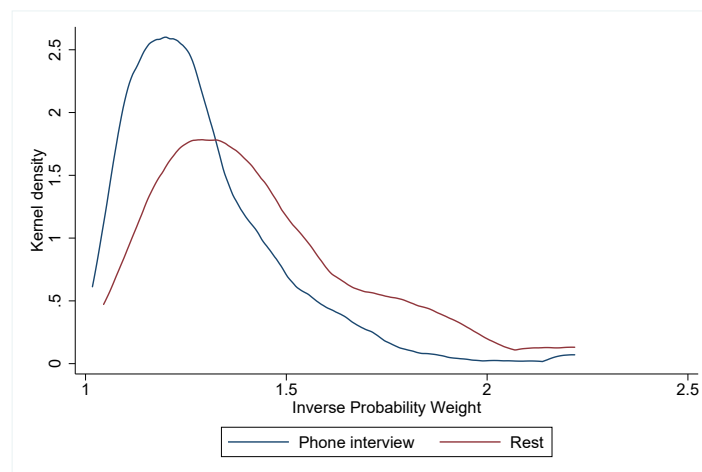
Table B.4.2.: Determinants of Participation in Phone Survey (Logit)

	(1)
Female=1	1.814*** (0.651)
Age	-0.084 (0.071)
Distance to school (km)	-0.021 (0.027)
Distance to district town (km)	0.021 (0.022)
Distance to high school (km)	0.018 (0.026)
Avg Math (Dec&Jan)	-0.020 (0.017)
Avg Khmer (Dec&Jan)	-0.006 (0.028)
Avg English (Dec&Jan)	-0.010 (0.029)
Avg Total (Dec&Jan)	0.004 (0.006)
Avg Total (Dec&Jan), class-std	0.424** (0.193)
Avg Math (Dec&Jan) × Avg Math (Dec&Jan)	0.000 (0.000)
Avg Khmer (Dec&Jan) × Avg Khmer (Dec&Jan)	-0.000 (0.000)
Avg English (Dec&Jan) × Avg English (Dec&Jan)	0.000 (0.001)
Avg Total (Dec&Jan) × Avg Total (Dec&Jan)	-0.000 (0.000)
Avg Total (Dec&Jan), class-std × Avg Total (Dec&Jan), class-std	-0.065 (0.099)
Female=1 × Avg Total (Dec&Jan)	-0.004** (0.002)
Treated students	-2.559 (2.227)
Female=1 × Treated students=1	-0.904 (0.837)
Treated students=1 × Age	0.092 (0.095)
Treated students=1 × Distance to school (km)	0.025 (0.036)
Treated students=1 × Distance to district town (km)	-0.034 (0.038)
Treated students=1 × Distance to high school (km)	-0.023 (0.042)
Treated students=1 × Avg Math (Dec&Jan)	0.022 (0.025)
Treated students=1 × Avg Khmer (Dec&Jan)	0.040 (0.040)
Treated students=1 × Avg English (Dec&Jan)	0.022 (0.039)
Treated students=1 × Avg Total (Dec&Jan)	-0.002 (0.008)
Treated students=1 × Avg Total (Dec&Jan), class-std	-0.317 (0.244)
Treated students=1 × Avg Math (Dec&Jan) × Avg Math (Dec&Jan)	-0.000 (0.000)
Treated students=1 × Avg Khmer (Dec&Jan) × Avg Khmer (Dec&Jan)	-0.000 (0.000)
Treated students=1 × Avg English (Dec&Jan) × Avg English (Dec&Jan)	0.000 (0.001)
Treated students=1 × Avg Total (Dec&Jan) × Avg Total (Dec&Jan)	-0.000 (0.000)
Treated students=1 × Avg Total (Dec&Jan), class-std × Avg Total (Dec&Jan), class-std	0.172 (0.142)
Female=1 × Treated students=1 × Avg Total (Dec&Jan)	0.003 (0.002)
Teacher: Female	-0.148 (0.219)
Teacher: Age	-0.033 (0.040)
Teacher: Years of Schoolexperience	0.027 (0.039)
Teacher: Has University Degree	0.047 (0.177)
Teacher: Logarithmic Distance to School (km)	-0.136 (0.103)
SchoolDistrict==Aek Phnum	-0.044 (0.454)
SchoolDistrict==Banteay Ampil	-0.318 (0.401)
SchoolDistrict==Kom Rieng	0.000 (.)
SchoolDistrict==Malai	0.000 (.)
SchoolDistrict==Ou Chrov	0.000 (.)
SchoolDistrict==Phnom Proek	0.000 (.)
SchoolDistrict==Pouk	-0.159 (0.410)
SchoolDistrict==Samroang	0.550 (0.438)
SchoolDistrict==Svay Check	0.109 (0.368)
SchoolDistrict==Svay Leu	-0.327 (0.414)
SchoolDistrict==Thma Pouk	-0.326 (0.405)
SchoolDistrict==Trapeang Prasat	0.000 (.)
Partnership with Child's Dream=1	0.102 (0.302)
Observations	1663
Pseudo $R^2$	0.071

Notes: (1): standard errors in parentheses (clustered at school level). \*\*\*/\*\* denote significance levels at 10/5/1 percent respectively. The highest achievable points in Khmer, English, and Math are 100, 50 and 100, respectively and individual subjects are averaged over the months December 2019 and January 2020. The total grade includes additional grades than the ones reported here. Both measures are averaged over December and January, the second measure is standardized within each class per month.



Figure B.4.1.: Distribution of Inverse Probability Weights



*Notes:* The graph shows density of the calculated inverse probability weights for both students participating in the phone interview and non-participants.

Table B.4.3 reports the student characteristics after survey weights are applied. There are no more significant differences between the sample of interviewed students via phone and the full sample.

Table B.4.3.: Balance after Weighting

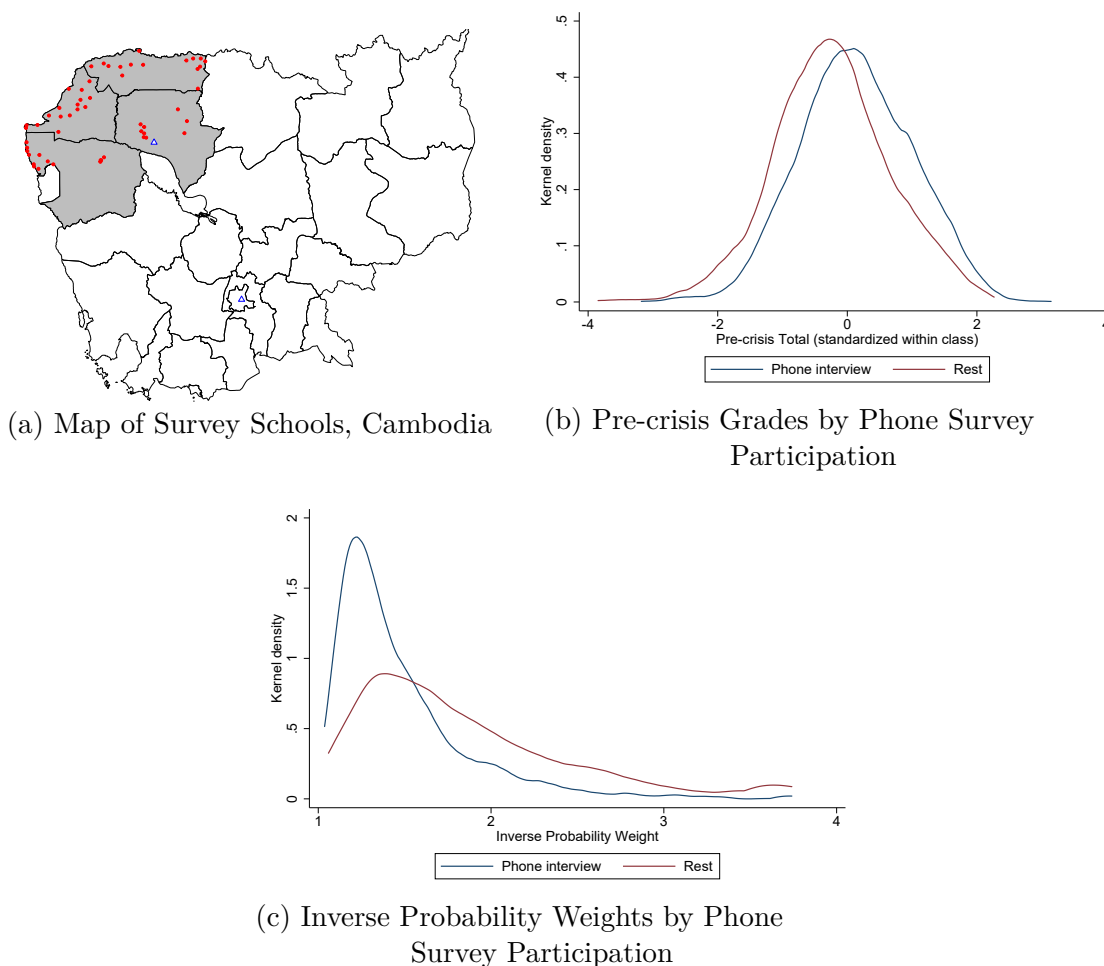
Variable	(1) Mean Interviewed	(2) Mean All	(3) Difference
Female	0.53 (0.50)	0.53 (0.50)	0.00 (0.94)
Age	15.07 (1.29)	15.07 (1.33)	-0.00 (0.99)
Distance to school (km)	3.56 (3.82)	3.56 (3.83)	0.00 (0.98)
Distance to district town (km)	11.30 (7.58)	11.29 (7.57)	0.01 (0.97)
Distance to high school (km)	9.63 (6.90)	9.60 (6.90)	0.03 (0.91)
Avg Math (Dec&Jan)	46.73 (23.41)	46.75 (23.37)	-0.03 (0.97)
Avg Khmer (Dec&Jan)	58.29 (19.08)	58.26 (19.10)	0.03 (0.97)
Avg English (Dec&Jan)	14.47 (12.04)	14.45 (12.03)	0.02 (0.96)
Avg Total (Dec&Jan)	334.33 (116.62)	334.18 (116.66)	0.16 (0.97)
Avg Total (Dec&Jan), class-std	0.06 (0.93)	0.05 (0.93)	0.00 (0.91)
Dec Absence	1.52 (2.39)	1.48 (2.27)	0.03 (0.70)
Jan Absence	1.57 (2.43)	1.55 (2.35)	0.02 (0.81)
Observations	1,285	1,663	

*Notes:* (1) and (2): standard errors in parentheses (clustered at school level); (3): p-values in parentheses. \*/\*\*/\*\* denote significance levels at 10/5/1 percent respectively. The highest achievable points in Khmer, English, and Math are 100, 50 and 100, respectively and individual subjects are averaged over the months December 2019 and January 2020. The total grade includes additional grades than the ones reported here. Both measures are averaged over December and January, the second measure is standardized within each class per month. Absences are absent days per month.

# C. Appendix for Chapter 4

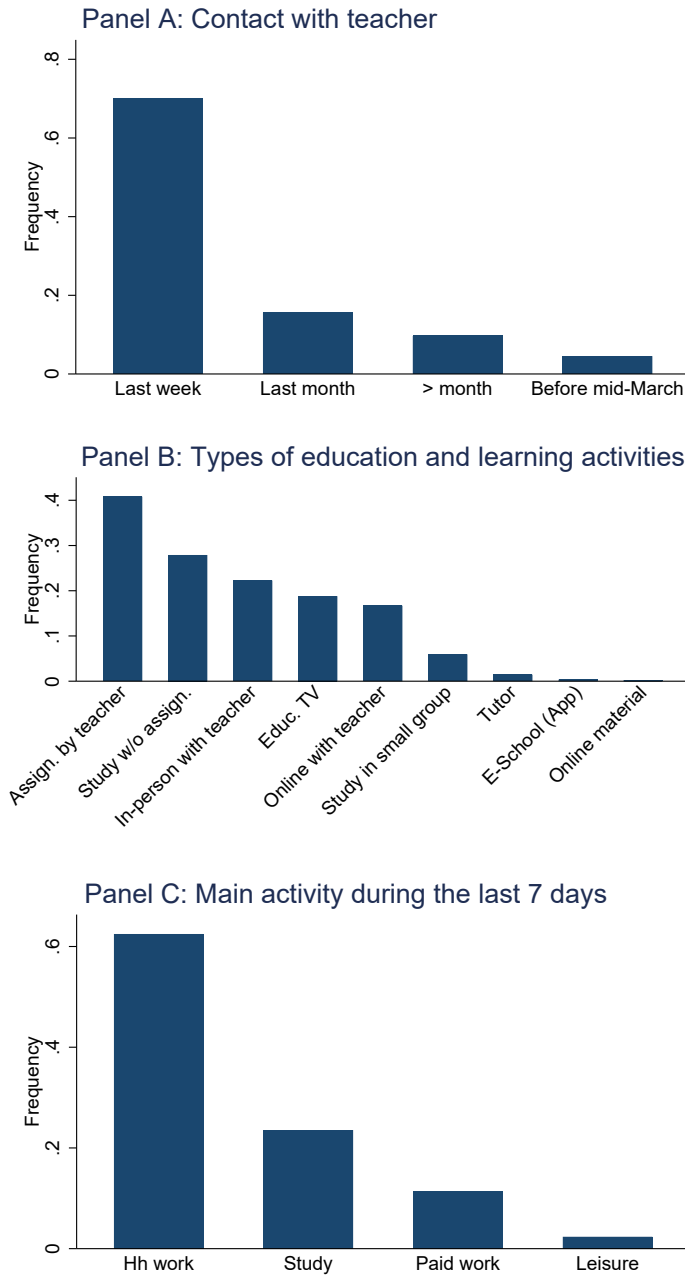
## C.1. Supplementary Figures

Figure C.1.1.: Sample Characteristics



*Notes:* Panel (a) maps the locations of all survey schools in our sample (red dots). Gray-shaded areas are the 4 provinces of interest, blue triangle in the South is Phnom Penh, blue triangle in the North is Siem Reap. Panel (b) shows the kernel densities of pre-crisis (3-month average) total grade (standardized within class) for phone survey participants and non-participants. Panel (c) shows the calculated inverse probability weights for phone survey participants and non-participants. The weights are based on the regression results displayed in Table C.2.2.

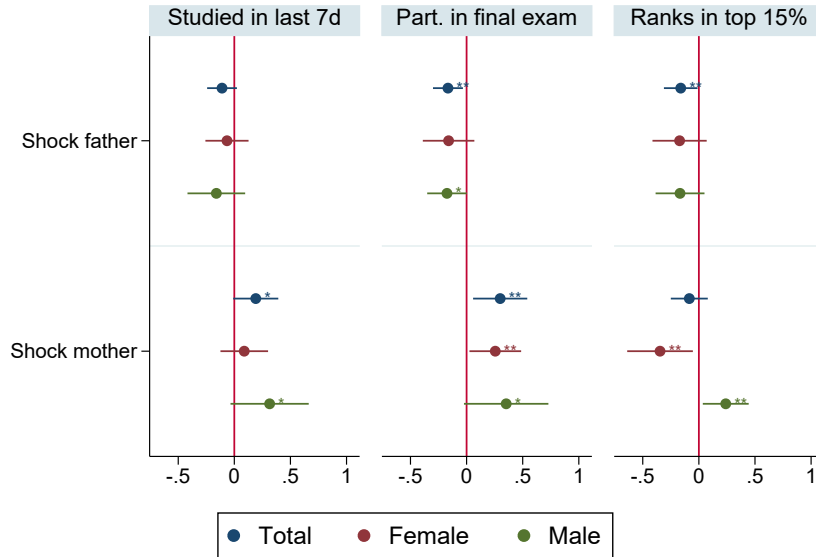
Figure C.1.2.: Learning Activities and Time Use during Lockdown



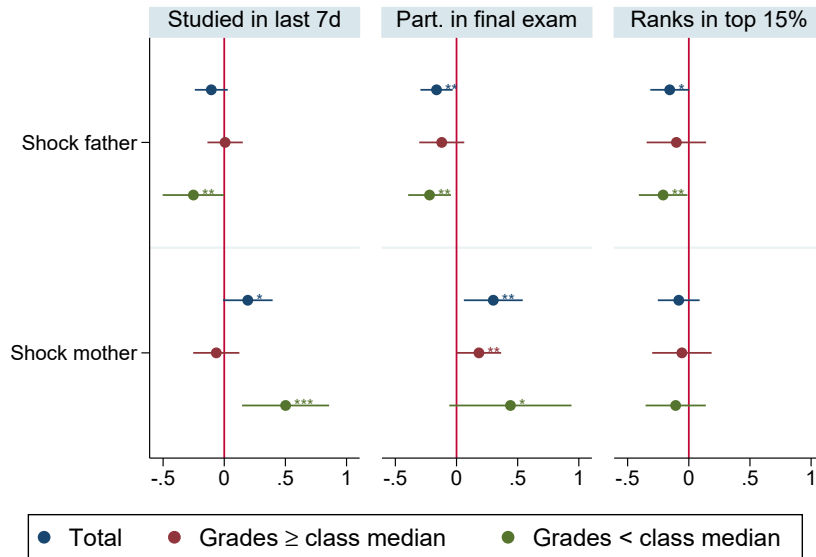
*Notes:* Contact with teacher refers to the last time the student heard from his/her teacher (in person, phone, facebook group, through class leader etc.). Types of education and learning activities reports answers to an open-ended question about these activities in the last 7 days, coded by the interviewer. Multiple answers were possible. Main activity during the last 7 days is the student-reported main activity on a typical week-day (mo-fr) during the previous week.

Figure C.1.3.: Treatment Effect Heterogeneity

Panel A: By Gender

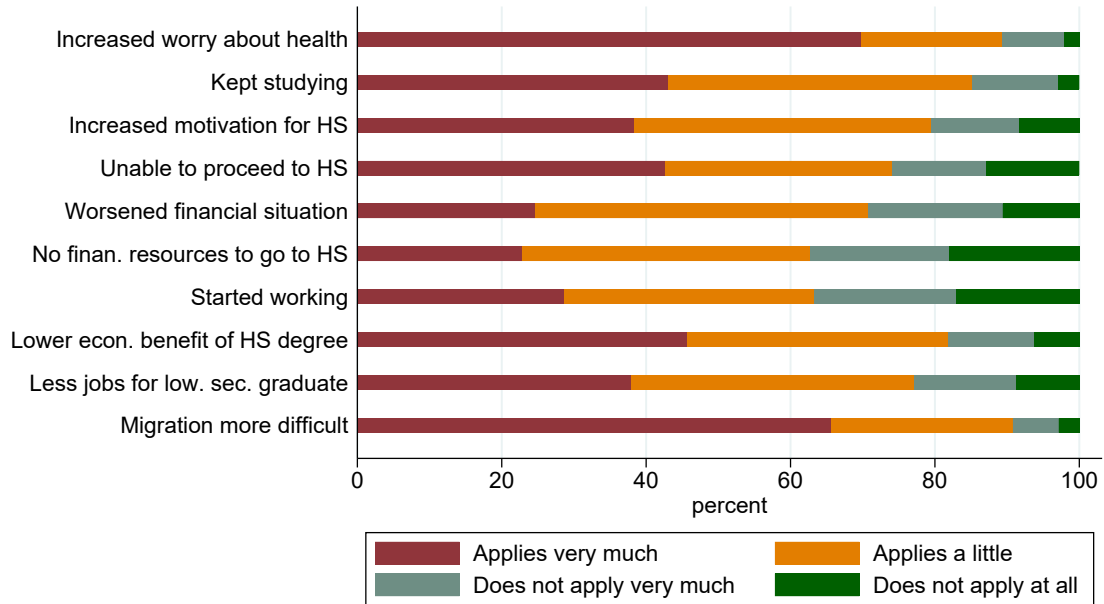


Panel B: By School Performance



Notes: This figure shows the effect of paternal and maternal income shocks on schooling outcomes disaggregated by gender or school performance (pre-crisis). Dependent variables are in the column header (Studied in last 7d (phone survey), Part. in final exam (adm. data), Ranks in top 15% (adm. data)). Weighted Least Squares (weights are inverse probability weights calculated from Table C.2.2) reported throughout. All regressions control for age, gender, pre-crisis grades, and for school, parental education, migration and interviewer fixed effects. Horizontal spikes are 95% confidence intervals, with standard errors clustered at the school level. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Figure C.1.4.: Perceptions of COVID-19 Crisis



*Notes:* This Figure shows students’ agreement on a 4-point Likert scale with 10 COVID-19 related statements. The exact wording of the statements is: 1) “The COVID-19 crisis increased my worry for my personal and my family’s health.”; 2) “During the COVID-19 school closure I keep studying for school.”; 3) “My motivation to go to high school increased due to COVID-19.”; 4) “I am worried I will not be able to continue to grade 10 because of the COVID-19 crisis.”; 5) “The COVID-19 crisis worsened the financial situation of my family.”; 6) “Because of the COVID-19 crisis, my family will not have the financial resources to allow me to go to high school.”; 7) “Because of the COVID-19 crisis, I had to start working in order to support my family financially.”; 8) “The COVID-19 crisis reduces the economic benefit of having a high school degree.”; 9) “There are no more well-paid jobs for lower-secondary graduates (such as in in tourism or garment) due to the COVID-19 crisis.”; 10) “Migrating for work is difficult due to the COVID-19 crisis.”.

## C.2. Supplementary Tables

Table C.2.1.: Balance Table

Variable	Full sample			Unweighted sample			Weighted sample			
	Mean (1)	SD (2)		Mean (3)	SD (4)	Difference (3)-(1) (5)	Mean (7)	SD (8)	Difference (7)-(1) (9)	p-value (10)
Age (adm. data)	15.063	(1.316)		15.017	(1.264)	-0.046	15.048	(1.309)	-0.015	(0.666)
Female student (adm. data)	0.529	(0.499)		0.555	(0.497)	0.026*	0.534	(0.499)	0.005	(0.736)
Pre-crisis Khmer	56.585	(19.066)		58.466	(18.538)	1.882***	56.770	(19.016)	0.185	(0.719)
Pre-crisis English	16.925	(12.489)		17.633	(12.537)	0.709**	17.023	(12.475)	0.098	(0.771)
Pre-crisis Math	47.802	(22.416)		49.911	(22.588)	2.109***	47.884	(22.406)	0.083	(0.892)
Pre-crisis Total (std. within class)	0.013	(0.903)		0.136	(0.877)	0.123***	0.019	(0.896)	0.007	(0.783)
Pre-crisis Absence	1.477	(1.906)		1.375	(1.892)	-0.102*	1.483	(2.036)	0.005	(0.923)
Teacher has uni. degree	0.485	(0.500)		0.475	(0.499)	-0.010	0.481	(0.500)	-0.004	(0.760)
Female Teacher	0.302	(0.459)		0.309	(0.462)	0.007	0.301	(0.459)	-0.001	(0.954)
Age of teacher	32.255	(6.062)		32.141	(6.088)	-0.115	32.247	(6.100)	-0.009	(0.957)
Dist. village to school	3.468	(3.722)		3.434	(3.728)	-0.034	3.409	(3.677)	-0.058	(0.560)
Dist. village to district town	11.762	(9.122)		11.773	(8.821)	0.011	11.887	(9.128)	0.125	(0.612)
Dist. village to province town	42.622	(29.343)		42.392	(29.731)	-0.230	42.279	(29.279)	-0.343	(0.665)
Dist. teacher's home to school	7.824	(9.138)		8.026	(9.044)	0.202	7.778	(9.108)	-0.046	(0.853)
Dist. teacher's home to student's village	8.920	(8.917)		9.164	(8.808)	0.244	8.923	(8.851)	0.003	(0.990)
No. of students living in 1km radius	13.453	(10.210)		13.568	(10.273)	0.115	13.607	(10.327)	0.154	(0.579)
Participated in final exam	0.878	(0.327)		0.922	(0.268)	0.044***	0.917	(0.276)	0.039***	(0.000)
Student passed final exam (cond. on part.)	0.948	(0.223)		0.947	(0.224)	-0.000	0.939	(0.240)	-0.009	(0.171)
Ranks in top 15% in final exam	0.131	(0.337)		0.155	(0.362)	0.025***	0.134	(0.341)	0.003	(0.710)
Observations	3,261			2,197			2,197			

Notes: This table shows sample means and standard deviations for the full sample of students and students that participated in the phone survey without weights (cols. 3-4) and weighted by the inverse probability weights calculated from regression in Table C.2.2 (cols. 7-8). Pre-crisis Khmer, English and Math are the students' monthly grade in the subject averaged over the months December, January and February. The maximum points achievable per subject are 100, 50 and 100, respectively. Pre-crisis Total (std.) is the 3-month average total grade (sum over all subjects) with each month being standardized within class to account for differences in the number of subjects across schools/classes. Pre-crisis absence is the average number of days absent per month over the months December, January, February. Participated in final exam equals 1 if the student participated in the final exam on November 30, 2020. Student passed final exam equals 1 if the student obtained 200 points or more in the final exam (conditional on participating in the exam). Columns 5 and 6, and 9 and 10 show the difference in means and the p-value relating to t-tests of equality of means between the phone survey sample and the full sample.

Table C.2.2.: Determinants of Participation in Phone Survey (Logit)

	(1)	
Pre-crisis Math	-0.003	(0.008)
Pre-crisis Khmer	0.004	(0.011)
Pre-crisis English	0.030***	(0.011)
Pre-crisis Math $\times$ Pre-crisis Math	0.000	(0.000)
Pre-crisis Khmer $\times$ Pre-crisis Khmer	-0.000	(0.000)
Pre-crisis English $\times$ Pre-crisis English	-0.000	(0.000)
Pre-crisis Total (std. within class)	0.429***	(0.078)
Teacher has univ. degree	-0.457***	(0.101)
Female Teacher	-0.099	(0.111)
Teacher's yrs. of experience at resp. school	0.004	(0.016)
Age of teacher	-0.019	(0.015)
Dist. teacher's home to school	0.017***	(0.006)
Priority classes=1	0.011	(0.939)
Age (admin. data)	1.218***	(0.454)
Priority classes=1 $\times$ Age (admin. data)	0.034	(0.061)
Age (admin. data) $\times$ Age (admin. data)	-0.041***	(0.014)
Female student (admin. data)=1	-0.208*	(0.108)
Priority classes=1 $\times$ Female student (admin. data)=1	0.693***	(0.165)
Student participated in RCT	0.054	(0.134)
School district=1	0.000	(.)
School district=2	-0.155	(0.254)
School district=3	-1.590***	(0.285)
School district=4	-1.590***	(0.304)
School district=5	-0.779**	(0.341)
School district=6	0.015	(0.245)
School district=7	-0.546***	(0.201)
School district=8	-0.659**	(0.286)
School district=9	-0.626***	(0.217)
School district=10	-0.405	(0.292)
School district=11	-0.573**	(0.251)
School district=12	-0.507**	(0.239)
School partners with Child's Dream=1	-0.445**	(0.174)
Observations	3261	
Pseudo $R^2$	0.099	

*Notes:* This table shows coefficients and standard errors of a logit regression with survey participation as the dependent variable. Pre-crisis Khmer, English and Math are the students' monthly grade in the subject averaged over the months December, January and February. Pre-crisis Total (std.) is the 3-month average total grade (sum over all subjects), with each month being standardized within class to account for differences in the number of subjects across schools/classes. Priority class equals 1 whenever the class is part of the educational RCT described in Gehrke et al. (2020a). Student participated in RCT equals 1 if the student participated in the intervention.



Table C.2.3.: Correlation of Income Shock with Family and Student Characteristics

	Migration (1)	Mo. educ (2)	Fa. educ (3)	Total std. (4)	Khmer (5)	Math (6)	English (7)	No. siblings (8)	Owms moto (9)	Owms bike (10)	Owms smartph. (11)
Probability of income loss (father)	0.495*** (0.124)	0.068 (0.124)	-0.454*** (0.142)	-0.221 (0.264)	-2.198 (4.916)	-7.674 (6.283)	-3.192 (2.826)	-3.301 (2.623)	0.006 (0.390)	-0.226 (0.194)	-0.094 (0.330)
Probability of income loss (mother)	0.261 (0.194)	-0.146 (0.175)	0.185 (0.146)	-0.043 (0.369)	-6.557 (5.787)	2.987 (8.145)	1.017 (2.134)	0.941 (2.109)	0.319 (0.336)	-0.153 (0.229)	0.773* (0.373)
Age (adm. data)	0.043*** (0.011)	-0.029*** (0.007)	-0.030*** (0.008)	-0.000 (0.023)	0.248 (0.320)	-0.529 (0.444)	-0.325* (0.163)	0.156** (0.067)	-0.003 (0.022)	-0.016 (0.018)	0.025 (0.021)
Female student (adm. data)	0.001 (0.021)	-0.014 (0.016)	-0.027 (0.024)	0.427*** (0.059)	8.906*** (0.897)	4.813*** (1.309)	2.881*** (0.437)	-0.031 (0.193)	-0.007 (0.044)	-0.000 (0.028)	-0.034 (0.044)
Observations	1789	1789	1789	1789	1789	1789	1789	493	493	493	493
Adjusted $R^2$	0.167	0.118	0.134	0.074	0.406	0.362	0.624	0.162	0.093	0.125	0.057
Dep. var. mean	0.365	0.167	0.284	0.026	56.689	47.942	17.083	2.584	0.432	0.731	0.423

Notes: Migration equals 1 if at least one family member migrated in the past 12 months. Mother (father) education equals 1 if the mother (father) finished at least primary education. Total std., Khmer, Math, English are the average monthly grades from December, January, February (Total is additionally standardized within class). No. siblings is a count of the student's sibling(s). Owms moto/ bike/ smartphone equals 1 whenever the student owns a motorcycle/ bicycle/ smartphone. Weighted Least Squares reported throughout. All columns control for school and interviewer fixed effects. Col. 1 additionally controls for parental education fixed effects, cols. 2-4 additionally control for migration fixed effects. Col. 2 (3) additionally controls for father (mother) education fixed effects. Columns 5-11 additionally control for parental education and migration fixed effects. Standard errors (clustered at the school level) are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table C.2.4.: Effect of Income Shock on Pre-crisis Consumption Levels

	(1)	(2)
Probability of income loss (father)	-0.133 (0.208)	-0.482 (0.530)
Probability of income loss (mother)	0.263 (0.288)	1.131 (1.140)
Observations	1024	97
Adjusted $R^2$	0.187	0.146
Dep. var. mean	11.130	10.964

*Notes:* Dep. var. is log consumption expenditures (per capita). Each regression controls for district fixed effects. Data come from the Cambodian Socio-Economic Survey 2017. Sample consists of households with children aged 12-19 who live with both parents (max. one child per hh to avoid double counting households). Column 1 restricts the sample to households in rural Cambodia, column 2 to the four provinces covered in this study. Standard errors are in parentheses and clustered at the district level. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Table C.2.5.: Robustness of COVID-19 Effects: Different Grade Thresholds

	Ranks in top 20%		Ranks in top 15%		Ranks in top 10%		Ranks in top 5%	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Probability of income loss (father)	-0.182*	-0.104	-0.230***	-0.162**	-0.156*	-0.108	-0.098	-0.068
	(0.099)	(0.084)	(0.080)	(0.075)	(0.084)	(0.073)	(0.064)	(0.056)
Probability of income loss (mother)	-0.158	-0.159	-0.081	-0.085	-0.010	-0.011	-0.028	-0.027
	(0.118)	(0.105)	(0.088)	(0.082)	(0.074)	(0.058)	(0.071)	(0.065)
Age (adm. data)	-0.008	-0.005	-0.010	-0.006	-0.005	-0.003	-0.005	-0.004
	(0.007)	(0.006)	(0.007)	(0.006)	(0.005)	(0.005)	(0.004)	(0.004)
Female student (adm. data)	0.105***	0.004	0.081***	-0.003	0.056***	-0.008	0.043***	0.004
	(0.020)	(0.018)	(0.018)	(0.015)	(0.014)	(0.012)	(0.011)	(0.008)
Pre-crisis Total (std. within class)		0.128***		0.098***		0.088***		0.032**
		(0.027)		(0.024)		(0.024)		(0.016)
Pre-crisis Khmer		0.002		0.001		0.001		0.001**
		(0.001)		(0.001)		(0.001)		(0.001)
Pre-crisis English		0.005***		0.005***		0.004***		0.003**
		(0.002)		(0.002)		(0.001)		(0.001)
Pre-crisis Math		0.004***		0.004***		0.002**		0.002**
		(0.001)		(0.001)		(0.001)		(0.001)
Observations	1789	1789	1789	1789	1789	1789	1789	1789
Adjusted $R^2$	0.104	0.402	0.089	0.355	0.073	0.281	0.041	0.181
Dep. var. mean	0.188	0.188	0.138	0.138	0.090	0.090	0.046	0.046

*Notes:* Dependent variables are in the column header (Ranks in top 20%, top 15%, top 10% and top 5% respectively (adm. data)). Weighted Least Squares (weights are inverse probability weights calculated from Table C.2.2) reported throughout. All regressions control for school, parental education, migration and interviewer fixed effects. Standard errors (clustered at the school level) are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table C.2.6.: Robustness of COVID-19 Effects: Alternative Income Shocks

	Studied in last 7d		Part. in final exam		Ranks in top 15%	
	(1)	(2)	(3)	(4)	(5)	(6)
PANEL A: Probabilities based on main occupation						
Probability of income loss (father)	-0.161** (0.075)	-0.147** (0.073)	-0.200*** (0.070)	-0.185*** (0.069)	-0.201*** (0.073)	-0.140* (0.074)
Probability of income loss (mother)	0.163 (0.113)	0.171 (0.108)	0.265** (0.124)	0.263** (0.122)	-0.114 (0.086)	-0.118 (0.084)
Adjusted $R^2$	0.077	0.110	0.033	0.067	0.088	0.355
PANEL B: Probabilities averaged across occupations						
Probability of income loss (father)	-0.156** (0.069)	-0.144** (0.066)	-0.203*** (0.069)	-0.191*** (0.066)	-0.221*** (0.080)	-0.165** (0.073)
Probability of income loss (mother)	0.145 (0.114)	0.145 (0.109)	0.297** (0.125)	0.289** (0.124)	-0.055 (0.090)	-0.088 (0.084)
Adjusted $R^2$	0.076	0.109	0.033	0.067	0.088	0.355
PANEL C: Probabilities calculated from World Bank survey						
Probability of income loss (father)	-0.070 (0.079)	-0.060 (0.073)	-0.148 (0.094)	-0.140 (0.094)	-0.126 (0.092)	-0.079 (0.082)
Probability of income loss (mother)	0.335* (0.198)	0.269 (0.163)	0.599** (0.229)	0.539*** (0.191)	-0.190 (0.212)	-0.346** (0.158)
Adjusted $R^2$	0.078	0.110	0.034	0.069	0.084	0.356
PANEL D: Student-reported income loss						
Father experienced income loss (0/1)	-0.031 (0.025)	-0.027 (0.025)	-0.017 (0.025)	-0.014 (0.024)	0.023 (0.025)	0.034 (0.022)
Mother experienced income loss (0/1)	0.051** (0.020)	0.049** (0.020)	0.058** (0.024)	0.056** (0.024)	-0.023 (0.023)	-0.035** (0.017)
Adjusted $R^2$	0.077	0.110	0.032	0.067	0.085	0.354
Grade controls	N	Y	N	Y	N	Y
Observations	1789	1789	1789	1789	1789	1789
Dep. var. mean	0.882	0.882	0.918	0.918	0.138	0.138

*Notes:* Dependent variables are in the column header (Studied in last 7d (phone survey), Part. in final exam (adm. data), Ranks in top 15% (adm. data)). Weighted Least Squares (weights are inverse probability weights calculated from Table C.2.2) reported throughout. All regressions control for age and gender, as well as for school, parental education, migration and interviewer fixed effects. Grade controls are pre-crisis average Total (std. within class), Khmer, Math and English. Standard errors (clustered at the school level) are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table C.2.7.: Robustness of COVID-19 Effects: Alternative Specifications

	Studied in last 7d		Part. in final exam		Ranks in top 15%	
	(1)	(2)	(3)	(4)	(5)	(6)
PANEL A: District and Child's Dream Partnership FE instead of school FE						
Probability of income loss (father)	-0.136* (0.068)	-0.114* (0.064)	-0.178** (0.069)	-0.154** (0.068)	-0.233*** (0.084)	-0.158** (0.071)
Probability of income loss (mother)	0.206* (0.104)	0.227** (0.103)	0.264** (0.124)	0.274** (0.127)	-0.020 (0.084)	-0.017 (0.089)
Observations	1789	1789	1789	1789	1789	1789
Adjusted $R^2$	0.065	0.099	0.015	0.052	0.060	0.310
Dep. var. mean	0.882	0.882	0.918	0.918	0.138	0.138
PANEL B: No reweighing for survey non-response						
Probability of income loss (father)	-0.116 (0.071)	-0.094 (0.067)	-0.180** (0.070)	-0.158** (0.067)	-0.227** (0.086)	-0.136* (0.075)
Probability of income loss (mother)	0.113 (0.088)	0.119 (0.088)	0.250*** (0.091)	0.251*** (0.093)	-0.083 (0.101)	-0.077 (0.078)
Observations	1789	1789	1789	1789	1789	1789
Adjusted $R^2$	0.073	0.105	0.033	0.063	0.100	0.379
Dep. var. mean	0.889	0.889	0.922	0.922	0.159	0.159
PANEL C: Controlling for smartphone ownership						
Probability of income loss (father)	-0.113 (0.070)	-0.099 (0.068)	-0.188*** (0.070)	-0.172** (0.067)	-0.230*** (0.081)	-0.163** (0.075)
Probability of income loss (mother)	0.160 (0.103)	0.170* (0.099)	0.310** (0.122)	0.310** (0.121)	-0.081 (0.091)	-0.082 (0.082)
Observations	1789	1789	1789	1789	1789	1789
Adjusted $R^2$	0.079	0.112	0.034	0.068	0.088	0.355
Dep. var. mean	0.882	0.882	0.918	0.918	0.138	0.138
PANEL D: Extending sample to households with only one working parent						
Probability of income loss (father)	-0.132** (0.064)	-0.109* (0.063)	-0.098* (0.056)	-0.078 (0.054)	-0.215*** (0.067)	-0.140** (0.058)
Probability of income loss (mother)	0.091 (0.069)	0.088 (0.067)	0.073 (0.069)	0.067 (0.071)	-0.029 (0.066)	-0.044 (0.059)
Observations	2027	2027	2027	2027	2027	2027
Adjusted $R^2$	0.066	0.099	0.032	0.064	0.093	0.363
Dep. var. mean	0.883	0.883	0.920	0.920	0.138	0.138
Grade controls	N	Y	N	Y	N	Y

*Notes:* Dependent variables are in the column header (Studied in last 7d (phone survey), Part. in final exam (adm. data), Ranks in top 15% (adm. data)). Weighted Least Squares (weights are inverse probability weights calculated from Table C.2.2) reported in Panels A, C and D, OLS reported in Panel B. All regressions control for age and gender, as well as for parental education, migration and interviewer fixed effects. Panel A additionally controls for district and Child's Dream partnership fixed effects, Panels B, C and D for school fixed effects. Grade controls are pre-crisis average Total (std. within class), Khmer, Math and English. Standard errors (clustered at the school level) are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table C.2.8.: Effect of COVID-19 on Main Activity

	Study		Paid work		Hh work		Leisure	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Probability of income loss (father)	-0.141 (0.112)	-0.119 (0.106)	0.217** (0.092)	0.212** (0.094)	-0.116 (0.145)	-0.133 (0.139)	0.046 (0.045)	0.048 (0.047)
Probability of income loss (mother)	-0.027 (0.194)	-0.018 (0.193)	-0.082 (0.148)	-0.092 (0.144)	0.124 (0.215)	0.126 (0.216)	-0.027 (0.049)	-0.029 (0.050)
Age (adm. data)	0.001 (0.009)	0.001 (0.009)	0.013* (0.007)	0.013* (0.007)	-0.013 (0.009)	-0.014 (0.010)	0.001 (0.003)	0.001 (0.003)
Female student (adm. data)	0.029 (0.020)	-0.005 (0.022)	-0.082*** (0.016)	-0.064*** (0.016)	0.069*** (0.025)	0.086*** (0.026)	-0.015* (0.008)	-0.014** (0.006)
Pre-crisis Total (std. within class)		0.014 (0.022)		-0.003 (0.020)		-0.011 (0.027)		-0.001 (0.012)
Pre-crisis Khmer		0.002* (0.001)		-0.001 (0.001)		-0.000 (0.001)		-0.000 (0.000)
Pre-crisis English		0.002 (0.002)		-0.002* (0.001)		-0.001 (0.002)		0.000 (0.001)
Pre-crisis Math		0.001 (0.001)		0.001 (0.001)		-0.002 (0.001)		0.000 (0.000)
Observations	1785	1785	1785	1785	1785	1785	1785	1785
Adjusted $R^2$	0.105	0.125	0.090	0.096	0.072	0.079	0.063	0.061
Dep. var. mean	0.229	0.229	0.113	0.113	0.636	0.636	0.022	0.022

Notes: Dependent variables are in the column header: Study equals 1 if main activity on a typical week-day in the last 7 days was studying, etc. Hh work equals 1 if main activity was household chores, work in family business or on family farm. Weighted Least Squares (weights are inverse probability weights calculated from Table C.2.2) reported throughout. All regressions control for school, parental education, migration and interviewer fixed effects. Standard errors (clustered at the school level) are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

## Author contributions

This thesis is composed of three research papers. One research paper is single-authored, the remaining two research papers have been co-authored with Esther Gehrke and Friederike Lenel, and the contributions to each paper of the respective authors are as follows:

### **Career goals and investments in education: Experimental evidence from Cambodia**

We equally contributed to the conceptualization of the idea and research design. Friederike Lenel and I were responsible for funding and I was additionally able to get extra funding for technical equipment. I was in the field to collect our experimental data and to supervise the local research team while we coordinated the administrative data collection process all together. Most of the data preparation was realized by Esther Gehrke and myself. Friederike Lenel was in charge for the data analysis and for writing the manuscript. I contributed to both with specific analyses and paragraphs in the text. We all contributed to the interpretation of the results.

### **COVID-19 crisis, economic hardships, and schooling outcomes**

We equally contributed to the the conceptualization of the idea and research design. Esther Gehrke and I were in charge for the data collection process and supervised the local research team while we coordinated the administrative data collection process all together. Most of the data preparation and analysis were realized by Esther Gehrke and myself. We all contributed to the interpretation of the results. Esther Gehrke was in charge for writing the manuscript to which Friederike Lenel and I contributed specific parts.

16.12.21



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Date and signature