ABSTRACT

Title of Dissertation: ESSAYS IN THE ECONOMICS OF
HEALTH EDUCATION IN DEVELOPING COUNTRIES:
EVIDENCE FROM VIETNAM

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Health education is widely implemented in school settings to prevent risky health behaviors of teenagers. The majority of the information-based programs target adolescents, when individuals' health attitudes and behaviors are formed. In particular, schools are a vital place to implement a health education program to reach a large number of teenagers for years in a financially sustainable and logistically convenient way. However, a body of empirical studies finds limited effects on behavioral changes. My dissertation exploits randomized controlled trials in Vietnam to investigate a school-based health education intervention.

In the first two chapters of my dissertation, I examine the effects of health education on adolescents' health outcomes. The first chapter explores multidimensional health domains, including health behaviors and psychological health factors. In the second chapter, I focus on sexual and reproductive health education to assess to which extent health education affects teenagers by evaluating the effects on health knowledge, attitudes, and behaviors.

In health education programs, classroom observation is often employed to improve the quality of teaching. However, its implications on students' learning in sensitive health topics are understudied. Against this background, in my third chapter, I investigate whether and how the presence of an observer affects students' learning in sexual and reproductive health education.

ESSAYS IN THE ECONOMICS OF HEALTH EDUCATION IN DEVELOPING COUNTRIES: EVIDENCE FROM VIETNAM

by

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Chapter 1: Introduction

1.1 Introduction

Health education aims to prevent risky health behaviors by updating an economic agent's perceived future costs resulting from risk behaviors. However, the effectiveness of health education has been questioned, along with a mounting body of empirical evidence documenting the null effects on behavioral changes. The overwhelming consensus from existing empirical evidence is that a health education program may increase teenagers' knowledge in health, but translating it into behavioral changes is exceptionally challenging.

Given the limited effects on risky health behaviors, we must answer the following questions: does health education have positive effects on crucial health domains of adolescents in addition to health practices? Why does health education not lead to behavioral changes? Finally, does direct observation make health education more effective by changing the way that teachers teach?

I address these questions by conducting randomized controlled trials involving 140 lower secondary schools in Vietnam. Schools were randomized 1:1 to either treatment or control groups. Students enrolled in the treatment schools received monthly stand-alone health education in five topics by school teachers at the class level, but control group students did not receive any intervention. The five topics include eye health, sexual and reproductive health, infectious dis-

eases and handwashing, food and nutrition, and anti-smoking. The topics were selected given rising myopic adolescents (Paudel et al., 2014), prevalent unprotected sex among youths (Duong et al., 2008; WHO, 2005), low adherence levels in handwashing (Dutton et al., 2011), the increasing teenage obesity rate (IFPRI, 2015; Khan and Khoi, 2008), and the highest rate of smoking male population (Van Minh et al., 2017; Page et al., 2012) in Vietnam. In each school, approximately 48 students were randomly sampled for surveys after stratifying by school class and sex of students. I evaluate the effects of health education by comparing treated students' health outcomes to their counterparts from the control group five months after they received the treatment in my first and second papers. Within the treated schools, I conducted another randomized controlled trial across 56 schools, where an in-classroom observer evaluated randomly selected teachers' sex education session, to examine the effects of classroom observation on students' learning in sensitive health education topics (the third paper).

In my first paper, I show that a school-based health education program has significant effects on teenagers' multidimensional psychological health factors. After receiving health education, adolescents' self-efficacy, life satisfaction, and health-related quality of life improve significantly. However, I find mixed effects on behavioral changes despite increased health knowledge as a result of health education, consistent with existing literature.

In the second chapter, I focus on sexual and reproductive health outcomes to investigate how health education affects each step of the behavioral changes. I find that sex education significantly improves students' sexual and reproductive health knowledge, but it has limited effects on teenagers' attitudes and behaviors. Despite improved understanding of contraceptives, students are not more likely to decide to use modern contraceptive methods after receiving sexual and reproductive health education. Also, sex education does not significantly affect Vietnamese

adolescents' present prevention plans but their future plans only.

Finally, my third paper shows that the presence of an observer has significant effects on students' learning, particularly with *abstinence-until-marriage* messages. Students' knowledge of *abstinence* improves significantly, and they are more likely to perceive it as an effective preventive method they plan to adopt to protect themselves from sexually transmitted infections and unwanted pregnancy. However, I do not find the observer effect on other prevention methods, namely *fidelity* and *contraceptives*. I show that classroom monitoring affects students' learning because teachers promote *abstinence* when an outsider evaluates their teaching.

1.2 Lessons Learned

Findings from the first paper suggest that policymakers should take into account the broader health dimensions when evaluating health education. Given limited effects on behavioral change, health education is often undervalued. However, my findings show that the information-based intervention has positive effects on adolescents' health domains that are closely linked to their current and future health outcomes.

Secondly, findings from my first and second papers show that health education does not have significant effects on health behaviors because it fails to convince participants that a risky sexual activity is an imminent threat, which requires prompt behavioral changes. Teenagers have a better understanding of risky behaviors and believe that they have the capability to avoid damaging health practices after receiving health education. However, health education does not affect adolescents' intentions to exercise their efforts to prevent risky health behaviors. As a result, teenagers' present prevention plans do not change, which leads to null effects on behavioral

changes.

Finally, my dissertation suggests that social norms may play a significant role in health education. While students understand the effectiveness of contraceptives, for example, they are unwilling to use the effective modern preventive measures in Vietnam, where premarital sex is considered immoral. Also, in-person observation unintentionally affects the direction of health education programs containing sensitive information by inducing teachers to emphasize socially acceptable messages when sex education is delivered under scrutiny.

A further study evaluating the direct link between teaching quality and students' learning in health education, particularly in sensitive health education topics, is necessary. Also, how students' learning is affected in a different culture should be examined in that observed participants may respond in the other direction depending on the social norms of the society. Finally, an intervention focused on changing students' attitudes and intentions should be further investigated.

Chapter 2: Effects of health education on adolescents' non-cognitive skills, life satisfaction and aspirations, and health-related quality of life: A cluster-randomized controlled trial in Vietnam

Joint with Sangchul Yoon, Shinki An, Le Thanh Tuan, and Jongwook Lee

2.1 Introduction

Adolescents are a vulnerable group in public health, along with rapid physical and emotional changes resulting from increased hormones and social context changes during puberty. Transitioning from primary to secondary schools, the chance of engaging in risky health behaviors surges substantially as teenagers encounter older students with distinct group norms and peer pressure. However, adolescents often initiate risky behaviors without knowing potential consequences of such actions. Most of the teenagers' sexual activities are unprotected (Bearinger et al., 2007), while sexual debut during adolescence (Haydon et al., 2012) and an increasing proportion of the young population experiencing premarital sex (Wu et al., 2020) are widely reported. The majority of the cigarette smoking population starts smoking from adolescence (Johnston et al., 2019), when peer pressure plays a significant role. Besides, teenagers tend to show low adherence levels in exercising preventive measures, such as handwashing (WHO and CDC, 2020) and

physical activities (Guthold et al., 2020) to avoid infectious diseases, myopia, and obesity.

While adolescence is a critical stage of the life cycle that requires social protection, suboptimal levels of attention and care are often provided in Low- and Middle-Income Countries (LMICs) due to limited resources, cultural barriers, and the policymakers' lack of interest. For example, uncorrected refractive errors among adolescents are a primary cause of vision impairment in Vietnam, where about 20 percent of lower secondary school students are estimated to have myopia (Paudel et al., 2014). Despite increasing abortion rates, Vietnamese adolescents are excluded from the national population policy, leading to approximately 20 percent of abortions involving teens (Ministry of Planning and Investment of Vietnam, 2010). Competitive environments in school leave little room for adolescents to spend time on outdoor activities in the middle-income country, where more than 85 percent of teenagers do not spend sufficient time on physical activities (Guthold et al., 2020).

The cost of risky health behaviors is substantial for both individuals and societies. Engaging in unprotected sex at a young age may lead to Sexually Transmitted Infections (Olesen et al., 2012), mental health problems (Zimmer-Gembeck and Helfand, 2008), or unplanned pregnancies (Wellings et al., 2001), causing severe health outcomes to teenagers. In particular, unwanted pregnancies of teenage girls are an urgent global challenge given its subsequent problems, such as complications during pregnancy and delivery (Nour, 2009), unsafe abortions (Bearinger et al., 2007), interrupted schooling (Baird et al., 2011), and loss of future earnings (Jayachandran, 2015). Likewise, smoking in adolescence may incur severe health issues—respiratory illnesses (Jayes et al., 2016), interruption in brain development (Jacobsen et al., 2005), and impairment in working memory (Zhao et al., 2012)—which leads to limited job opportunities in the future (Paavola et al., 2004). The short-run and long-run adverse effects of risky behaviors are re-

ported in preventive health domains, namely not washing hands at critical times (Waddington et al., 2009) and not engaging in outdoor physical activities (Guthold et al., 2020; Paudel et al., 2014). Besides, risky health behaviors of teenagers increase the burden on societies by escalating health care costs while losing human capital. A significant amount of taxpayers' money is spent on social problems attributed to unintended pregnancies (Sonfield and Kost, 2015), more than five percent of global health expenditure goes to smoking-related healthcare costs (Goodchild et al., 2018), and malnutrition-related healthcare claims up to USD 3.5 trillion per year globally (FAO, 2013). Human capital loss caused by risky health behaviors is considerable. Apart from approximately 20 percent and 11 percent of global deaths resulting from communicable, maternal, neonatal, and nutritional (CMNN) diseases (Naghavi et al., 2017) and smoking (Reitsma et al., 2017), respectively, risky health behaviors deprive societies of human capital accumulation as adolescents become pregnant (Field and Ambrus, 2008), smoke (Jacobsen et al., 2005; Zhao et al., 2012), experience a vision problem (Gilbert et al., 2018), have an unbalanced diet (Chakraborty and Jayaraman, 2019), and suffer from an infectious disease (Willmott et al., 2016).

Health education is a widely observed intervention designed to prevent such damaging health behaviors of teenagers in both LMICs and High-Income Countries (HICs). One of the underlying assumptions of health education is that an economic agent engages in unsafe health practices because her perceived immediate benefits are greater than the perceived future costs of such behaviors (Leibowitz et al., 1986). Hence, health education aims to prevent risky health behaviors by updating the agent's perceived future costs resulting from the risk factors. The majority of the information-based programs target teenagers, when individuals' health attitudes and behaviors are formed (Kohlberg, 1975; Markus and Nurius, 1986). In particular, schools are a vital place to implement a health education program to reach a large number of adolescents

for years (Campbell et al., 2008; UNESCO, 2008) in a financially sustainable and logistically convenient way thanks to existing learning structures (Utzinger et al., 2003), ensuring the high returns to the intervention (Heckman and Mosso, 2014).

However, the effectiveness of health education has been questioned, along with a mounting body of empirical evidence documenting the null effects of the information-based approach in behavioral changes. Despite a few studies presenting significant effects (Chou et al., 2006; Tahlil et al., 2013), the overwhelming consensus from existing empirical evidence is that a health education program may increase teenagers' knowledge in health, but translating it into behavioral changes is exceptionally challenging. The findings are consistent across topics, including sexual and reproductive health (de Walque, 2014), anti-smoking (Campbell et al., 2008), eye health (Congdon et al., 2011), hygiene (Chase and Do, 2012), and nutrition (Downs et al., 2009), leading to the conclusion that cost-effectiveness of health education is an *'illusion'* (Kremer and Miguel, 2007).

Although much of the literature focused on the effects of health education on teenagers' Knowledge, Attitudes, and Practices (KAP) in health, there exists limited evidence on psychological factors related to adolescents' current and future health outcomes, such as non-cognitive skills, the quality of life, and life satisfaction and aspirations gap. For example, self-efficacy, personal beliefs in own capacity (Bandura, 1977), is an essential mediating component necessary when translating knowledge into action (Armitage and Conner, 2001) as it shapes one's behavioral intentions. A teenager's life satisfaction elicits how healthy a student is physically, mentally, and socially, which are associated with school life (Gobina et al., 2008), other risky health behaviors (Kuntsche and Gmel, 2004), social problems, and mental health in both positive (Gilman and Huebner, 2006) and negative (Kapıkıran, 2013) ways. Finally, the Health-Related

Quality of Life (HRQoL), an individual's self-perceived multidimensional health domains (Cella et al., 2007) beyond morbidity and mortality, captures both the self-assessed physical and mental health status of adolescents, serving as an indicator of current health and a predictor of future health outcomes (CDC, 2018).

In this study, we examined the effects of a health education program on non-cognitive skills, life satisfaction, aspirations gap, and HRQoL besides health KAP. We conducted a randomized-controlled trial in Vietnam to investigate the impacts of school-based health education on adolescents' psychological health which should not be neglected when evaluating the information-based approach. Randomly selected lower secondary school students in Thanh Hoa province received monthly stand-alone health education in five topics: Eye Health; Sexual and Reproductive Health (SRH); Infectious Diseases and Handwashing; Food and Nutrition; and Anti-Smoking at the class level. Treated students learned essential health information and life skills necessary to make sound health decisions from trained school teachers. We assessed impacts of the health education program by comparing the treatment students to their control group counterparts five month after baseline data collection.

2.2 Methods

2.2.1 Study designs, randomization, and participants

We conducted a cluster-randomized controlled trial in lower secondary schools in Thanh Hoa province, Vietnam, from 2018 to 2019. From all of 652 public lower-secondary schools across the province, 140 schools were randomly selected based on the total number of lower-secondary schools in each district (Figure 2.1). The schools were assigned to either the treatment

(70 schools) or the control (70 schools) groups after stratifying by the district. Randomization took place at the school level rather than the student level to take into account spillover effects and to minimize potential ethical issues. All the selected treatment and control schools agreed to participate in the program. We distributed two types of consent forms for students to take home—one about the health education program participation to all treatment school students and another about survey participation to a subset of treatment and control school students. Of these, students who returned the form signed by their parent or guardian were enrolled in the program and the study. All the participating students in the treatment group received a series of health education sessions, while none of these was provided to the control group students.

In each school, approximately 48 students were randomly sampled for surveys after stratifying by school class and sex of students. Inclusion criteria for the study were the randomly selected student cohorts in grades 6, 7, 8, and 9 in the 2018-2019 academic year (aged 11 to 14) whose caregivers gave consent for their children to participate in the surveys. Also, students were required to provide assent and be able to read and speak Vietnamese fluently to join the study. Our analytic sample includes those who completed both baseline and follow-up surveys. However, including students who were surveyed at follow-up regardless of baseline survey participation in the sample does not change results significantly. Exclusion criteria were students who refused assent; whose parents or guardians declined for their children to join the study; and those who were unable to speak or read Vietnamese. Students who had been transferred to other schools between baseline and follow-up surveys were also excluded from our analysis. Ethical approval for the study was obtained from the Yonsei University Institutional Review Board (IRB ID: 4-2018-1060) and the University of Minnesota Institutional Review Board (IRB ID: STUDY00004327).

2.2.2 Procedures

Once a month, trained teachers instructed a 45-minute-long health education session in the treatment schools at the class level as a stand-alone course over five months. A total of five health topics, namely Eye Health, SRH, Infectious Diseases and Handwashing, Food and Nutrition, and Anti-Smoking, took place sequentially on regular school days. Each session consisted of two parts—lectures and in-class activities. A teacher started each session by explaining what constitutes risky health behaviors, why they matter, and how to prevent them (i.e., lecture), followed by student-centered participative activities (i.e., in-class activities) when students learned essential life skills to protect their own health from damaging health behaviors.

The health program aimed to reduce risky health behaviors of participating adolescents, including unprotected sex, sugar overconsumption, and cigarette smoking, and to increase their adherence to preventive health practices, namely outdoor activities and washing hands at critical times. The program was designed to enhance students' health knowledge and attitudes by updating their perceived future costs associated with such behaviors. Given the improved understanding and perspectives in risky behaviors, life skills acquired from in-class activities were to enable them to avoid risky behaviors. Along the way of obtaining crucial information and life skills, health education was expected to promote students' non-cognitive skills as their beliefs in personal ability to control their own behaviors improve, leading to increased life satisfaction and HRQoL.

Before providing health education to students, we trained treatment school teachers to serve as health education instructors via the Training of Trainers. Two health teachers from each treatment school recruited by headmasters were invited to two-day training sessions. Using the teach-

ing guidelines approved by the Department of Education and Training, professors at the Thanh Hoa Medical College led the training sessions. During the training sessions, the teachers learned what to teach (i.e., health promotion messages) and how to teach (i.e., pedagogical skills) using the guidelines. After completing training, the health teachers had organized another workshop at the school level, serving as peer educators for homeroom teachers who delivered health promotion messages to students at the class level. The homeroom teachers taught all health topics except SRH, which health teachers instructed, given the sensitivity of the topic. Pre- and post-training evaluation reveals that the trained teachers had a better understanding of teaching materials after completing training.

We collected a rich array of data, such as students' demographic information (e.g., age, sex, ethnicity, mother tongue, and the number of household members living together), school life, health KAP in five topics, non-cognitive skills, life satisfaction, aspirations gap, and HRQoL from in-person surveys. Moreover, students' health information such as height, weight, chest circumference, vision acuity, hearing ability, blood pressure levels, and dental problems, was collected from the treatment school students immediately after the baseline survey. The follow-up survey took place from March to April 2019, approximately five months after baseline data collection from October to December 2018, but the second follow-up survey scheduled to be collected in 2020 was interrupted due to the COVID-19 pandemic.

2.2.3 Outcomes

We measured outcomes at the individual level. The primary outcomes of the study were non-cognitive skills (i.e., self-esteem and self-efficacy), life satisfaction and aspirations gap, and

HRQoL, and the secondary outcomes were health knowledge and practices in the five topics students had learned. We calibrated levels of life satisfaction and aspirations gap by using an adapted version of the Cantril Ladder (Cantril, 1965), where respondents were asked to indicate where they thought that they were at the present time and five years from the present using a zero (the worst) to nine (the best) scale. Students' aspirations gap was computed as the difference between the expected future life satisfaction and the current life satisfaction. The KINDL-R questionnaire (Ravens-Sieberer and Bullinger, 2003) was used to measure HRQoL such as students' physical well-being, emotional well-being, self-esteem, family, friends, and school life. Students' health knowledge scores were constructed by using the two-parameter logistic Item Response Theory model (Embretson and Reise, 2013), and we used students' self-reported answers for health practice outcomes in our analysis. For sensitive health practice questions such as sexual intercourse and smoking, students had an option to choose *"I do not know,"* which was coded as missing.

2.2.4 Statistical analysis

The unit of analysis was an individual student. We estimated the intention-to-treat (ITT) effects where the impacts of offering the health program were evaluated regardless of compliance. First, we assessed whether the baseline characteristics of the treatment and control groups were statistically different. We then examined the treatment effects of health education by the panel fixed effects model, since students who had been surveyed at baseline were visited again for the follow-up survey. Continuous outcome variables were normalized by the means and standard deviations of the control group values of corresponding variables measured at baseline to report standardized effect sizes. Theoretically, the randomization allows us to estimate unbiased

treatment effects without covariates. However, we included some key individual characteristics—students' age, the number of siblings, and the number of rooms per household member—as control variables in addition to the student fixed effects, mainly due to baseline imbalances between the treatment and control groups to increase precision. Time-invariant characteristics, such as ethnicity and locality of schools, were excluded from the vector of covariates because the student fixed effects control for any differences attributed to factors that do not change across time. Throughout the analysis, standard errors were clustered at the school level—the unit of randomization. We used Stata version 15.1 for statistical analysis with 5 percent statistical significance level criteria.

2.3 Results

Details of the study sample are demonstrated in Figure 2.2. Of the 6,477 enrolled students at baseline, 5,925 students (2,958 treated and 2,967 control students) who had completed an assessment at five months were included in the study. The attrition rates of the treatment and control groups were eight percent and nine percent, respectively, but the differences in the baseline characteristics of the lost students to follow-up were marginal, and they were not statistically significant at the 5 percent level.

Table 2.1 presents baseline characteristics of the study participants by treatment status. Panel A confirms that the two groups were balanced, on average, except for a few variables with small differences in magnitude given a large sample size. About half of the respondents were female, and the average age of participants was between 12 and 13 years, reflecting the random sampling stratified by gender and class. The average household size was 4.7 for both groups, and

51 percent of respondents were the first child of the families. More than 97 percent of students in our study sample had answered that they had lived with at least one of their parents, and we did not find any statistical difference between the treatment and control groups. Despite the random assignment of schools, we found four demographic variables—ethnicity, language, the number of siblings, and the number of rooms per person—that were statistically different across groups. While the magnitude of the differences was small, we controlled for the number of siblings and the number of rooms per person when evaluating the treatment effects to increase precision, but ethnicity and language were excluded because of the student fixed effects that partial out any effects of time-invariant variables. Panel B reports two school characteristics—school size and locality—across treatment conditions. The average school size was about 270 students, which was in line with the General Statistics Office of Vietnam statistics (General Statistical Office of Vietnam, 2018) as a result of the random sampling of schools. The treated schools were more likely to be located in rural areas, but the difference was small, and the fixed effects model addresses any time-invariant factors, including locality.

We also conducted balance tests for both primary and secondary outcome variables. While Table 2.2 shows that some variables are statistically different across groups given a large number of observations, magnitudes are small, and the student fixed effects take into account any time-invariant pre-treatment differences.

Panel A of Figure 2.3 summarizes the treatment effects on students' non-cognitive skills, life satisfaction and aspirations gap, and HRQoL.[1] Despite the insignificant effects on self-esteem, we found that the health education program increased students' perceived beliefs in their

[1]See Appendix Tables 2.A.1 and 2.A.2 for full regression results. The tables are not included in the published paper (Yoon et al., 2021).

own capacity by 0.081 SDs (p-value=0.013). Besides, students' life satisfaction increased substantially after receiving health education on five topics. The current life satisfaction of students was 0.038 SDs (p-value=0.281) higher in the treatment group than the control group, but it was not statistically significant at the 5 percent level. However, when the students were asked where they thought they would stand five years from the present, the treated students' expectation regarding their future was increased by 0.129 SDs (p-value=0.001) compared to the control group, leading to the 0.075 SDs (p-value=0.036) higher aspirations gap after receiving health education. We then assessed the effects of the school-based health education program on students' HRQoL. Overall, we found positive treatment effects on all aspects of HRQoL. While physical well-being was the only HRQoL sub-component that had a significant treatment effect, we found positive coefficients for all the other sub-components, leading to 0.067 SDs (p-value=0.036) higher aggregated HRQoL scores from the treatment school students than the control group.

We also investigated how the school-based health program had affected primary outcomes of the existing health education literature: students' health knowledge and practices. Findings from this study are consistent with a rapidly growing body of empirical evidence: significant effects of health education on adolescents' knowledge but limited effects on behavioral changes. Overall, students' health knowledge increased significantly after receiving monthly health education (Panel B of Figure 2.3).[2] Student's aggregated health-related knowledge increased by 0.054 SDs (p-value$<$0.001) mostly attributed to the effects on Eye Health (β=0.059, p-value=0.020), SRH (β=0.102, p-value$<$0.001), and Infectious Diseases and Handwashing (β=0.065, p-value=0.004). While we found higher knowledge scores in Food and Nutrition (β=0.019, p-value=0.313) and

[2]See Appendix Table 2.A.3 for full regression results. The table is not included in the published paper (Yoon et al., 2021).

Anti-smoking (β=0.024, p-value=0.291) from the treated students relative to the control group counterparts, the differences are not statistically significant.

Table 2.3 shows mixed results for behavioral changes despite the positive treatment effects on students' knowledge in health. While students reduced risky behaviors in two areas, Infectious Diseases and Handwashing and Food and Nutrition, they did not change health behaviors in Eye Health, SRH, and Anti-smoking. First, students' handwashing behaviors improved significantly after receiving health education (Columns 3-6). The percentages of teenagers who answered that they wash their hands before eating a meal (β=0.019, p-value=0.008) and after using the toilet (β=0.018, p-value=0.010) with or without soap increased significantly, while the effects on handwashing behaviors with soap were not significant. The null effects on handwashing with soap are consistent with existing studies concluding that improvement in handwashing with soap behaviors requires the provision of soap. Column 7 shows that health education led to significantly decreased sugar consumptions from snacks and soft drinks among adolescents (β=-0.073, p-value=0.014). However, estimates for the other health behaviors were noisy. After receiving health education, students were more likely to engage in regular outdoor activities at least one hour per day as a preventive measure of myopia (Column 1), but the group difference between the treatment and control students was not significant at the 5 percent level (p-value=0.224). Finally, we found insignificant program effects on students' initiation of sexual activity (p-value=0.517) and smoking (p-value=0.153) as reported in Columns 2 and 8, respectively.

Table 2.4 reports heterogeneous treatment effects across gender and age. Panel A shows that, on average, male students benefited from the program more than female counterparts. First, male students' aspirations gap increased significantly by 0.182 SDs, while the effects on female students are not significant, leading to a statistically significant difference across gender by

0.105 SDs. The differential effects of the program on students across gender are well-manifested in HRQoL outcomes from which the group differences are observed for both aggregated index and sub-components, namely physical well-being, emotional well-being, self-esteem, and school life. The table shows that receiving health education has no significant effects on females students' most of the HRQoL outcomes, but it has positive effects on male counterparts for all of HRQoL variables except family, leading to heterogeneous treatment effects across gender within the treatment group. Panel B shows that the effects of the health education program were larger for younger students. The treatment effects on the aggregated HRQoL decreased by 0.057 SDs when a student was one year older, and we found similar results from sub-components.

2.4 Discussion

In this study, we focused on psychological health dimensions in addition to direct health knowledge and practices of adolescents as a result of health education. We reported that a school-based health education program had led to increases in adolescents' self-efficacy, life satisfaction, aspirations gap, and HRQoL. However, the program had limited effects on reducing risky health behaviors—the primary objective of the information-based intervention.

First, our findings showed significant improvement in self-efficacy after receiving a series of health education classes. Combining with limited behavioral changes despite improved health knowledge, this is an important finding from the perspective of behavioral changes. There exist three potential mechanisms through which enhanced health knowledge and self-efficacy were not translated into reduced risky health behaviors. According to the theory of planned behaviors (Ajzen, 1991), the absence of behavioral changes is caused by students' lack of intentions

to adhere to lessons from health education. In other words, students who received health education had a better understanding of risky health behaviors (i.e., increased knowledge in health), believed that they had the capability to refrain from them (i.e., increased self-efficacy), but they might not have enough intentions or motivations to exercise their efforts, leading to the limited behaviors changes. On the other hand, the limited effects on health practices may reflect circumstantial factors that prevent teenagers from improving preventive measures while avoiding risky behaviors regardless of their intentions. The prototype willingness model (Pomery et al., 2009) from the health psychology literature suggests that adolescents' intentions play a limited role in health practices because their risky behaviors are more likely to be reactive to risk conducive environments rather than planned actions. For example, even if a student has strong intentions to spend more time on outdoor activities to prevent myopia and obesity, it may require parents and teachers' permission whose one of the top priorities is academic success in school. Also, a student may be unable to wash their hands with soap despite the enhanced knowledge and attitudes simply because there exists no soap available at home and school as documented in the existing literature (Dutton et al., 2011). Although including parents and teachers does not necessarily lead to successful behavior changes of teenagers (Prina and Royer, 2014), ensuring conditions under which a teen has an option to make a health decision is a prerequisite condition for a health program to have an impact on adolescents' health behaviors. Finally, evaluating the treatment effects five months after baseline data collection may not give sufficient time for students to alter health behaviors, in particular in sexual intercourse and smoking, given low baseline prevalence. Despite serious problems caused by the risky behaviors during adolescence, less than four percent of students answered at baseline that they had had sex or had smoked before. Hence, examining the long-run effects is necessary before concluding that health education has no impact on behavior

changes since risks of initiating such health behaviors increase substantially as a teen advances from lower secondary to higher secondary schools.

Secondly, this study showed the positive impacts of health education on critical health domains that received relatively limited attention in the health education literature: life satisfaction and aspirations gap. A growing strand of literature pays attention to teenagers' subjective well-being given its strong association with behavioral (Valois et al., 2001; Zullig et al., 2001), social life (Gobina et al., 2008; Park, 2004), and psychological (Gilman and Huebner, 2006; Park, 2004) problems of the core risk group. In particular, life satisfaction is a useful indicator of severe mental health issues, such as depression (Koivumaa-Honkanen et al., 2004), loneliness (Kapıkıran, 2013), and suicide (Helliwell, 2007). The significant effects on life satisfaction we found highlight the possibility of the information-based intervention to address mental health problems of adolescents by increasing their hope and aspirations gap for a socially and mentally healthy future.

Finally, we found that students' perceived health, particularly in physical well-being, had improved significantly after participating in the school-based health education program. Despite the importance of HRQoL in assessing adolescents' current and future health (CDC, 2018), the result should be interpreted with caution. First, the increased physical well-being may reflect mere changes in adolescents' subjective perceptions rather than improvement in physical health per se because HRQoL was designed to measure a respondent's self-assessed health status. Second, the present study did not allow us to disentangle the effects on physical well-being attributed to health education from the effects caused by physical examination, since it took place in the treatment schools only. While students' increased physical well-being may indicate improved physical health as a result of reduced health behaviors, we cannot exclude other channels through

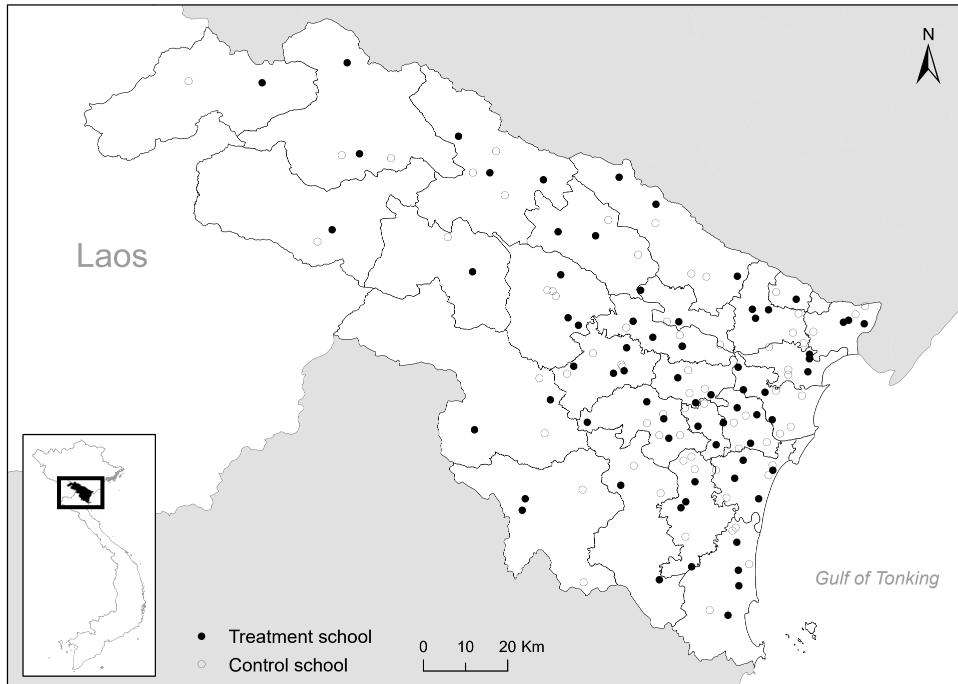
which health assessment affected students. For example, the physical examination might improve students' health status by identifying health issues that they were at risk for, leading to enhanced health conditions at follow-up. At the same time, the physical examination could function as an awakening tool for teenagers to confirm how healthy they were given that most students learned that they did not have health problems in vision (85 percent), hearing (97 percent), and dental (70 percent). Thus, measuring students' physical health status in the treatment schools may spur participating students into an active assessment of their own health, concluding that *'I am healthy,'* which could be reflected by higher physical health well-being scores relative to the control group.

There exist several limitations in this study. First, as mentioned above, isolating the treatment effects of health education on students from the school-based health check-up was difficult given the study design. While the physical examination was conducted as a part of data collection, it may play a role in behavioral changes if it induces participants to change their attitudes on certain behaviors as shown in existing studies (Bidwell et al., 2020; Dupas et al., 2018). Second, we examined short-run impacts of the school-based health education program only because additional data collection activities had been interrupted by the COVID-19 pandemic. A further study investigating the long-run effects is necessary to examine whether the health education program failed to achieve behavior changes, and to assess to which extent the treatment effects on psychological factors remain. Finally, our outcomes may be subject to potential social desirability bias, given that we relied on students' self-reported answers (Crowne and Marlowe, 1960).

2.5 Conclusion

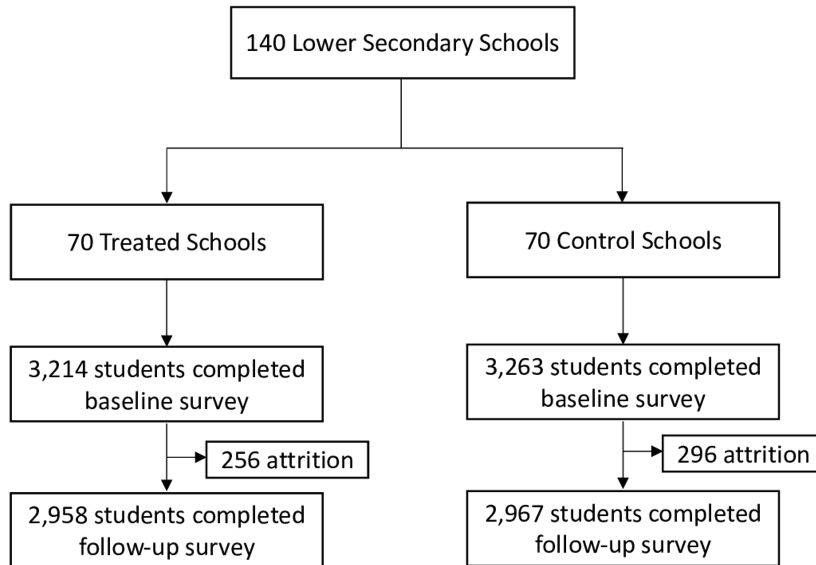
This study demonstrated significant treatment effects of a health education program on adolescents' vital psychological health domains: self-efficacy, life satisfaction, aspirations gap, and HRQoL. Taken together with mixed results for health practices, findings on self-efficacy revealed the teenagers' limited intentions or potential risk-conducive circumstances that may prevent adolescents from avoiding risky health behaviors, shedding light on the last mile to be addressed to incur behavioral changes among the risk group. This study also documented the positive effects of a school-based health education program on psychological health dimensions of adolescents that received relatively limited attention in the health education literature. Significant improvements in students' life satisfaction, aspirations gap, and HRQoL highlighted the necessity of taking into account the broader health dimensions that should not be neglected when evaluating impacts and effectiveness of a health education program on teenagers in resource-limited settings in LMICs.

Figure 2.1: Study Area



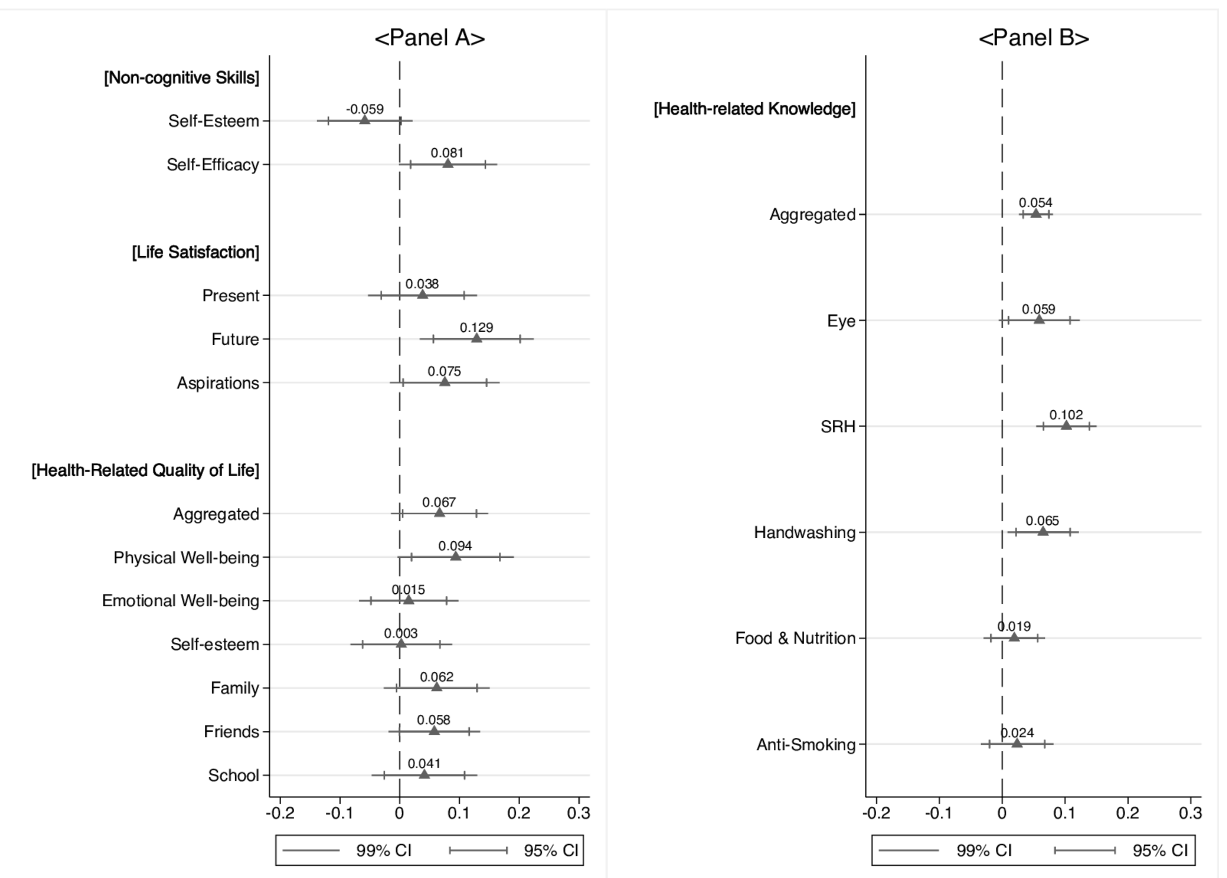
Notes: This figure plots study schools and district boundaries in Thanh Hoa province, Vietnam. The treatment schools are denoted by solid circles, while the control schools are denoted by hollow circles. Source: Government of Viet Nam.

Figure 2.2: Trial Profile



Notes: The follow-up survey took place approximately five months after the baseline survey. Students who had been surveyed both at baseline and follow-up were included in the sample.

Figure 2.3: Treatment Effects



Notes: Coefficients and confident intervals estimated from the panel fixed effects model are plotted. Standard errors were clustered at the school level. Students' age, the number of siblings, and the number of rooms per household member were included as control variables in addition to the student fixed effects. Continuous outcome variables were normalized by the means and standard deviations of the control group values of corresponding variables measured at baseline. Students' knowledge levels were constructed by using the two-parameter logistic IRT model. Students who had been surveyed both at baseline and follow-up were included in the sample.

Table 2.1: Student and School Characteristics

	Treatment (N=2,958)		**Control (N=2,967)**		**t-test (N=5,925)**
	Mean	**SD**	**Mean**	**SD**	**p-value**
Panel A: Demographic Characteristics					
Female (0–1)	0.51	0.50	0.52	0.50	0.351
Age (Years)	12.79	1.19	12.76	1.20	0.321
Ethnicity: Kinh (0–1)	0.75	0.43	0.79	0.41	<0.001
Language: Vietnamese (0–1)	0.77	0.42	0.82	0.38	<0.001
First Child (0–1)	0.52	0.50	0.51	0.50	0.683
Number of Household Members	4.75	1.46	4.74	1.35	0.585
Number of Siblings	1.64	1.24	1.49	1.03	<0.001
Number of Rooms/person	0.53	0.31	0.55	0.30	0.003
Living with Both Parents (0–1)	0.89	0.31	0.88	0.32	0.436
Living with Other Guardians (0–1)	0.03	0.17	0.03	0.18	0.313
Living with Mother Only (0–1)	0.06	0.23	0.06	0.24	0.641
Living with Father Only (0–1)	0.02	0.16	0.02	0.15	0.810
Panel B: School Characteristics					
School Size (Number of Students)	270.99	120.40	282.53	116.69	0.520
Rural (0–1)	0.86	0.35	0.77	0.42	0.171

Notes: The sample includes students who participated in both the baseline and the follow-up surveys. The p-values from the t-test of the null hypothesis that $H_0 : \beta_1 = 0$ in the regression Variable $= \beta_0 + \beta_1 \times$ Treat $+$ District Dummies $+ \epsilon$ are reported as randomization took place at the district level.

Table 2.2: Balance Test for Dependent Variables

	Treatment (N=2,958)		Control (N=2,967)		t-test (N=5,925)
	Mean	SD	Mean	SD	p-value
Panel A: Non-cognitive Skills					
Self-Esteem (0–100)	70.77	18.82	69.39	18.66	0.004
Self-Efficacy (0–100)	69.17	13.92	69.93	13.72	0.019
Panel B: Life Satisfaction					
Present (1–9)	6.54	1.64	6.46	1.61	0.062
Future (1–9)	7.43	1.44	7.52	1.39	0.010
Aspirations gap (Future-Present)	0.89	1.56	1.06	1.55	<0.001
Panel C: Health-Related Quality of Life					
Aggregated (0–100)	69.23	10.67	68.97	10.86	0.420
Physical Well-being (0–100)	72.48	14.97	73.70	15.52	0.001
Emotional Well-being (0–100)	74.17	15.16	73.68	15.61	0.293
Self-esteem (0–100)	54.77	20.75	53.55	20.12	0.020
Family (0–100)	80.67	15.15	81.05	14.91	0.279
Friends (0–100)	74.31	16.24	73.81	16.54	0.320
School (0–100)	58.96	16.81	58.00	16.96	0.025
Panel D: Health Knowledge					
Aggregated (0–100)	62.48	9.25	62.74	8.36	0.224
Eye (0–100)	57.91	15.96	57.21	14.99	0.100
SRH (0–100)	55.07	15.26	54.37	14.15	0.067
Handwashing (0–100)	77.97	15.81	79.94	15.42	<0.001
Food & Nutrition (0–100)	42.88	13.74	42.93	13.46	0.910
Anti-Smoking (0–100)	78.55	16.04	79.23	15.07	0.083
Panel E: Health Practices					
Outdoor Activities (Likert, 1–5)	3.41	1.03	3.40	1.02	0.675
Had Sex (0–1)	0.04	0.21	0.02	0.15	<0.001
Handwashing, Eating (0–1)	0.96	0.20	0.97	0.17	0.002
Handwashing with Soap, Eating (0–1)	0.88	0.33	0.86	0.34	0.225
Handwashing, Toilet (0–1)	0.96	0.21	0.97	0.17	0.004
Handwashing with Soap, Toilet (0–1)	0.91	0.29	0.91	0.29	0.570
Snacks (Likert, 0–5)	3.89	1.41	3.80	1.43	0.018
Had Smoked (0–1)	0.04	0.20	0.03	0.17	0.044

Notes: The sample includes students who participated in both the baseline and the follow-up surveys. The p-values from the t-test of the null hypothesis that $H_0 : \beta_1 = 0$ in the regression $\text{Variable} = \beta_0 + \beta_1 \times \text{Treat} + \text{District Dummies} + \epsilon$ are reported as randomization took place at the district level.

Table 2.3: Health-Related Practices

	Eye	SRH		Handwashing			Food	Anti-Smoking
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Outdoor	Sex	Eating	Eating (Soap)	Toilet	Toilet (Soap)	Snacks	Smoked
Treat	0.042	0.002	0.019**	-0.001	0.018*	-0.004	-0.073*	-0.007
	(0.034)	(0.003)	(0.007)	(0.012)	(0.007)	(0.011)	(0.030)	(0.005)
	[0.165]	[0.331]	[0.035]	[0.500]	[0.037]	[0.435]	[0.037]	[0.130]
Mean	3.396	0.022	0.971	0.865	0.970	0.906	3.799	0.031
SD	1.023	0.145	0.167	0.342	0.171	0.292	1.431	0.174
FE	X	X	X	X	X	X	X	X
Controls	X	X	X	X	X	X	X	X
Adj. R^2	0.002	0.011	0.001	-0.000	0.001	0.000	0.004	0.031
N	11,848	10,694	11,848	11,848	11,848	11,848	11,848	11,506

Notes: *P $<$ 0.05, **P $<$ 0.01, ***P $<$ 0.001. Standard errors in parentheses. The panel fixed effects model was used to estimate the treatment effects. Standard errors were clustered at the school level. Students' age, the number of siblings, and the number of rooms per household member were included as control variables in addition to the student fixed effects. Continuous outcome variables were normalized by the means and standard deviations of the control group values of corresponding variables measured at baseline. Students who had been surveyed both at baseline and follow-up were included in the sample. Sharpened false discovery rate q-values (Benjamini et al., 2006) are in brackets.

Table 2.4: Heterogeneity

	Treat × Group		Treat		Treat × Group+Treat		N
	Coef.	**SEs**	**Coef.**	**SEs**	**Coef.**	**SEs**	
Panel A: Female							
Non-cognitive Skills							
Self-Esteem	-0.039	0.045	-0.039	0.038	-0.078*	0.039	11,850
Self-Efficacy	-0.028	0.048	0.095*	0.044	0.067	0.035	11,850
Life Satisfaction							
Present	-0.000	0.046	0.038	0.040	0.038	0.044	11,850
Future	-0.105*	0.045	0.182***	0.043	0.077	0.043	11,850
Aspirations gap	-0.093	0.055	0.123**	0.045	0.030	0.046	11,850
HRQoL							
Aggregated	-0.188***	0.034	0.162***	0.033	-0.026	0.038	11,850
Physical Well-being	-0.211***	0.046	0.201***	0.045	-0.010	0.043	11,850
Emotional Well-being	-0.131**	0.041	0.082*	0.036	-0.049	0.040	11,850
Self-esteem	-0.190***	0.038	0.099*	0.040	-0.091*	0.036	11,850
Family	-0.022	0.039	0.073	0.041	0.051	0.038	11,850
Friends	-0.037	0.043	0.077*	0.036	0.040	0.038	11,850
School	-0.124**	0.040	0.104**	0.039	-0.020	0.040	11,850
Panel B: Age							
Non-cognitive Skills							
Self-Esteem	0.030	0.019	-0.456	0.254			11,850
Self-Efficacy	-0.021	0.020	0.354	0.256			11,850
Life Satisfaction							
Present	0.018	0.019	-0.193	0.251			11,850
Future	0.021	0.019	-0.148	0.259			11,850
Aspirations gap	0.002	0.021	0.050	0.281			11,850
HRQoL							
Aggregated	-0.057***	0.014	0.815***	0.189			11,850
Physical Well-being	-0.042*	0.020	0.647*	0.266			11,850
Emotional Well-being	-0.067***	0.016	0.903***	0.218			11,850
Self-esteem	0.024	0.016	-0.307	0.214			11,850
Family	-0.024	0.017	0.382	0.233			11,850
Friends	-0.050**	0.015	0.723***	0.210			11,850
School	-0.078***	0.019	1.074***	0.255			11,850

Notes: *P $<$ 0.05, **P $<$ 0.01, ***P $<$ 0.001. Standard errors in parentheses. The panel fixed effects model was used to estimate the treatment effects. Standard errors were clustered at the school level. Students' age, the number of siblings, and the number of rooms per household member were included as control variables in addition to the student fixed effects. Continuous outcome variables were normalized by the means and standard deviations of the control group values of corresponding variables measured at baseline. Students who had been surveyed both at baseline and follow-up were included in the sample.

Appendix

2.A Additional Tables

Table 2.A.1: Non-cognitive Skills and Life Satisfaction

	Non-cognitive Skills		Life Satisfaction		
	(1)	(2)	(3)	(4)	(5)
	Self-Esteem	Self-Efficacy	Present	Future	Aspirations (4)-(3)
Treat	-0.059	0.081*	0.038	0.129**	0.075*
	(0.031)	(0.032)	(0.035)	(0.037)	(0.036)
	[0.076]	[0.037]	[0.191]	[0.006]	[0.054]
Mean	69.391	69.927	6.462	7.521	1.059
SD	18.657	13.722	1.611	1.385	1.549
FE	X	X	X	X	X
Controls	X	X	X	X	X
Adj. R^2	0.009	0.006	0.001	0.006	0.001
Observations	11,850	11,850	11,850	11,850	11,850

Notes: *P < 0.05, **P < 0.01, ***P < 0.001. Standard errors in parentheses. The panel fixed effects model was used to estimate the treatment effects. Standard errors were clustered at the school level. Students' age, the number of siblings, and the number of rooms per household member were included as control variables in addition to the student fixed effects. Continuous outcome variables were normalized by the means and standard deviations of the control group values of corresponding variables measured at baseline. Students who had been surveyed both at baseline and follow-up were included in the sample. Sharpened false discovery rate q-values (Benjamini et al., 2006) are in brackets.

Table 2.A.2: Health-related Quality of Life

	(1) Index	(2) Physical	(3) Emotional	(4) Self-Esteem	(5) Family	(6) Friends	(7) School
Treat	0.067*	0.094*	0.015	0.003	0.062	0.058	0.041
	(0.032)	(0.038)	(0.032)	(0.033)	(0.034)	(0.030)	(0.034)
	[0.054]	[0.037]	[0.388]	[0.500]	[0.086]	[0.072]	[0.165]
Mean	68.965	73.700	73.675	53.550	81.049	73.811	58.005
SD	10.860	15.522	15.607	20.116	14.911	16.545	16.963
FE	X	X	X	X	X	X	X
Controls	X	X	X	X	X	X	X
Adj. R^2	0.002	0.002	0.001	-0.000	0.002	0.003	0.016
Observations	11,850	11,850	11,850	11,850	11,850	11,850	11,850

Notes: *P < 0.05, **P < 0.01, ***P < 0.001. Standard errors in parentheses. The panel fixed effects model was used to estimate the treatment effects. Standard errors were clustered at the school level. Students' age, the number of siblings, and the number of rooms per household member were included as control variables in addition to the student fixed effects. Continuous outcome variables were normalized by the means and standard deviations of the control group values of corresponding variables measured at baseline. Students who had been surveyed both at baseline and follow-up were included in the sample. Sharpened false discovery rate *q*-values (Benjamini et al., 2006) are in brackets.

Table 2.A.3: Health-related Knowledge

	(1) Aggregated	(2) Eye	(3) SRH	(4) Handwashing	(5) Food & Nutrition	(6) Anti-Smoking
Treat	0.054**	0.059*	0.102**	0.065**	0.019	0.024
	(0.010)	(0.025)	(0.019)	(0.022)	(0.019)	(0.022)
Mean	-0.034	-0.050	-0.102	-0.050	0.017	0.014
SD	0.354	0.624	0.716	0.636	0.533	0.633
FE	X	X	X	X	X	X
Controls	X	X	X	X	X	X
Adj. R^2	0.080	0.031	0.066	0.049	0.003	0.002
Observations	11,850	11,850	11,850	11,850	11,850	11,850

Notes: *P $<$ 0.05, **P $<$ 0.01, ***P $<$ 0.001. Standard errors in parentheses. The panel fixed effects model was used to estimate the treatment effects. Standard errors were clustered at the school level. Students' age, the number of siblings, and the number of rooms per household member were included as control variables in addition to the student fixed effects. Continuous outcome variables were normalized by the means and standard deviations of the control group values of corresponding variables measured at baseline. Students who had been surveyed both at baseline and follow-up were included in the sample. Sharpened false discovery rate q-values (Benjamini et al., 2006) are in brackets.

Chapter 3: Effects of School-Based Sexual and Reproductive Health Education on Vietnamese Adolescents' Health Knowledge, Attitudes, and Behavior

3.1 Introduction

Teen pregnancy is a major public health problem considering its social costs, such as maternal and infant death, unsafe abortions, and female labor force loss caused by the interrupted education of girls (Bruce and Hallman, 2008; Field and Ambrus, 2008; Nove et al., 2014). However, adolescents often engage in risky sexual behaviors without adequate knowledge (Nguyen et al., 2016; UNESCO, 2008), which leads to unwanted pregnancies and sexually transmitted infections (STIs). Nevertheless, teenagers in low- and middle-income countries (LMICs) have limited channels to obtain adequate sexual knowledge, and often look for advice from their peers or on the Internet (UNFPA, UNESCO, WHO, 2015).

School-based sexual and reproductive health (SRH) education is a widely implemented intervention in both high-income countries (HICs) and LMICs (Bearinger et al., 2007) for the prevention of unprotected sex. Ultimately, the information-based intervention aims to change adolescents' health behaviors by updating their perceived future costs of risky health behaviors (Leibowitz et al., 1986). However, myriad empirical evidence raises a question of the effec-

tiveness of school-based sex education in reducing teenagers' risky sexual behaviors. A large body of evidence shows that SRH education improves adolescents' SRH knowledge but does not lead to behavioral changes (de Walque, 2014; Paul-Ebhohimhen et al., 2008). By conducting a randomized controlled trial in Vietnam, we investigate to which extent SRH education affects adolescents.

Given the idea that a development program in LMICs should be sustainable (Utzinger et al., 2003), policymakers often implement SRH education in school settings. The school provides unique environments in which a large number of adolescents can be reached for years,[1] and it is financially affordable and logistically convenient. However, its impacts on teenagers are limited, excepting a few studies reporting significant behavioral changes (Chou et al., 2006; Dupas, 2011; Tahlil et al., 2013). The overall conclusion from the existing empirical studies is that SRH education improves teenagers' SRH knowledge significantly but does not reduce unprotected sex.

Therefore, we examine how sex education affects each step of the behavioral changes. First, we investigate whether providing information improves adolescents' understanding of SRH consistent with the existing literature. While knowing about risks associated with unprotected sex and how to avoid it is a necessary condition of behavioral changes, it does not necessarily prevent teenagers from engaging in risky sexual behaviors unless their attitudes towards unprotected sex and preventive measures change. Hence, we evaluate how SRH education affects participants' perceptions of efficacy and their willingness to use preventive measures. Finally, we examine whether SRH education affects teenagers' risky sexual behaviors followed by improved knowledge and attitudes.

[1]For example, the lower secondary completion rate is over 97 percent for the relevant age group in Vietnam (World Bank, 2018).

Of 140 lower secondary schools in Thanh Hoa province in Vietnam, half were randomly assigned to the treatment group, while the remaining schools served as the control group. Students enrolled in the treatment schools received SRH education from their teachers. The teachers delivered essential SRH information using the abstinence-plus curriculum, which introduces three main preventive measures against unprotected sex, namely abstinence-until-marriage (abstinence), being faithful to partners (fidelity), and contraceptive use (contraceptives). In addition to teaching health promotion messages, the instructors trained adolescents to develop essential life skills necessary to protect themselves from unwanted sex. We evaluate the effects of SRH education on Vietnamese teenagers by comparing treated students' SRH knowledge, attitudes, and practice to their counterparts from the control group five months after SRH education.

First, we find positive effects of SRH education on students' knowledge. The information-based intervention increases adolescents' overall SRH knowledge by 0.102 standard deviations. In particular, the treated students know better that unprotected sex leads to teen pregnancies and STIs at the statistically significant level after receiving SRH education. Students' understanding of prevention methods improves significantly after receiving health education as well, especially about abstinence and contraceptives. While estimates are noisy, we find that the knowledge score in fidelity is higher in the treated schools compared to the control group.

However, our results show that SRH education does not have significant effects on adolescents' willingness to use contraceptives, despite their improved understanding of them. After receiving SRH education, students' knowledge score in contraceptives increases by 0.105 standard deviations, followed by an improved perception of effectiveness in preventing unwanted pregnancies and STIs. However, it does not lead students to make a decision to use them. The effects of SRH education on students' plans to use contraceptives during adolescence and adulthood are

close to 0, and the group differences between treatment and control groups are not statistically significant. The null effects on their present and future plans elicit Vietnamese teenagers' unwillingness to use modern contraceptives despite knowing their importance, potentially because of social norms against unmarried youths engaging in sexual activity.

Finally, we find that SRH education does not have significant effects on adolescents' present prevention plans but only on future ones. After receiving SRH education, teenagers know better about the risks of unprotected sex and how to prevent them by using the three preventive measures. Followed by improved perceptions of its efficacy, the treated students are more likely to plan to adopt abstinence and fidelity as their prevention plans to avoid unwanted pregnancies and STIs. However, their current prevention plans are unchanged despite SRH education. The group difference between the treatment and control groups in terms of their present prevention plans is not statistically significant for all three preventive measures. The absence of treatment effects on their present plans suggests that Vietnamese teenagers may not perceive unprotected sex as an imminent threat that requires an immediate strategy. Given the relatively low prevalence of sexual intercourse among teenagers under the age of fifteen in Vietnam, SRH education may fail to induce teenagers to make a prevention plan to avoid teen pregnancies because they perceive it as irrelevant to them. As a result, we do not find significant behavioral changes either.

Our paper contributes to the existing literature in three ways. First, this study speaks to the literature on information-based interventions designed to prevent risky health behaviors. A robust body of evidence shows that providing health promotion messages alone is insufficient in preventing risky sexual behaviors (de Walque, 2014; Duflo et al., 2015; Kremer and Miguel, 2007). The absence of behavioral change is reported not only in the context of SRH education but also in tobacco prevention (Giné et al., 2010; Thomas et al., 2013; Wiehe et al., 2005), nu-

trition (Downs et al., 2009), and deworming (Kremer and Miguel, 2007; Meredith et al., 2013) education. Consistent with the recent strand of literature, this study presents additional evidence documenting the insignificant effects of an information-based program on behavioral changes.

Second, this paper adds to the literature aiming to understand the channel through which SRH education becomes unsuccessful. Against empirical studies that show the lack of behavioral changes, a growing body of literature disentangles health education to improve its impacts on risky health behaviors. Kirby et al. (2007) and Dupas (2011) show that the types of information delivered to teenagers play a significant role in their behavioral changes. Also, Chong et al. (2013) investigate the effects of online SRH education, and Dupas et al. (2018) examine whether instructor's characteristics have differential effects. Our findings suggest that cultural barriers may play a significant role in attenuating the effects of SRH education. In Vietnam, contraceptives are not recommended to unmarried youths due to strong social norms against premarital sex (Kaljee et al., 2007). As a result, teenagers are not willing to use them despite improved knowledge and perceptions of efficacy. At the same time, this paper shows that SRH education may not lead to immediate behavioral changes because it fails to convince teenagers to perceive unprotected sex as a probable threat to them.

Finally, our study contributes to the literature on the training of trainers (ToT) approach in a health program. ToT is widely utilized in health interventions to reach a greater number of beneficiaries by training trainers (Dutton et al., 2011; Sunguya et al., 2013). In a school-based health program, teachers are recruited to implement a health intervention (Dupas et al., 2018; Yi et al., 2015). However, the teachers are often blamed for the low quality of a health program's implementation when it ends up failing (UNESCO, 2011). Dupas et al. (2018) examine this claim by comparing SRH education provided by teachers to that introduced by outside instructors, but they

do not find a significant difference. This paper adds empirical evidence to the literature by evaluating the effectiveness of a school-based health program delivered by teachers. The improved SRH knowledge and perceptions suggest that ToT is a feasible strategy in school settings. However, the absence of the treatment effects on students' willingness to use contraceptives, present prevention plans, and behavioral changes underlines its limitation as well.

This paper is organized as follows. Section 3.2 provides the background and details of the intervention and its implementation. Section 3.3 describes the empirical strategy, and Section 3.4 presents the findings. Section 3.5 discusses the initial findings, and Section 3.6 concludes the paper.

3.2 Background and Experimental Design

3.2.1 Sexual and Reproductive Health in Vietnam

School-based SRH education was provided in Thanh Hoa province, Vietnam, for lower secondary school students. The middle-income country has a unique setting for our study, given its rapid change in social norms and perceptions of sexuality. Coupled with the Economic Renovation (*Doi Moi*) in the 1980s, sexual attitudes and behaviors were transformed radically, and premarital sex became a new norm among Vietnamese youth (Ghuman, 2005; Mensch et al., 2003).

However, the majority of the young population initiates their sexual activities without adequate SRH knowledge and life skills to make healthy sexual decisions (Symons et al., 2014). As a result, contraceptive use is low in Vietnam, and only a small fraction of sexually active youths use contraceptives with their partners (WHO, 2005). Unplanned pregnancies are increasing, par-

ticularly in rural areas where rates of unwanted pregnancies are six times higher compared to others regions (UNFPA, 2012). Vietnam has one of the highest abortion rates in the world, with approximately 83 abortions per 1,000 eligible women aged 15–44 (Singh et al., 1999).

Vietnamese adolescents engage in sexual relationships earlier than ever before (Ngoc Do et al., 2020). While the Vietnamese government finds the incidences of rising teen pregnancy alarming (Nguyen et al., 2016), the paucity of SRH programs for adolescents is reported. The country does not have responsive services specialized in adolescent SRH services despite a high unmet need for contraceptives (UNFPA, 2013a). Also, the lower secondary school curriculum does not include stand-alone SRH education, while less than one percent of sexually active students know how to avoid pregnancies (Asian Development Bank, 2010). Only brief information on sexual reproduction is provided during a biology class as SRH education receives low priority at school, given an overcrowded curriculum, academic aspirations, and cultural barriers (Dutton et al., 2011).

3.2.2 Experimental Design

We conducted an experiment where an implementing organization provided a comprehensive health education program to lower secondary school students (aged 11–14) In Thanh Hoa province, Vietnam, from 2018 to 2020.[2] A total of 140 public schools were randomly sampled for the study. After stratifying by district, randomization took place at the school level to assign 70 schools for the treatment while another 70 schools served as the control group.

The treatment group students received monthly health education on five topics at the class level, namely sexual and reproductive health, infectious diseases and handwashing, anti-smoking,

[2]See Yoon et al. (2021) for details of the experiment.

eye health, and food and nutrition. Each session was 45 minutes long, and students learned both crucial health information and essential life skills from their teachers during regular school days. The trained teachers provided SRH education on days when the implementing organization visited their schools. The curriculum includes both lecture and in-class activities. During the lecture, a teacher explained the risks associated with unprotected sex and how to prevent them. In particular, the curriculum introduced the ABC strategy (abstinence, being faithful, condom use) to students as effective ways to prevent unwanted pregnancies and STIs. After providing health promotion messages, the instructor led in-class activities to teach students life skills necessary to avoid unprotected sex.

Before teaching students, teachers participated in a one-day workshop because most teachers had not had previous experience teaching SRH education. Two teachers from each school, usually health teachers, were recruited and trained by medical college professors. The training included warm-up activities, an overview of sexual and reproductive health in Vietnam, and an introduction to the teaching guidelines. With the teaching guidelines developed by the implementing organization, the teachers learned what to teach and how to teach during health education. The guidelines include health promotion messages for students and pedagogical skills needed, such as introducing topics at the beginning and the end of the class, frequently asking questions to check if students understand well, and providing adequate feedback to students.

3.2.3 Sampling

Thanh Hoa province has a total of 652 government-run lower secondary schools, from which the implementing organization randomly chose 140 schools (Figure 3.1). All students

enrolled in the participating schools in the 2018–2019 academic year (cohorts in grades 6, 7, 8, and 9) were invited to participate in the program. From these, we randomly sampled twelve students per grade from each school after stratifying the students by class and gender for surveys. Our main sample includes 5,923 students who participate in both the baseline and the follow-up surveys.[3]

3.3 Data and Estimation Strategy

3.3.1 Data

3.3.1.1 Data Collection

We collected data on students' health knowledge, attitude, and practices (KAP) from in-person surveys. First, the implementing organization administered the baseline survey before providing any treatment. The follow-up survey took place five months after SRH education, and students were asked to answer the same set of questions about health KAP. Also, we measured students' level of social desirability bias using a Marlowe-Crowne module (Reynolds, 1982). Data collection activities occurred at schools during regular school days. Students who were absent on days that the implementing organization visited the schools for data collection were not replaced or followed.

[3]See Yoon et al. (2021) for inclusion and exclusion criteria of the study.

3.3.1.2 Outcomes of Interest

Our outcomes of interest are students' KAP in SRH. We examine the treatment effects on (i) knowledge, to examine whether health promotion messages are delivered to students, (ii) attitudes, to study whether students responded to the messages by modifying their attitudes in SRH, and (iii) risky sexual behavior, to investigate whether SRH education achieves the ultimate goal of health education by reducing risky health behaviors. We estimated each student's overall SRH knowledge level using the two-parameter logistic Item Response Theory model (Embretson and Reise, 2010). However, other knowledge outcomes were computed by dividing the number of questions they got correct by the number of total questions. The first set of attitude outcomes we evaluate is students' perceptions of the efficacy of three prevention methods: abstinence, fidelity, and contraceptives. Then, we investigate whether SRH education has significant effects on students' present and future plans to use a particular preventive measure to avoid unwanted pregnancies and STIs. Students were allowed to select as many choices as possible. Finally, we examine the causal effect of SRH education on the early onset of sexual intercourse defined as having a sexual debut before the age of fifteen (WHO, 2004).

3.3.1.3 Validation of the Experimental Design

Balance Checks In addition to demographic characteristics reported in Yoon et al. (2021), we examine the balance in outcome variables across treatment status using baseline survey data. Table 3.1 shows that the treatment and control groups are similar, on average, prior to SRH education. For most variables, the two groups are not significantly different. While we find statistically significant differences for some outcomes, the magnitude of the differences is small. Panel A

presents balance test results for students' SRH knowledge. Of the six outcomes, we find statistically significant results for two variables, but the magnitude of the differences is marginal. From Panels B, C, and D, we report the group differences in students' attitudes towards efficacy (Panel B), present prevention plans (Panel C), and future prevention plans (Panel D). While treatment group students are more likely to be favorable to abstinence, the magnitude of the group differences is very small. Finally, Panel E shows that approximately 3 percent of adolescents in our sample experienced sexual intercourse, which is 10-fold the Vietnamese government's estimate from 2011 (General Statistical Office, 2011), and we also find the significant group difference. While the magnitudes of group differences are small, we control for pre-treatment differences and time-invariant individual characteristics by using an individual fixed effects model.

Attrition Of 6,475 students who completed the baseline survey, we followed approximately 92 percent after five months of the intervention (Appendix Table 3.A.1). We find that the attrition rate across treatment status is about one percentage point, but the group difference is not statistically significant.

3.3.2 Empirical Strategy

We estimate intent-to-treat (ITT) effects of SRH education using the following fixed effects regression equation:

$$\text{Y}_{ist} = \beta_0 + \beta_1 \text{Treat}_{st} + \text{X}_{it}\beta_2 + \psi_i + \epsilon_{ist} \tag{3.1}$$

where Y_{ist} is the outcome of student i from school s measured in time t; Treat_{st} is a binary variable indicating that treatment is given at school s in time t; X_{it} is a vector of time-variant student characteristics; ψ_i are student fixed effects; and ϵ_{ist} are standard errors clustered at the school level. X_{it} includes students' age, number of siblings, and the number of rooms per household member. The student-level controls are included in the equation to increase precision, although excluding them does not change our results significantly.[4] Also, we use the student fixed effects to control for the pre-treatment differences we find from Table 3.1 and other time-invariant characteristics to increase precision.

We use normalized SRH knowledge outcomes to report standardized effect size using the mean and the standard deviation of control group students collected at baseline. When estimating the effects of SRH education on teenagers' attitudes and behavior, we use binary outcomes as dependent variables. Therefore, β_1 in Equation (3.1) captures the percentage point change in attitude and behavior outcomes caused by SRH education. We present the control group's mean and standard deviation values of corresponding outcome variables in all regression results. Finally, sharpened false discovery rate q-values (Benjamini et al., 2006) are reported.

3.4 Empirical Results

3.4.1 Effects on Students' SRH Knowledge

Table 3.2 shows that SRH education leads to significant improvement in students' knowledge in SRH, consistent with the existing health education literature. We find a significant improvement across knowledge outcomes after providing SRH education to lower secondary school

[4] Table 3.4 presents treatment effects estimated using various specifications, including a model without the vector of controls (Column 2). Results are consistent across models.

students in Vietnam.

Column 1 shows that 45-minute-long sex education leads to a 0.102 standard deviation increase in students' overall SRH literacy. In particular, we find that SRH education addresses the lack of students' understanding of risks associated with unprotected sex, namely teen pregnancies and STIs. Columns 2 and 3 show that the treatment school students' knowledge about teen pregnancies and STIs is higher than their counterparts from the control group by 0.134 and 0.264 standard deviations, respectively, five months after receiving SRH education. The group differences are both statistically significant and large in economic magnitude.

Table 3.2 also shows significant effects on Vietnamese adolescents' knowledge of means for preventing unwanted pregnancies and STIs (Columns 4–6). While the magnitude of the effects is smaller than the outcomes regarding the risks of unprotected sex (Columns 2 and 3), the treated students show consistently higher knowledge levels than control students in their understanding of prevention methods at follow-up. After receiving SRH education, the students know better about abstinence (Column 4) and contraceptives (Column 6) at statistically significant levels. Notably, students' SRH literacy in contraceptives increases by 0.105 standard deviations, which is twice as great as the effect size on abstinence. The effects of SRH education on students' knowledge in fidelity are limited (Column 5). The treatment group students' knowledge levels in fidelity are higher than those in the control group, but the group difference is not statistically significant, and the magnitude of the effect size is small.

3.4.2 Effects on Students' SRH Attitudes and Behavior

3.4.2.1 Attitudes

In line with improved students' knowledge, treatment school students are more likely to believe that abstinence is effective in preventing unwanted pregnancies and STIs (Column 1 of Table 3.3). However, the positive effects on knowledge (Column 4 of Table 3.2) and perceived efficacy of the most conservative prevention measure (Column 1 of Table 3.3) are not necessarily translated into their willingness to adopt it immediately. Column 4 of Table 3.3 shows that the treated students are 2.3 percentage points more likely to make a plan to adopt abstinence as their prevention plan during adolescence than the control group students. However, the group difference is not precisely estimated. Instead, SRH education has positive effects only on their future prevention plan to abstain from having sex until getting married. In the treated schools, the share of students who decided to adopt the conventional preventive measure increases by 4.5 percentage points (or a 13.5 percent increase) more than in the control schools, and the group difference is statistically significant at the 1 percent level (Column 7).

Of the three means of prevention, fidelity receives the least attention from students during SRH education. At baseline, only 14 percent of students thought that it is an effective prevention method (Column 2 of Table 3.3), and less than 14 percent answered that they plan to avoid teen pregnancies and STIs during adolescence (Column 5) and adulthood (Column 8) by being faithful to their partners. Teaching students about fidelity during SRH education does not lead to a significant change in their knowledge and attitudes. Students' perception of its efficacy is not significantly affected by SRH education (Column 2), followed by statistically indistinguishable

effects on their present avoidance plan (Column 5). Interestingly, Column 8 shows that adolescents are 3.7 percentage points (or 26.6 percent) more likely to answer that they will not have multiple sexual partners when they become adults after receiving SRH education. The finding is surprising considering the absence of the significant treatment effects on their fidelity-related knowledge and perceptions. While SRH education does not have significant effects on their knowledge of and perceptions of fidelity, students are still more likely to make a decision to be faithful to their partners to avoid unplanned pregnancies and STIs when they become adults.

Also, Vietnamese adolescents' attitudes towards contraceptive use are not significantly affected by SRH education despite the largest increase in knowledge compared to other prevention methods. Column 3 shows that SRH education updates the students' perceived efficacy of contraceptives in preventing unwanted pregnancies and STIs. After receiving SRH education, the percentage of students who believed that contraceptives are effective increases by 2.4 percentage points (or 12.7 percent). The effect size is non-trivial given that less than 19 percent of students had a positive perception of contraceptives at baseline. Nevertheless, the improved knowledge and perceived efficacy of the modern contraception method do not lead teenagers to decide to use it against unplanned pregnancies and STIs. Columns 6 and 9 show that the group differences between the treatment and control groups in students' intentions to use contraceptives are close to 0 for both present and future. The absence of treatment effects on students' prevention plans to use contraceptives is alarming as it shows adolescents' unwillingness to use the effective protection method.

3.4.2.2 Behavior

Finally, we examine whether SRH education reduces the incidence of the early onset of sexual intercourse. Column 10 of Table 3.3 shows the null effect of SRH education on the sexual activity of lower secondary students. The group difference is close to 0, and it is not statistically significant. The limited effect on sexual behavior is not surprising in that the age of adolescents included in the study is relatively low, while the follow-up data collection was administered only five months after treatment.

3.4.3 Robustness Checks

We assess the robustness of our findings by examining various specifications with or without control variables. In particular, we compare our estimates from the fixed effects model to the ones from the following ordinary least squares regression model:

$$\mathrm{Y}_{isd} = \alpha_0 + \alpha_1 \mathrm{Treat}_{sd} + \mathrm{X}_i\beta_2 + \mathrm{District}_d + \mu_{isd} \tag{3.2}$$

where Y_{isd} denotes the outcome at follow-up for student i from school s in district d; Treat_{sd} is a dummy variable that equals 1 if a school s in district d is randomly selected for SRH education treatment or 0 otherwise; X_i is a vector of student control variables (gender, age, ethnicity, baseline analogue of the outcome, and social desirability score); $\mathrm{District}_d$ are district fixed effects; and μ_{isd} are student-specific error terms clustered at the school level. We control for the outcome value at baseline to take into account the pre-treatment differences we find from Table 3.1. Equation (3.2) allows us to control for time-invariant student characteristics which are excluded in the

student-fixed effect model. In particular, we examine whether social desirability bias (Crowne and Marlowe, 1960) affects our results. Because most of our outcomes are self-reported answers, there exist potential experimental effects for the treated students (Zizzo, 2010). Thus, we test whether the inclusion of the social desirability score measured by a Marlowe-Crowne module (Reynolds, 1982) in the vector of student controls leads to significant changes in our estimates. The Marlowe-Crowne module was included in the follow-up questionnaire only. District fixed effects are included in the model to increase the precision as randomization took place at the district level.

Table 3.4 summarizes the treatment effects estimated using various models, including our preferred model from Equation (3.1) in Column 1 as reference.[5] We find robust results across the models once the baseline outcome value is controlled for (Columns 1, 4, and 5). Panel A presents a significant increase in students' SRH knowledge after receiving SRH education. From both Equations (3.1) and (3.2), we find statistically significant effects of SRH education on teenagers' knowledge outcomes, excepting fidelity, and the effect sizes are similar across the different specifications.

We present the robustness of our findings for students' attitude and behavior outcomes across models from Panels B to E in Table 3.4. Consistent with the results from our preferred model in Column 1, estimates for Equation (3.2) show that Vietnamese teenagers are more likely to believe that abstinence and contraceptives are effective preventive measures. However, we do not find significant effects on fidelity. We find heterogeneous results for students' present prevention plans from different models (Panel C), but findings are consistent for the future plans (Pane D). Finally, Panel E shows that SRH education does not have significant effects on adolescents'

[5]Full regression results for each specification are presented in Appendix B.

SRH behavior after controlling for the pre-treatment group difference. Comparing Columns 4 and 5, we conclude that social desirability bias does not significantly influence students' answers regarding their SRH KAP outcomes.

3.4.4 Heterogeneity

We evaluate the differential treatment effects on students by their characteristics using the following equation:

$$\mathrm{Y}_{ist} = \theta_0 + \theta_1 \mathrm{Treat}_{st} \times \mathrm{Hetero}_i + \theta_2 \mathrm{Treat}_{st} + \mathrm{X}_{it}\theta_3 + \phi_i + v_{ist} \tag{3.3}$$

where Hetero_i indicates a particular characteristic of student i, namely gender, ethnicity, locality, and age at follow-up. First, we evaluate whether a particular gender of students learns better from SRH education. For ethnicity, we use a $\mathrm{Minority}_i$ dummy which equals 1 if student i is from an ethnic minority group or 0 otherwise. In addition to differential effects by age, we examine whether students in rural areas learn better or worse during SRH education. The same set of student-level control variables from Equation (3.1) is included in X_{it}. Then, θ_1 captures the heterogenous effects by the group.

Table 3.5 summarizes the heterogeneous treatment effects on students' SRH knowledge.[6] We find that SRH education has limited heterogeneous treatment effects on SRH knowledge outcomes by gender. Abstinence is the only knowledge outcome from which we detect statistically significant differential effects by gender. Compared to boys, girls learn better about abstinence by 0.144 standard deviations. We find consistent results from students' attitude outcomes. The

[6] Each row from Table 3.5 and Table 3.6 reports coefficient and standard errors of the interaction term from a separate regression. Full regression results for each group are presented in Appendix C.

first row of Table 3.6 shows that SRH education improves girls' attitudes towards abstinence significantly relative to boys, but not towards the other prevention methods. Column 1 shows that girls are 6.8 percentage points more likely than boys to believe that abstinence is an effective prevention method. As a result, girls are more likely to decide to abstain from having sex until getting married during adolescence (Column 4) and adulthood (Column 7) than their male counterparts. The finding suggests that girls and boys respond differently, particularly to lessons about abstinence, even when they receive the same messages from the same teachers.

Heterogeneous treatment effects on SRH knowledge outcomes for students' ethnicity, locality, and age suggest that younger ethnic minority adolescents from rural areas benefit more from SRH education than their counterparts, potentially because there exists larger room to improve. First, Column 1 of Table 3.5 shows that students from ethnic minority groups and rural regions learn better than their counterparts in the treatment group by 0.057 standard deviations and 0.056 standard deviations, respectively. Also, a one-year increase in students' age is associated with a 0.028 standard deviations lower SRH knowledge increase, suggesting larger effects of SRH education for younger adolescents. Interestingly, students from rural regions learn more about abstinence (Column 4) and less about contraceptives (Column 6). One of potential explanations is that teachers in rural areas may emphasize the traditional conservative prevention messages while they avoid talking about modern contraceptives, including condoms. Also, we find that younger students learn much more about teen pregnancy (Column 2), STIs (Column 3), and contraceptives (Column 6) compared to higher grade students. Table 3.6 shows that older adolescents endorse the traditional prevention method after receiving SRH education. Compared to younger graders, older students are more likely to believe that abstinence is an effective prevention method (Column 1) that they plan to adopt now (Column 4) and in the future (Column

6).

3.5 Discussion

Consistent with the existing literature, we find that SRH education improves teenagers' knowledge but does not significantly affect their behavior. Our findings on the mixed effects on students' attitudes towards prevention methods may explain the missing link between the improved knowledge and behavioral changes.

First, we show that SRH education does not have significant effects on students' present prevention plans but only on future ones. After receiving a 45-minute-long session by teachers in regular school settings, Vietnamese teenagers' understanding of SRH improves significantly at follow-up. However, their increased knowledge of and attitudes towards the prevention methods are not translated into adolescents' willingness to use it as their present prevention plan. For example, we find that SRH education helps adolescents learn about abstinence and believe that it prevents unwanted pregnancies and STIs. However, it does not lead them to decide to adopt the prevention plan during adolescence, but only in the future when they become adults.

The absence of effects on students' current prevention plans suggests that adolescents may not perceive unprotected sex as an imminent threat they need to deal with now but only as a potential threat for adults. At the same time, the limited effects of SRH education on teens' plans to adopt fidelity may be explained by a low prevalence of sexual activities among Vietnamese adolescents under fifteen (General Statistical Office, 2011). For students who have not engaged in any sexual relationship, the recommendation to be faithful to their partners to avoid unwanted pregnancies and STIs may not be relevant advice. Teenagers may think that fidelity is an issue for

adults who have sexual partners, which may explain the positive effects on their future plans to be faithful to their partner. Given that most adolescents in LMICs engage in sexual relationships unexpectedly without appropriate SRH information and prevention plans, the findings underline the importance of ensuring adolescents have present prevention strategies to avoid unwanted teen pregnancies.

Second, our findings show adolescents' unwillingness to use contraceptives. Even after learning about the risks of unprotected sex and the effectiveness of contraceptives in preventing teen pregnancies and STIs, it does not lead to a significant change in their attitudes towards contraceptive use during both adolescence and adulthood. The hesitance of the students may reflect substantial cultural barriers that adolescents may face in a country where abstinence is the only acceptable prevention method recommended for unmarried youth (Kaljee et al., 2007).

Finally, the limited treatment effects on preventing teenagers' sexual intercourse in this study may be explained by the participating teenagers' age and the time span between the treatment and the follow-up data collection. Five months may not be a sufficient time for us to find statistically significant behavioral changes in a country with a low rate of the early onset of sexual intercourse.

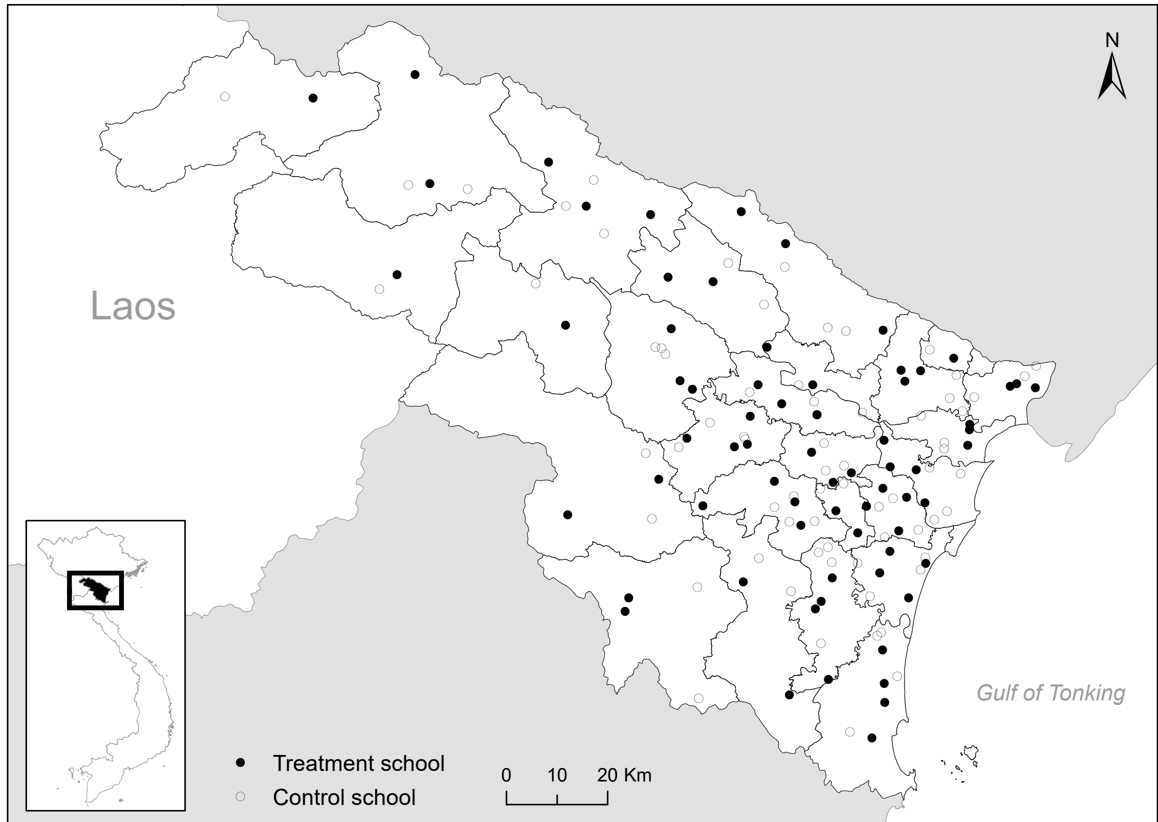
3.6 Conclusions

We evaluate the impact of SRH education on Vietnamese adolescents by conducting a randomized controlled trial. Our findings show that the information-based intervention has positive effects on teenagers' SRH knowledge. However, the improved SRH knowledge does not necessarily lead to a change in students' attitudes and risky sexual behaviors consistent with the

existing empirical studies. In particular, we show that SRH education does not have significant effects on adolescents' willingness to use contraceptives. Despite the increased understanding and improved beliefs in its efficacy, SRH education fails to affect teenagers' plans to use a modern contraceptive both in the present and the future after they become adults. Finally, we find that SRH education does not have significant effects on the present prevention plans but only on future ones.

This paper elicits difficulties in generating behavioral changes via health education. In particular, adolescents' unwillingness to use contraceptives highlights significant cultural barriers that policymakers should take into account when implementing SRH education. Although teenagers learn the importance of preventing unprotected sex and the effectiveness of preventive measures, they still hesitate to use it, potentially due to social norms against premarital sex and the stigma associated with contraceptive use. Therefore, a holistic approach targeting both adolescents and other community members should be considered to address the negative perceptions of contraceptive use. Also, the limited effects on present prevention plans underline the importance of a health intervention to convince participants that costs associated with risky health behaviors are imminent, which requires prompt behavioral changes.

Figure 3.1: Study Area



Notes: A total of 140 participating schools in Thanh Hoa province, Vietnam, are plotted on the map. The treatment schools are denoted by solid circles, while the control schools are denoted by hollow circles.

Table 3.1: Balance Test

	Control		Treat		Difference
	(N=2,966)		(N=2,957)		(N=5,923)
	Mean	SD	Mean	SD	p-value
Panel A: Knowledge(range 0–1)					
Overall	0.54	0.14	0.55	0.15	0.067
Teen Pregnancy	0.73	0.30	0.74	0.30	0.797
STIs	0.53	0.16	0.54	0.18	0.001
Abstinence	0.32	0.47	0.32	0.47	0.714
Fidelity	0.50	0.38	0.52	0.38	0.316
Contraceptives	0.75	0.34	0.72	0.35	0.009
Panel B: Mentioned Means, Effective (range 0–1)					
Abstinence	0.33	0.47	0.36	0.48	0.019
Fidelity	0.14	0.35	0.13	0.34	0.536
Contraceptives	0.19	0.39	0.20	0.40	0.306
Panel C: Mentioned Plan, Now (range 0–1)					
Abstinence	0.35	0.48	0.38	0.48	0.022
Fidelity	0.14	0.34	0.14	0.35	0.774
Contraceptives	0.20	0.40	0.21	0.41	0.077
Panel D: Mentioned Plan, Future (range 0–1)					
Abstinence	0.33	0.47	0.35	0.48	0.062
Fidelity	0.14	0.35	0.13	0.34	0.398
Contraceptives	0.18	0.38	0.19	0.39	0.406
Panel E: Behavior (range 0–1)					
Had Sex	0.02	0.15	0.04	0.21	0.000

Notes: *P $<$ 0.10, **P $<$ 0.05, ***P $<$ 0.01. The sample includes students who participated in both baseline and the follow-up surveys. The p-values from the null hypothesis test that $H_0 : \beta_1 = 0$ in the regression Variable $= \beta_0 + \beta_1 \times$ Treat $+$ District Dummies $+ \epsilon$ are reported, where Variable is a vector of outcome variables collected at baseline.

Table 3.2: Effects of SRH Education on Students' SRH Literacy

	Overall	Ch1: Risks of Unprotected Sex		Ch2: Preventing Means		
	(1) Index	(2) Teen Pregnancy	(3) STIs	(4) Abstinence	(5) Fidelity	(6) Contraceptives
Treat	0.102***	0.134***	0.264***	0.056*	0.023	0.105***
	(0.019)	(0.033)	(0.041)	(0.031)	(0.033)	(0.031)
	[0.001]	[0.001]	[0.001]	[0.097]	[0.306]	[0.003]
Constant	-4.007***	-4.088***	-5.229***	-1.794**	-2.576***	-2.436***
	(0.395)	(0.704)	(0.709)	(0.703)	(0.689)	(0.639)
Fixed Effects	X	X	X	X	X	X
Controls	X	X	X	X	X	X
Mean	0.544	0.735	0.528	0.317	0.505	0.747
SD	0.141	0.295	0.157	0.465	0.381	0.343
Adj. R^2	0.065	0.030	0.065	0.006	0.006	0.015
Schools	140	140	140	140	140	140
Students	5,923	5,923	5,923	5,923	5,923	5,923
Observations	11,846	11,846	11,846	11,846	11,846	11,846

Notes: *$P < 0.10$, **$P < 0.05$, ***$P < 0.01$. The sample includes students who participated in both baseline and the follow-up surveys. The mean and standard deviation of a baseline outcome of unobserved class students are presented. Student fixed effects and time-variant controls (age, number of siblings, number of rooms per household member) are included as student covariates. Standard errors, clustered at the school level, are in parentheses. Sharpened false discovery rate *q*-values (Benjamini et al., 2006) are in brackets.

Table 3.3: Effects of SRH Education on Students' SRH Attitudes and Behavior

	Mentioned means			Mentioned plan, now			Mentioned plan, adult			Behavior
	(1) Abst.	(2) Fid.	(3) Cont.	(4) Abst.	(5) Fid.	(6) Cont.	(7) Abst.	(8) Fid.	(9) Cont.	(10) Had Sex
Treat	0.029*	0.013	0.024*	0.023	0.013	0.006	0.045***	0.037***	0.005	0.002
	(0.015)	(0.011)	(0.014)	(0.015)	(0.012)	(0.012)	(0.016)	(0.011)	(0.013)	(0.003)
	[0.097]	[0.197]	[0.114]	[0.164]	[0.205]	[0.337]	[0.014]	[0.003]	[0.357]	[0.306]
Constant	-0.076	1.368***	-0.161	-0.052	1.528***	0.021	-0.094	1.599***	-0.242	-0.277***
	(0.333)	(0.254)	(0.335)	(0.363)	(0.263)	(0.258)	(0.387)	(0.228)	(0.299)	(0.078)
Fixed Effects	X	X	X	X	X	X	X	X	X	X
Controls	X	X	X	X	X	X	X	X	X	X
Mean	0.334	0.140	0.189	0.348	0.137	0.195	0.333	0.139	0.179	0.022
SD	0.472	0.347	0.392	0.476	0.343	0.396	0.471	0.346	0.384	0.145
Adj. R^2	0.003	0.006	0.003	0.002	0.008	0.000	0.006	0.006	0.001	0.011
Schools	140	140	140	140	140	140	140	140	140	140
Students	5,923	5,923	5,923	5,923	5,923	5,923	5,923	5,923	5,923	5,721
Observations	11,846	11,846	11,846	11,846	11,846	11,846	11,846	11,846	11,846	10,693

Notes: *P < 0.10, **P < 0.05, ***P < 0.01. The sample includes students who participated in both baseline and the follow-up surveys. The mean and standard deviation of a baseline outcome of unobserved class students are presented. Student fixed effects and time-variant controls (age, number of siblings, number of rooms per household member) are included as student covariates. Standard errors, clustered at the school level, are in parentheses. Sharpened false discovery rate *q*-values (Benjamini et al., 2006) are in brackets.

Table 3.4: Effects of SRH Education on Students' SRH Knowledge, Attitudes, and Behavior, Summary

	Fixed Effects		Cross-sectional		
	(1)	(2)	(3)	(4)	(5)
Panel A: Knowledge					
Index	0.102***	0.224***	0.115***	0.113***	0.114***
	(0.019)	(0.014)	(0.030)	(0.017)	(0.017)
Teen Pregnancy	0.134***	0.257***	0.129***	0.140***	0.139***
	(0.033)	(0.024)	(0.030)	(0.026)	(0.027)
STIs	0.264***	0.429***	0.342***	0.324***	0.330***
	(0.041)	(0.034)	(0.043)	(0.033)	(0.032)
Abstinence	0.056*	0.114***	0.065**	0.069**	0.069**
	(0.031)	(0.021)	(0.031)	(0.027)	(0.027)
Fidelity	0.023	0.100***	0.044	0.040	0.043*
	(0.033)	(0.026)	(0.029)	(0.024)	(0.024)
Contraceptives	0.105***	0.179***	0.025	0.051**	0.053**
	(0.031)	(0.024)	(0.024)	(0.021)	(0.021)
Panel B: Mentioned Means					
Abstinence	0.029*	0.042***	0.058***	0.051***	0.052***
	(0.015)	(0.012)	(0.016)	(0.013)	(0.013)
Fidelity	0.013	-0.025***	0.011	0.011	0.012*
	(0.011)	(0.008)	(0.007)	(0.007)	(0.007)
Contraceptives	0.024*	0.035***	0.034***	0.031***	0.032***
	(0.014)	(0.010)	(0.012)	(0.011)	(0.011)
Panel C: Mentioned Plan, Now					
Abstinence	0.023	0.034***	0.051***	0.044***	0.045***
	(0.015)	(0.011)	(0.015)	(0.013)	(0.013)
Fidelity	0.013	-0.031***	0.019***	0.017**	0.019**
	(0.012)	(0.008)	(0.007)	(0.007)	(0.007)
Contraceptives	0.006	0.012	0.024**	0.016*	0.018*
	(0.012)	(0.009)	(0.011)	(0.010)	(0.010)
Panel D: Mentioned Plan, Future					
Abstinence	0.045***	0.057***	0.069***	0.065***	0.067***
	(0.016)	(0.011)	(0.015)	(0.013)	(0.012)
Fidelity	0.037***	-0.010	0.032***	0.032***	0.033***
	(0.011)	(0.008)	(0.007)	(0.007)	(0.007)
Contraceptives	0.005	0.017**	0.011	0.007	0.009
	(0.013)	(0.008)	(0.010)	(0.010)	(0.010)
Panel E: Behavior					
Had Sex	0.002	0.011***	0.025***	0.002	0.002
	(0.003)	(0.002)	(0.006)	(0.003)	(0.003)
District			X	X	X
Controls	X			X	X
Social Desirability Score					X

Notes: *P < 0.10, **P < 0.05, ***P < 0.01. The sample includes students who participated in both baseline and the follow-up surveys. See Appendix B for full regression results.

Table 3.5: Effects of SRH Education on Students' SRH Literacy: Heterogeneity

	Overall	Ch1: Risks of Unprotected Sex		Ch2: Preventing Means		
	(1) Index	(2) Teen Pregnancy	(3) STIs	(4) Abstinence	(5) Fidelity	(6) Contraceptives
Treat × Female	0.038	0.034	0.078	0.144***	-0.005	-0.016
	(0.025)	(0.047)	(0.049)	(0.042)	(0.044)	(0.045)
	[0.001]	[0.001]	[0.001]	[0.097]	[0.306]	[0.003]
Treat × Minority	0.057*	0.078	-0.011	0.028	0.091*	-0.031
	(0.031)	(0.051)	(0.079)	(0.048)	(0.050)	(0.051)
	[0.001]	[0.001]	[0.001]	[0.097]	[0.306]	[0.003]
Treat × Rural	0.056*	0.082	0.053	0.106*	0.006	-0.175***
	(0.029)	(0.073)	(0.075)	(0.060)	(0.089)	(0.064)
	[0.001]	[0.001]	[0.001]	[0.097]	[0.306]	[0.003]
Treat × Age	-0.028**	-0.074***	-0.040*	-0.026	0.016	-0.060***
	(0.011)	(0.020)	(0.024)	(0.019)	(0.019)	(0.017)
	[0.001]	[0.001]	[0.001]	[0.076]	[0.687]	[0.023]
Fixed Effects	X	X	X	X	X	X
Controls	X	X	X	X	X	X
Mean	0.544	0.735	0.528	0.317	0.505	0.747
SD	0.141	0.295	0.157	0.465	0.381	0.343
Schools	140	140	140	140	140	140
Students	5,923	5,923	5,923	5,923	5,923	5,923
Observations	11,846	11,846	11,846	11,846	11,846	11,846

Notes: *P < 0.10, **P < 0.05, ***P < 0.01. The sample includes students who participated in both baseline and the follow-up surveys. The mean and standard deviation of a baseline outcome of unobserved class students are presented. Student fixed effects and time-variant controls (age, number of siblings, number of rooms per household member) are included as student covariates. When estimating the heterogeneous treatment effects by age, the age control variable is excluded. Standard errors, clustered at the school level, are in parentheses. Each row reports separate regression results. Sharpened false discovery rate q-values (Benjamini et al., 2006) are in brackets.

Table 3.6: Effects of SRH Education on Students' SRH Attitudes and Behavior: Heterogeneity

	Mentioned means			Mentioned plan, now			Mentioned plan, adult			Behavior
	(1) Abst.	(2) Fid.	(3) Cont.	(4) Abst.	(5) Fid.	(6) Cont.	(7) Abst.	(8) Fid.	(9) Cont.	(10) Had Sex
Treat × Female	0.068***	0.003	-0.008	0.067***	0.007	-0.018	0.057**	-0.009	0.001	-0.009**
	(0.020)	(0.014)	(0.019)	(0.022)	(0.018)	(0.020)	(0.022)	(0.017)	(0.017)	(0.004)
	[0.097]	[0.197]	[0.114]	[0.164]	[0.205]	[0.337]	[0.014]	[0.003]	[0.357]	[0.306]
Treat × Minority	0.003	-0.003	-0.017	0.016	0.013	-0.000	-0.017	-0.008	-0.001	0.015***
	(0.025)	(0.016)	(0.019)	(0.021)	(0.021)	(0.020)	(0.022)	(0.017)	(0.019)	(0.005)
	[0.097]	[0.197]	[0.114]	[0.164]	[0.205]	[0.337]	[0.014]	[0.003]	[0.357]	[0.306]
Treat × Rural	0.010	0.024	-0.044	0.065**	0.020	-0.015	-0.007	0.004	-0.030	-0.002
	(0.042)	(0.025)	(0.034)	(0.033)	(0.027)	(0.025)	(0.038)	(0.026)	(0.034)	(0.006)
	[0.097]	[0.197]	[0.114]	[0.164]	[0.205]	[0.337]	[0.014]	[0.003]	[0.357]	[0.306]
Treat × Age	0.017*	0.017***	-0.002	0.014*	0.018***	0.010	0.017*	0.011	0.004	-0.002
	(0.009)	(0.006)	(0.008)	(0.008)	(0.006)	(0.008)	(0.010)	(0.007)	(0.008)	(0.002)
	[0.559]	[0.559]	[0.253]	[0.559]	[0.507]	[0.476]	[0.056]	[0.056]	[0.559]	[0.948]
Fixed Effects	X	X	X	X	X	X	X	X	X	X
Controls	X	X	X	X	X	X	X	X	X	X
Mean	0.334	0.140	0.189	0.348	0.137	0.195	0.333	0.139	0.179	0.022
SD	0.472	0.347	0.392	0.476	0.343	0.396	0.471	0.346	0.384	0.145
Schools	140	140	140	140	140	140	140	140	140	140
Students	5,923	5,923	5,923	5,923	5,923	5,923	5,923	5,923	5,923	5,721
Observations	11,846	11,846	11,846	11,846	11,846	11,846	11,846	11,846	11,846	10,693

Notes: *P $<$ 0.10, **P $<$ 0.05, ***P $<$ 0.01. The sample includes students who participated in both baseline and the follow-up surveys. The mean and standard deviation of a baseline outcome of unobserved class students are presented. Student fixed effects and time-variant controls (age, number of siblings, number of rooms per household member) are included as student covariates. When estimating the heterogeneous treatment effects by age, the age control variable is excluded. Standard errors, clustered at the school level, are in parentheses. Each row reports separate regression results. Sharpened false discovery rate q-values (Benjamini et al., 2006) are in brackets.

Appendix

3.A Attrition

Table 3.A.1: Survey Completion

	Control (1)	Treat (2)	Difference (3)	Total (4)
Panel A: Students Surveyed				
Baseline	3,262	3,213	-49	6,475
Follow-up	2,966	2,957	-9	5,923
Percent Followed	0.909	0.920	0.011 (0.007)	0.915

Notes: *P $<$ 0.10, **P $<$ 0.05, ***P $<$ 0.01. The sample includes students who completed the baseline survey. The regression results are estimated from the equation Attrition $= \beta_0 + \beta_1 \times$ Treat $+ \epsilon$. Standard errors are in parentheses.

3.B Regression Results from Different Specifications

Panel Fixed Effects without Controls

Table 3.B.1: Effects of SRH Education on Students' SRH Literacy

	Overall	Ch1: Risks of Unprotected Sex		Ch2: Preventing Means		
	(1) Index	(2) Teen Pregnancy	(3) STIs	(4) Abstinence	(5) Fidelity	(6) Contraceptives
Treat	0.224***	0.257***	0.429***	0.114***	0.100***	0.179***
	(0.014)	(0.024)	(0.034)	(0.021)	(0.026)	(0.024)
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Constant	-0.061***	0.055***	0.093***	0.022***	0.035***	-0.013**
	(0.004)	(0.006)	(0.008)	(0.005)	(0.006)	(0.006)
Fixed Effects	X	X	X	X	X	X
Controls						
Mean	0.544	0.735	0.528	0.317	0.505	0.747
SD	0.141	0.295	0.157	0.465	0.381	0.343
Adj. R^2	0.050	0.022	0.057	0.004	0.004	0.013
Schools	140	140	140	140	140	140
Students	5,923	5,923	5,923	5,923	5,923	5,923
Observations	11,846	11,846	11,846	11,846	11,846	11,846

Notes: *P $<$ 0.10, **P $<$ 0.05, ***P $<$ 0.01. The sample includes students who participated in both baseline and the follow-up surveys. The mean and standard deviation of a baseline outcome of unobserved class students are presented. Standard errors, clustered at the school level, are in parentheses. Sharpened false discovery rate q-values (Benjamini et al., 2006) are in brackets.

Table 3.B.2: Effects of SRH Education on Students' SRH Attitudes and Behavior

	Mentioned means			Mentioned plan, now			Mentioned plan, adult			Behavior
	(1) Abst.	(2) Fid.	(3) Cont.	(4) Abst.	(5) Fid.	(6) Cont.	(7) Abst.	(8) Fid.	(9) Cont.	(10) Had Sex
Treat	0.042***	-0.025***	0.035***	0.034***	-0.031***	0.012	0.057***	-0.010	0.017**	0.011***
	(0.012)	(0.008)	(0.010)	(0.011)	(0.008)	(0.009)	(0.011)	(0.008)	(0.008)	(0.002)
	[0.001]	[0.001]	[0.001]	[0.002]	[0.001]	[0.037]	[0.001]	[0.043]	[0.010]	[0.001]
Constant	0.352***	0.126***	0.198***	0.365***	0.126***	0.205***	0.347***	0.122***	0.188***	0.035***
	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.000)
Fixed Effects	X	X	X	X	X	X	X	X	X	X
Controls										
Mean	0.334	0.140	0.189	0.348	0.137	0.195	0.333	0.139	0.179	0.022
SD	0.472	0.347	0.392	0.476	0.343	0.396	0.471	0.346	0.384	0.145
Adj. R^2	0.003	0.002	0.003	0.002	0.003	0.000	0.005	0.000	0.001	0.006
Schools	140	140	140	140	140	140	140	140	140	140
Students	5,923	5,923	5,923	5,923	5,923	5,923	5,923	5,923	5,923	5,721
Observations	11,846	11,846	11,846	11,846	11,846	11,846	11,846	11,846	11,846	10,693

Notes: *P < 0.10, **P < 0.05, ***P < 0.01. The sample includes students who participated in both baseline and the follow-up surveys. The mean and standard deviation of a baseline outcome of unobserved class students are presented. Standard errors, clustered at the school level, are in parentheses. Sharpened false discovery rate *q*-values (Benjamini et al., 2006) are in brackets.

Cross-sectional without Controls

Table 3.B.3: Effects of SRH Education on Students' SRH Literacy

	Overall	Ch1: Risks of Unprotected Sex		Ch2: Preventing Means		
	(1) Index	(2) Teen Pregnancy	(3) STIs	(4) Abstinence	(5) Fidelity	(6) Contraceptives
Treat	0.115***	0.129***	0.342***	0.065**	0.044	0.025
	(0.030)	(0.030)	(0.043)	(0.031)	(0.029)	(0.024)
	[0.001]	[0.001]	[0.001]	[0.019]	[0.051]	[0.081]
Constant	0.024	0.152***	0.180***	0.061**	0.084***	0.084***
	(0.021)	(0.021)	(0.026)	(0.024)	(0.021)	(0.017)
District	X	X	X	X	X	X
Controls						
SDS						
Mean	0.544	0.735	0.528	0.317	0.505	0.747
SD	0.141	0.295	0.157	0.465	0.381	0.343
Adj. R^2	0.033	0.019	0.045	0.005	0.007	0.005
Schools	140	140	140	140	140	140
Observations	5,923	5,923	5,923	5,923	5,923	5,923

Notes: *P $<$ 0.10, **P $<$ 0.05, ***P $<$ 0.01. The sample includes students who participated in both baseline and the follow-up surveys. The mean and standard deviation of a baseline outcome of unobserved class students are presented. District dummies are included as randomization took place at the district level. Standard errors, clustered at the school level, are in parentheses. Sharpened false discovery rate q-values (Benjamini et al., 2006) are in brackets.

Table 3.B.4: Effects of SRH Education on Students' SRH Attitudes and Behavior

	Mentioned means			Mentioned plan, now			Mentioned plan, adult			Behavior
	(1) Abst.	(2) Fid.	(3) Cont.	(4) Abst.	(5) Fid.	(6) Cont.	(7) Abst.	(8) Fid.	(9) Cont.	(10) Had Sex
Treat	0.058***	0.011	0.034***	0.051***	0.019***	0.024**	0.069***	0.032***	0.011	0.025***
	(0.016)	(0.007)	(0.012)	(0.015)	(0.007)	(0.011)	(0.015)	(0.007)	(0.010)	(0.006)
	[0.001]	[0.048]	[0.004]	[0.002]	[0.007]	[0.015]	[0.001]	[0.001]	[0.081]	[0.001]
Constant	0.347***	0.098***	0.202***	0.361***	0.089***	0.201***	0.344***	0.089***	0.195***	0.031***
	(0.012)	(0.005)	(0.009)	(0.011)	(0.005)	(0.008)	(0.011)	(0.005)	(0.008)	(0.004)
District	X	X	X	X	X	X	X	X	X	X
Controls										
SDS										
Mean	0.334	0.140	0.189	0.348	0.137	0.195	0.333	0.139	0.179	0.022
SD	0.472	0.347	0.392	0.476	0.343	0.396	0.471	0.346	0.384	0.145
Adj. R^2	0.009	0.002	0.006	0.007	0.004	0.005	0.012	0.004	0.004	0.036
Schools	140	140	140	140	140	140	140	140	140	140
Observations	5,923	5,923	5,923	5,923	5,923	5,923	5,923	5,923	5,923	5,449

Notes: *P $<$ 0.10, **P $<$ 0.05, ***P $<$ 0.01. The sample includes students who participated in both baseline and the follow-up surveys. The mean and standard deviation of a baseline outcome of unobserved class students are presented. District dummies are included as randomization took place at the district level. Standard errors, clustered at the school level, are in parentheses. Sharpened false discovery rate *q*-values (Benjamini et al., 2006) are in brackets.

Cross-sectional with Controls

Table 3.B.5: Effects of SRH Education on Students' SRH Literacy

	Overall	Ch1: Risks of Unprotected Sex		Ch2: Preventing Means		
	(1)	(2)	(3)	(4)	(5)	(6)
	Index	Teen Pregnancy	STIs	Abstinence	Fidelity	Contraceptives
Treat	0.113***	0.140***	0.324***	0.069**	0.040	0.051**
	(0.017)	(0.026)	(0.033)	(0.027)	(0.024)	(0.021)
	[0.001]	[0.001]	[0.001]	[0.011]	[0.042]	[0.014]
Constant	-0.932***	0.649***	0.142	-0.021	-0.379**	0.534***
	(0.094)	(0.141)	(0.170)	(0.135)	(0.151)	(0.132)
District	X	X	X	X	X	X
Controls	X	X	X	X	X	X
SDS						
Mean	0.544	0.735	0.528	0.317	0.505	0.747
SD	0.141	0.295	0.157	0.465	0.381	0.343
Adj. R^2	0.334	0.094	0.137	0.117	0.126	0.149
Schools	140	140	140	140	140	140
Observations	5,922	5,922	5,922	5,922	5,922	5,922

Notes: *P $<$ 0.10, **P $<$ 0.05, ***P $<$ 0.01. The sample includes students who participated in both baseline and the follow-up surveys. The mean and standard deviation of a baseline outcome of unobserved class students are presented. Student characteristics (sex, age, Kinh ethnicity dummy, and baseline value of outcome) are included as student covariates. District dummies are included as randomization took place at the district level. Standard errors, clustered at the school level, are in parentheses. Sharpened false discovery rate q-values (Benjamini et al., 2006) are in brackets.

Table 3.B.6: Effects of SRH Education on Students' SRH Attitudes and Behavior

	Mentioned means			Mentioned plan, now			Mentioned plan, adult			Behavior
	(1) Abst.	(2) Fid.	(3) Cont.	(4) Abst.	(5) Fid.	(6) Cont.	(7) Abst.	(8) Fid.	(9) Cont.	(10) Had Sex
Treat	0.051***	0.011	0.031***	0.044***	0.017**	0.016*	0.065***	0.032***	0.007	0.002
	(0.013)	(0.007)	(0.011)	(0.013)	(0.007)	(0.010)	(0.013)	(0.007)	(0.010)	(0.003)
	[0.001]	[0.046]	[0.007]	[0.002]	[0.014]	[0.042]	[0.001]	[0.001]	[0.147]	[0.147]
Constant	-0.596***	0.069	-0.322***	-0.594***	0.161***	-0.246***	-0.646***	0.113**	-0.241***	0.041**
	(0.072)	(0.046)	(0.059)	(0.067)	(0.044)	(0.058)	(0.066)	(0.047)	(0.059)	(0.020)
District	X	X	X	X	X	X	X	X	X	X
Controls	X	X	X	X	X	X	X	X	X	X
SDS										
Mean	0.334	0.140	0.189	0.348	0.137	0.195	0.333	0.139	0.179	0.022
SD	0.472	0.347	0.392	0.476	0.343	0.396	0.471	0.346	0.384	0.145
Adj. R^2	0.162	0.028	0.110	0.169	0.029	0.111	0.152	0.026	0.106	0.763
Schools	140	140	140	140	140	140	140	140	140	140
Observations	5,922	5,922	5,922	5,922	5,922	5,922	5,922	5,922	5,922	4,971

Notes: *$P < 0.10$, **$P < 0.05$, ***$P < 0.01$. The sample includes students who participated in both baseline and the follow-up surveys. The mean and standard deviation of a baseline outcome of unobserved class students are presented. Student characteristics (sex, age, Kinh ethnicity dummy, and baseline value of outcome) are included as student covariates. District dummies are included as randomization took place at the district level. Standard errors, clustered at the school level, are in parentheses. Sharpened false discovery rate *q*-values (Benjamini et al., 2006) are in brackets.

Cross-sectional with Controls (Including Social Desirability Score)

Table 3.B.7: Effects of SRH Education on Students' SRH Literacy

	Overall	Ch1: Risks of Unprotected Sex		Ch2: Preventing Means		
	(1) Index	(2) Teen Pregnancy	(3) STIs	(4) Abstinence	(5) Fidelity	(6) Contraceptives
Treat	0.114***	0.139***	0.330***	0.069**	0.043*	0.053**
	(0.017)	(0.027)	(0.032)	(0.027)	(0.024)	(0.021)
	[0.001]	[0.001]	[0.001]	[0.009]	[0.030]	[0.012]
Constant	-0.880***	0.598***	0.429**	0.001	-0.238	0.615***
	(0.102)	(0.148)	(0.183)	(0.157)	(0.162)	(0.144)
District	X	X	X	X	X	X
Controls	X	X	X	X	X	X
SDS	X	X	X	X	X	X
Mean	0.544	0.735	0.528	0.317	0.505	0.747
SD	0.141	0.295	0.157	0.465	0.381	0.343
Adj. R^2	0.334	0.094	0.140	0.117	0.127	0.149
Schools	140	140	140	140	140	140
Observations	5,922	5,922	5,922	5,922	5,922	5,922

Notes: *$P < 0.10$, **$P < 0.05$, ***$P < 0.01$. The sample includes students who participated in both baseline and the follow-up surveys. The mean and standard deviation of a baseline outcome of unobserved class students are presented. Student characteristics (sex, age, Kinh ethnicity dummy, and baseline value of outcome, social desirability score) are included as student covariates. District dummies are included as randomization took place at the district level. Standard errors, clustered at the school level, are in parentheses. Sharpened false discovery rate q-values (Benjamini et al., 2006) are in brackets.

Table 3.B.8: Effects of SRH Education on Students' SRH Attitudes and Behavior

	Mentioned means			Mentioned plan, now			Mentioned plan, adult			Behavior
	(1) Abst.	(2) Fid.	(3) Cont.	(4) Abst.	(5) Fid.	(6) Cont.	(7) Abst.	(8) Fid.	(9) Cont.	(10) Had Sex
Treat	0.052***	0.012*	0.032***	0.045***	0.019**	0.018*	0.067***	0.033***	0.009	0.002
	(0.013)	(0.007)	(0.011)	(0.013)	(0.007)	(0.010)	(0.012)	(0.007)	(0.010)	(0.003)
	[0.001]	[0.032]	[0.004]	[0.001]	[0.009]	[0.030]	[0.001]	[0.001]	[0.103]	[0.110]
Constant	-0.537***	0.127***	-0.240***	-0.536***	0.236***	-0.162**	-0.549***	0.155***	-0.156**	0.037
	(0.078)	(0.048)	(0.064)	(0.073)	(0.046)	(0.064)	(0.075)	(0.049)	(0.063)	(0.024)
District	X	X	X	X	X	X	X	X	X	X
Controls	X	X	X	X	X	X	X	X	X	X
SDS	X	X	X	X	X	X	X	X	X	X
Mean	0.334	0.140	0.189	0.348	0.137	0.195	0.333	0.139	0.179	0.022
SD	0.472	0.347	0.392	0.476	0.343	0.396	0.471	0.346	0.384	0.145
Adj. R^2	0.162	0.030	0.111	0.170	0.032	0.113	0.154	0.026	0.108	0.763
Schools	140	140	140	140	140	140	140	140	140	140
Observations	5,922	5,922	5,922	5,922	5,922	5,922	5,922	5,922	5,922	4,971

Notes: *P $<$ 0.10, **P $<$ 0.05, ***P $<$ 0.01. The sample includes students who participated in both baseline and the follow-up surveys. The mean and standard deviation of a baseline outcome of unobserved class students are presented. Student characteristics (sex, age, Kinh ethnicity dummy, and baseline value of outcome, social desirability score) are included as student covariates. District dummies are included as randomization took place at the district level. Standard errors, clustered at the school level, are in parentheses. Sharpened false discovery rate q-values (Benjamini et al., 2006) are in brackets.

3.C Heterogeneity

Female

Table 3.C.1: Effects of SRH Education on Students' SRH Literacy: Heterogeneity

	Overall	Ch1: Risks of Unprotected Sex		Ch2: Preventing Means		
	(1) Index	(2) Teen Pregnancy	(3) STIs	(4) Abstinence	(5) Fidelity	(6) Contraceptives
Treat × Female	0.038	0.034	0.078	0.144***	-0.005	-0.016
	(0.025)	(0.047)	(0.049)	(0.042)	(0.044)	(0.045)
	[0.279]	[0.863]	[0.255]	[0.007]	[0.999]	[0.999]
Constant	-4.008***	-4.089***	-5.230***	-1.796**	-2.576***	-2.435***
	(0.395)	(0.704)	(0.709)	(0.703)	(0.689)	(0.639)
Fixed Effects	X	X	X	X	X	X
Controls	X	X	X	X	X	X
Mean	0.544	0.735	0.528	0.317	0.505	0.747
SD	0.141	0.295	0.157	0.465	0.381	0.343
Adj. R^2	0.066	0.030	0.066	0.007	0.006	0.015
Schools	140	140	140	140	140	140
Students	5,923	5,923	5,923	5,923	5,923	5,923
Observations	11,846	11,846	11,846	11,846	11,846	11,846

Notes: *P $<$ 0.10, **P $<$ 0.05, ***P $<$ 0.01. The sample includes students who participated in both baseline and the follow-up surveys. The mean and standard deviation of a baseline outcome of unobserved class students are presented. Student fixed effects and time-variant controls (age, number of siblings, number of rooms per household member) are included as student covariates. Standard errors, clustered at the school level, are in parentheses. Sharpened false discovery rate *q*-values (Benjamini et al., 2006) are in brackets.

Table 3.C.2: Effects of SRH Education on Students' SRH Attitudes and Behavior: Heterogeneity

	Mentioned means			Mentioned plan, now			Mentioned plan, adult			Behavior
	(1) Abst.	(2) Fid.	(3) Cont.	(4) Abst.	(5) Fid.	(6) Cont.	(7) Abst.	(8) Fid.	(9) Cont.	(10) Had Sex
Treat × Female	0.068***	0.003	-0.008	0.067***	0.007	-0.018	0.057**	-0.009	0.001	-0.009**
	(0.020)	(0.014)	(0.019)	(0.022)	(0.018)	(0.020)	(0.022)	(0.017)	(0.017)	(0.004)
	[0.007]	[0.999]	[0.999]	[0.012]	[0.999]	[0.723]	[0.040]	[0.999]	[0.999]	[0.087]
Constant	-0.077	1.368***	-0.161	-0.053	1.528***	0.021	-0.095	1.599***	-0.242	-0.277***
	(0.333)	(0.254)	(0.335)	(0.363)	(0.263)	(0.258)	(0.387)	(0.228)	(0.299)	(0.078)
Fixed Effects	X	X	X	X	X	X	X	X	X	X
Controls	X	X	X	X	X	X	X	X	X	X
Mean	0.334	0.140	0.189	0.348	0.137	0.195	0.333	0.139	0.179	0.022
SD	0.472	0.347	0.392	0.476	0.343	0.396	0.471	0.346	0.384	0.145
Adj. R^2	0.005	0.006	0.003	0.004	0.008	0.001	0.007	0.006	0.001	0.011
Schools	140	140	140	140	140	140	140	140	140	140
Students	5,923	5,923	5,923	5,923	5,923	5,923	5,923	5,923	5,923	5,721
Observations	11,846	11,846	11,846	11,846	11,846	11,846	11,846	11,846	11,846	10,693

Notes: *P $<$ 0.10, **P $<$ 0.05, ***P $<$ 0.01. The sample includes students who participated in both baseline and the follow-up surveys. The mean and standard deviation of a baseline outcome of unobserved class students are presented. Student fixed effects and time-variant controls (age, number of siblings, number of rooms per household member) are included as student covariates. Standard errors, clustered at the school level, are in parentheses. Sharpened false discovery rate *q*-values (Benjamini et al., 2006) are in brackets.

Ethnic Minority

Table 3.C.3: Effects of SRH Education on Students' SRH Literacy: Heterogeneity

	Overall	Ch1: Risks of Unprotected Sex		Ch2: Preventing Means		
	(1)	(2)	(3)	(4)	(5)	(6)
	Index	Teen Pregnancy	STIs	Abstinence	Fidelity	Contraceptives
Treat × Minority	0.057*	0.078	-0.011	0.028	0.091*	-0.031
	(0.031)	(0.051)	(0.079)	(0.048)	(0.050)	(0.051)
	[0.570]	[0.758]	[0.999]	[0.999]	[0.570]	[0.999]
Constant	-4.027***	-4.116***	-5.223***	-1.800**	-2.609***	-2.421***
	(0.395)	(0.705)	(0.709)	(0.703)	(0.689)	(0.639)
Fixed Effects	X	X	X	X	X	X
Controls	X	X	X	X	X	X
Mean	0.544	0.735	0.528	0.317	0.505	0.747
SD	0.141	0.295	0.157	0.465	0.381	0.343
Adj. R^2	0.066	0.030	0.065	0.006	0.007	0.015
Schools	140	140	140	140	140	140
Students	5,923	5,923	5,923	5,923	5,923	5,923
Observations	11,844	11,844	11,844	11,844	11,844	11,844

Notes: *P $<$ 0.10, **P $<$ 0.05, ***P $<$ 0.01. The sample includes students who participated in both baseline and the follow-up surveys. The mean and standard deviation of a baseline outcome of unobserved class students are presented. Student fixed effects and time-variant controls (age, number of siblings, number of rooms per household member) are included as student covariates. Standard errors, clustered at the school level, are in parentheses. Sharpened false discovery rate q-values (Benjamini et al., 2006) are in brackets.

Table 3.C.4: Effects of SRH Education on Students' SRH Attitudes and Behavior: Heterogeneity

	Mentioned means			Mentioned plan, now			Mentioned plan, adult			Behavior
	(1) Abst.	(2) Fid.	(3) Cont.	(4) Abst.	(5) Fid.	(6) Cont.	(7) Abst.	(8) Fid.	(9) Cont.	(10) Had Sex
Treat $\times$ Minority	0.003	-0.003	-0.017	0.016	0.013	-0.000	-0.017	-0.008	-0.001	0.015***
	(0.025)	(0.016)	(0.019)	(0.021)	(0.021)	(0.020)	(0.022)	(0.017)	(0.019)	(0.005)
	[0.999]	[0.999]	[0.999]	[0.999]	[0.999]	[0.999]	[0.999]	[0.999]	[0.999]	[0.041]
Constant	-0.075	1.368***	-0.155	-0.056	1.523***	0.021	-0.087	1.601***	-0.242	-0.283***
	(0.333)	(0.254)	(0.335)	(0.363)	(0.263)	(0.258)	(0.387)	(0.228)	(0.299)	(0.078)
Fixed Effects	X	X	X	X	X	X	X	X	X	X
Controls	X	X	X	X	X	X	X	X	X	X
Mean	0.334	0.140	0.189	0.348	0.137	0.195	0.333	0.139	0.179	0.022
SD	0.472	0.347	0.392	0.476	0.343	0.396	0.471	0.346	0.384	0.145
Adj. R^2	0.003	0.006	0.003	0.002	0.008	0.000	0.005	0.006	0.001	0.013
Schools	140	140	140	140	140	140	140	140	140	140
Students	5,923	5,923	5,923	5,923	5,923	5,923	5,923	5,923	5,923	5,721
Observations	11,844	11,844	11,844	11,844	11,844	11,844	11,844	11,844	11,844	10,691

Notes: *$P < 0.10$, **$P < 0.05$, ***$P < 0.01$. The sample includes students who participated in both baseline and the follow-up surveys. The mean and standard deviation of a baseline outcome of unobserved class students are presented. Student fixed effects and time-variant controls (age, number of siblings, number of rooms per household member) are included as student covariates. Standard errors, clustered at the school level, are in parentheses. Sharpened false discovery rate q-values (Benjamini et al., 2006) are in brackets.

Rural

Table 3.C.5: Effects of SRH Education on Students' SRH Literacy: Heterogeneity

	Overall	Ch1: Risks of Unprotected Sex		Ch2: Preventing Means		
	(1) Index	(2) Teen Pregnancy	(3) STIs	(4) Abstinence	(5) Fidelity	(6) Contraceptives
Treat × Rural	0.056*	0.082	0.053	0.106*	0.006	-0.175***
	(0.029)	(0.073)	(0.075)	(0.060)	(0.089)	(0.064)
	[0.376]	[0.999]	[0.999]	[0.411]	[0.999]	[0.127]
Constant	-4.022***	-4.110***	-5.243***	-1.822**	-2.578***	-2.390***
	(0.395)	(0.704)	(0.709)	(0.703)	(0.688)	(0.639)
Fixed Effects	X	X	X	X	X	X
Controls	X	X	X	X	X	X
Mean	0.544	0.735	0.528	0.317	0.505	0.747
SD	0.141	0.295	0.157	0.465	0.381	0.343
Adj. R^2	0.066	0.030	0.066	0.006	0.006	0.017
Schools	140	140	140	140	140	140
Students	5,923	5,923	5,923	5,923	5,923	5,923
Observations	11,846	11,846	11,846	11,846	11,846	11,846

Notes: *P < 0.10, **P < 0.05, ***P < 0.01. The sample includes students who participated in both baseline and the follow-up surveys. The mean and standard deviation of a baseline outcome of unobserved class students are presented. Student fixed effects and time-variant controls (age, number of siblings, number of rooms per household member) are included as student covariates. Standard errors, clustered at the school level, are in parentheses. Sharpened false discovery rate *q*-values (Benjamini et al., 2006) are in brackets.

Table 3.C.6: Effects of SRH Education on Students' SRH Attitudes and Behavior: Heterogeneity

	Mentioned means			Mentioned plan, now			Mentioned plan, adult			Behavior
	(1) Abst.	(2) Fid.	(3) Cont.	(4) Abst.	(5) Fid.	(6) Cont.	(7) Abst.	(8) Fid.	(9) Cont.	(10) Had Sex
Treat × Rural	0.010	0.024	-0.044	0.065**	0.020	-0.015	-0.007	0.004	-0.030	-0.002
	(0.042)	(0.025)	(0.034)	(0.033)	(0.027)	(0.025)	(0.038)	(0.026)	(0.034)	(0.006)
	[0.999]	[0.999]	[0.925]	[0.376]	[0.999]	[0.999]	[0.999]	[0.999]	[0.999]	[0.999]
Constant	-0.078	1.362***	-0.149	-0.069	1.523***	0.025	-0.092	1.598***	-0.234	-0.277***
	(0.333)	(0.254)	(0.335)	(0.362)	(0.263)	(0.258)	(0.387)	(0.228)	(0.300)	(0.078)
Fixed Effects	X	X	X	X	X	X	X	X	X	X
Controls	X	X	X	X	X	X	X	X	X	X
Mean	0.334	0.140	0.189	0.348	0.137	0.195	0.333	0.139	0.179	0.022
SD	0.472	0.347	0.392	0.476	0.343	0.396	0.471	0.346	0.384	0.145
Adj. R^2	0.003	0.006	0.003	0.003	0.008	0.000	0.005	0.006	0.001	0.011
Schools	140	140	140	140	140	140	140	140	140	140
Students	5,923	5,923	5,923	5,923	5,923	5,923	5,923	5,923	5,923	5,721
Observations	11,846	11,846	11,846	11,846	11,846	11,846	11,846	11,846	11,846	10,693

Notes: *P $<$ 0.10, **P $<$ 0.05, ***P $<$ 0.01. The sample includes students who participated in both baseline and the follow-up surveys. The mean and standard deviation of a baseline outcome of unobserved class students are presented. Student fixed effects and time-variant controls (age, number of siblings, number of rooms per household member) are included as student covariates. Standard errors, clustered at the school level, are in parentheses. Sharpened false discovery rate q-values (Benjamini et al., 2006) are in brackets.

Age

Table 3.C.7: Effects of SRH Education on Students' SRH Literacy: Heterogeneity

	Overall	Ch1: Risks of Unprotected Sex		Ch2: Preventing Means		
	(1) Index	(2) Teen Pregnancy	(3) STIs	(4) Abstinence	(5) Fidelity	(6) Contraceptives
Treat × Age	-0.028**	-0.074***	-0.040*	-0.026	0.016	-0.060***
	(0.011)	(0.020)	(0.024)	(0.019)	(0.019)	(0.017)
	[0.028]	[0.006]	[0.129]	[0.199]	[0.201]	[0.007]
Constant	-0.030	0.134***	0.082*	0.077*	0.046	0.028
	(0.023)	(0.038)	(0.041)	(0.040)	(0.037)	(0.032)
Fixed Effects	X	X	X	X	X	X
Controls	X	X	X	X	X	X
Mean	0.544	0.735	0.528	0.317	0.505	0.747
SD	0.141	0.295	0.157	0.465	0.381	0.343
Adj. R^2	0.051	0.027	0.058	0.005	0.004	0.015
Schools	140	140	140	140	140	140
Students	5,923	5,923	5,923	5,923	5,923	5,923
Observations	11,846	11,846	11,846	11,846	11,846	11,846

Notes: *P $<$ 0.10, **P $<$ 0.05, ***P $<$ 0.01. The sample includes students who participated in both baseline and the follow-up surveys. The mean and standard deviation of a baseline outcome of unobserved class students are presented. Student fixed effects and time-variant controls (number of siblings, number of rooms per household member) are included as student covariates. Standard errors, clustered at the school level, are in parentheses. Sharpened false discovery rate q-values (Benjamini et al., 2006) are in brackets.

Table 3.C.8: Effects of SRH Education on Students' SRH Attitudes and Behavior: Heterogeneity

	Mentioned means			Mentioned plan, now			Mentioned plan, adult			Behavior
	(1) Abst.	(2) Fid.	(3) Cont.	(4) Abst.	(5) Fid.	(6) Cont.	(7) Abst.	(8) Fid.	(9) Cont.	(10) Had Sex
Treat × Age	0.017*	0.017***	-0.002	0.014*	0.018***	0.010	0.017*	0.011	0.004	-0.002
	(0.009)	(0.006)	(0.008)	(0.008)	(0.006)	(0.008)	(0.010)	(0.007)	(0.008)	(0.002)
	[0.129]	[0.023]	[0.355]	[0.129]	[0.019]	[0.199]	[0.129]	[0.129]	[0.305]	[0.199]
Constant	0.343***	0.110***	0.208***	0.344***	0.108***	0.227***	0.322***	0.100***	0.192***	0.032***
	(0.016)	(0.016)	(0.014)	(0.016)	(0.015)	(0.015)	(0.015)	(0.013)	(0.014)	(0.004)
Fixed Effects	X	X	X	X	X	X	X	X	X	X
Controls	X	X	X	X	X	X	X	X	X	X
Mean	0.334	0.140	0.189	0.348	0.137	0.195	0.333	0.139	0.179	0.022
SD	0.472	0.347	0.392	0.476	0.343	0.396	0.471	0.346	0.384	0.145
Adj. R^2	0.003	0.003	0.002	0.002	0.004	0.001	0.006	0.001	0.001	0.007
Schools	140	140	140	140	140	140	140	140	140	140
Students	5,923	5,923	5,923	5,923	5,923	5,923	5,923	5,923	5,923	5,721
Observations	11,846	11,846	11,846	11,846	11,846	11,846	11,846	11,846	11,846	10,693

Notes: *P $<$ 0.10, **P $<$ 0.05, ***P $<$ 0.01. The sample includes students who participated in both baseline and the follow-up surveys. The mean and standard deviation of a baseline outcome of unobserved class students are presented. Student fixed effects and time-variant controls (number of siblings, number of rooms per household member) are included as student covariates. Standard errors, clustered at the school level, are in parentheses. Sharpened false discovery rate q-values (Benjamini et al., 2006) are in brackets.

Chapter 4: Effects of Classroom Observation on Students' Learning in Sexual and Reproductive Health Education: Evidence from Vietnam

4.1 Introduction

Given the significant impact of teaching quality on student learning (Nye et al., 2004), classroom observation is widely used in school settings to assess (Aaronson et al., 2007; Leaver et al., 2021) and improve instructors' proficiency in teaching (Kane et al., 2013; O'Leary, 2020). School-based health education programs also employ this monitoring instrument to enhance the quality of health education students receive by having teachers under scrutiny. While much research has examined the effects of classroom observation in regular education contexts (Muralidharan and Sundararaman, 2010), its implications on students' learning in sensitive health topics are understudied.

This is of particular interest in sexual and reproductive health (SRH) education, considering the ongoing controversy over its curriculum. Growing empirical evidence concludes that introducing contraception to teenagers reduces their risky sexual behaviors significantly (Kirby, 2007). However, teachers often skip it during SRH education in low- and middle-income countries (LMICs) due to cultural norms that regard *abstinence* as the only acceptable prevention means to recommend to adolescents (Kaljee et al., 2007). Against this background, monitoring

measures are often integrated into school-based sex education programs to ensure that teachers deliver essential health messages (Buston et al., 2002; Kershner et al., 2014); however, this may affect students' learning due to the Hawthorne effect.[1] Using a field experiment, we investigate whether and how the presence of an observer affects students' learning in SRH education. In particular, we focus on its impacts on students' knowledge and attitudes toward the three preventive measures of sexually transmitted infections (STIs) and unwanted pregnancy: *abstinence*, *fidelity*, and *contraceptives*.

The observer effect is well-documented in school (Muralidharan and Sundararaman, 2010) and health (Leonard and Masatu, 2006) settings, but the direction of the impact on students in health education is ambiguous: students may learn better if their attention levels increase as the presence of an observer limits disruptive behaviors of students; however, alternatively, the presence of an outsider in a classroom may distract students (Whitcomb and Merrell, 2013). Classroom observation can affect students' learning indirectly through a teacher's quality of teaching as well: the observation may have positive effects on students' learning if an instructor's proficiency in teaching improves under observation; or it may have negative effects if an observed teacher's quality of teaching deteriorates because she finds monitoring to be stressful and loses confidence in her teaching (Aubusson et al., 2007).

In addition to overall teaching quality, having an outsider in a classroom during SRH education may affect the types of information transferred to students, given the sensitivity of the topics. For example, teachers under observation may emphasize *abstinence* as an effective prevention method to students while not mentioning a condom in a conservative society where premarital

[1] The Hawthorne effect is also known as the observer effect, and it refers to changes in human subjects' behaviors caused by their perception of being observed.

sex is considered taboo. On the other hand, teachers observed by an implementing organization may encourage students to use a condom if they believe that it is an essential message that the experimenter expects them to deliver.

To assess the effects of an observer's class visit, we conducted a randomized controlled trial (RCT) across 56 government lower secondary schools in Vietnam, collecting data from 1,376 adolescents who received stand-alone SRH education. We recruited two teachers from each school to serve as health education instructors. After participating in a training workshop, the teachers taught sex education to students at the class level. Of those, randomly selected lessons were observed by a nurse who recorded teachers' teaching practices on a checklist in a classroom. We examine the effects of classroom observation on students by comparing their SRH knowledge and attitude outcomes collected from a student survey five months after they received sex education. To shed light on mechanisms behind the effects on students, we analyze the observer effects on teachers' adherence to the curriculum (hereafter adherence) as a potential channel through which students learn differently under observation.

We present three main findings. First, we show that classroom observation has positive effects on students' learning in sex education. Students' SRH knowledge increases by 0.050 standard deviations when they receive sex education under observation. This is an additional gain generated by the presence of an observer on top of initial gains that originate from SRH education itself. Given that sex education without an observer improves students' SRH literacy by 0.102 standard deviations (Yoon et al., 2021), we find that having classes under scrutiny amplifies the effects of sex education by 49 percent.[2]

[2] Yoon et al. (2021) find that the SRH education curriculum used in this study improves Vietnamese students' SRH knowledge by 0.102 standard deviations compared with their counterparts who did not receive it.

Second, classroom observation significantly affects particular messages in line with Vietnamese culture that perceives premarital sex as immoral. The presence of an observer improves students' knowledge of *abstinence* significantly, whereas their understanding of *fidelity*and *contraceptives* is not affected. The differential effects across the three prevention methods are well-manifested in students' subjective attitudes. When SRH education is delivered under observation, the percentage of students who believe that *abstinence* is an effective means of prevention increases by 10.8 percent, and they are more likely to include this strategy in their personal prevention plan during adolescence (a 12.4 percent increase) and adulthood (a 12.4 percent increase). Meanwhile, such effects for *fidelity* and *contraceptives* are small in magnitude, and the group differences between the students from the observed and unobserved classes are not statistically significant.

Finally, our analysis of teaching quality presents suggestive evidence that the differential effects on students' knowledge and attitudes toward *abstinence* are attributable to teachers who emphasize it when an observer evaluates their teaching. Rather than improving overall teaching adherence, the instructors selectively increase adherence for certain topics when they deliver sex education under scrutiny. We find that classroom observation leads to a significant increase in adherence for teaching *abstinence,* but its effects on teaching *fidelity* and *contraceptives* are marginal, consistent with findings from students. Also, in the presence of an observer, teachers tend to exert extra effort, encouraging students to ask questions during SRH education and administering participatory in-class activities.

This article contributes to the SRH education literature. While school-based health education is widely implemented in both high-income countries (HICs) and LMICs (Bearinger et al., 2007), its impacts on behavior changes have been questioned in conjunction with a growing body

of empirical evidence presenting insignificant effects on adolescents (Downs et al., 2009; Duflo et al., 2015; Kremer and Miguel, 2007). To improve the effectiveness of the information-based intervention, the SRH education literature examines its components, such as the type of information delivered (Dupas, 2011), the delivery method (Jamison et al., 2013), and the attributes of the messengers (Dupas et al., 2018). In particular, the SRH education curriculum receives extensive attention in the literature, leading to an intense debate regarding which prevention methods should be promoted to adolescents (Fonner et al., 2014). Proponents of the abstinence-based curriculum argue that SRH education should deliver *abstinence-until-marriage* messages, while supporters of the comprehensive sexuality education (CSE) curriculum claim that the use of contraceptives should be encouraged as well.[3] A robust body of evidence shows that CSE is more effective than abstinence programs in reducing adolescents' risky behaviors (Johnson et al., 2011; Kirby et al., 2007), but CSE programs encounter strong opposition in communities engendered by cultural norms against premarital sex (Vanwesenbeeck et al., 2016). As a result, teachers often truncate sensitive content due to fear of moral judgment that may occur when they teach controversial topics, such as contraception. Classroom observation can be a useful tool to ensure that sensitive but essential messages are delivered to students as intended. However, our findings suggest that such an effort may skew the direction of sex education toward culturally acceptable content.

Second, this paper speaks to the literature on program fidelity. A large body of the literature documents the implementation infidelity problem (Dane and Schneider, 1998). The literature claims that inadequate program implementation leads to "type III errors," evaluating an intervention that is not delivered as intended (Basch et al., 1985), and it causes attenuated impacts (Elliott

[3] CSE refers to various types of curricula in the SRH education literature. Following Kirby (2008), we define CSE as curricula that introduce not only *abstinence* but also *fidelity* and *contraceptives* as preventive measures.

and Mihalic, 2004). In health education, teachers often shorten the length of the class, reduce the frequency of sessions, and skip sensitive topics (Rohrbach et al., 2010; Thomas, 2006) because they consider health education a nonessential subject (Dutton et al., 2011). The program fidelity literature proposes instruments to ensure satisfactory program delivery, such as precise and straightforward intervention manuals (Mowbray et al., 2003), intensive training for implementers (Rohrbach et al., 2010), and close monitoring (Elliott and Mihalic, 2004). In particular, direct observation is considered the gold standard for safeguarding fidelity (Bellg et al., 2004). This study complements the existing literature by showing that the instrument intended to ensure faithful delivery of an intervention may affect core components of programs that involve sensitive information.

Finally, this study relates to the Hawthorne effect literature. Since its first introduction in the original studies at the Hawthorne plant (Festinger and Katz, 1953; Mayo, 1933; Roethlisberger and Dickson, 1939), this concept has amassed a large body of literature. Numerous studies report temporary behavior changes caused by subjects' awareness of being observed in education (Muralidharan and Sundararaman, 2010) and health (McCambridge and Day, 2008) settings. This paper presents additional evidence of the Hawthorne effect in a school-based health education context where we find a significant increase in students' attention in the presence of an observer. Additionally, our findings provide empirical evidence that direct observation may have significant effects on subjects depending on the nature of activities under scrutiny because the reactive effects are substantial when behaviors under observation entail ethical considerations (Levitt and List, 2007).

This paper proceeds as follows: in Section 4.2, we describe the background and the design of our experiment. Section 4.3 outlines the empirical estimation strategy, followed by initial

findings in Section 4.4. The interpretation of our results is presented in Section 4.5, and Section 4.6 concludes.

4.2 Background and Experimental Design

4.2.1 Sexual and Reproductive Health in Vietnam

An increasing number of Vietnamese teenagers engage in premarital sex, coupled with rapid change in social norms and perceptions about sexuality (General Statistics Office, 2008; Ghuman, 2005). However, most of their sexual acts are unprotected because of low condom use. Only 20 percent of sexually active youths used a condom for their first sexual intercourse, and less than half of them use the contraceptive regularly (Duong et al., 2008; WHO, 2005), contributing to the country's one of the highest abortion rates in the world.[4]

However, Vietnamese teenagers receive limited SRH care services because they are excluded from the national family planning programs (Nguyen et al., 2016). The unmet need for contraception among adolescents is over 35 percent (UNFPA, 2013b), and they face substantial obstacles when seeking contraceptives because of social norms against teens' sexual activities. The exclusion of adolescents from SRH care services leads to high abortion rates among Vietnamese teenagers, which accounts for 20 percent of abortions cases in the country (Ministry of Planning and Investment of Vietnam, 2010).[5]

Despite substantial social and private costs associated with teen pregnancy,[6] Vietnamese

[4]The abortion rate in Vietnam is 35.2 abortions per 1,000 women aged 15 to 44 years as of 2000 (UN DESA, 2007). Two-thirds of women who terminated their pregnancies pointed out unwanted pregnancy as the main reason for abortion (UNFPA, 2012).

[5]Abortion up to the first 22 weeks of gestation is legal in Vietnam, and adolescents can get it at public clinics under parental consent. However, unmarried women often visit unregulated private clinics for illegal abortions due to the social stigma associated with premarital pregnancy (Kaljee et al., 2007).

[6]Having sexual intercourse during the early stage of life has negative impacts on health (Bearinger et al., 2007;

teenagers have limited channels to obtain necessary SRH information and life skills. Parents are unwilling to broach a conversation regarding the sensitive topic with their children, claiming that a school should provide sex education (Do et al., 2017). Likewise, teachers remain hesitant to teach sexuality to their students and insist that it is a family matter (UNESCO, 2010). A lack of incentives for schools to offer SRH education hampers the provision of suitable sex education to teenagers as well. Although the formal lower secondary school curriculum includes sex education, it is integrated into five subjects in which only a limited scope of the biology of sexual reproduction is taught, rather than sexual practices in social contexts and essential life skills.[7] Vietnamese schools consider sex education a secondary responsibility because it is not a critical indicator on which schools are evaluated, such as graduation rates. As a result, the Internet has become a primary source of SRH information for Vietnamese adolescents (UNFPA, UNESCO, WHO, 2015).

4.2.2 Experimental Design

This study coincided with a school-based health program by an international non-profit organization, targeting lower secondary school students aged 11–14 in Vietnam from 2018 to 2020. In each participating school, two teachers were selected by a school headmaster to serve as SRH education instructors, and the implementing organization administered in-depth training for them. Teacher training included the background justification of the program, core SRH information, and pedagogical skills teachers should exercise during sex education. The training

Sabia and Rees, 2008), education (Baird et al., 2011), and future labor outcomes (UNFPA, 2013b).

[7] SRH education is integrated into biology, civic education, geography, literature, and extra-curriculum in Vietnamese lower secondary schools (Ministry of Education and Training of Vietnam, 2009).

sessions were conducted by a medical college professor using the detailed teaching guidelines.[8] The handbook fully documents what to teach (i.e., health promotion messages) and how to teach (i.e., pedagogical skills) to ensure that students receive the standardized messages.

The 45-minute long SRH education took place at the class level. Each teacher provided no more than four sessions (one class per grade $\times$ four grades per school) throughout the day when the implementing organization visited a school. The health education was comprised of two sections: lecture and in-class activities. First, students obtained essential health knowledge such as risks of unprotected sex and ways to avoid STIs and teen pregnancy. The curriculum is based on the abstinence-plus approach (Cushman et al., 2014), where *abstinence* is recommended to teenagers, but *fidelity* and *contraceptives* are also introduced as alternative prevention methods. After delivering essential SRH information, a teacher administered student-centered participative activities (e.g., role-playing) to empower students with critical life skills to protect themselves from risky sexual situations and make sound health decisions.

While teachers provided sex education to multiple classes throughout the day, a trained nurse conducted an unannounced in-classroom evaluation for randomly selected classes.[9] The observer had entered and sat in the back of a classroom before a session began. Once SRH education had started, the observer evaluated a teacher's pedagogy by marking on a checklist whether the educator delivered certain information in particular ways as instructed in the teaching guidelines. However, observers did not engage in any other interaction with students and

[8]Providing detailed teaching guidelines is crucial in successful sex education implementation (Kirby et al., 2011). For example, the handbook instructs teachers to preview topics at the beginning of each chapter, review each chapter's key takeaways, and frequently check whether students have any questions. Also, the guidelines provide the suggested amount of time that educators should spend on each part. See Muijs et al. (2014) for details of the list of pedagogical skills known to be effective in students' learning.

[9]The implementing organization had informed teachers that their SRH education may or may not be monitored based on randomization results, but it was unknown to teachers that who would be observed from which period until observation started.

teachers before, during, and after SRH education. Also, the evaluation results were not shared with anyone, including headmasters, other teachers, or government officials, as explained to the teachers before the program started.

Randomization took place in three levels: (i) which class each teacher teaches (stratified by grade within school); (ii) which teacher an observer follows (stratified by school); (iii) and at which period the evaluation begins. Panel A of Figure 4.1 illustrates the simplified experimental design of the study. Firstly, teachers were assigned, through block-randomization, to a group of classes to teach. For example, one teacher taught A-classes (i.e., Class 6A, Class 7A, Class 8A, and Class 9A) while another one from the same school was in charge of B-classes (i.e., Class 6B, Class 7B, Class 8B, and Class 9B). Secondly, we randomly selected one teacher from each school for in-classroom observer evaluation. Finally, the timing of the classroom observation was random: of 56 schools, we randomly assigned schools into three groups for which a nurse started classroom evaluation from the first, second, or third period for school Groups 1, 2, or 3, respectively.[10] Once observation began, an observer continued to follow the same teacher in subsequent periods and evaluated her teaching pedagogy in the same manner. At the beginning of the day, we provided a daily schedule of the program, including a list of classes of which each teacher was in charge. However, neither teachers nor students had any prior information on whether their classes had been selected for evaluation until an observer entered a classroom.

[10]We have the largest number of schools in Group 2 to have sufficient classes right before and after observation begins to capture the immediate effects of observation. Out of 70 schools that participated in a school-based health program, we have 20, 30, and 20 schools in Group 1, Group 2, and Group 3, respectively. This study excludes fourteen schools with only one class for each grade because there was no unobserved teacher in those schools.

4.2.3 Sampling

We conducted the experiment in Thanh Hoa province, Vietnam (Figure 4.2). From the universe of 652 government-run lower secondary schools in the North Central region, the implementing organization randomly chose 70 schools for a school-based health program. Students enrolled in the schools received a series of monthly health education in five topics.[11] This study includes 56 schools after excluding 14 schools in which only one teacher provided SRH education for all classes. From each school, two classes in the same grade are included in our sample.[12] The study participants are the student cohorts in grades 6, 7, 8, and 9 in the academic year 2018–2019. On average, twelve pupils from each grade were randomly selected for surveys after stratifying by gender and class. As summarized in Panel B of Figure 4.1, 1,773 students completed both the baseline and the follow-up surveys (hereafter the broader sample). Of those, our main sample is restricted to those who received SRH education after classroom observation began within a school (hereafter the RCT sample), leaving 1,376 students from 263 classes from 56 schools.[13] Schools are all co-ed and have an average of 30 students per class.

4.2.4 Timeline

Two waves of surveys were administered between October 2018 and April 2019. After providing a day-long workshop to teachers, we visited participating schools from October to December 2018 for the baseline survey and the intervention. The follow-up survey took place

[11] The five topics include SRH, eye health, infectious diseases and handwashing, food and nutrition, and anti-smoking. See Yoon et al. (2021) for details.

[12] If there were more than two classes per grade in a school, only two classes that received SRH education on the day the implementing organization visited the school are included in the sample. Also, grades with only one class from each school are excluded from the sample.

[13] In Panel B of Figure 4.1, the broader sample includes students in Groups A, B, C, and D, while the RCT sample includes those in Groups C and D.

five months after the treatment, from March to April 2019.

4.3 Data and Estimation Strategy

4.3.1 Data

We use several sources of data to examine the effects of classroom observation: (i) two waves of student surveys; (ii) a teacher survey; (iii) evaluation on teaching adherence by observers; (iv) evaluation on teaching adherence by students; and (v) an enumerator survey.

4.3.1.1 Data Collection

We collected data on students from the baseline and the follow-up surveys. An enumerator administered the surveys in a dedicated room on the school premises during regular class periods. We obtained a rich array of data on students, including demography and SRH knowledge, attitudes, and practices. Most of the data were collected via face-to-face interviews, but questions regarding sexual attitudes and behaviors were self-administered by students, given the sensitivity of the questions. In addition, we included a Marlowe-Crowne module (Reynolds, 1982) in the questionnaires to address potential social desirability bias (Crowne and Marlowe, 1960), which is a key concern for self-reported outcomes in the risky behavior literature.[14] Based on students' answers, we constructed a social desirability score for each student, which was used to control for the levels of students' tendency to give socially desirable answers when estimating the treatment effects.

Teachers' information on demography, education levels, duties at school, and their SRH

[14]The module includes eleven questions that are unrealistically good or bad traits for students to have. See Appendix B for the Marlowe-Crowne module items included in the surveys.

literacy levels and attitudes were collected before providing SRH education.[15] We also measured teachers' adherence levels using two instruments: one submitted by observers and the other by students. Firstly, a trained nurse used a checklist to measure a teacher's adherence level instantaneously in a classroom for randomly selected sessions. All items in the checklist are binary (yes/no), indicating whether a teacher delivered certain information in particular ways as described in the teaching guidelines.[16] Secondly, we conducted the exit survey on students from all classes that received SRH education immediately after each session was completed, using a subset of items from the checklist.[17] Adherence levels are computed by dividing the number of items marked *'Yes'* by the number of total items. The reliability of students' scores measured by Cronbach's α is 0.85, and students' answers are highly correlated with the observers' evaluation (p-value< 0.001). The evaluations on teaching practices calibrate both the quantity and quality of teaching they demonstrated in a classroom.[18] Finally, the enumerators' age, gender, and personality traits measured by the International Personality Item Pool (Goldberg et al., 2006) were collected from an enumerator survey.

[15] Of the 112 teachers in this study, fourteen teachers taught SRH education without training to replace those who were absent on days the implementing organization visited schools. The substituting teachers' surveys had been collected on the school premises before SRH education started.

[16] Example items on the checklist include '*A teacher introduces the goal of the session*' and '*A teacher mentions that abstinence is the most recommended way for teenagers to prevent unplanned pregnancy and STIs.*'

[17] Once a teacher had left the classroom after finishing SRH education, an enumerator entered the room for the exit survey. The enumerator administrated the anonymous survey by reading questions out loud one by one. Each student marked *'Yes'* if a student thought that the teacher had adhered to an item that the enumerator read or *'No'* otherwise on an optical mark recognition answer sheet. Students were instructed to give their answers to the best of their knowledge without discussing questions with their friends during the survey.

[18] Quantity-type questions examine whether a teacher delivered core health promotion messages to students (e.g., '*Does a teacher say that abstinence is the most recommended prevention method for teens?*'). On the other hand, quality-type questions ask whether a teacher exercised certain pedagogical skills (i.e., Structuring and Soliciting) at particular moments as instructed in the teaching guidelines (e.g., '*Does a teacher introduce objectives of SRH education at the beginning of the class?*').

4.3.1.2 Outcomes of Interest

The prevalence of sexual intercourse under fifteen is extremely low in Vietnam. Hence, we focus on students' SRH literacy and attitudes toward prevention methods against unprotected sex: *abstinence*, *fidelity*, and *contraceptives*. First, we evaluate the effects on the students' knowledge of each prevention means to examine what types of information are transferred to students under an outsider's observation. Students' SRH knowledge levels are calibrated by the two-parameter logistic Item Response Theory model (Embretson and Reise, 2010).[19] Second, we investigate how classroom observation affects students' subjective perspectives on prevention methods and their willingness to use them. For each means, students answered (i) whether they believe it is an effective prevention means, (ii) whether they have a plan to use it now, and (iii) whether they would adopt it in the future when they become adults.

Secondary outcomes of this study are the teachers' adherence levels. While our primary interest lies in the effects on students' learning, we examine the effects on the instructors' teaching adherence as a potential mechanism through which the presence of an observer affects students. The adherence outcomes evaluated by students can be used when assessing the treatment effects on teaching pedagogy because data were collected from all classes. However, evaluation results submitted by students are not as credible as ones measured by observers, in that the students' evaluation took place after SRH education was completed by teenagers with limited understanding of SRH in contrast to observers' evaluation which was collected during sessions by highly trained medical professionals. Thus, we use enhanced adherence outcomes predicted by the least

[19] While the Item Response Theory model estimates students' overall SRH literacy levels, the knowledge level of each topic (e.g., knowledge scores in *abstinence*) is calculated by dividing the number of questions they are correct by the number of total questions due to a small number of items for each outcome.

absolute shrinkage and selection operator (LASSO; Tibshirani, 1996). From a subset of classes for which we have both students' and observers' evaluations, the LASSO estimates a coefficient on each item reported by students based on its correspondence with the adherence levels measured by an observer, and predicts the true adherence levels for all classes. We use outcomes predicted by the cross-validation (CV) method because of its lowest out-of-sample mean squared error (See Appendix Table 4.A.1).

4.3.1.3 Validation of the Experimental Design

Balance Checks Panel A of Table 4.1 shows that students from observed and unobserved classes are well-balanced in their demographic characteristics at baseline. The group differences are small and not statistically significant at the 10 percent level. Panel B presents balance test results for a range of primary outcome variables. First, the two groups have similar levels of SRH literacy for all knowledge outcomes. Regarding their attitudes toward prevention methods, *abstinence* is the most preferred prevention means in line with the existing literature (Kaljee et al., 2007). While students have similar perspectives on the effectiveness of prevention methods, pupils from the observed classes are more likely to select *abstinence* as their avoidance plan. Hence, we control for students' baseline answers when estimating the effects of classroom observation on students. Finally, we do not find any statistically significant differences in students' sexual activity between the two groups. The joint F-test for all variables in Panels A and B shows no sign of systematic differences between the two groups (p-value=0.465).[20]

The balance test results in Table 4.2 show that observed and unobserved teachers are not

[20] We conduct the same balance test for additional variables, but only four out of thirty-five p-values are smaller than 0.100, the magnitude of differences is small, and the p-value from the F-test of joint significance is 0.265 (See Appendix Table 4.A.2).

systematically different. Panel B shows that the instructors in this study have roughly 15 years of teaching history. Of the 112 instructors, 16 percent are non-teaching staff, and half of the SRH educators are health teachers, but the composition of the instructors between the groups is the same, on average.[21] Panel C shows that teachers are not significantly different in their SRH knowledge and attitudes across observed and unobserved groups. The joint orthogonality test result (p-value=0.699) shows that teachers are overall well-balanced.

Attrition Five months after baseline data collection, the implementing organization visited schools for the follow-up survey. Of the 1,484 RCT sample students who completed the baseline survey, 92.7 percent were re-interviewed (Appendix Table 4.A.3). A difference in attrition rates between the unobserved and the observed groups is 1.1 percentage points, and it is not significantly associated with the students' randomization status.

4.3.2 Empirical Strategy

We estimate the effects of classroom observation on students in the RCT framework using the following specification:

$$\mathrm{Y}_{ick} = \beta_0 + \beta_1 \mathrm{Observe}_{ck} + \beta_2 \mathrm{Y}^{\mathbf{B}}_{ick} + \mathrm{X}_{ic}\beta_3 + \psi_k + \epsilon_{ick} \tag{4.1}$$

where Y_{ick} denotes the outcome measured at the follow-up for student i from class c in randomization strata k; $\mathrm{Observe}_{ck}$ is a binary variable that equals 1 if a class c in strata k was assigned for in-classroom observation or 0 otherwise; $\mathrm{Y}^{\mathbf{B}}_{ick}$ is the baseline analogue of the outcome for student

[21] Although school headmasters were requested to recruit two health teachers from each school as SRH education instructors, they needed additional school personnel to teach sex education because most schools had only one teacher assigned as a health teacher.

i from class c in strata k; X_{ic} is a vector of control variables; ψ_k are strata fixed effects following Duflo et al. (2007); and ϵ_{ick} are the student-specific error terms that are allowed to be correlated at the class level. We include Y^{B}_{ick} in the equation to take into account baseline group differences in students' avoidance plans, and to increase precision. Controls in X_{ic} include student, teacher, and class covariates in our preferred model to increase precision, but excluding them does not change our findings significantly.[22] Thus, β_1 captures the average treatment effect of classroom observation on the student outcome. There may exist possible spillover effects within school, because we have students from both observed and unobserved classes in the same school, but these effects, if they exist, would only attenuate our findings. When an outcome variable is continuous, we present a standardized effect size by normalizing it to the mean and standard deviation of unobserved class students' baseline outcome. For binary outcomes, we report the percentage point change caused by the treatment. We present sharpened false discovery rate q-values (Benjamini et al., 2006) when reporting treatment effects.

When estimating the effects on teaching adherence, we examine the following ordinary least squares regression model at the class level:

$$\widehat{\text{Adhere}}_{chk} = \delta_0 + \delta_1 \text{Observe}_{ck} + \text{C}_{ch}\delta_2 + \psi_k + \mu_{chk} \tag{4.2}$$

where $\widehat{\text{Adhere}}_{chk}$ denotes the predicted adherence outcome in class c of teacher h from randomization strata k; C_{ch} is a vector of controls; and μ_{chk} are the error terms clustered at the teacher level. The control vector C_{ch} includes the same sets of teacher- and class-level covariates from

[22]Control variables in X_{ic} include student (sex, age, an ethnic minority dummy, and social desirability score), teacher (sex, age, a dummy for a health teacher, and a dummy for participating in the training session), and class (whether SRH education was provided in the morning and the order of classes) characteristics. We present results from regressions without X_{ic} in Appendix Tables 4.A.4 and 4.A.5.

Equation 4.1 as well as enumerator characteristics.[23] Throughout the analysis of teachers' adherence, we report standardized effect sizes by normalizing the dependent variables to means and standard deviations of corresponding variables from unobserved teachers' classes.

As a robustness check, we estimate the effects of classroom observation on students in the difference-in-differences (DID) framework. Theoretically, the randomization allows us to estimate the causal effects by comparing students from observed classes to their counterparts from unobserved classes. At the same time, we can also use DID estimators with the broader sample to control for time-invariant teacher characteristics and time trends. In particular, we test the standard two-way fixed effects (TWFE) estimator and an alternative DID estimator proposed by de Chaisemartin and D'Haultfœuille (2020a,b). While the TWFE estimator requires the homogeneous treatment effect assumption across groups or over time, the alternative estimator is robust to heterogeneous treatment effects.

4.4 Empirical Results

4.4.1 Effects on Students' Learning

Table 4.3 summarizes the effects of classroom observation on students' SRH literacy. We find that having an observer in a classroom during sex education improves students' SRH overall knowledge by 0.050 standard deviations (Column 1), suggesting the positive Hawthorne effect on students' learning. This is a 49 percent extra gain for students caused by the monitoring instrument compared to 0.102 standard deviations improvement in pupils' learning attributed to SRH education without an observer (Yoon et al., 2021).

[23] Enumerator control variables include age and personality traits of those who administered the group exit survey to take into account variations in students' evaluation on teaching adherence caused by enumerator characteristics.

A more important question is how classroom monitoring affects the direction of SRH education, given the ongoing controversy and passionate debates over its curriculum. Columns 2–6 show that the direction of the Hawthorne effect varies depending on the topics. While most of the coefficients on knowledge outcomes are positive or close to 0, we find that the presence of an observer decreases students' knowledge in teen pregnancy by 0.076 standard deviations (Column 2). Of the three prevention methods, Column 4 shows that classroom observation has positive and significant effects on *abstinence* (a 0.099 standard deviations increase), but not on alternative methods. Students' knowledge of *fidelity* is higher in observed classes by 0.069 standard deviations (Column 5), but the estimates are noisy. The effects on *contraceptives* are close to 0, and the group difference between observed and unobserved classes is not statistically significant (Column 6).

To understand the extent to which classroom observation affects students' attitudes toward the three prevention methods, we examine the impacts on attitude outcomes. Consistent with findings from students' knowledge, Table 4.4 shows that *abstinence*is the only preventive measure on which the presence of an observer has significant effects. The first attitude variables we test are respondents' beliefs regarding the effectiveness of each prevention means. At baseline, *abstinence* is selected by the most students (36.9 percent) as an effective method, followed by *contraceptives* (19.1 percent) and *fidelity* (11.8 percent). Column 1 shows that students' positive perception regarding the effectiveness of *abstinence* is strengthened when students receive sex education with an observer. Compared to unobserved classes, the number of students perceiving *abstinence* as an effective prevention method increases by 4 percentage points (or 10.8 percent) under observation. However, the presence of an evaluator does not affect students' perceptions toward the alternative means of protection (Columns 2 and 3).

As the second set of attitude outcomes, we evaluate how an observer's class visit affects students' present and future avoidance plans. In line with Vietnamese social norms against premarital sex, students' most preferred avoidance plan is *abstinence* at baseline. Our results show that such strong preferences for *abstinence* over the alternative methods are reinforced by classroom observation. Column 4 shows that the number of students whose prevention plan during adolescence includes *abstinence*increases by 4.4 percentage points (or 12.4 percent). Also, students from observed classes are 4.2 percentage points (or 12.4 percent) more likely to have a plan to avoid sexual intercourse until marriage, even after they become adults (Column 7). However, students' willingness to remain faithful to their partners and to use contraceptives is not significantly affected by the presence of an observer.

We do not find significant effects on students' attitudes toward teenagers' sexual activities (Panel A of Table 4.5). Students from observed classes are more likely to answer that teens should not have sex until marriage (Column 5), but the group difference is not statistically significant. Panel B shows that classroom observation does not have a significant impact on students' subjective perspectives regarding whether teens should remain virgins (Column 1), whether it is ok to for teens to use a condom (Column 2), and their confidence levels (Columns 3 and 4). Finally, having SRH education under scrutiny does not affect students' sexual behavior (Column 5) five months after receiving sex education.

4.4.2 Effects on Teaching Adherence

We examine the effects of classroom observation on teaching adherence as a potential channel behind students' improved knowledge and attitudes toward *abstinence*. Figure 4.3 summa-

rizes the estimated impacts of classroom observation on educators' teaching adherence. Surprisingly, teachers' overall adherence is not affected by classroom observation (Panel A). The finding is inconsistent with other Hawthorne effect literature where an observed subject improves her quality of work. Instead, teachers selectively increase teaching adherence for particular content when sex education is delivered under scrutiny. We find that observed teachers tend to deliver more information on STIs (Panel B) and *abstinence* (Panel C). The findings are consistent with results from students, where we detect significant improvements in their knowledge of STIs and *abstinence* (Table 4.3), and attitudes toward *abstinence* (Table 4.4). In line with findings from students, however, adherence levels in teaching *fidelity* and *contraceptives* are not affected by the presence of an observer (Panel C of Figure 4.3).

Classroom observation affects not only the types of information educators deliver but also the pedagogical skills they exercise during SRH education. Panel E of Figure 4.3 shows that observed teachers are more likely to encourage students to ask questions during the class (i.e., Encourage) and summarize key takeaways at the end of each chapter by asking questions to students (i.e., Summary). Finally, student-centered participative activities are more likely to take place when SRH education is under observation (Panel F). The in-class activities are crucial components of sex education to empower adolescents with essential life skills, but teachers often skip or shorten them because it requires extra efforts to induce students' participation (UNESCO, 2010; UNFPA, 2014).[24] However, the presence of an evaluator prevents teachers from disregarding in-class activities.

[24]Students' exit survey reveals that the average adherence level in in-class activities is 43 percent in the absence of an observer.

4.4.3 Robustness Checks

4.4.3.1 The Difference-in-Differences Estimators

We assess the robustness of our results by evaluating the effects of classroom observation on students in the DID framework with the broader sample. DID estimators allow us to hold time-invariant teacher characteristics and time trends constant. First, we test the standard TWFE estimator by examining the following regression:

$$\mathrm{Y}_{icht} = \alpha_h + \lambda_t + \pi_1 \mathrm{Observe}_{cht} + \pi_2 \mathrm{Y}^{\mathrm{B}}_{icht} + \mathrm{X}_{ic}\pi_3 + \upsilon_{icht} \tag{4.3}$$

where Y_{icht} denotes the outcome of students i in class $c$that received SRH education from teacher h in class period t; α_h are teacher fixed effects; λ_t are class period fixed effects. The standard errors are clustered at the class level.

One caveat is that the TWFE estimates of DID require the homogeneous treatment effect assumption. A growing body of the DID literature raises a concern regarding the validity of the standard TWFE estimator when the treatment effects are heterogeneous (Callaway and Sant'Anna, 2021; Goodman-Bacon, 2021; Sun and Abraham, 2021). By decomposing the TWFE estimates of DID, Goodman-Bacon (2021) shows that a researcher may end up with incorrectly weighted or biased estimates if treatment effects vary across units or over periods. In particular, Sun and Abraham (2021) show that coefficients from a TWFE regression in a staggered adoption design are not robust to heterogeneous treatment effects.

Hence, we test an alternative DID estimator, $\mathrm{DID_M}$, proposed by de Chaisemartin and D'Haultfœuille (2020b) and compare results to those from the standard TWFE estimator. $\mathrm{DID_M}$

uses not-yet-switchers as controls to estimate the treatment effect for switchers whose treatment status is changed in a particular time period. DID_M is robust to heterogeneous treatment effects, but we lose statistical power in this study settings because class periods without teachers switching observation status (i.e., class periods 1 and 4) are excluded from the sample. As a result, we have a smaller sample size for DID_M ($N_{Students}$=1,146) than the RCT sample ($N_{Students}$=1,376) and the standard TWFE estimation sample ($N_{Students}$=1,773).

Figure 4.4 summarizes the treatment effects estimated in the DID framework.[25] Despite large standard errors, Graph A shows that DID_M estimates are similar to those from the RCT estimation. Results from the DID_M estimation suggest improved students' knowledge and attitudes toward *abstinence* when they receive sex education in the presence of an observer. Students from observed classes have higher knowledge levels in *abstinence*(Panel A), and are more likely to believe that *abstinence* is an effective prevention measure (Panel B) than their counterparts from unobserved classes. Consistent with findings from the RCT estimation, the DID_M results show that the presence of an observer increases the likelihood of a student adopting *abstinence* as their prevention method. In particular, we find a statistically significant 11.6 percentage points increase in the likelihood of a student including *abstinence* as their future plan (Panel D). The effect size is larger than what we find from the RCT estimation, but it is less precisely estimated due to the decreased sample size.

Graph B shows the treatment effects estimated using a standard TWFE regression (Equation 4.3), from which we find inconsistent results. The effects of classroom observation on students' knowledge and attitudes toward *abstinence* are no longer statistically significant. Instead,

[25]The common trends assumptions are tested using the placebo test of DID_M. We do not find significant differences in trends between observed and unobserved teachers' classes before the observation was initiated except for one knowledge outcome. See Appendix Table 4.A.6.

we find significant improvement in *contraceptives* as students' future avoidance plan (Panel D). The inconsistency may be attributed to the violation of the homogeneous treatment effect assumption. The TWFE estimate of DID captures a weighted sum of treatment effects estimated from all possible 2×2 DID estimators, where a group weight depends on sample size and variance of a treatment dummy in each DID pair (Goodman-Bacon, 2021). The randomization across schools in this study leaves the largest sample size in class period 3, leading to the largest weights given to students who received SRH education at that time. Moreover, some weights can even be negative. de Chaisemartin and D'Haultfœuille (2020b) show that negative weights are problematic if the average treatment effects (ATEs) are heterogeneous because one may end up with the negative treatment effect estimated by a standard TWFE regression while a vector of all ATEs is positive.[26] Using the Stata package *twowayfeweights* (de Chaisemartin and D'Haultfœuille, 2020b), we find that approximately 35 percent of the weights attached to the TWFE regression on *contraceptives* are negative. Hence, the TWFE estimates in this study are not robust to heterogeneous treatment effects.

4.4.3.2 The Lasso Dependent Variables

When estimating the effects of in-person observation on teaching adherence, we use the LASSO prediction to improve the quality of outcome variables by penalizing irreverent students' evaluation items. In particular, we use outcomes predicted by the CV method because it has the smallest out-of-sample mean squared error of the predictions (Appendix Table 4.A.1). We examine whether our results are robust to LASSO prediction models by estimating the effects

[26]For example, if weights are 1.5 and -0.5 for two groups with the positive ATEs 1 and 4, respectively, the TWFE estimate $(1 \times 1.5 + 4 \times (-0.5) = -0.5)$ is negative while ATEs for all groups are positive (de Chaisemartin and D'Haultfœuille, 2020b).

using both the CV-based and the adaptive LASSO methods.[27] We test not only the LASSO predictions that apply penalized coefficients but also the post-selection predictions that use the unpenalized LASSO estimates, leaving four different types of outcomes.

Figure 4.5 shows that our findings on adherence are robust across different LASSO methods. Coefficients on *abstinence*are stable and statistically significant whether the CV-based (Graph A) or the adaptive (Graph C) methods are used for outcome prediction. Also, our results are robust to post-selection predictions (Graphs B and D). We do not find significant effects on *fidelity* and *contraceptives* from any LASSO models.[28]

4.4.4 Heterogeneity

We examine the heterogeneous treatment effect across students' gender by estimating the following equation:

$$\mathrm{Y}_{ick} = \theta_0 + \theta_1 \mathrm{Observe}_{ck} \times \mathrm{Girl}_{ick} + \theta_2 \mathrm{Observe}_{ck} + \theta_3 \mathrm{Y}^{\mathbf{B}}_{ick} + \mathrm{X}_{ic}\theta_4 + \psi_k + \nu_{ick} \tag{4.4}$$

where Girl_{ick} is an indicator variable for female student i from class c in strata k. From the vector of controls, X_{ic}, a dummy for student's gender is excluded so that θ_1 captures the differential effects by gender.

Table 4.6 shows that female students learn better than their male counterparts in the presence of an observer across all knowledge outcomes, except *contraceptives*. Column 1 shows that

[27] We do not test the plug-in method because it is so parsimonious in item selection (Belloni et al., 2012, 2016) that it fails to predict adherence levels for most outcomes, given only 27 items included in students' evaluation.

[28] Appendix Figure 4.A.1 reports the robustness check using different LASSO models for all adherence outcomes, where we find consistent results.

classroom observation increases the gender gap in SRH literacy by 0.148 standard deviations because female students' knowledge increases by 0.120 standard deviations while male students' understanding of it is unaffected. Column 2 shows that the negative effects on students' knowledge of teen pregnancy (Column 2 of Table 4.3) are driven by male students whose learning is interrupted by an observer. We find strong heterogeneous effects on students' knowledge of prevention methods. In particular, the gender gap in *abstinence* is substantial. Classroom observation increases female students' learning in *abstinence* by 0.310 standard deviations while decreasing male students' scores by 0.134 standard deviations, leading to a 0.444 standard deviation gender gap. Having a monitoring enumerator in a classroom helps girls learn about *fidelity* as well (a 0.162 standard deviations increase), but it does not affect boys. Instead, boys learn better about *contraceptives*under observation (Column 6). This is the only knowledge outcome that classroom observation improves boys' learning, while adversely affecting girls.

Similarly, the effects on students' attitudes suggest that the presence of an observer has positive effects on learning *abstinence* and *contraceptives* for girls and boys, respectively. Table 4.7 shows that female students from observed classes are 11.1 percentage points more likely to believe that *abstinence* is effective (Column 1) and include this as a personal prevention plan (Columns 4 and 7). However, we do not find significant effects for male counterparts. On the other hand, male students lean toward *fidelity* (Columns 2, 5, and 8) and *contraceptives* (Columns 3 and 6) when they received SRH education with an observer, but its impacts on female students are not statistically significant or even negative.

4.5 Discussion

We find evidence of the Hawthorne effect on students' learning as the presence of an observer improves students' SRH literacy. In particular, null effects on teachers' overall adherence suggest that classroom observation has a direct impact on students' learning. As documented in the education literature, students may behave differently when they recognize a stranger intruding into their classes due to the reactive effect (Merrett, 2006). While an observer did not engage in any interaction with students and teachers during SRH education, students in a classroom are likely to be aware of the outsider sitting in the back of a classroom. Hence, students may refrain from disruptive behaviors while increasing their attention levels to impress an observer (Whitcomb and Merrell, 2013).

It is surprising that teachers' overall proficiency in delivering SRH lessons does not improve when they are under scrutiny, considering the Hawthorne effect literature reporting short-term improvement in workers' performance under observation. In contrast to other Hawthorne effect studies, two unique attributes of sex education in this study may explain the absence of the observer effect on overall teaching adherence. First, the study subjects in the SRH education program were under scrutiny for performing a task with which they were not familiar. In the other studies, workers were under observation for their regular works, such as factory workers' daily tasks (Mayo, 1933), teachers' mathematics and language course teaching (Muralidharan and Sundararaman, 2010), and doctors' outpatient consultations (Leonard and Masatu, 2006). Then, the observed subjects improved their quality of works by reducing the 'know-do' gap: the difference between what they know and what they actually do. This is different for the teachers in this study. Although sex education was implemented in regular school settings by teachers

with sufficient teaching experiences, this was their first time teaching SRH for most instructors.[29] The lack of training and teaching experience in the health topic suggests that teachers may not be able to teach it better even if they want because they do not know how to do it. Second, the sex education instructors were under a strict time constraint. Compared to doctors whose quality of care increases significantly when their outpatient consultations are under scrutiny (Leonard and Masatu, 2006), the teachers were restricted to a 45-minute class period because SRH education was provided during the regular school schedule. Therefore, the educators may not be able to improve adherence levels by increasing the amount of information delivered to students because of the time limitation.

Finally, the positive effects of classroom observation on teachers' adherence in teaching *abstinence* present suggestive evidence that students learn better about the conservative preventive means because teachers stress it when their pedagogy is under scrutiny. The observer effect on teachers is expected to be strong in sex education in that the curriculum includes sensitive information that could be subject to moral judgment by others (Levitt and List, 2007). Although teachers were informed that observers' teaching evaluation would not be shared with anyone, they may be worried about delivering controversial messages to students when an outsider records their teaching practices. Hence, the fear may shift the SRH education into an abstinence-centered approach as teachers emphasize culturally acceptable messages.

[29]Over 60 percent of participating teachers in our study schools answered that they had not received any sex education training, and 43 percent of them had never taught it before.

4.6 Conclusions

This paper examines the impact of classroom observation on students' learning in sensitive health education topics by conducting a randomized controlled trial in Vietnam. First, we find that the presence of an observer has positive effects on students' learning because of an improvement in students' attention. The second finding shows that classroom observation has significant effects on students' knowledge and attitudes toward *abstinence*.Finally, we provide suggestive evidence that the positive impacts on *abstinence*are attributed to teachers whose SRH education becomes abstinence-focused when an outsider evaluates their teaching practices due to social norms that regard premarital sex unacceptable.

One implication of the findings is that the direct observation in health education does not capture what would have happened in a classroom in the absence of an observer because the outsider causes behavior changes in students and teachers. Hence, an additional instrument, such as students' evaluation on teaching adherence, is necessary to recover the true teaching practices of health education instructors. Secondly, our results confirm that what teachers teach is well-reflected on students' health knowledge and attitudes. Therefore, student outcomes would be a better measure of the teaching quality than in-classroom evaluation in a health education program in that student outcomes capture how teachers teach in a classroom without causing the Hawthorne effect. Finally, a significant modification in the curriculum caused by an observer's class visit suggests that less invasive intervention, such as in-depth training and detailed guidelines, should be prioritized as a means to improve the program fidelity while avoiding the observer effect.

Figure 4.1: Study Design and the Sample

Panel A

Randomization across Schools and Teachers					
School-level	**Teacher-level**	**Class-level**			
		Period 1	**Period 2**	**Period 3**	**Period 4**
School Group 1 (20 schools)	Observed Teacher	Class 6A	Class 7A	Class 9A	Class 8A
	Unobserved Teacher	Class 6B	Class 7B	Class 9B	Class 8B
School Group 2 (24 schools)	Observed Teacher	Class 6A	Class 7A	Class 9A	Class 8A
	Unobserved Teacher	Class 6B	Class 7B	Class 9B	Class 8B
School Group 3 (12 schools)	Observed Teacher	Class 6A	Class 7A	Class 9A	Class 8A
	Unobserved Teacher	Class 6B	Class 7B	Class 9B	Class 8B

Panel B

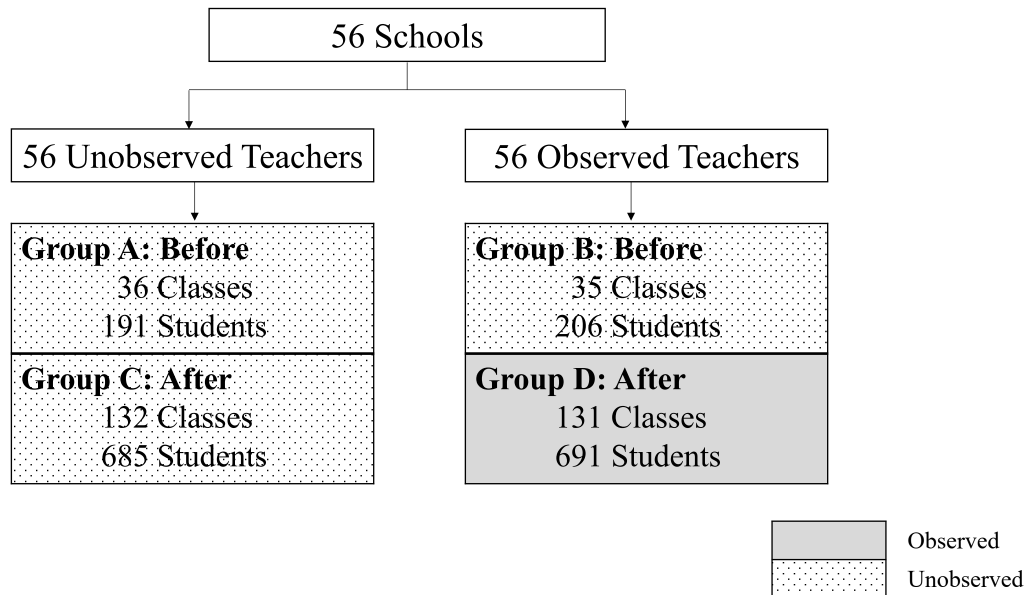
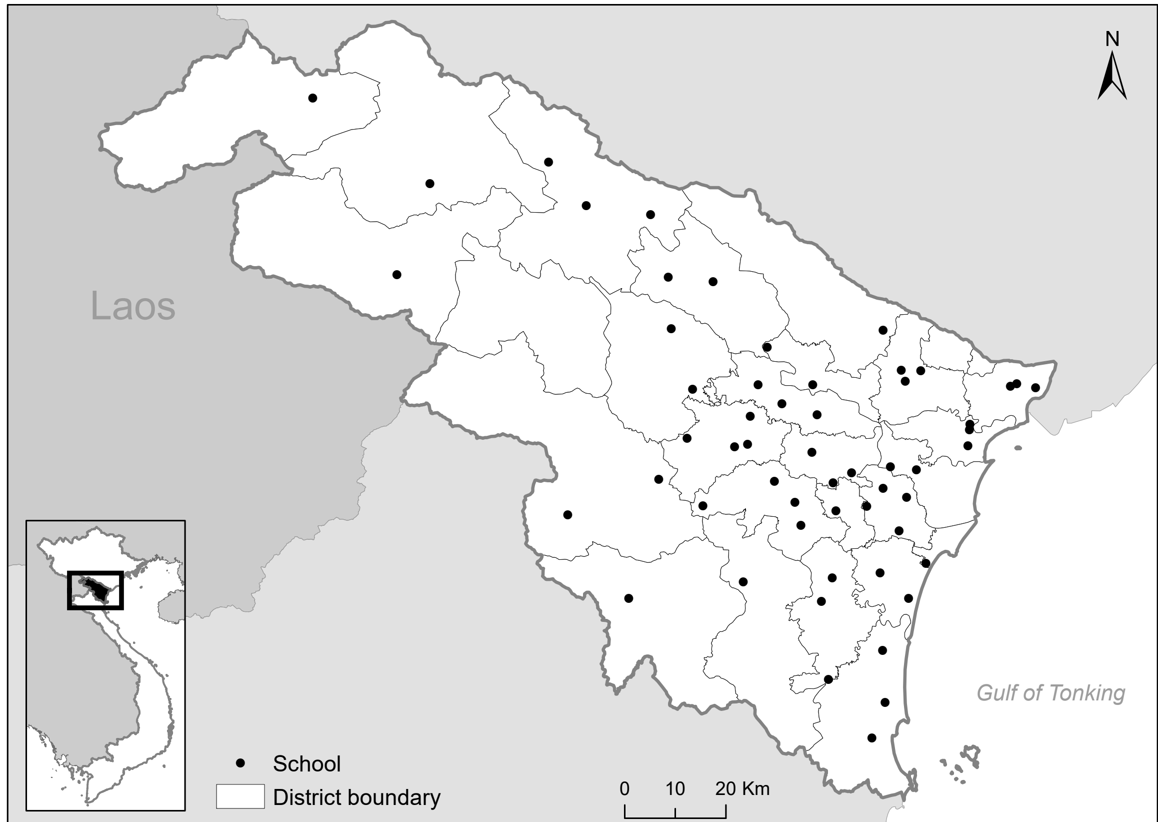
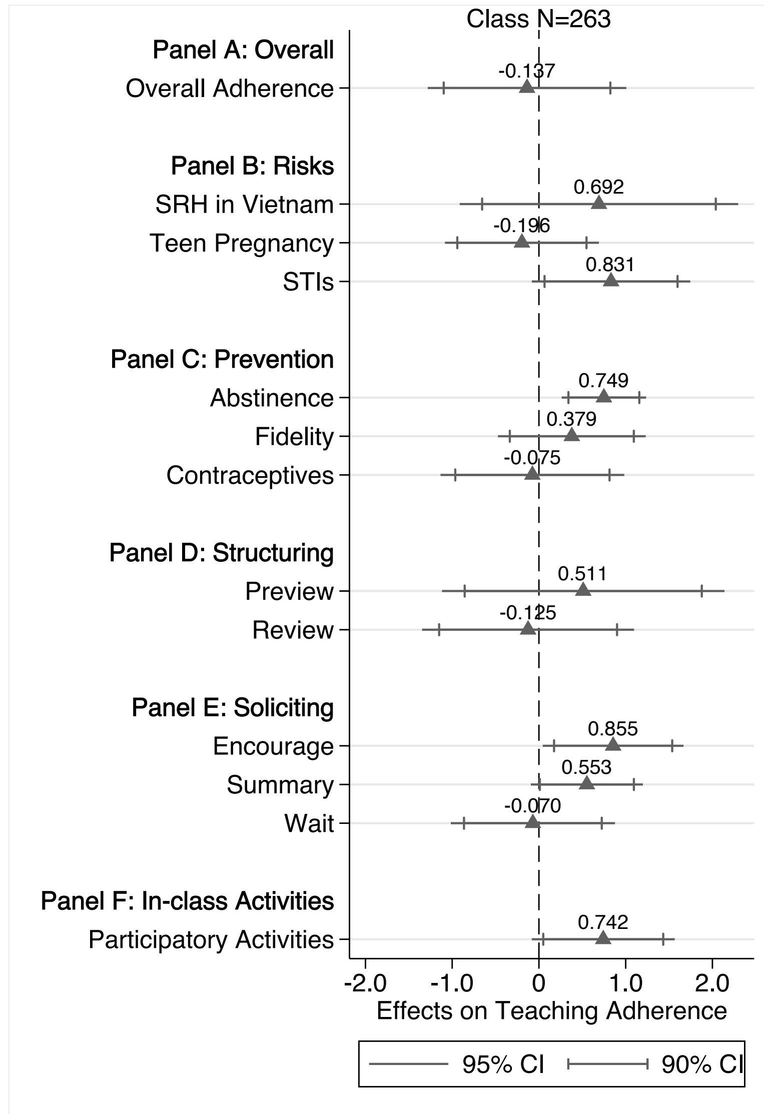


Figure 4.2: Study Area



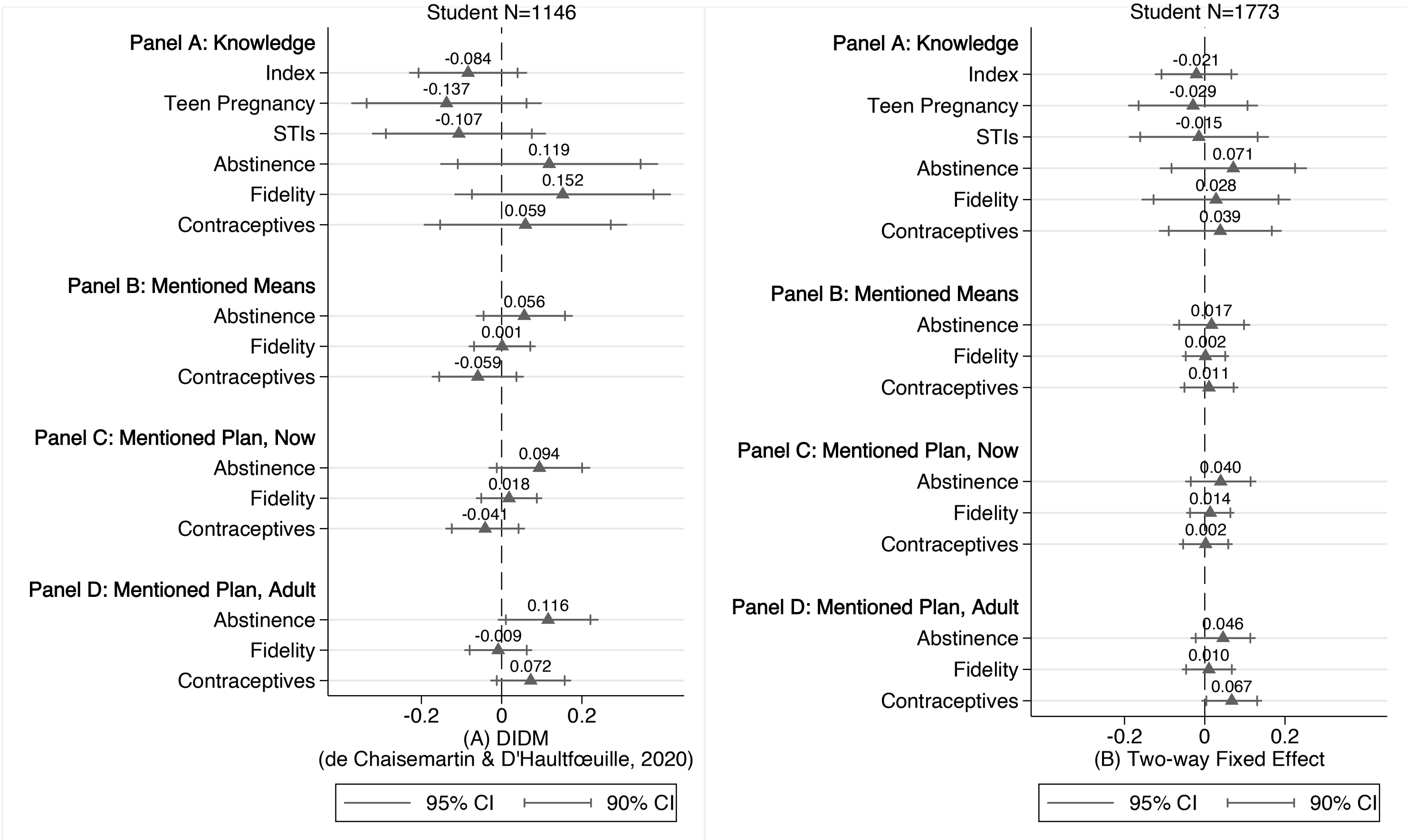
Notes: A total of 56 participating schools are plotted on the map. Of 70 schools in Thanh Hoa province that were randomly selected for a school-based health program, this study includes 56 schools after excluding schools in which only one teacher provided SRH education for all classes.

Figure 4.3: Effects of Classroom Observation on Teaching Adherence



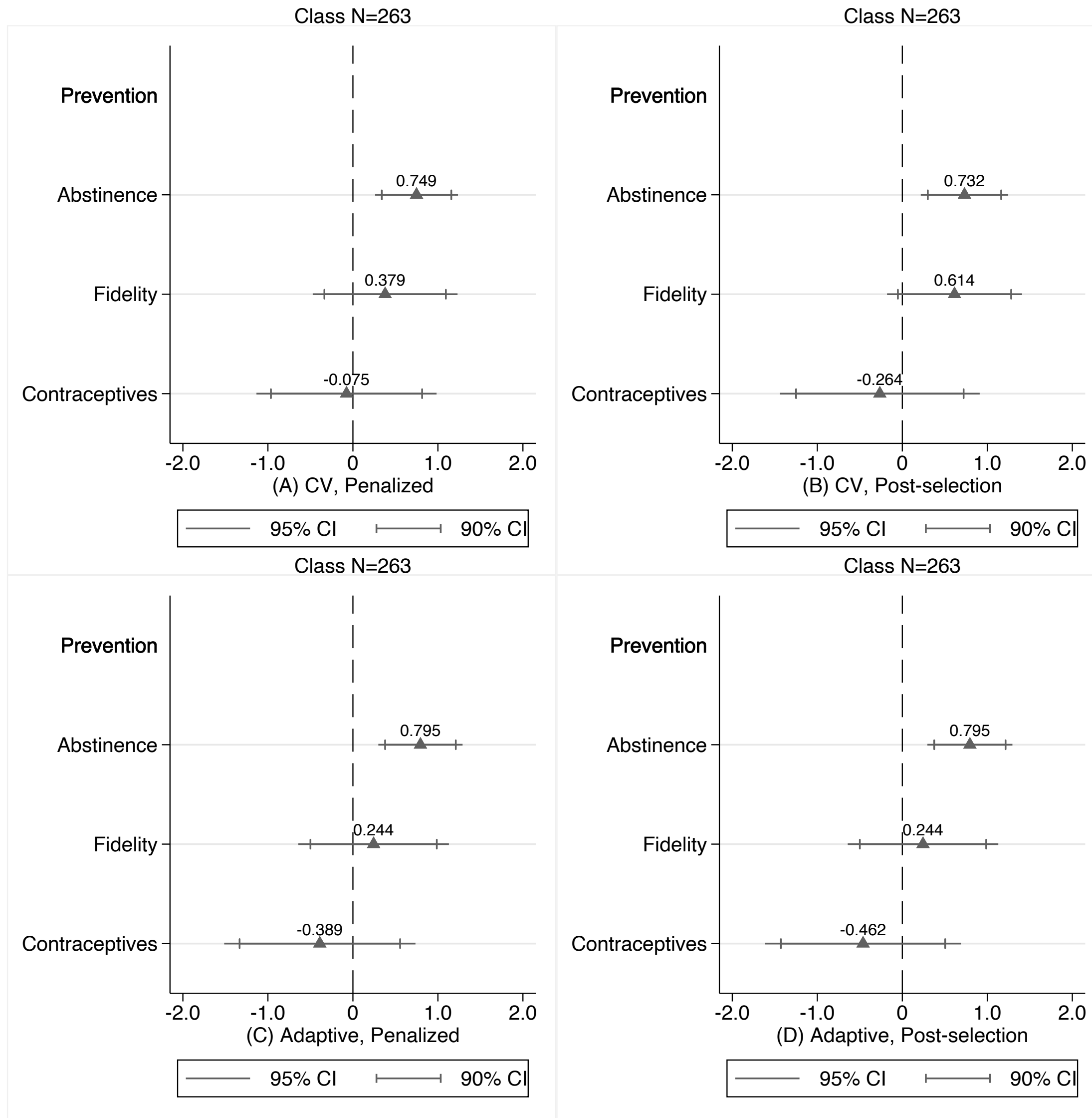
Notes: The figure plots the treatment effects of classroom observation on teaching adherence. The point estimates and their confidence intervals are presented. The sample includes classes of students who participated in both the baseline and the follow-up surveys. Only classes that SRH education was provided after observation began within a school are included in the sample. Dependent variables are CV-based LASSO predicted outcomes where observer-evaluated adherence score is regressed on a total of 27 student-evaluated adherence items. Teacher (sex, age, a dummy for a health teacher, and a dummy for participating in the training session), class (whether SRH education was provided in the morning and the order of classes), and enumerator (IPIP personality traits from Goldberg et al. (2006) and ages of enumerators who conducted the exit survey) controls are included in the model besides School $\times$ Grade strata dummies to increase precision. Standard errors are clustered at the teacher level.

Figure 4.4: Effects of Classroom Observation on Students' SRH Literacy and Attitudes (DID Estimators)



Notes: Treatment effects on students estimated using DID_M and the two-way fixed effects of DID (Equation 4.3) are plotted in Graphs A and B, respectively. The point estimates and their confidence intervals are presented. For DID_M, bootstrapping is used to estimate the average treatment effects after controlling for students (sex, age, an ethnic minority dummy, social desirability score, and the baseline observation of the outcome) and class (whether SRH education was provided in the morning and the order of classes) characteristics. A two-way fixed effects regression includes the same set of students and class controls. For both models, teacher fixed effects and period fixed effects are included, and standard errors are clustered at the class level.

Figure 4.5: Effects of Classroom Observation on Teaching Adherence (Lasso Dependent Variables)



Notes: The figures plot the treatment effects of classroom observation on teaching adherence. The point estimates and their confidence intervals are presented. The sample includes classes of students who participated in both the baseline and the follow-up surveys. Only classes that SRH education was provided after observation began within a school are included in the sample. Dependent variables are LASSO predicted values where observer-evaluated adherence score is regressed on a total of 27 student-evaluated adherence items. Teacher (sex, age, a dummy for a health teacher, and a dummy for participating in the training session), class (whether SRH education was provided in the morning and the order of classes), and enumerator (IPIP personality traits from Goldberg et al. (2006) and ages of enumerators who conducted the exit survey) controls are included in the model besides School × Grade strata dummies to increase precision. Standard errors are clustered at the teacher level.

Table 4.1: Balance Test: Students

	Unobserved		Observed		Difference
	(N=685)		(N=691)		(N=1,376)
	Mean	SD	Mean	SD	p-value
Panel A: Demographic Characteristics					
Female	0.52	0.50	0.50	0.50	0.438
Kinh Ethnic Group	0.82	0.38	0.80	0.40	0.114
Age	13.04	1.13	13.07	1.09	0.598
First Child	0.51	0.50	0.50	0.50	0.889
Household Size	4.72	1.27	4.78	1.61	0.348
Number of Siblings	1.73	1.30	1.73	1.24	0.866
HH Member Number/Room	0.54	0.33	0.54	0.26	0.584
Panel B: Sexual and Reproductive Health					
Knowledge (range 0–1)					
Overall	0.58	0.16	0.59	0.15	0.153
Teen Pregnancy	0.75	0.29	0.77	0.28	0.341
STIs	0.57	0.18	0.59	0.19	0.155
Abstinence	0.32	0.47	0.35	0.48	0.395
Fidelity	0.52	0.38	0.52	0.37	0.901
Contraceptives	0.76	0.33	0.75	0.33	0.582
Attitudes (range 0–1)					
Mentioned Means					
Abstinence	0.38	0.48	0.40	0.49	0.324
Fidelity	0.13	0.33	0.15	0.36	0.176
Contraceptives	0.20	0.40	0.21	0.41	0.441
Mentioned Plan, Now					
Abstinence	0.36	0.48	0.43	0.50	0.008
Fidelity	0.13	0.34	0.15	0.35	0.443
Contraceptives	0.20	0.40	0.24	0.42	0.057
Mentioned Plan, Adult					
Abstinence	0.34	0.47	0.40	0.49	0.019
Fidelity	0.12	0.32	0.15	0.35	0.109
Contraceptives	0.19	0.39	0.21	0.41	0.231
Practice (range 0–1)					
Had Sexual Intercourse, Ever	0.05	0.21	0.04	0.19	0.552
Joint Orthogonality Test					0.465

Notes: The sample includes students who participated in both the baseline and the follow-up surveys from classes where SRH education was provided after observation began within a school. The p-values from the null hypothesis test that $H_0 : \beta_1 = 0$ in the regression Variable $= \beta_0 + \beta_1 \times$ Observed Class $+$ Strata Dummies $+ \epsilon$ are reported. The joint orthogonality test row reports the p-value from F-test for all variables presented in the table.

Table 4.2: Balance Test: Teachers

	Unobserved		Observed		Difference
	(N=56)		(N=56)		(N=112)
	Mean	SD	Mean	SD	p-value
Panel A: Demographic Characteristics					
Female	0.61	0.49	0.70	0.46	0.168
Kinh Ethnic Group	0.94	0.23	0.92	0.27	0.322
Age (yr)	38.51	5.57	37.46	4.53	0.240
20-29 Years Old	0.04	0.19	0.04	0.19	0.999
30-39 Years Old	0.61	0.49	0.70	0.46	0.322
40-49 Years Old	0.29	0.46	0.25	0.44	0.674
50-59 Years Old	0.07	0.26	0.02	0.13	0.182
Education					
Vocational Training	0.00	0.00	0.02	0.14	0.322
College	0.19	0.39	0.12	0.33	0.290
Undergraduate	0.81	0.39	0.82	0.39	0.598
Postgraduate	0.00	0.00	0.04	0.20	0.322
Panel B: School Duties					
Teaching Experience (yr)	16.65	5.87	15.11	4.57	0.119
Regular Teacher	0.86	0.35	0.82	0.39	0.621
Health Teacher	0.50	0.50	0.48	0.50	0.837
Biology Teacher	0.13	0.34	0.16	0.37	0.598
Panel C: Sexual and Reproductive Health					
Knowledge	0.72	0.13	0.73	0.13	0.771
A Recommended Prevention Means for Teens					
Abstinence	0.36	0.48	0.23	0.43	0.128
Fidelity	0.02	0.13	0.04	0.19	0.568
Contraceptives	0.57	0.50	0.62	0.49	0.536
Attitude					
Teen's Sexual Intercourse Is					
Not Acceptable until Marriage	0.50	0.50	0.43	0.50	0.438
Not Acceptable until Adulthood	0.61	0.49	0.61	0.49	0.999
Ok with Partners	0.11	0.31	0.20	0.40	0.168
Ok with Anyone	0.04	0.19	0.05	0.23	0.659
Joint Orthogonality Test					0.699

Notes: The sample includes teachers who taught SRH education in classes of students who participated in both the baseline and the follow-up surveys. The p-values from the null hypothesis that $H_0 : \beta_1 = 0$ in the regression Variable $= \beta_0 + \beta_1 \times$ Observed Teacher $+$ Strata Dummies $+ \epsilon$ are reported. The joint orthogonality test row reports the p-value from F-test for all variables presented in the table.

Table 4.3: Effects of Classroom Observation on Students' SRH Literacy

	Overall	Ch1: Risks of Unprotected Sex		Ch2: Preventing Means		
	(1)	(2)	(3)	(4)	(5)	(6)
	Index	Teen Pregnancy	STIs	Abstinence	Fidelity	Contraceptives
Observe	0.050**	-0.076**	0.080**	0.099**	0.069	-0.003
	(0.024)	(0.036)	(0.040)	(0.039)	(0.047)	(0.035)
	[0.221]	[0.221]	[0.221]	[0.221]	[0.457]	[0.999]
Constant	3.024***	2.925***	3.332***	3.035***	1.222	0.032
	(0.889)	(1.029)	(1.178)	(1.118)	(1.348)	(0.924)
Strata	X	X	X	X	X	X
Controls	X	X	X	X	X	X
Mean	0.567	0.741	0.571	0.324	0.510	0.724
SD	0.157	0.294	0.183	0.468	0.382	0.349
Adj. R^2	0.381	0.130	0.226	0.186	0.142	0.133
School N	56	56	56	56	56	56
Teacher N	112	112	112	112	112	112
Class N	263	263	263	263	263	263
Student N	1,376	1,376	1,376	1,376	1,376	1,376

Notes: *P $<$ 0.10, **P $<$ 0.05, ***P $<$ 0.01. The sample includes students who participated in both the baseline and the follow-up surveys. The classes that received SRH education after observation began within a school are included. The mean and standard deviation of a baseline outcome of unobserved class students are presented. Student (sex, age, an ethnic minority dummy, social desirability score, and the baseline observation of the outcome), teacher (sex, age, a dummy for a health teacher, and a dummy for participating in the training session), class (whether SRH education was provided in the morning and the order of classes) characteristics, and School $\times$ Grade dummies are included as covariates. Standard errors, clustered at the class level, are in parentheses. Sharpened false discovery rate q-values (Benjamini et al., 2006) are in brackets.

Table 4.4: Effects of Classroom Observation on Students' SRH Attitudes toward Prevention Methods

	Mentioned means			Mentioned plan, now			Mentioned plan, adult		
	(1) Abst.	(2) Fid.	(3) Cont.	(4) Abst.	(5) Fid.	(6) Cont.	(7) Abst.	(8) Fid.	(9) Cont.
Observe	0.040*	0.010	0.003	0.044**	0.001	0.003	0.042**	0.015	-0.006
	(0.020)	(0.013)	(0.017)	(0.021)	(0.014)	(0.018)	(0.019)	(0.012)	(0.018)
	[0.221]	[0.999]	[0.999]	[0.221]	[0.999]	[0.999]	[0.221]	[0.743]	[0.999]
Constant	0.734	-0.294	0.384	0.900*	-0.204	0.307	0.573	-0.192	0.793
	(0.544)	(0.399)	(0.545)	(0.519)	(0.412)	(0.484)	(0.565)	(0.422)	(0.498)
Strata	X	X	X	X	X	X	X	X	X
Controls	X	X	X	X	X	X	X	X	X
Mean	0.369	0.118	0.191	0.356	0.122	0.193	0.338	0.103	0.172
SD	0.483	0.322	0.393	0.479	0.328	0.395	0.473	0.304	0.378
Adj. R^2	0.195	0.027	0.107	0.175	0.041	0.087	0.175	0.032	0.100
School N	56	56	56	56	56	56	56	56	56
Teacher N	112	112	112	112	112	112	112	112	112
Class N	263	263	263	263	263	263	263	263	263
Student N	1,376	1,376	1,376	1,376	1,376	1,376	1,376	1,376	1,376

Notes: *P $<$ 0.10, **P $<$ 0.05, ***P $<$ 0.01. The sample includes students who participated in both the baseline and the follow-up surveys. The classes that received SRH education after observation began within a school are included. The mean and standard deviation of a baseline outcome of unobserved class students are presented. Student (sex, age, an ethnic minority dummy, social desirability score, and the baseline observation of the outcome), teacher (sex, age, a dummy for a health teacher, and a dummy for participating in the training session), class (whether SRH education was provided in the morning and the order of classes) characteristics, and School $\times$ Grade dummies are included as covariates. Standard errors, clustered at the class level, are in parentheses. Sharpened false discovery rate q-values (Benjamini et al., 2006) are in brackets.

Table 4.5: Effects of Classroom Observation on Students' SRH Attitudes and Behavior

Panel A: Attitudes toward Teens' Sex	(1) OK with Anyone	(2) OK with Partner	(3) OK with Future Spouse	(4) Never until Adult	(5) Never until Marriage
Observe	0.003	-0.008	-0.015	0.007	0.022
	(0.009)	(0.009)	(0.013)	(0.020)	(0.023)
	[0.999]	[0.772]	[0.743]	[0.999]	[0.772]
Constant	0.287	-0.055	-0.551	1.072*	0.458
	(0.223)	(0.286)	(0.448)	(0.591)	(0.616)
Mean	0.050	0.041	0.108	0.454	0.372
SD	0.219	0.199	0.311	0.498	0.484
Adj. R^2	0.074	0.016	0.051	0.074	0.090
Student N	1,376	1,376	1,376	1,376	1,376

Panel B: Attitudes & Behavior	(1) OK for Teens to Remain as Virgin	(2) OK for Teens to Use a Condom	(3) Confident to Not Having STIs	(4) Confident to Refused Unwanted Sex	(5) Had Sex
Observe	-0.015	-0.022	-0.001	0.036	0.006
	(0.043)	(0.038)	(0.042)	(0.035)	(0.006)
	[0.999]	[0.999]	[0.999]	[0.772]	[0.772]
Constant	4.007***	2.772**	-0.241	0.629	-0.058
	(1.237)	(1.157)	(1.135)	(1.132)	(0.141)
Strata	X	X	X	X	X
Controls	X	X	X	X	X
Mean	2.921	2.489	3.564	3.466	0.042
SD	1.069	1.063	1.356	1.604	0.201
Adj. R^2	0.012	0.067	0.233	0.191	0.794
School N	56	56	56	56	56
Teacher N	112	112	112	112	112
Class N	263	263	263	263	263
Student N	1,376	1,376	1,376	1,376	1,180

Notes: *$P < 0.10$, **$P < 0.05$, ***$P < 0.01$. The sample includes students who participated in both the baseline and the follow-up surveys. The classes that received SRH education after observation began within a school are included. The mean and standard deviation of a baseline outcome of unobserved class students are presented. Student (sex, age, an ethnic minority dummy, social desirability score, and the baseline observation of the outcome), teacher (sex, age, a dummy for a health teacher, and a dummy for participating in the training session), class (whether SRH education was provided in the morning and the order of classes) characteristics, and School $\times$ Grade dummies are included as covariates. Standard errors, clustered at the class level, are in parentheses. Sharpened false discovery rate q-values (Benjamini et al., 2006) are in brackets.

Table 4.6: Heterogeneous Effects on Students' SRH Literacy

	Overall	Ch1: Risks of Unprotected Sex		Ch2: Preventing Means		
	(1) Index	(2) Teen Pregnancy	(3) STIs	(4) Abstinence	(5) Fidelity	(6) Contraceptives
Observe × Girl	0.148***	0.201***	0.086	0.444***	0.192***	-0.241***
	(0.047)	(0.068)	(0.065)	(0.080)	(0.071)	(0.071)
	[0.003]	[0.004]	[0.021]	[0.001]	[0.005]	[0.002]
Observe	-0.029	-0.182***	0.034	-0.134**	-0.030	0.123***
	(0.033)	(0.051)	(0.051)	(0.054)	(0.060)	(0.047)
Constant	3.232***	3.295***	3.490***	3.529***	1.357	-0.151
	(0.876)	(1.036)	(1.168)	(1.141)	(1.333)	(0.920)
Strata	X	X	X	X	X	X
Controls	X	X	X	X	X	X
lincom:						
b	0.120	0.019	0.120	0.310	0.162	-0.119
p-val	0.001	0.698	0.021	0.000	0.005	0.025
Mean	0.567	0.741	0.571	0.324	0.510	0.724
SD	0.157	0.294	0.183	0.468	0.382	0.349
Adj. R^2	0.373	0.115	0.224	0.170	0.141	0.131
School N	56	56	56	56	56	56
Teacher N	112	112	112	112	112	112
Class N	263	263	263	263	263	263
Student N	1,376	1,376	1,376	1,376	1,376	1,376

Notes: *P < 0.10, **P < 0.05, ***P < 0.01. The sample includes students who participated in both the baseline and the follow-up surveys. The classes that received SRH education after observation began within a school are included. The mean and standard deviation of a baseline outcome of unobserved class students are presented. Student (age, an ethnic minority dummy, social desirability score, and the baseline observation of the outcome), teacher (sex, age, a dummy for a health teacher, and a dummy for participating in the training session), class (whether SRH education was provided in the morning and the order of classes) characteristics, and School × Grade dummies are included as covariates. Standard errors, clustered at the class level, are in parentheses. The linear combinations of Observe × Girl and Girl are presented under $lincom$. Sharpened false discovery rate q-values (Benjamini et al., 2006) are in brackets.

Table 4.7: Heterogeneous Effects on Students' SRH Attitudes toward Prevention Methods

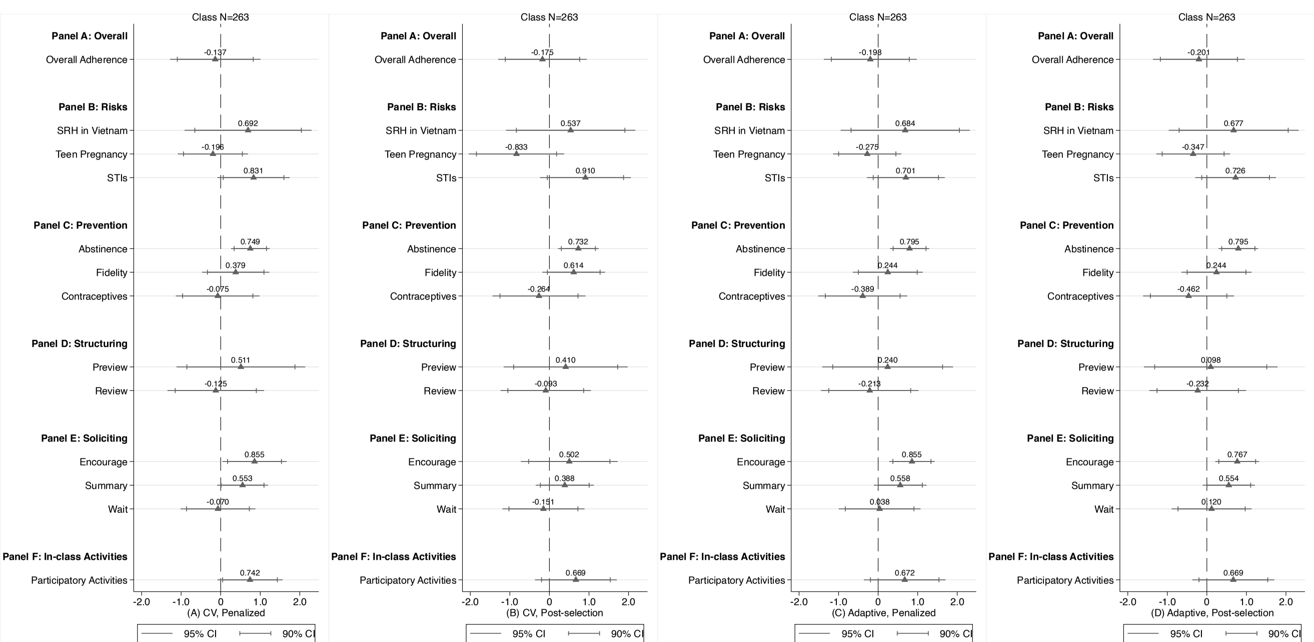
	Mentioned Means			Mentioned Plan, Now			Mentioned Plan, Adult		
	(1) Abst.	(2) Fid.	(3) Cont.	(4) Abst.	(5) Fid.	(6) Cont.	(7) Abst.	(8) Fid.	(9) Cont.
Observe × Girl	0.151***	-0.069**	-0.077**	0.174***	-0.077***	-0.123***	0.140***	-0.078***	-0.088***
	(0.036)	(0.029)	(0.032)	(0.035)	(0.025)	(0.033)	(0.041)	(0.028)	(0.031)
	[0.001]	[0.008]	[0.008]	[0.001]	[0.004]	[0.001]	[0.002]	[0.004]	[0.004]
Observe	-0.040	0.046**	0.043*	-0.048*	0.041**	0.067***	-0.033	0.056***	0.039
	(0.026)	(0.021)	(0.023)	(0.027)	(0.020)	(0.025)	(0.027)	(0.020)	(0.025)
Constant	0.975*	-0.369	0.274	1.126**	-0.283	0.206	0.810	-0.286	0.688
	(0.559)	(0.400)	(0.534)	(0.527)	(0.406)	(0.476)	(0.576)	(0.424)	(0.503)
Strata	X	X	X	X	X	X	X	X	X
Controls	X	X	X	X	X	X	X	X	X
lincom:									
b	0.111	-0.023	-0.034	0.126	-0.036	-0.056	0.107	-0.022	-0.048
p-val	0.000	0.192	0.140	0.000	0.036	0.022	0.000	0.204	0.033
Mean	0.369	0.118	0.191	0.356	0.122	0.193	0.338	0.103	0.172
SD	0.483	0.322	0.393	0.479	0.328	0.395	0.473	0.304	0.378
Adj. R^2	0.172	0.023	0.102	0.153	0.037	0.085	0.155	0.026	0.095
School N	56	56	56	56	56	56	56	56	56
Teacher N	112	112	112	112	112	112	112	112	112
Class N	263	263	263	263	263	263	263	263	263
Student N	1,376	1,376	1,376	1,376	1,376	1,376	1,376	1,376	1,376

Notes: *P $<$ 0.10, **P $<$ 0.05, ***P $<$ 0.01. The sample includes students who participated in both the baseline and the follow-up surveys. The classes that received SRH education after observation began within a school are included. The mean and standard deviation of a baseline outcome of unobserved class students are presented. Student (age, an ethnic minority dummy, social desirability score, and the baseline observation of the outcome), teacher (sex, age, a dummy for a health teacher, and a dummy for participating in the training session), class (whether SRH education was provided in the morning and the order of classes) characteristics, and School × Grade dummies are included as covariates. Standard errors, clustered at the class level, are in parentheses. The linear combinations of Observe × Girl and Girl are presented under $lincom$. Sharpened false discovery rate q-values (Benjamini et al., 2006) are in brackets.

Appendix

4.A Additional Figures and Tables

Figure 4.A.1: Effects of Classroom Observation on Teaching Adherence (Lasso Dependent Variables)



Notes: The figures plot the treatment effects of classroom observation on teaching adherence. The point estimates and their confidence intervals are presented. The sample includes classes of students who participated in both the baseline and the follow-up surveys. Only classes that SRH education was provided after observation began within a school are included in the sample. Dependent variables are LASSO predicted values where observer-evaluated adherence score is regressed on a total of 27 student-evaluated adherence items. Teacher (sex, age, a dummy for a health teacher, and a dummy for participating in the training session), class (whether SRH education was provided in the morning and the order of classes), and enumerator (IPIP personality traits from Goldberg et al. (2006) and ages of enumerators who conducted the exit survey) controls are included in the model besides School $\times$ Grade strata dummies to increase precision. Standard errors are clustered at the teacher level.

Table 4.A.1: The LASSO Out-of-Sample Mean Squared Error

	Benchmark	CV-based LASSO		Adaptive LASSO	
	(1) OLS	(2) Penalized	(3) Post-selection	(4) Penalized	(5) Post-selection
Panel A: Overall					
Overall Adherence	0.015	0.012	0.013	0.013	0.013
Panel B: Risks					
SRH in Vietnam	0.093	0.074	0.080	0.081	0.087
Teen Pregnancy	0.015	0.014	0.013	0.014	0.015
STIs	0.071	0.064	0.068	0.067	0.069
Panel C: Prevention					
Abstinence	0.083	0.076	0.088	0.088	0.089
Fidelity	0.183	0.098	0.105	0.101	0.102
Contraceptives	0.097	0.055	0.057	0.058	0.058
Panel D: Structuring					
Preview	0.069	0.041	0.047	0.046	0.053
Review	0.089	0.091	0.093	0.095	0.097
Panel E: Soliciting					
Encourage	0.094	0.044	0.049	0.044	0.043
Summary	0.080	0.057	0.058	0.061	0.062
Wait	0.433	0.188	0.202	0.191	0.197
Panel F: In-class Activities					
Participatory Activities	0.042	0.025	0.029	0.029	0.029

Notes: The LASSO out-of-sample mean squared errors are reported. As a benchmark, out-of-sample mean squared errors of OLS are presented in Column 1.

Table 4.A.2: Balance Test for Additional Variables: Students

	Unobserved		Observed		Difference
	(N=685)		(N=691)		(N=1,376)
	Mean	SD	Mean	SD	p-value
10 Years Old	0.03	0.18	0.02	0.16	0.411
11 Years Old	0.16	0.37	0.15	0.35	0.530
12 Years Old	0.31	0.46	0.31	0.46	0.496
13 Years Old	0.24	0.43	0.24	0.43	0.787
14 Years Old	0.25	0.43	0.27	0.45	0.374
Mother Alive	0.99	0.09	0.99	0.12	0.453
Father Alive	0.98	0.15	0.96	0.19	0.110
Living with Both Parents	0.89	0.31	0.88	0.32	0.388
Living with Mother Only	0.05	0.22	0.05	0.22	0.811
Living with Father Only	0.02	0.16	0.03	0.18	0.486
Living with Other Caregiver	0.03	0.16	0.03	0.18	0.576
Study after School (range 1–5)	3.10	1.38	3.26	1.36	0.025
Satisfied with School (range 1–5)	4.72	0.59	4.72	0.60	0.974
Life Satisfaction, Present (range 1–9)	6.47	1.63	6.43	1.64	0.363
Life Satisfaction, 5 Years Later (range 1–9)	7.25	1.53	7.43	1.39	0.080
Self-esteem	0.70	0.20	0.71	0.18	0.192
Self-efficacy	0.69	0.14	0.70	0.14	0.157
Self-reported Health (range 1–5)	3.58	0.78	3.58	0.79	0.685
Number of Meals per Day	2.83	0.55	2.84	0.62	0.947
HRQoL	0.68	0.11	0.70	0.10	0.030
HRQoL: Physical	0.72	0.15	0.73	0.15	0.419
HRQoL: Emotional Well-being	0.74	0.15	0.75	0.15	0.359
HRQoL: Self-esteem	0.53	0.20	0.55	0.20	0.149
HRQoL: Family	0.80	0.15	0.81	0.15	0.125
HRQoL: Friends	0.73	0.16	0.76	0.16	0.006
HRQoL: School	0.57	0.17	0.58	0.17	0.446
Have Heard of HIV/AIDS	0.91	0.28	0.93	0.25	0.296
Have Friends/Relatives Died from HIV/AIDS	0.06	0.23	0.07	0.26	0.189
Knowing Unprotected Sex May Cause Pregnancy	0.91	0.28	0.90	0.30	0.310
Knowing a Condom Prevents Unwanted Pregnancy	0.83	0.37	0.83	0.37	0.960
Knowing Paths of HIV Transmission	0.31	0.46	0.37	0.48	0.023
Confident Not to Get Infected with HIV/AIDS (range 1–4)	3.62	1.34	3.68	1.34	0.515
OK for Teens Remaining Virgin (range 1–4)	2.95	1.09	2.97	1.08	0.836
OK for Teens Using a Condom (range 1–4)	2.51	1.06	2.49	1.06	0.571
Confidence to Refuse Unwanted Sex (range 1–5)	3.55	1.57	3.62	1.55	0.369
Joint Orthogonality Test					0.265

Notes: The sample includes students who participated in both the baseline and the follow-up surveys from classes where SRH education was provided after observation began within a school. The p-values from the null hypothesis test that $H_0 : \beta_1 = 0$ in the regression Variable $= \beta_0 + \beta_1 \times$ Observed Class $+$ Strata Dummies $+ \epsilon$ are reported. The joint orthogonality test row reports the p-value from F-test for all variables presented in the table.

Table 4.A.3: Survey Completion

	Unobserved (1)	Observed (2)	Difference (3)	Total (4)
Panel A: Students Surveyed				
Baseline	743	741	-2	1,484
Follow-up	685	691	6	1,376
Percent Followed	0.922	0.933	0.011 (0.013)	0.927

Notes: *P $<$ 0.10, **P $<$ 0.05, ***P $<$ 0.01. The sample includes the RCT sample students who received SRH education after completing the baseline survey. The regression results are estimated from the equation Attrition $= \beta_0 + \beta_1 \times$ Observed Class $+ \epsilon$. Standard errors are in parentheses.

Table 4.A.4: Effects of Classroom Observation on Students' SRH Literacy without Controls

	Overall	Ch1: Risks of Unprotected Sex		Ch2: Preventing Means		
	(1) Index	(2) Teen Pregnancy	(3) STIs	(4) Abstinence	(5) Fidelity	(6) Contraceptives
Observe	0.039	-0.055	0.068*	0.080**	0.062	-0.015
	(0.025)	(0.035)	(0.037)	(0.040)	(0.046)	(0.032)
	[0.725]	[0.725]	[0.725]	[0.725]	[0.807]	[0.999]
Y^B	0.518***	0.208***	0.352***	0.313***	0.319***	0.325***
	(0.028)	(0.028)	(0.029)	(0.030)	(0.028)	(0.030)
Constant	0.768***	0.803***	0.500*	0.412	0.518*	0.056
	(0.199)	(0.115)	(0.273)	(0.439)	(0.266)	(0.184)
Strata	X	X	X	X	X	X
Mean	0.567	0.741	0.571	0.324	0.510	0.724
SD	0.157	0.294	0.183	0.468	0.382	0.349
Adj. R^2	0.354	0.100	0.213	0.138	0.127	0.124
School N	56	56	56	56	56	56
Teacher N	112	112	112	112	112	112
Class N	263	263	263	263	263	263
Student N	1,376	1,376	1,376	1,376	1,376	1,376

Notes: *P $<$ 0.10, **P $<$ 0.05, ***P $<$ 0.01. The sample includes students who participated in both the baseline and the follow-up surveys. The classes that received SRH education after observation began within a school are included. The mean and standard deviation of a baseline outcome of unobserved class students are presented. School $\times$ Grade strata dummies are included in the model. Standard errors, clustered at the class level, are in parentheses. Sharpened false discovery rate q-values (Benjamini et al., 2006) are in brackets.

Table 4.A.5: Effects of Classroom Observation on Students' SRH Attitudes without Controls

	Mentioned Means			Mentioned Plan, Now			Mentioned Plan, Adult		
	(1) Abst.	(2) Fid.	(3) Cont.	(4) Abst.	(5) Fid.	(6) Cont.	(7) Abst.	(8) Fid.	(9) Cont.
Observe	0.031	0.013	0.002	0.039**	0.003	-0.000	0.036*	0.010	-0.010
	(0.020)	(0.012)	(0.016)	(0.020)	(0.013)	(0.017)	(0.019)	(0.012)	(0.017)
	[0.725]	[0.950]	[0.999]	[0.725]	[0.999]	[0.999]	[0.725]	[0.999]	[0.999]
Y^B	0.307***	0.147***	0.321***	0.311***	0.084***	0.255***	0.293***	0.135***	0.291***
	(0.027)	(0.034)	(0.037)	(0.031)	(0.030)	(0.033)	(0.030)	(0.037)	(0.032)
Constant	0.666***	-0.003	0.169***	0.663***	-0.001	0.186***	0.741***	-0.002	0.253***
	(0.114)	(0.005)	(0.065)	(0.112)	(0.003)	(0.070)	(0.083)	(0.004)	(0.090)
Strata	X	X	X	X	X	X	X	X	X
Mean	0.369	0.118	0.191	0.356	0.122	0.193	0.338	0.103	0.172
SD	0.483	0.322	0.393	0.479	0.328	0.395	0.473	0.304	0.378
Adj. R^2	0.153	0.017	0.098	0.136	0.021	0.077	0.135	0.018	0.091
School N	56	56	56	56	56	56	56	56	56
Teacher N	112	112	112	112	112	112	112	112	112
Class N	263	263	263	263	263	263	263	263	263
Student N	1,376	1,376	1,376	1,376	1,376	1,376	1,376	1,376	1,376

Notes: *P $<$ 0.10, **P $<$ 0.05, ***P $<$ 0.01. The sample includes students who participated in both the baseline and the follow-up surveys. The classes that received SRH education after observation began within a school are included. The mean and standard deviation of a baseline outcome of unobserved class students are presented. School $\times$ Grade strata dummies are included in the model. Standard errors, clustered at the class level, are in parentheses. Sharpened false discovery rate q-values (Benjamini et al., 2006) are in brackets.

Table 4.A.6: Placebo Test Results

(1) Student Outcomes	(2) Difference	(3) N
Panel A: Knowledge		
Overall	0.084 (0.183)	187
Teen Pregnancy	0.490 (0.318)	187
STIs	0.158 (0.296)	187
Abstinence	0.048 (0.290)	187
Fidelity	-0.299 (0.298)	187
Contraceptives	0.481** (0.239)	187
Panel B: Mentioned Means		
Abstinence	0.109 (0.148)	187
Fidelity	0.115 (0.089)	187
Contraceptives	0.091 (0.118)	187
Panel C: Mentioned Plan, Now		
Abstinence	0.190 (0.152)	187
Fidelity	0.015 (0.093)	187
Contraceptives	0.040 (0.132)	187
Panel C: Mentioned Plan, Adult		
Abstinence	0.082 (0.146)	187
Fidelity	0.075 (0.097)	187
Contraceptives	0.073 (0.118)	187

Notes: *P $<$ 0.10, **P $<$ 0.05, ***P $<$ 0.01. The DID_M placebo test results from de Chaisemartin and D'Haultfœuille (2020b) are presented. Standard errors are in parentheses.

4.B Marlowe-Crowne Module

An 11-Item Marlowe-Crowne module and Socially Desirable Answers (Reynolds, 1982)

1. It is sometimes hard for me to go on with my work if I am not encouraged (False)
2. I sometimes feel resentful when I don't get my way (False)
3. No matter who I'm talking to, I'm always a good listener (True)
4. There have been occasions when I have taken advantage of someone (False)
5. I'm always willing to admit it when I make a mistake (True)
6. I sometimes try to get even rather than forgive and forget (False)
7. I am always courteous, even to people who are disagreeable (True)
8. I have never been irked when people expressed ideas very different from my own (True)
9. There have been times when I was quite jealous of the good fortune of others (False)
10. I am sometimes irritated by people who ask favors of me (False)
11. I have never deliberately said something that hurt someone's feelings (True)

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