In-person vs. mobile business training, what works better for women entrepreneurs in Ethiopia

Pre-Analysis Plan

September 2023

Abstract: This document outlines the pre-analysis plan for a randomized controlled trial evaluating the impact of offering in-person and mobile business training to female business owners based in Addis Ababa, Ethiopia. This plan was created while follow-up data collection was ongoing, before the follow-up data was analyzed.

1. Introduction

At least US$1 billion is spent annually training potential and existing entrepreneurs in developing countries (McKenzie 2021). Classroom-based business training is one of the most popular tools to help small firms around the world. A key policy question is how to scale such a training to serve many small firms in developing countries at an affordable cost. Digital technologies offer an alternative solution to help scale business training. First, through a web platform or a phone-based application, training can be provided at a close to zero marginal cost to as many firms as desired. Second, digital training can offer users full flexibility in terms of location and time, which could be particularly relevant for women business owners who might be affected by mobility constraints or demands from household work. These advantages need to be weighed against the drawbacks of online education. Most importantly, access to digital training requires cellphone ownership and internet connection. It also requires at least some basic knowledge of digital tools. If training is provided via an app or web platform on an individual basis, the learning process might be affected by the lack of interaction with trainers or other peers. This could generate higher dropout rates than for classroom-based training programs (already around 35% on average as surveyed in McKenzie and Woodruff 2014) given that there is no peer pressure or a clear schedule of classes. Another open question is the profile of business owners that select into in-person versus online training given these factors, and which of these profiles have higher returns to training in terms of knowledge acquisition, ability to implement new practices, and returns to those practices within their firms.

This randomized controlled trial intends to measure the effects of an e-learning app for women entrepreneurs and compare it with in-person training including similar content. The phone-based application contains the materials of an international course designed to help women business owners expand their business. Its content has been customized to the local context faced by women entrepreneurs in Ethiopia. The in-person training will use the same curriculum as the e-learning app.

2. Context

Ethiopia's first National Entrepreneurship Strategy was presented in August 2019. The strategy outlines an ambitious agenda to review regulations, increase access to finance for startups, expand opportunities for business training, and promote a culture of entrepreneurship. However, it is unclear how much these interventions will benefit women-led businesses. Women-led firms are outperformed by male-led firms, with the difference in profits linked to the fact that they work on less profitable sectors and invest less in their business (World Bank 2019). This could be due to women entrepreneurs being more credit constrained

than male entrepreneurs; they are less likely to receive loans and often get smaller loans (World Bank, 2019b). Lower levels of technical and business education matter, too. According to government data, 50 percent of women have no education at all, compared to 30 percent of men; and while 69 percent of men are literate, only 42 percent of women are (CSA 2016). Given this educational differential it is not surprising that women's lack of business skills is cited as an important determinant of low returns for women entrepreneurs in Ethiopia (Melat 2015).

3. Study design

3.1. Intervention

This project is offering three interventions: an e-learning entrepreneurship app for smartphones, virtual interaction in chat rooms, and in-person business training covering the same content as the app.[1]

(i) **E-learning app only (T1):** The e-learning app has been developed by an international company, pioneer in mobile learning. It is based on material used in preparatory courses for MBA programs, which has been adapted and translated to the needs of Ethiopian women business-owners. The content of the app aims to fill a gap at the higher end of business education, with a focus on slightly more advanced learning for successful entrepreneurs in comparison to the material offered by 'traditional' training courses. One distinctive feature of the app is a 'gamified', interactive experience that has the user work through a series of small problems rather than retain information from video lectures or readings. This interactive, gamified, feature might help motivate participation and reduce the risks of low usage (see Lafortune et al. 2022 for an RCT testing a gamified e-learning entrepreneurship program for students in Rwandan schools). The app contains 13 foundational modules that includes introductions to accounting, marketing and teamworking and are self-paced.

(ii) **E-learning app + Networking (T2): The second intervention is a** networking intervention, which will be offered only in combination with the e-learning app. Women are invited to participate in Telegram groups of 25 training participants. To foster interaction, each week a moderator sends out a motivation question across all groups related to the material covered in the modules of the app. This is the only role of the moderator, to make the intervention cheap and as scalable as possible.

(iii) **In-person training (T3):** the in-person training is delivered by a local training provider with demonstrated experience in business training. The training course includes the same content as the app and is delivered in 6 weeks (twice per week for a total of 12 sessions) for each class of 25 randomized participants. These trainings are staggered so that only 5 classes are running at a time.

3.2. Sample and randomization

[1] A second experiment will also test the effectiveness of a lower-cost version of the program. A group of additional 228 women who were eligible and expressed interested in the program were randomized into two groups. All 228 women were sent their log-in credentials via text, along with an FAQ page and a guidance document on how to install and run the app. However, one half of the group (N=114) would also receive three weekly phone calls to get one-on-one support on how to use the app. The goal is to produce a cost-benefit analysis of the information sessions, where the main goal was to provide help in downloading the app.

Given the context described above, the most relevant target for the e-learning app is the group of women entrepreneurs, business owners or managers who have a smartphone, some basic access to the internet and a relatively high level of education. The World Bank's Women Entrepreneurship Development Project (WEDP) has registered more than 40,000 women business owners in its Management Information System (MIS), out of which about 14,000 are based in Addis Ababa. To construct our sampling frame, we first conducted a screening interview with almost all the 14,000 women entrepreneurs based in Addis Ababa to determine their eligibility and interest in the e-learning app. Specifically, the eligibility criteria were that the individual must: i) have access to and know how to use a smartphone; ii) have access to internet; iii) have completed high school education; iv) be a business owner or active manager; v) have 30 or fewer employees in their business and; (vi) be able to understand either English or Amharic.

Respondents meeting the eligibility criteria were asked at the end of the screening if they were interested in a free of cost business training mobile app. If they said yes, they were then invited to attend information sessions with a travel compensation. Information sessions were held every month for four months from March 2023 to June 2023 to reach a sample size of 2000 women. In every session that women attended (which ranged from 8 people attending to 40), women were first given a brief orientation about the experiment and randomization process and were then asked to complete a baseline survey on their phone. Once the survey was completed by participants, they were invited one by one to pick a token from an urn. Moderators placed equal numbers of four different tokens representing the three treatment groups and one control group.[2]

The four groups were: a) Access to the e-learning app only (N=495); b) Access to the e-learning app + networking (N=502); c) Access to an in-person training (N=520); and d) Access to the e-learning app after the last follow-up survey (control) (N=483). Once women were randomized, only women assigned to receiving access to the e-learning app were given an orientation on the app, where moderators also helped every woman download the app and log in. Women assigned to the in-person training were told that they would receive more details on when and where the in-person business training would happen.

The first follow-up survey for the 2000 women is currently on-going. As the orientation sessions and in-person training was staggered in batches, the current follow-up survey will target those oriented in March and April 2023, and target those oriented in May and June 2023 three months later. The follow-up survey is a phone-based, 20-minute survey to capture the main key business outcomes.

3.3. Key data sources

Baseline Survey

March 2023-June 2023, N=2000. The baseline survey includes questions about the respondent and their household characteristics; their primary and secondary business characteristics and performance; business practices; access to finance; networks; digital skills, and an entrepreneurial self-efficacy scale.

Follow-up Survey

September 2023-January 2024, target N=2000. This is an abbreviated version of the baseline survey, but includes some extra questions. Modules included: demographic information, current business characteristics, business performance, business practices, access to business finance, networks, digital skills, and intervention take-up

[2] If the number of participants was a multiple of four, then the same number of tokens were added, and if not, then the closest multiple of 4 that was higher than the number of participants was used (eg. If 30 participants attended, then 32 tokens were placed in the urn where each treatment group was represented by 8 tokens).

Administrative data

(i) E-learning admin data: March 2023 - present (ongoing), N=997 (495 from T1 and 502 from T2). Automated admin data that shows number of modules completed, number of lessons completed, and last log-in attempt.

(ii) Networking data: March 2023 – August 2023, N=502 (T2 only). Individual-level participation (0/1) in telegram groups as recorded by moderators. It also includes data on number of messages posted by each person and the topic of the message (business, personal). If participation in networking is low, we will use the binary variable for the main analysis.

(iii) In-person attendance data: April 2023-September 2023, N=483 (T3 only). Attendance data recorded by in-person trainers.

3.4. Research questions and hypotheses

This study design will allow us to answer the following research questions:

(i) What are the impacts of business training on business outcomes for women-owned firms?

(ii) What is the impact of the training modality (in-person vs. app-based training on take-up, learning, business practices and business performance?

4. Analysis

4.1. Variable lists

Entrepreneur characteristics

- Age (years)
- Post-secondary education (0/1)
- Has children (0/1)
- Household size (number of individuals, integer)
- Head of household (0/1)
- Household income, last month (total; ETB)
- Number of businesses owned in lifetime including current (integer)
- Digital Skills

Firm characteristics

- If business is over 5 years old (0/1)
- If business is in the trade sector (0/1)
- If business is in the services sector (0/1)

Primary outcomes

Training take-up

- Number of courses/classes completed/attended (integer)
- Completed/attended at least 2 courses/classes (0/1)
- Completed/attended at least 8 courses/classes (0/1)

Business Survival

- Owner has at least one business (0/1)

Business performance

- Profits (last 30 days; main business, and across all businesses; ETB)
- Revenues (last 30 days; main business, and across all businesses; ETB)

Secondary outcomes

Business inputs

- Number of employees (integer)
- Number of hours worked on business in a typical week (integer)
- Number of hours business is open in a week (integer)

Capital

- Assets (current value of business premises, machines, total value of inventory/stock, ETB)
- The business made a large investment in capital over the past 6 months (0/1)
- Capital investments over the past 6 months, (total, ETB)

Business knowledge and practices

- Fraction of 9 business practices followed (studied by McKenzie and Woodruff, 2017) (%).
- Fraction of correct answers out of 3 knowledge questions pulling from the training content (%)

We will winsorize at the 99th percentile all quasi-continuous variables (e.g. age) and continuous variables (e.g. profits). For variables in ETB, we will also use the inverse hyperbolic sine transformation.

4.2. Balance

We will test for balance between the three treatment groups (T1, T2, T3) and control (C) group of the 2000 women in the IE sample. Tested variables will include the lists of baseline respondent and firm characteristics, as well our primary and secondary outcome variables as measured at baseline, all as specified above.

For each tested variable, we will present the sample mean, i.e. the mean in T1, T2, T3 and C, and a t-test of equality of the T1, T2, T3, and C- group means. We will also report an F-test of joint significance of the t-tests across all tested variables.

4.3. Attrition

To test for differential attrition, we will regress a dummy for not answering each of the follow-up surveys on, baseline characteristics and the interaction of treatment and baseline characteristics, controlling for strata treatment assignment dummies. We will conduct a joint test of significance for all interaction terms, separately for each treatment arm.

If treatment status does not affect survey attrition at the 5% significance level and it is not significantly different across treatment arms, then we will not adjust the estimates for attrition.

If treatment status does have a statistically significant effect on survey attrition, we will test the robustness of our results using Lee bounds.

4.4 Impact analyses

Our main estimations will use the following ANCOVA specification:

$$Y_{i,t=1} = \beta_0 + \beta_1 T1_i + \beta_2 T2_i + \beta_3 T3_i + \beta_4 Y_{i,t=0} + \beta_5 M_{i,t=0} + \beta_6 X'_{i,t=0} + \beta_7 S_i + \mu_i + \varepsilon_{it} \quad (1)$$

Where:

$Y_{ib,t=1}$ is the outcome variable measured at endline. We will estimate Equation (1) for each of the primary and secondary outcomes as specified above.

$T1_{ib}$, $T2_{ib}$, $T3_{ib}$ are dummy variables taking the value of one if the individual was in treatment group 1 ,2, or 3 respectively.

β_1, β_2, and β_3 will measure the intent-to-treat effect of being assigned to receiving access to the app, access to the app with networking, and access to the in-person training, compared to the control group respectively.

$Y_{ib,t=0}$ is the baseline value of the outcome variable, set to zero for missing values. If a very similar but non-identical question was asked at baseline (e.g., the same outcome but for a different recall period), we will control for the similar variable as measured at baseline instead.

$M_{i,t=0}$ is a dummy variable indicating whether the baseline value is missing.

$X'_{ib,t=0}$ is a vector of any baseline control variables identified as unbalanced above.

S_i is a vector of strata dummies used in the randomization.

ε_i is the error term, robust to individual heteroskedasticity (i.e., clustered at the individual level, since treatment was randomized at that level).

Huber White standard errors that are robust to heteroskedasticity will be used.

We can also estimate a local average treatment effect of actually using the e-learning app, participating in the networking intervention, and attending in-person sessions by instrumenting the assignment to treatment dummies with proxies for usage of the e-learning app (at least two courses completed), networking (at least 1 message sent) and in-person (at least 1 session attended). Given that there will be no always takers (no control participant will be able to use the app after module 1 or to send messages in program chat rooms), the local average treatment effect will be equal to the treatment effect on the treated.

4.5 Item non-response

Many of our outcome variables are only observed among those respondents whose business is still open at endline: for example, a respondent's profits cannot be observed if her business closed since baseline. For such variables, we will estimate: (i) unconditional regressions, in which we will treat such observations as being zero by definition; for example, coding zero profits for those whose businesses closed since baseline; and (ii) conditional regressions, treating such observations as missing and hence dropping them from the estimation in question. We will test to see if closure is statistically significantly related to treatment status using the same methodology as in the survey attrition section. If the treatment status does not have an effect on closure at the 5% level, then no corrections will be made. If the treatment status does significantly affect closure, then we will test the robustness of our results using Lee bounds.

4.6. Questions with Limited Variation

Questions for which 95 percent of observations have the same value within the relevant sample will be omitted from the analysis and will not be included in any indicators or hypothesis tests. In the event that omission decisions result in the exclusion of all constituent variables for an indicator, the indicator will not be calculated.

4.7 Heterogeneity

We will re-estimate the above equations with an interaction between treatment and the following variables (using an indicator variable for below/above median in IE sample for continuous variables):

- Baseline business sector (trade; services) (0/1)
- Baseline profits
- Digital skills score
- If respondent has completed post-secondary education (0/1)

4.8 Multiple hypotheses testing

We have identified a set of primary outcomes above. We will follow the methodology of Kling, Katz and Liebman (2007) to test the significance of families of outcomes in a single aggregate. For each family of outcomes described above, we will:

1) Convert all outcomes so that the sign of all of the variables in a family goes in the same direction

2) Calculate the z-score of each variable by subtracting the control group mean and dividing by the control group standard deviation

3) Take an average of the z-scores in the family

Secondly, we will control for multiple inference by calculating q-values for coefficients of interest within the families of outcome variables specified above (survival; performance; inputs; capital; practices), limiting the false discovery rate (FDR) using the method proposed by Benjamini and Hochberg (1995). We will report both uncorrected p-values and FDR-adjusted q-values for each regression. For heterogeneity analyses, we will also correct p-values for each interaction of the treatment with the heterogeneity variable in question across the regressions with outcome variables within each family.