The Role of Educational Intervention in Eliminating Knowledge Barriers on Energy And Energy-Efficient Decision-Making in Young People

Massimo Filippini, Chair of Energy and Public Economics (ETH Zurich), +41446320649, mfilippini@ethz.ch
Bigyan Babu Regmi, Center for Energy Policy and Economics (ETH Zurich), +41778124404, bregmi@ethz.ch
Suchita Srinivasan, Center for Energy Policy and Economics (ETH Zurich) and University of Otago, ssrinivasan@ethz.ch

Overview

To fight climate change, it is necessary to promote the adoption of renewable energy sources and energy-efficient technologies/behaviors by all agents of society, including households and individuals. Achieving this would require that individuals and households are aware of the environmental impact of their decisions, and that they have the skills to make investments in energy efficiency (through their choice of energy-efficient durable) that can have consequences on their levels of energy consumption for several years. A basic determinant of this is that households and individuals have a high level of "energy-related financial literacy", i.e., as defined by Blasch et. al. (2021) "the combination of energy cost-specific knowledge, financial literacy and cognitive abilities that are needed to take decisions with respect to the investment for the production of energy services and their consumption."

One of the ways in which the energy-related financial literacy can be enhanced among individuals is through educational interventions (Filippini et. al., 2020; Blasch et. al, 2021; Brent and Ward, 2018). Such educational tools can be particularly effective and sensible to implement among young people as (1) targeted courses such as multi-dimensional energy-related program can be integrated into the existing curriculum at minimal cost (2) young people have a longer time horizon for consumption and educating them early on about energy and sustainability could make them develop more efficient consumption habits.

There are a number of studies based on randomized controlled trails (RCTs) that try to identify the impact of financial literacy programs on the level of student's financial knowledge. (Bruhn et al., 2016; Berry et al., 2018; Banarjee et al., 2007). However, studies that evaluate the impact of educational programs on combination of energy-related financial literacy and sustainability literacy (which can collectively be called multi-dimensional energy-related literacy) are missing in the literature.

Against this backdrop, through an RCT among high schools students in Kathmandu, Nepal, our study aims to assess (1) the impact of a multi-dimensional education program on the energy-related financial literacy level of students, (2) the impact of such program in the ability of student's to apply energy-related financial concepts, and (3) the impact of the intervention in the choice of motorbikes depicted through a hypothetical choice experiment.
As a first of its kind in the developing country setting, this paper fills the gap in the literature by evaluating an RCT-based study in energy-related financial literacy program inform policymakers in making effective policies to enable energy-efficient consumption behaviour among young people.

Methods

In this study, an RCT among 1320 high school students in Kathmandu is adopted as the primary experimental method to achieve the research objectives. The randomization was done at the school level among where a half of the total classes from grade 12 in each school were assigned to the treatment group and the other half to the control group, 20 classes in each cohort in total (~660 students each). The treated sections go through three different recorded video lessons on financial literacy, energy-related financial literacy, and sustainability literacy (20-minutes long, in total). The control sections go through a similar-length video lessons on topics that are irrelevant to the study. Immediately after the lessons, students answer 17 questions on the above-mentioned topics of literacy, individual/socio-economic questions, and a choice question on two different motorbikes with varying level of energy efficiency. Incentives, in the form of lottery prizes, were put in place to minimize attrition.

Balance test on observables were performed across various individual and household-level characteristics, and there were no significant differences between the treatment group and the control group.
The collected data is analyzed using the following potential outcome framework:

$$Y_i = \alpha + \beta D_i + \mu \quad (1)$$

$$\beta = E[y_i|D_i = 1] - E[y_i|D_i = 0] \quad (2)$$

Where the outcome variable Y_i is either of knowledge (total literacy score), application skills (score in calculation-based questions), and choice (hypothetical choice of motorbike), and D_i is an indicator for treatment, which takes the

value of 1 if the subject is treated and 0 otherwise. When the outcome variable is a count variable, we apply OLS regression and ordered probit regression models to estimate the results, whereas for binary outcome variables we adopt a logistic regression method.

Results

Table 2 shows the main results of the study, with average treatment effects on three different outcomes: knowledge, application, and bike choice. Standard errors are clustered at the school level for all models presented, and the results do not differ when clustering is done at the class level.

Table 2: Treatment effects on three different dependent variables

Dependent variable	**OLS (I)**	**OLS (II)**	**Ordered Probit (I)**	**Ordered Probit (II)**	**Logit (I)**	**Logit (II)**
Knowledge	7.860***	7.329***	2.461***	2.313***	-	-
	(0.148)	(0.501)	(0.309)	(0.196)		
Application	1.729***	1.628***	1.476***	1.418***	-	-
	(0.064)	(0.158)	(0.066)	(0.114)		
Bike choice	0.247***	0.170***	-	-	1.009***	0.698***
	(0.027)	(0.0470)	-	-	(0.114)	(0.195)
Socio-economic controls	x	✓	x	✓	x	✓
Academic ability	x	✓	x	✓	x	✓
Bike ownership	x	✓	x	✓	x	✓
Participation in family-level decision-making	x	✓	x	✓	x	✓
Observations	1307	1307	1307	1307	1307	1307

*Note: The independent variable is the treatment. Robust std. errros are in parentheses, and *, **, and *** denote significance at 10%, 5%, and 1% level, respectively.*

Given the outcome variables, column 2-3, 4-5, and 6-7 present the estimates from OLS, ordered probit, and logit specification respectively. The table presents estimates for each specifications with and without relevant controls included, which are mentioned in the bottom rows of the table. As shown in columns 2-7, the treatment has a significant positive effect on student's knowledge in energy, finance, and sustainability. Similarly, the treatment also has a distinct positive impact on both the ability of students to apply energy-related concepts and make energy-efficient decision-making, indicated by their performance in the applications-based questions and the hypothetical choice of motorbike.

Although not presented in detail in Table 2, the results also reveal a few interesting outcomes. For instance, female participants tend to have a higher improvement in the literacy level as a result of the treatment compared to the male counterparts. Also, in the ordered probit model, decision variable (a dummy variable which takes the value of 1 if the individual reports participation in decision-making process in the household and 0 otherwise) when interacted with the treatment variable shows a positive result in the improvement of literacy score -- suggesting young people who participate at the household-level decision-making are more likely to grasp the educational treatment. This evidence is also uniform in the choice of motorbike, where individuals who participate in joint decision-making and receive the treatment are more likely to choose an energy-efficient bike model.

Conclusions

As one of the first studies to assess the impact of energy-related financial education program for high school students in a developing country setting, our study contributes to fill the gap in both the literature and policy instigation. Due to nature of our study, we cannot claim the long-term and medium-term effects of the program, however the short-term effects of the intervention points towards a crucial imperative for energy-related educational programs for young people. As a small scale RCT, our results are internally valid, although the (magnitude of) the results in the wider context with varying geography and population might be different. While we see the effect of treatment to have significant positive impact on energy-efficient choices of students, more real-life experiments in this direction would augment the preliminary findings of this study.