Policy Research Working Paper 10992

Testing the Promise of Digital Scaling

In-Person versus App-Based Training for Women Entrepreneurs

Rachel Cassidy
Menaal Ebrahim
Diego Ubfal

WORLD BANK GROUP
Gender Group
December 2024

Policy Research Working Paper 10992

Abstract

Business training has long been a staple of development policy, with annual expenditures exceeding US$ 1 billion in low- and middle-income countries. The vast majority of training is delivered in person, but there is growing interest in alternative modalities to deliver at scale. Digital delivery offers the potential to enhance impact, cost-effectiveness, and accessibility—especially for women, who may face constraints on their time and mobility. Challenges may include gaps in digital skills and ensuring participants' engagement. This study conducted a randomized controlled trial to evaluate a business training program targeted at women entrepreneurs in Ethiopia. The paper tests two modalities: a smartphone app or in-person sessions, versus a control group. The findings reveal high initial take-up rates for both modalities (over 75 percent), but a significant disparity in completion rates (22 percent for the digital training, versus 71 percent for the in-person training). These results suggest that the potential of digital platforms for scaling up business training must be carefully tested and treated with caution. Despite the high take-up of in-person training, negligible impacts are observed on business practices and performance from either modality. This finding underscores the stylized fact that business training alone may offer limited benefits for women entrepreneurs.

This paper is a product of the Africa Gender Innovation Lab, Gender Group. It is part of a larger effort by the World Bank to provide open access to its research and make a contribution to development policy discussions around the world. Policy Research Working Papers are also posted on the Web at http://www.worldbank.org/prwp. The authors may be contacted at dubfal@worldbank.org. A verified reproducibility package for this paper is available at http://reproducibility.worldbank.org, click **here** for direct access.

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Rachel Cassidy, Menaal Ebrahim and Diego Ubfal*

Keywords: entrepreneurship, training, digital, gender, field experiments
JEL Codes: C93, J16, L26, O12

*Cassidy: World Bank, International Finance Corporation; Ebrahim: World Bank; Ubfal: World Bank, corresponding author, dubfal@worldbank.org. We thank Toni Johannes Weis for excellent project management and Tsedey Asheber for excellent field coordination. We thank Girum Abebe, Shanthi Manian, David McKenzie and Sreelakshmi Papineni for useful comments. Funding for this study was provided by Global Affairs Canada under the Innovations in Financing Women Entrepreneurs (IFWE) project, as well as the World Bank Umbrella Fund for Gender Equality (UFGE) and other World Bank sources. This paper is a product of the Gender Innovation Lab, within the Office of the Chief Economist for the Africa Region. The findings, interpretations, and conclusions expressed in this work do not necessarily reflect the views of The World Bank Group, its Board of Executive Directors, or the governments they represent. All errors and omissions are our own. The project received ethical approval from HML IRB, study ID #2230. The trial and pre-analysis plan were pre-registered in the AEA RCT Registry at: https://doi.org/10.1257/rct.11193-2.0.

1 Introduction

Business training has long been a staple tool in development policy, aimed at alleviating human capital constraints among entrepreneurs. Annually, at least USD 1 billion is allocated to such programs in low- and middle-income countries, the vast majority of which are delivered in person (McKenzie and Woodruff, 2014). However, research indicates that the outcomes of these programs are modest at best (McKenzie et al., 2023), with even smaller or negligible benefits for women. These limited benefits are often due to restrictive social norms that impose mobility and time constraints on women (Jayachandran, 2021; Ubfal, 2024).

Following extensive experimentation with digital learning during the COVID-19 pandemic, policy makers have increasingly recognized the potential of digital technologies to deliver training at scale. Digital delivery can increase cost-effectiveness and scalability, by substantially reducing expenses related to facility rentals, supplies, and staff (Chang, 2016). Furthermore, digital training offers full flexibility in terms of location and time — potentially addressing constraints that women face, such as unpaid care work and limited mobility (Bandiera and Zipfel, 2019; Beegle and Rubiano-Matulevich, 2020). However, access to digital training may require cell phone or computer ownership, internet connectivity, and a basic level of digital skills. Furthermore, virtual training is not necessarily more cost-effective than traditional methods, particularly when trainers still need to be recruited and some content is delivered live (Davies et al., 2024). Additionally, digital applications often experience high dropout rates due to insufficient instructor and peer engagement (Bawa, 2016). Therefore, it is crucial to address the evidence gap regarding the impact of digital training, and to evaluate empirically the trade-offs between digital and in-person modalities.

We conduct a randomized controlled trial (RCT) to compare the impact of digital versus in-person business training, using the same curriculum with the same target population. Specifically, we compare in-person delivery against delivery via a specialized ed-tech mobile app, adapted to the local context. We deliberately select a sample predisposed to engage with digital training and likely to benefit from it, aiming to maximize the chances of demonstrating the feasibility and impact of app-based learning.

Our study specifically targets established, growth-oriented women entrepreneurs. We focus on this sample due to the relatively weak evidence supporting the impact of training for individuals — particularly women —who have not yet become entrepreneurs or are subsistence entrepreneurs (McKenzie et al., 2023). The training employs a curriculum that is more advanced than traditional, basic business training, and is designed to benefit entrepreneurs who have already acquired foundational business skills. Our study thus also provides evidence on whether tailoring training content to above-subsistence women entrepreneurs may

produce a greater impact than traditional business training, even if delivered in person.

Despite our targeted approach —and high initial take-up rates for both the app (80%) and the in-person training (76%) — our results reveal very low completion rates for the digital training (22%), compared to high completion rates for the in-person training (71%). Low usage of the app persists despite additional efforts to incentivize engagement, including weekly reminders, cash-prize draws, and making the app available offline.

Both treatment arms produce statistically significant but modest improvements in business knowledge, with no larger gains observed for the in-person training despite its higher completion rate. Six months after accessing the training, both treatments yield negligible impacts on business practices and performance. Taken at face value, our results suggest that even more advanced business training targeted at existing, growth-oriented entrepreneurs may not work. Our data do not allow us to distinguish whether the lack of impact is due to lack of capacity to implement learning, or because other constraints to growth are binding.

The details of our experiment are as follows. We recruit a sample of 2,000 women in Addis Ababa, Ethiopia, who own or manage a business and are looking to expand it. The recruited businesses are small but above subsistence levels, with 79% having at least one employee and a median of three employees. We further focus on women with at least secondary education, given the target level of the curriculum. Our eligibility criteria include access to a smartphone and the internet, as well as a reported interest in digital training modalities.

The app-based training program offers interactive business education accessible on both iOS and Android devices, and is available in Amharic and English. It consists of eleven modules derived from mobile MBA preparatory courses provided by a U.S. ed-tech firm. These modules encompass a wide range of topics, including entrepreneurship, marketing, accounting, and finance. Originally designed for pre-MBA preparatory courses in the United States, the materials were meticulously adapted to suit the Ethiopian context in collaboration with the ed-tech firm. Additionally, we partnered with a local business training provider to develop an in-person course that mirrors the app-based training. This in-person course follows the same syllabus and is delivered in eleven two-hour sessions, conducted twice a week over a six-week period.

As an additional screening device and to increase the likelihood of training participation, we invited women to an in-person information session. During this session, women received detailed information about the training content and its two delivery modalities. At the conclusion of the session, women were randomly assigned through a public lottery to one of three groups: the app-based training, the in-person training, or a control group. The control group was justified due to the over-subscription to the app during its pilot phase and the limited availability of in-person training slots. The app-based group was offered assistance to

download the app, log in and start using it. To understand the importance of this assistance, we conduct an additional experiment with a similar sample, in which we offer access to the app *without previously inviting women to information sessions*. We observe minimal take-up of even one app module. The information sessions may also have contributed to the relatively high take-up of the in-person training — although we do not test this experimentally.

Recognizing the need for sustained incentives to ensure engagement with the app-based learning and to replicate the group interaction inherent in the in-person training, we introduced an additional treatment arm. In this arm, half of the women assigned to the app-based training were also included in social messaging groups and received weekly prompts to discuss the course content with their peers. However, this intervention did not impact participation or outcomes. We observed negligible engagement in the groups, partly due to intermittent government blocks on the popular social messaging app used, and partly due to a lack of interest among women in virtual group interactions. Consequently, when reporting results, we pool all women assigned to the app-based training, regardless of their inclusion in the social messaging groups.

In exploratory analysis, self-reported digital skills at baseline emerges as the only significant predictor of completing the app-based course. This finding aligns with the observation that, despite screening for smartphone ownership and interest in digital training, some women reported difficulties in using the app and troubleshooting basic issues. Such observations indicated lower digital literacy and digital confidence among this population than initially expected. Internet connectivity did not seem to hinder participation, as most of the sample reported having moderately to very reliable internet access. Furthermore, as previously mentioned, the app was available for offline use in the later phases of the experiment. Our findings indicate that neither internet connectivity nor the app's offline functionality were correlated with take-up.

In our follow-up survey, qualitative responses from women also frequently cite "not having the time" as a reason for not completing the app modules. This response suggests that the commitment device of scheduled in-person training and the presence of an in-person peer group may play a crucial role in fostering training completion. Commitment could be important for addressing self-control issues, negotiating with employers for time off from work, or coordinating with family members to take time off from unpaid care work. We do not find a correlation between app take-up and proxies for "other-control" issues, such as hours spent working per day, hours spent on care work, marital status, or having children under the age of five. However, we cannot rule out self-control issues.

To our knowledge, ours is the first experiment to compare the effects of app-based training versus in-person training with identical content, conducted in parallel for the same target

population. Our findings underscore the challenges in sustaining participation in digital training, even among educated women who already own businesses and have access to digital tools. While in-person information sessions were effective in generating initial engagement with the app, they did not lead to sustained use. Additionally, these information sessions increased costs, thereby weakening the cost-saving argument in favor of digital training over in-person training. Further efforts to boost participation also increased costs and proved ineffective. Our results also contribute to the existing body of evidence on (in-person) business training, by demonstrating the limited impacts of a more advanced business training curriculum, targeted at educated women with above-subsistence businesses.

The extensive literature on business training for entrepreneurs in developing countries is reviewed by McKenzie and Woodruff (2014) and McKenzie et al. (2023). Their meta-analysis indicates that classroom-based training remains the most popular method for training small business owners and has the potential to increase firm profits by approximately 5 to 10 percent. However, the effects tend to be lower for women entrepreneurs, who are more likely to be constrained by time and mobility limitations (Jayachandran, 2021; Ubfal, 2024). Even non-traditional business training focused on socio-emotional skills, that shows large positive impacts for both men and women in the short run, may have limited benefits for women in the long run (Campos et al., 2024). We confirm the limited effects of in-person business training programs on business outcomes for women entrepreneurs in low-income settings, even when the training content is more advanced than basic business training, and targeted at growth-oriented entrepreneurs.

Digital and remote learning programs remain understudied, particularly for women entrepreneurs in low-income countries. One such approach involves online, one-to-one mentoring or live online training sessions (Kyrgidou and Petridou, 2013; Hunt et al., 2019; Anderson and McKenzie, 2022; Alhorr, 2023; Davies et al., 2024). For instance, Davies et al. (2024) offer live Zoom training sessions to female entrepreneurs in Mexico and Guatemala. While they find high take-up and improvements in business practices and performance after two months, the impacts are no longer significant after six months — the same time frame for the null results presented in our paper. Due to recruitment costs and reliance on live training, their intervention is also not significantly more cost-effective than in-person training.

An alternative approach is to provide asynchronous content, such as short pre-recorded videos or provision of feedback using artificial intelligence. For example, Estefan et al. (2024) offer short video capsules to Guatemalan chicken franchise owners, and Jin and Sun (2022) use AI to provide feedback to entrepreneurs. This approach significantly reduces cost but suffers from high dropout rates. While Estefan et al. (2024) find positive impacts on business practices, sales and profits, they note that virtual one-on-one consulting meetings —

offered alongside the asynchronous content — are crucial for impact. Similarly, Mehmood (2023) evaluates SMS-based business training for farmers in Kenya and finds positive short-run effects on knowledge and adoption of business practices after three months. However, engagement with the content diminishes within the first few months, and impacts fade out by twelve months. Our study contributes to this literature by assessing the impact of asynchronous mobile app-based training compared to equivalent in-person training for women microentrepreneurs in a low-income context. Consistent with the literature, our findings underscore the significant challenge of achieving sustained engagement with digital training.

One potentially promising direction to increase engagement with digital training may be gamified entrepreneurship education. Empirical studies have shown positive effects of the use of games on entrepreneurial intention among students (Fellnhofer, 2018; Fox et al., 2018; Lafortune et al., 2024; Melo et al., 2023). For instance, Lafortune et al. (2024) show that a gamified virtual entrepreneurship challenge for secondary students in Rwanda during the COVID-19 pandemic helps to keep their small business open and profitable. The app-based training we study includes some basic features of gamification (e.g., interactive tasks that need to be completed to move on to the next module). We show that these features are not enough to sustain engagement with the app. The inclusion of stronger gamification (e.g., point scoring, competition with other users, prizes) might be necessary to foster engagement in digital training.

2 Interventions

A primary goal of our study is to test, under favorable conditions, for a "proof-of-concept" of the feasibility of this kind of digital training, for women entrepreneurs in low-income settings. The main intervention we study is an app-based training program, tailored to the relevant context. Classroom-based training serves as the natural counterfactual for comparison, given its widespread implementation in developing contexts. To replicate the interactive group dynamics of classroom training, we designed a variation of the app-based training that also encourages women to interact through a widely used instant messaging service.

2.1 App-based training

We partnered with a globally recognized leader in mobile education technology to design an app-based training program tailored for women entrepreneurs in low-income settings. The target audience comprises women entrepreneurs with at least a high school education and some basic level of business knowledge and experience. The training material is adapted from

preparatory courses for MBA programs in the United States, and has been customized and translated to meet the needs of our target population. The app aims to fill a gap in business education by offering slightly more advanced learning for entrepreneurs compared to traditional training courses (see McKenzie and Woodruff (2014) for a description of traditional business training).

A distinctive feature of the app is its creation of an interactive experience, incorporating elements of gamification to encourage users to work through a series of small problems, rather than merely retaining information from video lectures or readings. Each module concludes with an interactive challenge that must be successfully completed for the module to be marked as finished. This approach is designed to keep users attentive and engaged with the app.

The app comprises eleven modules, covering topics from Entrepreneurship Fundamentals to Marketing Fundamentals and Mechanics, Data Collection, and intermediate concepts in Accounting and Finance. It concludes with a module that encourages participants to prepare a business plan (see Appendix Table A14 for details).[1] The course is designed to be self-directed and flexible, allowing learners to progress at their own pace and revisit the content as needed. The app also offers the option to switch between English and Amharic, the primary language spoken by the target population. Participants who successfully complete at least eight modules receive a completion certificate.

2.2 Virtual interaction in chat rooms

To replicate the networking features of classroom interaction, we introduced a virtual networking component to half of the women participating in the app-based training. We formed groups of 25 participants and encouraged them to interact via a widely-used instant messaging service. To stimulate engagement, a moderator posed a motivating question each week related to the material covered in one of the app modules. Despite these efforts, participation and interaction within these groups remained minimal. This low engagement can be partly attributed to intermittent government blocks on the instant messaging service. However, even when the service was accessible, participants showed a lack of appetite to communicate with each other. This observed behavior suggests a weak demand for virtual interaction on this topic among women entrepreneurs who likely have not met in person. Given the low uptake of this additional treatment, we present results that combine data from women invited to use the app alone with those invited to use the app and offered virtual interaction.

[1] There was also a 12th short introductory module on using the app that most users completed during the information sessions.

2.3 In-person business training

The content for the in-person training mirrors that of the app-based training (Appendix Table A14), but is adapted for a face-to-face format. This training is delivered by a local provider with proven expertise in business training. While the primary teaching method is slideshow presentations, the classes also incorporate interactive techniques such as role plays, plenary discussions, brainstorming activities, and group projects to maintain participant engagement. To optimize the learning experience, participants in this group completed a needs assessment survey, indicating their preferences for session schedules, venues, and childcare facilities. Based on these preferences, they were organized into cohorts of 25, ensuring their individual needs were met. The training course was structured to cover all modules in individual sessions over a six-week period, with two-hour sessions held twice a week. These sessions were staggered so that only five training groups were active at any given time. Similar to the app-based training, participants who attend at least eight sessions receive a completion certificate.

3 Experimental Design

3.1 Recruitment, information sessions, and randomization

Our sampling frame is derived from the Ethiopia Women Entrepreneurship Development Project (WEDP), which has registered over 40,000 women business owners in its Management Information System, with approximately 17,700 based in Addis Ababa. WEDP is a national program run by the Government of Ethiopia, with financial and technical assistance from the World Bank. The project targets growth-oriented women-owned enterprises, offering interventions that include information, training, and financial support.

To build our sampling frame, we reached out to all 17,700 entrepreneurs and successfully conducted screening phone interviews with approximately 6,000 women. The phone interview assessed participants based on the following eligibility criteria: i) access to and knowledge of how to use a smartphone; ii) access to the internet; iii) completion of at least a high school education; iv) ability to understand either English or Amharic; v) being a business owner or active manager of an operating business; and vi) the business having 30 or fewer employees. This screening process resulted in about 4,000 eligible women.

Respondents who met the eligibility criteria were asked at the end of the screening survey if they were interested in a free-of-cost business training mobile app. If they answered positively, they were then invited to attend in-person information sessions about the training,

and offered a travel compensation to do so. These sessions took place monthly in four central locations over a span of four months, from March to June 2023. Recruitment was staggered to allow the in-person training sessions to run with five simultaneous classes of 25 participants, according to the training provider's capacity. Overall, 2,000 participants attended information sessions.

Our eligibility criteria naturally resulted in a specialized sample being invited to the information sessions. However, attendance at these sessions further filtered the participant pool. Appendix Table A1 compares the characteristics of eligible participants who attended the information sessions with those who did not, using data from the screening phone interview. On average, attendees of the information sessions are older, more educated, own larger businesses, live closer to the session venues, and are less likely to prefer only the app-based training over in-person training. The greater distance from information venues and the higher preference for app-based training among non-attendees may suggest that they face more significant mobility constraints or belong to a slightly younger generation that favors digital learning over in-person training.

During the information sessions, participants were asked to complete the baseline survey on their smartphones under the supervision of enumerators. The survey took approximately an hour and included questions about the respondent and their household characteristics, their primary and secondary business characteristics and performance, business practices, access to finance, networks, and their digital skills. After completing the survey, participants were provided with details on the range of interventions being offered and the randomization process. Participants were then invited individually to draw a token from an urn containing an equal number of four different tokens corresponding to three treatment groups and one control group. The three treatment arms included app-based training alone, app-based training combined with social networking, and in-person training. Given that the total number of participants at each session was not usually divisible by four, this in-person lottery generated some small, statistically insignificant differences in the number of participants assigned to each treatment arm, with 495, 502, and 520 women assigned to the first, second, and third treatment arms, respectively, while 483 women were assigned to the control group.

Women assigned to the app-based training were given immediate and unrestricted access to the app, along with support for the download and login process, and a tutorial on its features. Those assigned to the in-person training were informed that their sessions would commence within the following weeks, with a training duration of approximately six weeks. They were also told that they would be contacted by the trainers to receive more details on the exact timing and location of the sessions.

As discussed below, conducting in-person information sessions increases the overall cost

of offering the course. However, without in-person help to download the app and start using it, we believed that very few women would experiment with the app. To test this assumption, we conducted an additional experiment with 228 women who had not attended information sessions but expressed interest in the app. We shared with them the login credentials to access the app via phone call and text message. A random half of the sample received three basic help and troubleshooting calls from agents. Overall, only about 10 percent of this sample, —regardless of phone call assistance — completed at least one module, and just three percent completed at least eight modules. This additional experiment confirms the need for an initial in-person orientation to generate take-up for app-based training. The information sessions may also have acted as an effective screening device for the in-person training, and contributed to the relatively high take-up of the in-person training, although we do not test this experimentally. For comparison, Alibhai et al. (2019) find take-up of just 41% for a personal initiative training offered to a similar population of women entrepreneurs in Addis Ababa.

3.2 Sample characteristics

Table 1 describes the main characteristics of the sample and checks for balance across the app-based training, in-person training, and control arms. As mentioned above, take-up for the networking intervention is very low, and we observe no significant differences at baseline or in outcomes between those assigned to the app-based training with versus without the networking arm. Therefore, in all tables, we present pooled results for the two app-based training treatment arms. Results that include the three treatment arms are reported in the Online Appendix (Tables A2 - A5).

The average participant is a 38-year-old mother, often the head of her household. She manages a business with an average of four employees (median of three employees) and reports implementing around five out of eight recommended business practices.[2] The majority of participants have completed more than secondary education and operate businesses in the service (41 percent) or trade (32 percent) sectors. The average monthly household income is USD 881 (at nominal exchange rate), monthly business revenues are USD 1,311, and monthly profits are USD 268.

Table 1 shows that the randomization resulted in only one imbalanced variable (respondent's main business is over five years old) out of twenty between the in-person training and

[2]Of the eight questions, three focus on marketing and product innovation, two address supplier competitiveness, and three pertain to forecasting and accounting. Although more than half of these practices were implemented at baseline, marketing practices were adopted to a lesser extent compared to the other two categories. The curriculum extensively covered marketing and accounting, but it did not emphasize supplier competitiveness as much.

control groups. Overall, two variables out of twenty show significant imbalances between the app-based training and the control groups at the five percent level, contributing to a rejection of the F-test of joint orthogonality across these groups. Specifically, the app-based group is younger and significantly more likely to have completed post-secondary education. All of our regressions use post-double LASSO to select the control variables to include, often picking up the imbalanced variables. Additionally, we find that our results are robust when using a matching estimator with exact matching on a post-secondary education dummy (Appendix Table A8).

3.3 Follow-up data collection

Over the duration of the interventions, the research team gathered administrative data pertinent to both training modalities. For the app-based training, the team utilized an administrative portal to monitor course progression in real time. For the in-person training, attendance was documented by the training facilitators.

From September to December 2023, approximately six months after participants first engaged with the training, we conducted a short follow-up telephone survey. This survey was a streamlined version of the baseline survey and included additional queries related to business performance, business practices, and the motivations behind participants' level of involvement in the training or absence thereof. We successfully re-interviewed 1,928 women during this follow-up, resulting in a low attrition rate of only five percent from the original cohort. Importantly, the rate of attrition and the profile of those who dropped out did not significantly vary across the different treatment groups (Appendix Table A9).

4 Results

4.1 Empirical strategy

We estimate the effects of being assigned to the app-based or in-person training using the following ANCOVA specification:

$$Y_{i1} = \beta_0 + \beta_1 T_{1i} + \beta_2 T_{2i} + \beta_3 Y_{i0} + \beta_4 X'_{i0} + \beta_5 S_i + \epsilon_{i1}, \tag{1}$$

where Y_{i1} is the outcome variable for individual i measured at follow-up ($t = 1$). T_{1i}, and T_{2i} are dummy variables taking the value of one if the individual is assigned to the app-based or the in-person training, respectively. Y_{i0} is the baseline value of the outcome variable. X'_{i0} is a vector of LASSO-selected baseline control variables from Table 1, which includes

imbalanced variables such as age and education. S_i is a vector of randomization strata, containing dummies for each of the information sessions where public lotteries occurred. We report Eicker-White standard errors that are robust to heteroskedasticity. The parameters β_1 and β_2 correspond to the intention-to-treat effect of being assigned to the app-based or in-person training compared to the control group, respectively.

4.2 Treatment compliance and training take-up

Table 2 presents the effects of being invited to the training on training take-up, compared to women in the control group. According to the administrative app data, no woman in the control group or the in-person training group had access to the app-based training. Similarly, no woman assigned to the app-based training was invited to the in-person training. There was only one instance where a woman in the control group was mistakenly invited to the in-person training.

Column 1 indicates that in both the app-based and in-person training groups, over 75% of individuals completed at least one module or session, respectively. For the app-based training, this initial engagement was partly facilitated by enumerators who encouraged and guided participants through the first part of the first module during the information sessions. However, when it comes to course completion—defined as completing at least eight modules of the app-based training or attending at least eight sessions of the in-person training, which is required to obtain the certificate—there is a significant difference between the two treatment modalities. Column 2 reveals that only 22% of the app-based group completed at least eight modules, whereas 71% of the in-person group attended at least eight training sessions.

Columns 3-5 of Table 2 provide a detailed analysis of the initiation and completion rates of the courses. On average, participants in the app-based training started 5.2 modules (measured by simply opening the module), partially completed 3.7 modules (measured by completing at least half of the lessons in a module), and fully completed 3.3 modules (measured by passing a short quiz at the end of the module). In contrast, participants in the in-person training attended an average of 7.2 sessions. Even under the conservative assumption that the average in-person participant only paid attention to half of the content—suggesting that in-person attendance is best compared to partial completion of an app module—these figures indicate that in-person participants engaged with twice as much of the course content as app-based users (attending 7.2 sessions versus partially completing 3.7 app modules).

Column 6 presents self-reported completion data, which largely corroborates the administrative data for in-person training. However, it shows that app-based participants report completion rates more in line with the initiation of modules (Column 3) rather than their

partial or full completion (Columns 4 and 5). The inflated completion rates reported by app-based participants could reflect response bias, or a misunderstanding of what constitutes successful completion of a module. However, the latter seems unlikely, given that most modules reported as incomplete were not even half-completed.

Figure 1 illustrates that the average number of courses completed conceals substantial disparities in their distributions across treatment arms. For in-person training, a dichotomy emerges: 23 percent of individuals never attend a single session, while 71 percent attend enough sessions to earn a training certificate. There is considerable mass in the higher attendance brackets of eight, nine, ten, and eleven classes. While there is a noticeable jump at eight classes, indicating the binding incentive of the certificate, most respondents continue to complete nine to eleven classes even when the incentive to obtain the certificate is no longer present. The distribution of in-person class attendance aligns with existing literature on in-person business training. It is consistent with a behavioral "lock-in" effect, whereby attendees are likely to persist once they have begun. Alternatively, it is consistent with the existence of two underlying types — those who will never start, and those who will complete —potentially due to a threshold in individual preferences, travel, or transaction costs.

In contrast, while the distribution for app-based training participants shows a similar proportion completing no classes at all, a substantial number of participants complete just one to three app modules. There is another peak at the maximum of eleven classes, but scant participation in the four-to-ten class range. A similar trend is observed for "starting" modules. The app-based training appears to lack the lock-in effect observed for in-person training. An alternative, more favorable explanation for the app-based training is that it offered a low-cost opportunity for learners to sample various courses and discontinue those that did not align with their interests or covered material they already knew. However, this explanation seems somewhat unlikely, given that participants opened just five courses out of eleven, despite the zero cost of opening a module. Furthermore, an analysis of module completion by topic reveals no discernible patterns suggesting a preference for certain modules over others. Instead, users appear to follow the chronological order presented within the app. There is no significant mass at eight classes for the app-based training, suggesting that the certificate did not provide a strong incentive for app-based learners.

Leveraging real-time app usage data, we implemented a series of strategies to enhance user engagement with the app. First, as previously mentioned, we sought to replicate the in-group interaction characteristic of in-person training through an online networking intervention. However, government restrictions on the instant messaging app we employed may have discouraged participation. Moreover, even when the app was accessible, we ob-

served minimal interaction. Additionally, we sent weekly reminders to encourage participants to complete the app's modules. To further incentivize module completion, we introduced small cash-prize lotteries, which were announced via the instant messaging service and text messages. Although we observed some increases in module completion a few days following these announcements (see Appendix Figure A3), the overall completion rate of the app-based training remained low, despite the various incentives and nudges provided.

4.3 Impacts on primary and secondary outcomes

Table 3 Panel A presents results from ANCOVA regressions for our pre-specified primary outcomes: business survival and performance.[3] The results indicate no significant effects of being assigned to either modality of business training on these outcomes.

Panel A, Column 1 shows the effect on whether the business remained open at follow-up. Approximately 91% of businesses in both the treatment and control groups remained open, with almost no difference across treatment arms. Columns 2-6 indicate no significant treatment effects on business sales and profits. The effects on winsorized sales (Column 5) and profits (Column 3) for the main business are imprecisely estimated, with point estimates very close to zero. However, the estimated coefficients and standard errors do not rule out positive effects of up to 15 percent. This pattern holds true when considering both the main and secondary businesses operated by women (Columns 4 and 6, respectively). The pre-specified profits and sales index, which combines outcomes from Columns 3-6, shows more precisely estimated null effects, allowing us to rule out effects above 0.1 standard deviations.

Panel B in Table 3 presents results for our pre-specified secondary outcomes: business inputs, capital, practices, and knowledge. Once again, we observe almost no statistically significant impact from either of the two treatments.

We first verify that business owners gained knowledge from both modalities of training. There is a statistically significant, albeit small, impact of two percentage points for both treatment arms on business knowledge, as measured by a seven-question test (Column 9). Notably, the impact on business knowledge does not differ across treatment arms, despite a much higher completion rate for the in-person training. This effect represents only a 5 percent increase over the control mean of 43 percent correct answers. A similar effect size is reported by Davies et al. (2024) for synchronous online training.

We find precisely estimated null effects on business practices, measured by a subset of eight business practices from McKenzie and Woodruff (2017). The control group reports implementing 62 percent of these practices, and the share is similar for the two training

[3]Our pre-analysis plan was registered at: https://www.socialscienceregistry.org/trials/11193.

groups (Column 8). There are also no significant treatment effects on a capital index that combines business assets and investments (Columns 5-7), nor on an inputs index that includes the number of employees, hours worked, and hours the business is open (Columns 1-4). For the inputs index, the number of hours the business is open, and the number of hours worked ($p = 0.12$), we observe statistically significant differences between the two treatment arms. Specifically, there are positive point estimates for the in-person training and negative point estimates for the app-based training, although these differences are not statistically significant at the 5 percent level. Overall, the lack of effects on inputs and investment, as well as the lack of changes in business practices, is consistent with the null effects observed for business performance.

4.4 Robustness and treatment effect heterogeneity

Appendix Tables A2 - A7 examine the robustness of the results by excluding controls and by using three instead of two treatment arms, as pre-specified. We confirm the lack of any statistically significant effect on both primary and secondary outcomes.

In addition, Appendix Tables A10 - A13 show no statistically significant heterogeneity by pre-specified variables, including education, baseline profits, digital skills, and business sector. We also explore heterogeneous effects using the generic machine learning approach of Chernozhukov et al. (2018), and find no sub-groups with differential impacts.

Finally, Figures A1 - A2 show that for both the in-person and app-based training, quantile treatment effects for the level of profits are below the average treatment effect for all but the top percentile, for which effects are very imprecisely estimated. For business practices, we observe some statistically significant effects in the middle of the distribution, with lower effects in the tails.

5 Costs of app-based versus in-person training

We consider it informative as part of the "proof-of-concept" aspect of the study to quantify the potential cost savings from using app-based delivery versus a face-to-face modality. Such evidence on costs could be useful for future interventions, especially if relatively cost-neutral changes to the content of similar training programs are found to lead to stronger effects.

We calculate an average cost per person assigned to receive the training of USD 278 for the app-based training and of USD 511 for the in-person training. These costs are based on the detailed financial proposals to train 997 individuals via the app, and 521 in person, hence we note that the comparison is unfavorable to the in-person training given the

presence of fixed costs and economies of scale. The app-based training costs can be broken down into fixed costs for developing the curriculum, adapting and translating the material, plus app programming, and staff support for app maintenance (82%). Variable costs include recruitment (16%) and user licenses (2%). For the in-person training, the average cost includes fixed costs for developing the curriculum, staff costs, and adapting and translating the material (65%). In our setting, most of these costs were absorbed by the app developers, but we allocate them evenly between the two training types as they draw from the same curriculum. Variable costs are training implementation (27%), and recruitment through in-person information sessions (8%). The fact that the average per-potential-participant cost of app-based training is 54% of that of in-person training indicates that while cost savings from app-based training are significant, they are not as substantial as might be anticipated. This finding aligns with that of Davies et al. (2024), who identified high costs for synchronous digital training, which includes significant costs for online live training. The average cost per participant *who completed the course* is mechanically higher for both training modalities, and significantly more so for the app-based training due to lower completion rates. However, the key advantage of asynchronous training is that it can be offered to additional participants at a low *marginal* cost. Specifically, the marginal cost for our app-based training, based on the variable costs reported above, was one-third of that for in-person training: USD 49 for the app-based training versus USD 178 for in-person training. Most of the variable costs for the app-based training are attributed not to licenses or other costs directly linked to the app, but rather to recruitment, particularly the in-person information sessions. These recruitment costs are often excluded from cost calculations in other studies but are typically crucial for training providers to ensure a minimum threshold number of participants. In the case of our app-based training, these in-person sessions also assisted participants in downloading and learning how to navigate the app. Our additional experiment showed that the in-person sessions were essential to obtain any engagement with the app. For in-person training, in addition to recruitment costs, the main variable expenses were for venues and trainers.[4] We further note that these marginal costs may be non-linear when scaling. For example, marginal costs of recruitment may increase if it is increasingly difficult to find eligible participants (Maffioli et al., 2023), or decrease if the app gains viral popularity.

[4]For comparison, the average per-participant cost of an in-person 5-7 day training course reported in Van Lieshout and Mehtha (2017) is USD 177; while marginal costs are not reported. Our costs are higher compared to shorter training programs in Ethiopia implemented via the government Technical and Vocational Education and Training (TVET) structure, for example, the training in Alibhai et al. (2019) with a cost of USD 30.

6 How might app usage be fostered?

Our results demonstrate that sessions where participants receive assistance in downloading the app are effective, though costly, in generating initial engagement. However, once participants are left to explore the app independently at home, sustained participation declines. The additional incentives offered, such as cash-prize lotteries, resulted in only minor and temporary increases in module completion.

Table 4 examines the correlates of training take-up for both the app-based and in-person training. Column 1 includes all baseline characteristics and reveals that older, more educated participants, particularly those with higher self-rated digital abilities, complete a higher number of app courses. Column 2 employs LASSO-selected predictors and indicates that self-reported digital skills are the only significant predictor of course completion. For the in-person training, several factors are correlated with attendance. Older women who are not the household head, have smaller networks, and lower self-efficacy are more likely to attend the training. Additionally, digital skills are positively correlated with attendance at the in-person training, suggesting that this variable may be capturing some underlying trait (Columns 3-4). For our third and fourth training cohorts, the app developers enabled offline capabilities during the recruitment phase, allowing participants to download the course materials for offline use after a dedicated tutorial. However, as shown in Column 1 of Table 4, we do not observe higher completion rates for app-based training in these two cohorts.[5]

Our follow-up survey asked participants for feedback regarding training completion. The most common reasons cited for not completing the app-based training were losing login credentials, technical difficulties in navigating the app, and time constraints. The first two reasons align with our earlier finding that digital literacy predicted app completion. Anecdotally, field staff reported lower digital literacy and digital confidence among this relatively young, urban, smartphone-owning sample than expected. The latter reason, time constraints, suggests that the commitment device of having a scheduled in-person training and an in-person peer group may be important. The benefits of commitment could arise from self-control issues, the need to negotiate for time away from work, or to bargain with family for time off from unpaid care work. In our exploratory analysis, we did not find that app take-up was correlated with proxies for "other-control" issues, such as hours spent working per day, hours spent on care work, being married, or having children under the age of five. Nonetheless, we cannot rule out self-control issues. Lastly, respondents did not

[5]We cannot entirely rule out a positive effect of offering an offline version of the app. The fact that these last two cohorts also attend fewer in-person training sessions (Column 3 of Table 4) suggests that participants in these cohorts may be less inclined to attend any type of training. This could be due to their inherent characteristics or external circumstances affecting both treatment arms.

explicitly cite internet connectivity problems as a reason for not completing the app-based course. Half of the respondents reported moderately reliable internet, while the other half reported very reliable internet. This does not correlate with respondents citing 'technical challenges' as a reason for not completing the course.

A promising avenue for enhancing participation in digital training programs could be the incorporation of gamified elements into entrepreneurship education. Empirical research has indicated that gaming can positively influence students' entrepreneurial aspirations (Fellnhofer, 2018; Fox et al., 2018; Melo et al., 2023; Lafortune et al., 2024). For example, Lafortune et al. (2024) find that a gamified online entrepreneurship contest helped secondary school students in Rwanda maintain and grow their businesses amid the COVID-19 crisis. The app-based training we study integrates elementary gamification aspects, such as interactive tasks that are prerequisites for advancing to subsequent modules. However, our findings suggest that these elements alone do not significantly increase user engagement with the application. To boost completion rates of digital training, a more robust gamification strategy including elements such as scoring, user competition, rewards, and incentives to keep a "streak" of using the app every day or every week may be needed.

7 Conclusion

Our study suggests that, at least in this context, the promise of digital technology for delivering training should be approached with caution. Although initial interest in the app-based training was high, there was a significant drop-off, resulting in low completion rates. This lack of follow-through occurred despite targeting educated women entrepreneurs who had smartphones and internet access. Additionally, participants were screened through in-person sessions where they received support to download the app, which increased the marginal cost of training delivery.

One factor may be that digital literacy required to navigate the app and troubleshoot basic issues, such as forgetting a password, was lower than expected for this sample. Attempts to support women via a helpline and FAQs did not overcome these obstacles. Baseline digital literacy was correlated with the number of modules completed in the app, although not with the impacts.

Another possible explanation is that women reported "not having the time," which may indicate that they found it harder to commit to using the app while at home or at work compared to attending an in-person training session with its in-built commitment device of a specific place, time, and peer group. We did not find evidence of "other-control" issues, as app usage was not correlated with unpaid care work, being married, or having young

children. However, we cannot rule out self-control issues.

Future work might consider targeting app-based training at an even more selected group, such as "Gen-Z" entrepreneurs who are highly familiar with using similar apps. It might also be fruitful to test an app that is more gamified, which has been shown to produce success in other contexts (Melo et al., 2023; Lafortune et al., 2024). Gamification might keep digitally literate users more engaged and even encourage less digitally literate users to learn skills such as troubleshooting through engagement with the app. On a broader level, policy makers should prioritize initiatives to improve digital literacy. Additionally, other access and adoption challenges should be addressed, such as providing affordable hardware and enhancing mobile connectivity infrastructure.

That said, the lack of impacts on business practices and outcomes, even from the well-attended in-person training, suggests that a fundamental issue may lie in the content or in barriers to implementing the learning. We cannot rule out the possibility that women did improve their business practices or outcomes following the in-person training, but that our survey measures were not well-calibrated to capture these impacts within a short time frame. However, taken at face value, our results suggest that even more sophisticated and targeted business training may not produce significant impacts, even when the modality ensures high completion rates.

An open question is whether women realized during the in-person training that it would not produce the desired impact, and if so, why they continued to attend. It is possible that the social benefits of attending or the peer pressure costs of not attending outweighed the disutility and opportunity cost of participating in a training they did not expect to improve their business. Either way, the results suggest that in-person training may offer a stronger commitment device than app-based training. If effective training programs are designed, the challenge for digital training will be to find alternative commitment devices to encourage course completion.

Table 1: Balance Check

Control Variable	**All** Mean (1)	**Control** Mean (2)	**App (T1)** Coefficient (3)	**In-person (T2)** Coefficient (4)	**T1=T2** P-val (5)
Age of respondent (years)	38.02	38.52	-1.08**	0.07	0.00
Completed post-secondary education	0.66	0.62	0.08***	0.04	0.07
Has children	0.84	0.84	0.00	0.02	0.35
Household size	5.38	5.32	0.10	0.06	0.73
Head of her hh	0.57	0.60	-0.05*	-0.05	0.98
Last month's household income (USD)	880.52	791.40	81.22	217.02	0.31
Number of businesses owned	1.91	1.85	0.08	0.10	0.76
Self-rated ability to install app on phone (range 0-5)	3.10	3.08	0.13	-0.13	0.02
Main business is in the services sector	0.41	0.40	0.01	0.01	0.90
Main business is in the trade sector	0.32	0.30	0.03	0.02	0.69
Main business is over 5 years old	0.51	0.55	-0.05*	-0.06**	0.61
Business was open at baseline	0.83	0.81	0.02	0.04	0.59
Main business monthly profits (USD)	267.68	247.70	24.50	30.06	0.77
Main business monthly revenue (USD)	1,311.49	1,224.78	78.82	192.03	0.32
Number of employees in main business	4.39	4.50	-0.22	0.04	0.40
Number of hours respondent spends on her business	8.58	8.57	-0.10	0.16	0.15
Number of hours main business is open	10.56	10.66	-0.13	-0.12	0.94
Value of assets in main business (USD)	26,741.88	25,154.93	6,278.28	-2,757.71	0.04
Made a large investment to their business in the past 6 months	0.33	0.35	-0.00	-0.04	0.12
Fraction of business practices followed (over 8 practices)	0.63	0.62	0.02	-0.00	0.10
Observations	2000	483	997	520	
Joint orthogonality test			.025	.236	
Joint orthogonality test (RI)			.047	.291	

Notes: Column 1 shows the mean for each variable for the entire IE sample. Column 2 shows the mean for each variable for just the control group. Columns 3 and 4 show the coefficients from a regression of the dependent variable on treatment dummies controlling for strata dummies and using robust standard errors. Column 5 shows the p-value for a test of equality between app-based training and in-person training. The second last row shows the p-value of a joint significance test including all variables presented in the table. The last row shows the p-value of a joint significance test including all variables using the randomization inference method (cite). Variables with monetary values are expressed in USD using the nominal exchange rate of 100 ETB = 1.8 USD at baseline. Continuous variables are winsorized at the 99th percentile.

Table 2: Impacts on Training Completion

	Admin Data					Self-reported
	(1) Partial compliance (at least 1 course)	(2) Full compliance (at least 8 courses)	(3) App modules started or Training sessions attended	(4) App modules partially completed or Training sessions attended	(5) App modules completed or Training sessions attended	(6) App modules completed or Training sessions attended
App-based training (T1)	0.80***	0.22***	5.21***	3.72***	3.33***	6.85***
	(0.01)	(0.01)	(0.14)	(0.14)	(0.13)	(0.13)
In-person training (T2)	0.76***	0.71***	7.21***	7.21***	7.21***	8.07***
	(0.02)	(0.02)	(0.19)	(0.19)	(0.19)	(0.21)
Observations	2000	2000	2000	2000	2000	1928
Control mean	0.00	0.00	0.00	0.00	0.00	0.00
P-val t1=t2	0.09	0.01	0.01	0.01	0.01	0.01

Notes: Outcomes used in Columns 1-5 are constructed from administrative data, whereas the outcome used in Column 6 is constructed from self-reported data. Outcome 1 takes the value of 1 if the respondent completed at least 1 module on the app or attended 1 session of the in-person training course. Outcome 2 takes the value of 1 if respondent completed at least 8 modules on the app or attended at least 8 sessions of the in-person training course. Outcome 3 indicates the number of modules started on the app, or the number of classes attended, as there is no similar measure for in-person training. Outcome 4 indicates the number of modules partially completed, where the respondent completes at least half the lessons in a module, or the number of classes attended, as there is no partial measure for in-person attendance. Outcome 5 indicates the number of modules completed on the app, or the number of in-person sessions attended. Outcome 6 indicates the number of courses completed on the app, or the number of in-person sessions attended according to self-reported data from the follow-up survey. Results are obtained from OLS regressions of the outcome on two treatment dummies, controlling for LASSO selected controls, and randomization cohort fixed effects. Robust standard errors are in parentheses. $*p < 0.1$, $**p < 0.05$, $***p < 0.01$

Table 3: Impacts on Primary and Secondary outcomes

Panel A: Impact on Primary outcomes

	(1) Business was operating at follow-up (Yes 1; No 0)	(2) Profits and sales Index (SD)	(3) Last month's profit Main business (USD)	(4) Last month's profit Main and secondary business (USD)	(5) Last month's revenues Main business (USD)	(6) Last month's revenues Main and secondary business (USD)
App-based training (T1)	-0.02	0.01	7.32	-5.03	3.17	-32.16
	(0.01)	(0.04)	(23.08)	(24.27)	(91.42)	(96.50)
In-person training (T2)	0.01	0.01	-1.00	-15.26	-24.59	-69.60
	(0.02)	(0.05)	(26.72)	(27.78)	(105.17)	(111.89)
Observations	1928	1928	1928	1928	1928	1928
Control mean	0.91	0.00	398.85	421.81	1420.53	1513.11
P-val t1=t2	0.09	0.89	0.73	0.69	0.77	0.70

Panel B: Impact on Secondary outcomes

	(1) Inputs Index (SD)	(2) Number of employees	(3) Number of hours worked	(4) Number of hours open	(5) Capital Index (SD)	(6) Business assets (USD)	(7) Made investments (Yes 1; No 0)	(8) Business practice score (Proportion)	(9) Knowledge score (Proportion)
App-based training (T1)	-0.03	0.08	-0.10	-0.32*	0.01	1450.08	0.01	0.00	0.02**
	(0.03)	(0.16)	(0.18)	(0.18)	(0.04)	(1516.67)	(0.02)	(0.01)	(0.01)
In-person training (T2)	0.04	0.25	0.17	0.03	0.01	1209.45	0.00	0.02	0.02*
	(0.04)	(0.19)	(0.20)	(0.20)	(0.04)	(1701.71)	(0.02)	(0.01)	(0.01)
Observations	1928	1928	1928	1928	1928	1928	1928	1928	1928
Control mean	0.00	3.42	7.69	9.63	0.00	16035.48	0.09	0.62	0.43
P-val t1=t2	0.03	0.31	0.12	0.04	0.94	0.88	0.75	0.23	0.79

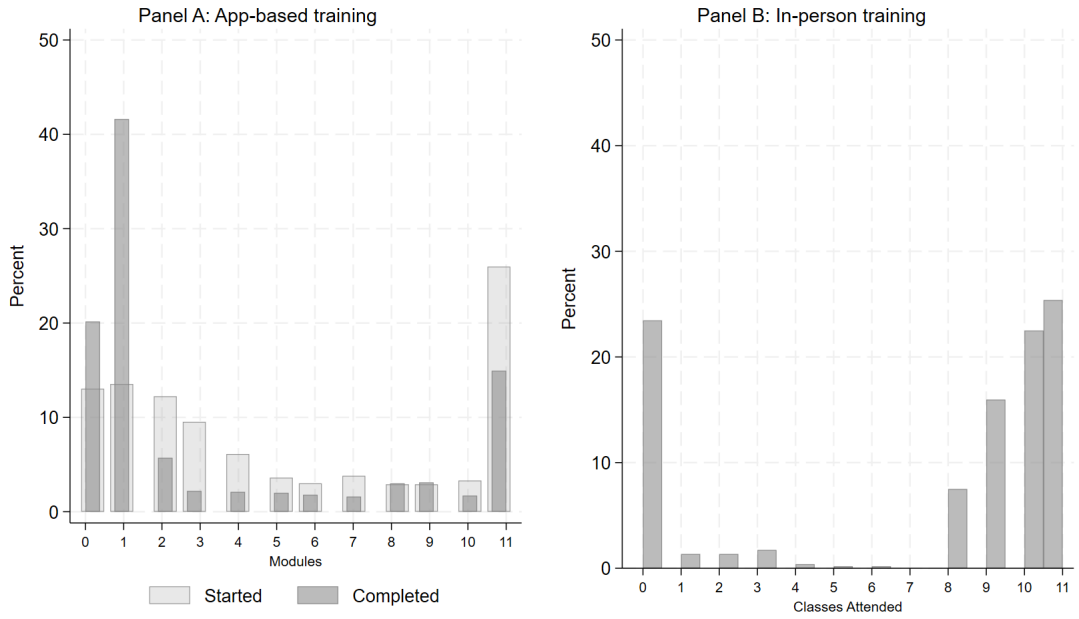
Notes: Panel A presents impacts on primary outcomes and Panel B presents impacts on secondary outcomes. Panel A, Outcome 1 is a binary variable indicating if the business was open at follow-up. Outcome 2 shows a profits and sales index, which is constructed by averaging the z scores (relative to the control group) of main and secondary business profits and sales, both IHS transformed and levels. Outcome 3 shows winsorized last month profits for the main business in USD. Outcome 4 shows last month winsorized profits for both the main and secondary business in USD. Outcome 5 shows last month winsorized sales for the main business in USD. Outcome 6 shows last month winsorized sales for both the main and secondary business in USD. Panel B, Outcome 1 is an inputs index, which is constructed by averaging the z scores (relative to the control group) of outcomes in Columns 2-4. Outcome 2 is the winsorized number of employees in the main business. Outcome 3 is the number of hours worked by the entrepreneur in her main business. Outcome 4 shows the number of hours the main business is open in a day. Outcome 5 is a capital index, which is constructed by averaging the z scores (relative to the control group) of assets and investments, both IHS transformed and in levels. Outcome 6 shows the winsorized value of business assets in USD. Outcome 7 is a binary variable which takes the value of 1 if the entrepreneur made a large investment in the past 6 months. Outcome 8 is the proportion of business practices implemented in the past 6 months. Outcome 9 is the proportion of correct answers to business knowledge questions. Results are obtained from OLS regressions of the outcome on two treatment dummies, controlling for the baseline value of the outcome, LASSO selected controls, and randomization cohort fixed effects. Robust standard errors are in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Table 4: Correlates of take-up

	App-based training		In-person	
	(1) No of courses completed (Log-transformed) (All variables)	(2) No of courses completed (Log-transformed) (LASSO-selected)	(3) No of courses completed (Log-transformed) (All variables)	(4) No of courses completed (Log-transformed) (LASSO-selected)
Age of respondent (years)	0.01*		0.01*	0.01**
	(0.00)		(0.01)	(0.01)
Completed post-secondary education	0.12*		-0.04	
	(0.06)		(0.10)	
Married	0.01		-0.12	-0.13
	(0.07)		(0.11)	(0.10)
Has children aged 5 or less	0.01		0.01	
	(0.06)		(0.10)	
Household size	-0.02		0.03	0.03
	(0.01)		(0.02)	(0.02)
Head of her hh	0.04		-0.24**	-0.24**
	(0.07)		(0.10)	(0.10)
Last month's household income (USD)	-0.00		-0.00	
	(0.00)		(0.00)	
Network size	-0.00		-0.00**	-0.00*
	(0.00)		(0.00)	(0.00)
Entrepreneurial self-efficacy score	0.00		-0.02**	-0.02**
	(0.01)		(0.01)	(0.01)
Hours spent on care while working	-0.01		0.01	
	(0.01)		(0.02)	
Hours spent on care outside work	0.01		-0.02	
	(0.01)		(0.02)	
Able to meet clients alone without permission (mobility)	-0.05		0.11	0.12
	(0.06)		(0.09)	(0.09)
Has very reliable internet access	-0.01		-0.04	
	(0.06)		(0.09)	
Number of businesses owned	-0.04		0.02	
	(0.03)		(0.03)	
Fraction of business practices followed (over 8 practices)	-0.00		0.12	0.11
	(0.11)		(0.17)	(0.16)
Self-rated ability to install app on phone (range 0-5)	0.05***	0.05***	0.06**	0.06**
	(0.01)	(0.01)	(0.02)	(0.02)
Main business is in the services sector	-0.07		-0.15	-0.14
	(0.07)		(0.10)	(0.11)
Main business is in the trade sector	-0.05		-0.21*	-0.21*
	(0.07)		(0.11)	(0.11)
Main business is over 5 years old	0.02		0.05	
	(0.06)		(0.09)	
Time spent working in a day (hours)	0.00		-0.02	-0.01
	(0.01)		(0.01)	(0.01)
Respondent indicated they prefer only app training	0.06		-0.04	
	(0.06)		(0.10)	
Batch of info session (1,2,3 or 4)=2	0.06		-0.03	
	(0.08)		(0.11)	
Batch of info session (1,2,3 or 4)=3	0.10		-0.21*	-0.20*
	(0.08)		(0.12)	(0.10)
Batch of info session (1,2,3 or 4)=4	0.10		-0.75***	-0.73***
	(0.08)		(0.13)	(0.11)
Observations	997	997	520	520
Mean	1.07	1.07	1.76	1.76

Notes: All columns show OLS regressions for log(1+ number of modules) attended or completed on covariates. Covariates are constructed from the baseline survey and administrative data. Columns 1 and 2 are run for the app-based treatment arm only. Columns 3 and 4 are run for the in-person arm only. Column 1 and 3 show regressions including all covariates. Column 2 and 4 show OLS regressions with only LASSO-selected covariates. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$

Figure 1: Course completion



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A Online Appendix

Table A1: Comparing eligible IE and non-IE individuals

Variable	(1) Eligible, not in IE Mean/(SE)	(2) IE sample Mean/(SE)	(1)-(2) Pairwise t-test Mean difference
Age	36.68	38.02	-1.34***
	(0.16)	(0.17)	
Completed post-secondary education	0.61	0.67	-0.06***
	(0.01)	(0.01)	
Is fluent in English	0.73	0.76	-0.02*
	(0.01)	(0.01)	
Number of paid employees	2.83	3.14	-0.31**
	(0.09)	(0.10)	
Has managed business for more than 5 years	0.61	0.63	-0.02
	(0.01)	(0.01)	
Has very reliable internet access	0.48	0.50	-0.02
	(0.01)	(0.01)	
Lives close to the information session venue	0.72	0.77	-0.04***
	(0.01)	(0.01)	
Indicated they prefer only app training	0.46	0.32	0.14***
	(0.01)	(0.01)	
F-test of joint significance (P-value)			0.00***
Number of observations	2427	1998	4425

Notes: The first column includes individuals who were eligible but did not attend information sessions. The second column includes individuals who attended information sessions and participated in the randomization. All variables are from the phone screening survey. Only two individuals attended information sessions without previously completing a screening survey. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$

Table A2: Balance Check - four treatment arms

Variable	(1) Total Mean/(SE)	(2) App-based training Mean/(SE)	(3) App + networking Mean/(SE)	(4) In-person training Mean/(SE)	(5) Control Mean/(SE)	F-test for balance across all groups F-stat/P-value	(2)-(3)	(2)-(4)	(2)-(5)	(3)-(4)	(3)-(5)	(4)-(5)
							Pairwise t-test					
							P-value	P-value	P-value	P-value	P-value	P-value
Age of respondent (years)	38.02	37.44	37.49	38.61	38.52	3.73	0.77	0.01	0.02	0.02	0.02	0.75
	(0.17)	(0.32)	(0.33)	(0.33)	(0.35)	0.01						
Completed post-secondary education	0.66	0.70	0.69	0.65	0.62	3.53	0.58	0.06	0.01	0.17	0.01	0.31
	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	0.01						
Has children	0.84	0.84	0.83	0.86	0.84	0.33	0.87	0.49	0.94	0.42	0.92	0.35
	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	0.80						
Household size	5.38	5.45	5.37	5.38	5.32	0.36	0.51	0.65	0.41	1.00	0.62	0.52
	(0.05)	(0.09)	(0.10)	(0.08)	(0.10)	0.78						
Head of her hh	0.57	0.55	0.56	0.56	0.60	1.31	0.61	0.79	0.10	0.82	0.19	0.11
	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	0.27						
Last month's household income (USD)	880.52	863.81	858.46	1,000.51	791.40	0.82	0.97	0.50	0.43	0.30	0.52	0.13
	(50.02)	(88.52)	(102.63)	(115.62)	(88.32)	0.48						
Number of businesses owned	1.91	1.96	1.89	1.95	1.85	1.21	0.24	0.79	0.07	0.43	0.48	0.12
	(0.02)	(0.05)	(0.05)	(0.05)	(0.05)	0.30						
Self-rated ability to install app on phone (range 0-5)	3.10	3.24	3.16	2.94	3.08	2.00	0.47	0.02	0.19	0.08	0.38	0.22
	(0.05)	(0.09)	(0.09)	(0.09)	(0.09)	0.11						
Main business is in the services sector	0.41	0.42	0.40	0.42	0.40	0.22	0.40	0.80	0.59	0.58	0.97	0.77
	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	0.89						
Main business is in the trade sector	0.32	0.31	0.34	0.32	0.30	0.80	0.27	0.86	0.64	0.46	0.15	0.58
	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	0.49						
Main business is over 5 years old	0.51	0.49	0.51	0.49	0.55	1.64	0.50	0.87	0.06	0.45	0.12	0.05
	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	0.18						
Business was open at baseline	0.83	0.83	0.84	0.85	0.81	0.90	0.67	0.43	0.36	0.83	0.21	0.20
	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	0.44						
Main business monthly profits (USD)	267.68	276.75	267.81	277.49	247.70	0.85	0.70	0.87	0.18	0.65	0.29	0.16
	(7.58)	(15.39)	(14.47)	(15.72)	(14.97)	0.47						
Main business monthly revenue (USD)	1,311.49	1,297.95	1,298.08	1,417.86	1,224.78	0.77	0.92	0.51	0.46	0.35	0.57	0.13
	(45.48)	(88.27)	(88.72)	(95.42)	(90.78)	0.51						
Number of employees in main business	4.39	4.45	4.08	4.54	4.50	0.62	0.31	0.93	0.94	0.20	0.22	0.83
	(0.12)	(0.26)	(0.21)	(0.25)	(0.27)	0.61						
Number of hours respondent spends on her business	8.58	8.33	8.65	8.77	8.57	1.46	0.15	0.04	0.33	0.60	0.74	0.51
	(0.08)	(0.16)	(0.15)	(0.14)	(0.16)	0.22						
Number of hours main business is open	10.56	10.42	10.60	10.56	10.66	0.35	0.46	0.70	0.46	0.84	1.00	0.52
	(0.08)	(0.18)	(0.17)	(0.15)	(0.17)	0.79						
Value of assets in main business (USD)	26,741.88	35,297.80	25,202.57	21,557.37	25,154.93	2.42	0.15	0.01	0.06	0.38	0.83	0.59
	(1,902.90)	(4,835.91)	(3,628.37)	(3,007.94)	(3,561.44)	0.06						
Made a large investment to their business in the past 6 months	0.33	0.33	0.35	0.30	0.35	1.12	0.47	0.25	0.73	0.12	0.96	0.16
	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	0.34						
Fraction of business practices followed (over 8 practices)	0.63	0.65	0.64	0.62	0.62	1.63	0.35	0.04	0.06	0.44	0.45	0.86
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	0.18						
F-test of joint significance (P-value)							0.89	0.04	0.04	0.36	0.31	0.29
Number of observations	2000	495	502	520	483	2000	997	1015	978	1022	985	1003

Notes: Column 1 shows the mean and standard errors of all balance variables for the entire sample. Columns 2-5 shows the mean and standard errors of all balance variables for each of the three treatment groups and control group. The 6th column presents the F stat and the associated p value for balance across all groups for the variable. Next 6 columns present the p values for pairwise t-tests between each of the treatment arms and control group. Variables with monetary values are expressed in USD using the nominal exchange rate of 100 ETB = 1.8 USD at baseline. Continuous variables are winsorized at the 99th percentile. The joint F-test presented at the bottom includes all covariates in this table.

Table A3: Impacts on Training Attendance - with four treatment groups

	Admin Data					Self-reported
	(1) Partial compliance (at least 1 course)	(2) Full compliance (at least 8 courses)	(3) App modules started or Training sessions attended	(4) App modules partially completed or Training sessions attended	(5) App modules completed or Training sessions attended	(6) App modules completed or Training sessions attended
App-based training	0.80***	0.21***	5.15***	3.60***	3.20***	6.91***
	(0.02)	(0.02)	(0.19)	(0.18)	(0.18)	(0.18)
App + networking	0.80***	0.24***	5.27***	3.84***	3.46***	6.80***
	(0.02)	(0.02)	(0.19)	(0.19)	(0.19)	(0.18)
In-person training	0.76***	0.71***	7.21***	7.21***	7.21***	8.07***
	(0.02)	(0.02)	(0.19)	(0.19)	(0.19)	(0.21)
Observations	2000	2000	2000	2000	2000	1928
Control mean	0.00	0.00	0.00	0.00	0.00	0.00
P-val t1=t2	1.00	0.16	0.65	0.34	0.28	0.66

Notes: Outcomes used in Columns 1-5 are constructed from administrative data, whereas the outcome used in Column 6 is constructed from self-reported data. Outcome 1 takes the value of 1 if the respondent completed at least 1 module on the app or attended 1 session of the in-person training course. Outcome 2 takes the value of 1 if respondent completed at least 8 modules on the app or attended at least 8 sessions of the in-person training course. Outcome 3 indicates the number of modules started on the app, or the number of classes attended, as there is no similar measure for in-person training. Outcome 4 indicates the number of modules partially completed, where the respondent completes at least half the lessons in a module, or the number of classes attended, as there is no partial measure for in-person attendance. Outcome 5 indicates the number of modules completed on the app, or the number of in-person sessions attended. Outcome 6 indicates the number of courses completed on the app, or the number of in-person sessions attended according to self-reported data from the follow-up survey. Results are obtained from OLS regressions of the outcome on three treatment dummies, controlling for LASSO selected controls, and randomization cohort fixed effects. Robust standard errors are in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Table A4: Impacts on Primary outcomes - with four treatment groups

	Survival	**Performance**				
	(1) Business was operating at follow-up (Yes 1; No 0)	(2) Profits and sales Index (SD)	(3) Last month's profit Main business (USD)	(4) Last month's profit Main and secondary business (USD)	(5) Last month's revenues Main business (USD)	(6) Last month's revenues Main and secondary business (USD)
App-based training	-0.02	0.01	10.13	-8.38	6.80	-30.87
	(0.02)	(0.05)	(27.33)	(28.46)	(105.61)	(110.51)
App + networking	-0.01	0.00	4.56	-1.76	-0.39	-33.44
	(0.02)	(0.05)	(27.07)	(28.58)	(107.52)	(112.84)
In-person training	0.01	0.01	-1.00	-15.27	-24.58	-69.60
	(0.02)	(0.05)	(26.72)	(27.78)	(105.17)	(111.89)
Observations	1928	1928	1928	1928	1928	1928
Control mean	0.91	0.00	398.85	421.81	1420.53	1513.11
P-val t1=t2	0.77	0.88	0.85	0.83	0.95	0.98

Notes: Outcome 1 is a binary variable indicating if the business was open at follow-up. Outcome 2 shows a profits and sales index, which is constructed by averaging the z scores (relative to the control group) of main and secondary business profits and sales, both IHS transformed and levels. Outcome 3 shows winsorized last month profits for the main business in USD. Outcome 4 shows last month winsorized profits for both the main and secondary business in USD. Outcome 5 shows last month winsorized sales for the main business in USD. Outcome 6 shows last month winsorized sales for both the main and secondary business in USD. Results are obtained from OLS regressions of the outcome on three treatment dummies, controlling for the baseline value of the outcome, LASSO selected controls, and randomization cohort fixed effects. Robust standard errors are in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Table A5: Impacts on Secondary outcomes - with four treatment groups

	Inputs				**Capital**			**Practices**	**Knowledge**
	(1) Inputs Index (SD)	(2) Number of employees	(3) Number of hours worked	(4) Number of hours open	(5) Capital Index (SD)	(6) Business assets (USD)	(7) Made investments (Yes 1; No 0)	(8) Business practice score (over 8 items)	(9) Knowledge score (over 3 items)
App-based training	-0.03	0.17	-0.13	-0.38*	0.08*	2989.44	0.04**	0.00	0.02*
	(0.04)	(0.18)	(0.21)	(0.20)	(0.04)	(1934.94)	(0.02)	(0.01)	(0.01)
App + networking	-0.03	-0.01	-0.07	-0.27	-0.06	-436.08	-0.03*	0.01	0.03**
	(0.04)	(0.19)	(0.21)	(0.21)	(0.04)	(1615.45)	(0.02)	(0.01)	(0.01)
In-person training	0.04	0.25	0.17	0.03	0.01	1236.49	0.00	0.02	0.02*
	(0.04)	(0.19)	(0.20)	(0.20)	(0.04)	(1702.05)	(0.02)	(0.01)	(0.01)
Observations	1928	1928	1928	1928	1928	1928	1928	1928	1928
Control mean	0.00	3.42	7.69	9.63	0.00	16035.48	0.09	0.62	0.43
P-val t1=t2	0.96	0.38	0.79	0.61	0.00	0.06	0.00	0.47	0.83

Notes: Outcome 1 is an inputs index, which is constructed by averaging the z scores (relative to the control group) of outcomes in Columns 2-4. Outcome 2 is the winsorized number of employees in the main business. Outcome 3 is the number of hours worked by the entrepreneur in her main business. Outcome 4 shows the number of hours the main business is open in a day. Outcome 5 is a capital index, which is constructed by averaging the z scores (relative to the control group) of assets and investments, both IHS transformed and in levels. Outcome 6 shows the winsorized value of business assets in USD. Outcome 7 is a binary variable which takes the value of 1 if the entrepreneur made a large investment in the past 6 months. Outcome 8 is the proportion of business practices implemented in the past 6 months. Outcome 9 is the proportion of correct answers to business knowledge questions. Results are obtained from OLS regressions of the outcome on three treatment dummies, controlling for the baseline value of the outcome, LASSO selected controls, and randomization cohort fixed effects. Robust standard errors are in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Table A6: Impacts on Primary outcomes - without controls

	Survival	**Performance**				
	(1) Business was operating at follow-up (Yes 1; No 0)	(2) Profits and sales Index (SD)	(3) Last month's profit Main business (USD)	(4) Last month's profit Main and secondary business (USD)	(5) Last month's revenues Main business (USD)	(6) Last month's revenues Main and secondary business (USD)
App-based training (T1)	-0.01	0.05	27.47	24.95	65.72	55.53
	(0.02)	(0.05)	(29.80)	(31.69)	(116.45)	(124.15)
In-person training (T2)	0.02	0.07	28.48	17.67	98.09	72.68
	(0.02)	(0.06)	(34.21)	(35.86)	(132.44)	(140.57)
Observations	1928	1928	1928	1928	1928	1928
Control mean	0.91	0.00	398.85	421.81	1420.53	1513.11
P-val t1=t2	0.13	0.74	0.97	0.81	0.78	0.89

Notes: Outcome 1 is a binary variable indicating if the business was open at follow-up. Outcome 2 shows a profits and sales index, which is constructed by averaging the z scores of main and secondary business profits and sales, both IHS transformed and levels. Outcome 3 shows winsorized last month profits for the main business in USD. Outcome 4 shows last month winsorized profits for both the main and secondary business in USD. Outcome 5 shows last month winsorized sales for the main business in USD. Outcome 6 shows last month winsorized sales for both the main and secondary business in USD. Results are obtained from OLS regressions of the outcome on two treatment dummies and including randomization cohort fixed effects. Robust standard errors are in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Table A7: Impacts on Secondary outcomes, without controls

	Inputs				**Capital**			**Practices**	**Knowledge**
	(1) Inputs Index (SD)	(2) Number of employees	(3) Number of hours worked	(4) Number of hours open	(5) Capital Index (SD)	(6) Business assets (USD)	(7) Made investments (Yes 1; No 0)	(8) Business practice score (Proportion)	(9) Knowledge score (Proportion)
App-based training (T1)	-0.03	0.07	-0.05	-0.28	0.04	2458.31	0.01	0.02	0.02**
	(0.04)	(0.26)	(0.21)	(0.21)	(0.04)	(1799.83)	(0.02)	(0.01)	(0.01)
In-person training (T2)	0.07	0.46	0.25	0.11	0.04	1936.64	0.01	0.03	0.02*
	(0.05)	(0.31)	(0.23)	(0.23)	(0.05)	(2045.14)	(0.02)	(0.02)	(0.01)
Observations	1928	1928	1928	1928	1928	1928	1928	1928	1928
Control mean	0.00	3.42	7.69	9.63	0.00	16035.48	0.09	0.62	0.43
P-val t1=t2	0.03	0.14	0.12	0.05	0.88	0.78	0.89	0.65	0.80

Notes: Outcome 1 is an inputs index, which is constructed by averaging the z scores (relative to the control group) of outcomes in Columns 2-4. Outcome 2 is the winsorized number of employees in the main business. Outcome 3 is the number of hours worked by the entrepreneur in her main business. Outcome 4 shows the number of hours the main business is open in a day. Outcome 5 is a capital index, which is constructed by averaging the z scores (relative to the control group) of assets and investments, both IHS transformed and in levels. Outcome 6 shows the winsorized value of business assets in USD. Outcome 7 is a binary variable which takes the value of 1 if the entrepreneur made a large investment in the past 6 months. Outcome 8 is the proportion of business practices implemented in the past 6 months. Outcome 9 is the proportion of correct answers to business knowledge questions. Results are obtained from OLS regressions of the outcome on two treatment dummies and including randomization cohort fixed effects. Robust standard errors are in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Table A8: Impacts with exact matching on education

	Panel A: App-based training					
	(1) Business was operating at follow-up (Yes 1; No 0)	(2) Profits and sales Index (SD)	(3) Inputs Index (SD)	(4) Capital Index (SD)	(5) Business practice score (Proportion)	(6) Knowledge score (Proportion)
ATT	-0.01	0.04	-0.02	0.02	0.02	0.02*
	(0.01)	(0.05)	(0.05)	(0.05)	(0.02)	(0.01)
Y1	0.90***	0.05**	-0.02	0.04	0.64***	0.45***
	(0.01)	(0.03)	(0.03)	(0.03)	(0.01)	(0.01)
Y0	0.91***	0.01	0.01	0.02	0.62***	0.43***
	(0.01)	(0.04)	(0.04)	(0.04)	(0.01)	(0.01)
Observations	1428	1428	1428	1428	1428	1428
	Panel B: In-person training					
	(1) Business was operating at follow-up (Yes 1; No 0)	(2) Profits and sales Index (SD)	(3) Inputs Index (SD)	(4) Capital Index (SD)	(5) Business practice score (Proportion)	(6) Knowledge score (Proportion)
ATT	0.02	0.06	0.07	0.02	0.02	0.02
	(0.02)	(0.06)	(0.05)	(0.05)	(0.02)	(0.02)
Y1	0.93***	0.07	0.07**	0.03	0.65***	0.45***
	(0.01)	(0.05)	(0.03)	(0.03)	(0.01)	(0.01)
Y0	0.91***	0.01	0.01	0.01	0.62***	0.43***
	(0.01)	(0.04)	(0.04)	(0.04)	(0.01)	(0.01)
Observations	967	967	967	967	967	967

Notes: Panel A presents results for only the app-based training group against the control group. Panel B presents results for the in-person training group against the control group. ATT shows the average treatment effect on the treated. Y1 is the outcome for the treatment group. Y0 is the outcome for the control group for both the app-based and in-person treatment in the two panels respectively. Outcome 1 is a binary variable indicating if the business was open at follow-up. Outcome 2 shows a profits and sales index, which is constructed by averaging the z scores (relative to the control group) of main and secondary business profits and sales, both IHS transformed and levels. Outcome 3 is an inputs index, which is constructed by averaging the z scores (relative to the control group) of the number of employees, hours worked, and hours business is open. Outcome 4 is a capital index, which is constructed by averaging the z scores (relative to the control group) of assets and investments, both IHS transformed and in levels. Outcome 5 is the proportion of business practices implemented in the past 6 months. Outcome 6 is the proportion of correct answers to business knowledge questions. Outcomes are regressed using exact matching on respondent having post secondary education. Observations represent number of individuals. Robust standard errors are in parentheses. $*p < 0.1$, $**p < 0.05$, $***p < 0.01$

Table A9: Analysis of attrition

	(1) Attriter (0/1)
App-based training (T1)	-0.02
	(0.04)
In-person training (T2)	-0.03
	(0.06)
Observations	2000
Attrition for App-based training	0.96
Attrition for in-person training	0.96
Attrition for control	0.97
P-value varXt1=varXt2	0.83

Notes: Attriter indicates if respondent completed the followup survey (=1). The variable was regressed against treatment dummies and their interaction with baseline variable characteristics. Coefficients on interaction terms and baseline variable are hidden for formatting purposes. Last row present tests of equality of all interaction terms. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Table A10: Impacts by sector

	Survival	**Performance**	**Inputs and Capital**		**Practices and knowledge**	
	(1) Business was operating at follow-up (Yes 1; No 0)	(2) Profits and sales Index (SD)	(3) Inputs Index (SD)	(4) Capital Index (SD)	(5) Business practice score (Proportion)	(6) Knowledge score (Proportion)
App-based training (T1)	-0.03	-0.01	-0.04	0.01	-0.01	0.03**
	(0.02)	(0.06)	(0.04)	(0.04)	(0.02)	(0.01)
In-person training (T2)	0.01	-0.01	0.06	0.06	0.02	0.02
	(0.02)	(0.07)	(0.05)	(0.05)	(0.02)	(0.02)
Main business is in the services sector	0.02	0.01	0.08	-0.06	-0.02	0.01
	(0.02)	(0.06)	(0.06)	(0.07)	(0.02)	(0.02)
Service sector x T1	0.04	0.04	0.02	0.02	0.01	-0.02
	(0.03)	(0.08)	(0.07)	(0.08)	(0.03)	(0.02)
Service sector x T2	0.01	0.05	-0.05	-0.11	-0.01	-0.01
	(0.03)	(0.09)	(0.08)	(0.08)	(0.03)	(0.03)
Observations	1928	1928	1928	1928	1928	1928
Control mean	0.91	0.01	-0.01	0.01	0.62	0.43
P-val t1+Xt1	0.81	0.53	0.80	0.69	0.52	0.46
P-val t2+Xt2	0.64	0.47	0.82	0.44	0.41	0.38
P-val Xt1=Xt2	0.31	0.92	0.28	0.08	0.58	0.65

Notes: Heterogeneity is shown by if the business was in the services sector, which makes up 41% of the sample. Outcome 1 is a binary variable indicating if the business was open at follow-up. Outcome 2 shows a profits and sales index, which is constructed by averaging the z scores (relative to the control group) of main and secondary business profits and sales, both IHS transformed and levels. Outcome 3 is an inputs index, which is constructed by averaging the z scores (relative to the control group) of the number of employees, hours worked, and hours business is open. Outcome 4 is a capital index, which is constructed by averaging the z scores (relative to the control group) of assets and investments, both IHS transformed and in levels. Outcome 5 is the proportion of business practices implemented in the past 6 months. Outcome 6 is the proportion of correct answers to business knowledge questions. Results are obtained from OLS regressions of the outcome on two treatment dummies, a service sector dummy, and two interaction terms with services sector and the treatment groups, controlling for the baseline value of the outcome, LASSO selected controls, and randomization cohort fixed effects. Robust standard errors are in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Table A11: Impacts by profits

	Survival	**Performance**	**Inputs and Capital**		**Practices and knowledge**	
	(1) Business was operating at follow-up (Yes 1; No 0)	(2) Profits and sales Index (SD)	(3) Inputs Index (SD)	(4) Capital Index (SD)	(5) Business practice score (Proportion)	(6) Knowledge score (Proportion)
App-based training (T1)	-0.03	-0.01	-0.03	0.04	0.01	0.02
	(0.02)	(0.05)	(0.05)	(0.04)	(0.02)	(0.02)
In-person training (T2)	0.01	0.06	0.02	0.08*	0.04**	0.04**
	(0.02)	(0.06)	(0.05)	(0.04)	(0.02)	(0.02)
Baseline profits were above the median (0/1)	0.01	0.15**	0.01	0.09	0.05**	-0.01
	(0.03)	(0.07)	(0.06)	(0.06)	(0.02)	(0.02)
Profits x T1	0.02	0.01	0.01	-0.07	-0.02	0.01
	(0.03)	(0.08)	(0.07)	(0.07)	(0.03)	(0.02)
Profits x T2	0.01	-0.09	0.04	-0.14*	-0.05	-0.04
	(0.03)	(0.10)	(0.08)	(0.08)	(0.03)	(0.02)
Observations	1928	1928	1928	1928	1928	1928
Control mean	0.91	0.01	-0.01	0.01	0.62	0.43
P-val t1+Xt1	0.72	0.91	0.59	0.62	0.67	0.10
P-val t2+Xt2	0.54	0.69	0.27	0.38	0.91	0.98
P-val Xt1=Xt2	0.68	0.28	0.66	0.39	0.37	0.04

Notes: Heterogeneity is shown by if the respondent's baseline business profits were above the sample median. Outcome 1 is a binary variable indicating if the business was open at follow-up. Outcome 2 shows a profits and sales index, which is constructed by averaging the z scores (relative to the control group) of main and secondary business profits and sales, both IHS transformed and levels. Outcome 3 is an inputs index, which is constructed by averaging the z scores (relative to the control group) of the number of employees, hours worked, and hours business is open. Outcome 4 is a capital index, which is constructed by averaging the z scores (relative to the control group) of assets and investments, both IHS transformed and in levels. Outcome 5 is the proportion of business practices implemented in the past 6 months. Outcome 6 is the proportion of correct answers to business knowledge questions. Results are obtained from OLS regressions of the outcome on two treatment dummies, a profit over the median dummy, and two interaction terms with the profit dummy and the treatment groups, controlling for the baseline value of the outcome, LASSO selected controls, and randomization cohort fixed effects. Robust standard errors are in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Table A12: Impacts by digital skills

	Survival	**Performance**	**Inputs and Capital**		**Practices and knowledge**	
	(1) Business was operating at follow-up (Yes 1; No 0)	(2) Profits and sales Index (SD)	(3) Inputs Index (SD)	(4) Capital Index (SD)	(5) Business practice score (Proportion)	(6) Knowledge score (Proportion)
App-based training (T1)	-0.02	0.01	-0.01	0.07	0.01	0.04**
	(0.02)	(0.06)	(0.05)	(0.05)	(0.02)	(0.02)
In-person training (T2)	0.02	0.09	0.06	0.08	0.02	0.02
	(0.02)	(0.07)	(0.06)	(0.06)	(0.02)	(0.02)
Digital skills were above the median (0/1)	0.03	0.08	0.13	0.13	0.07**	0.01
	(0.04)	(0.12)	(0.10)	(0.09)	(0.03)	(0.03)
Digital skills x T1	0.01	-0.01	-0.02	-0.10	-0.01	-0.02
	(0.03)	(0.08)	(0.07)	(0.07)	(0.03)	(0.02)
Digital skills x T2	-0.03	-0.13	-0.04	-0.11	-0.01	0.01
	(0.03)	(0.10)	(0.08)	(0.08)	(0.03)	(0.03)
Observations	1928	1928	1928	1928	1928	1928
Control mean	0.91	0.01	-0.01	0.01	0.62	0.43
P-val t1+Xt1	0.45	0.96	0.37	0.54	0.88	0.23
P-val t2+Xt2	0.80	0.53	0.65	0.57	0.34	0.15
P-val Xt1=Xt2	0.22	0.19	0.82	0.92	0.93	0.35

Notes: Heterogeneity is shown by if the respondent's baseline digital skills were above the sample median. Outcome 1 is a binary variable indicating if the business was open at follow-up. Outcome 2 shows a profits and sales index, which is constructed by averaging the z scores (relative to the control group) of main and secondary business profits and sales, both IHS transformed and levels. Outcome 3 is an inputs index, which is constructed by averaging the z scores (relative to the control group) of the number of employees, hours worked, and hours business is open. Outcome 4 is a capital index, which is constructed by averaging the z scores (relative to the control group) of assets and investments, both IHS transformed and in levels. Outcome 5 is the proportion of business practices implemented in the past 6 months. Outcome 6 is the proportion of correct answers to business knowledge questions. Results are obtained from OLS regressions of the outcome on two treatment dummies, a digital skills over the median dummy, and two interaction terms with digital skills dummy and the treatment groups, controlling for the baseline value of the outcome, LASSO selected controls, and randomization cohort fixed effects. Robust standard errors are in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Table A13: Impacts by education

	Survival	**Performance**	**Inputs and Capital**		**Practices and knowledge**	
	(1) Business was operating at follow-up (Yes 1; No 0)	(2) Profits and sales Index (SD)	(3) Inputs Index (SD)	(4) Capital Index (SD)	(5) Business practice score (Proportion)	(6) Knowledge score (Proportion)
App-based training (T1)	-0.01	-0.01	0.02	0.03	-0.02	0.03*
	(0.02)	(0.06)	(0.06)	(0.05)	(0.02)	(0.02)
In-person training (T2)	0.03	0.05	0.02	0.05	0.03	0.02
	(0.02)	(0.07)	(0.06)	(0.06)	(0.03)	(0.02)
Completed post-secondary education	0.02	0.11*	0.03	0.11*	0.02	0.03
	(0.02)	(0.06)	(0.06)	(0.06)	(0.02)	(0.02)
Post secondary education x T1	-0.01	-0.01	-0.07	-0.04	0.04*	-0.02
	(0.03)	(0.08)	(0.07)	(0.07)	(0.03)	(0.02)
Post secondary education x T2	-0.03	-0.06	0.02	-0.06	-0.01	-0.01
	(0.03)	(0.10)	(0.08)	(0.08)	(0.03)	(0.03)
Observations	1928	1928	1928	1928	1928	1928
Control mean	0.91	0.01	-0.01	0.01	0.62	0.43
P-val t1+Xt1	0.30	0.98	0.21	0.84	0.22	0.28
P-val t2+Xt2	0.79	0.87	0.34	0.82	0.35	0.27
P-val Xt1=Xt2	0.38	0.56	0.18	0.78	0.08	0.65

Notes: Heterogeneity is shown by if the respondent completed post-secondary education, which makes up 66% of the sample. Outcome 1 is a binary variable indicating if the business was open at follow-up. Outcome 2 shows a profits and sales index, which is constructed by averaging the z scores(relative to the control group) of main and secondary business profits and sales, both IHS transformed and levels. Outcome 3 is an inputs index, which is constructed by averaging the z scores (relative to the control group) of the number of employees, hours worked, and hours business is open. Outcome 4 is a capital index, which is constructed by averaging the z scores (relative to the control group) of assets and investments, both IHS transformed and in levels. Outcome 5 is the proportion of business practices implemented in the past 6 months. Outcome 6 is the proportion of correct answers to business knowledge questions. Results are obtained from OLS regressions of the outcome on two treatment dummies, a post-secondary education dummy, and two interaction terms with the post-secondary education dummy and the treatment groups, controlling for the baseline value of the outcome, LASSO selected controls, and randomization cohort fixed effects. Robust standard errors are in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Figure A1: Quantile treatment effects - for app-based training

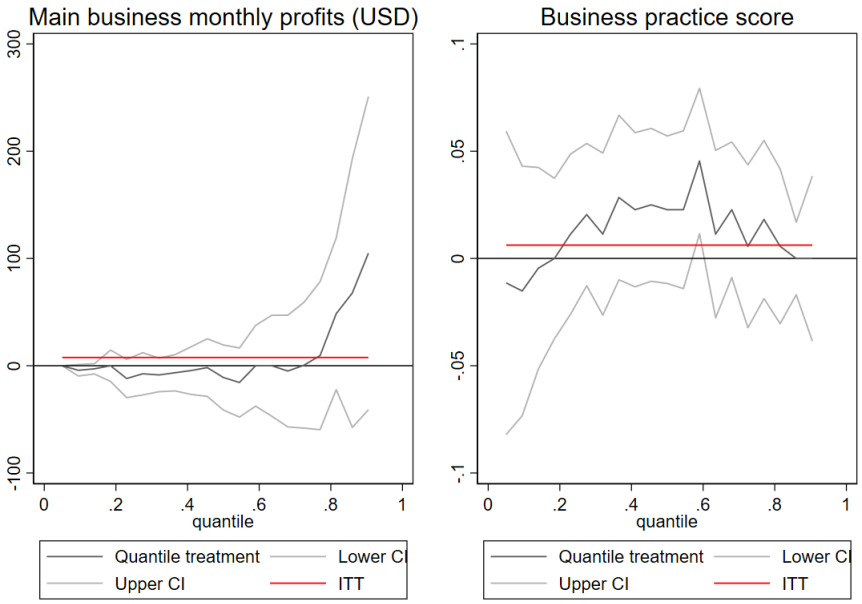


Figure A2: Quantile treatment effects - for in-person training

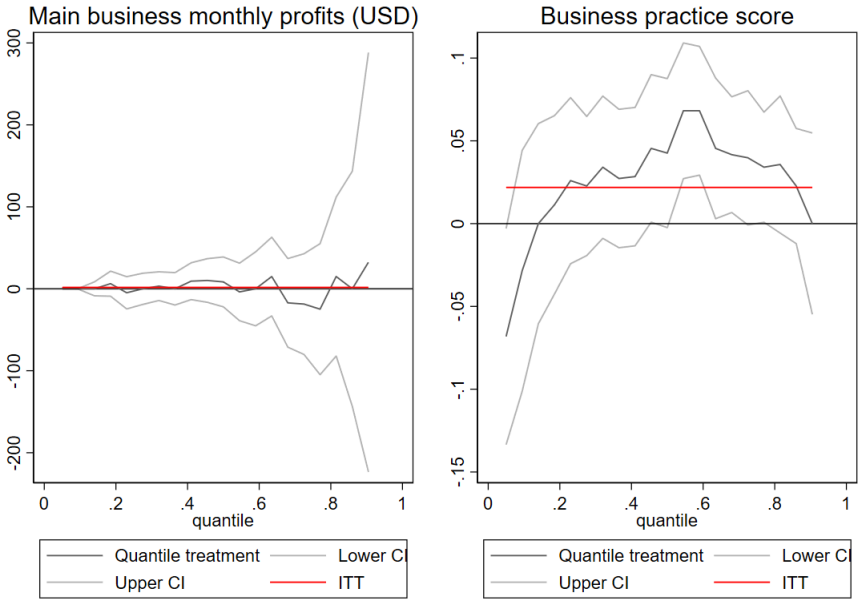
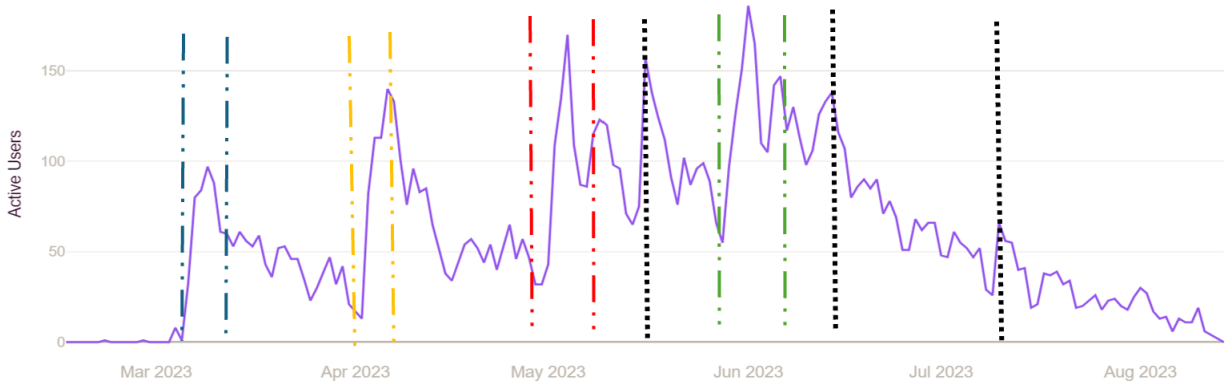


Table A14: Training details

	E-learning	In-person
Delivery and costs of delivery		
Length	Indefinite	6 weeks
Costs per participant	278 USD	511 USD
Methodology	Online, via app and self-paced	Classroom-based, including lectures, presentations, and group exercises
Language	English or Amharic (user's choice)	Amharic
Logistics and attendance		
Venue	N/A	Central training centers across Addis Ababa
Groups	N/A	20
Size of groups	N/A	25
Spacing of classes	N/A	Classes ran twice a week in the morning or afternoon for 6 weeks straight for each cohort of 5 classes (about 125 participants trained at a time, before moving onto the next cohort)
Completed at least 1 module/Attended at least 1 session	80%	76%
Partially completed at least 8 modules/Attended at least 8 sessions	31%	71%
Completed at least 8 modules/Attended at least 8 sessions	22%	71%
Content		
1. Entrepreneurship Fundamentals		
2. Opportunity Recognition		
3. Customer Discovery		
4. Defining your business vision		
5. Working in groups and teams		
6. Marketing fundamentals		
7. Marketing Mechanics		
8. Data collection		
9. Accounting		
10. Finance fundamentals		
11. Developing a business plan		

Figure A3: Online user activity



	Cohort 1	Cohort 2	Cohort 3	Cohort 4
Week of Info sessions	**March 6th to March 10th**	**April 3rd to April 7th**	**May 3rd to May 9th**	**May 30th to June 5th**
	Blue dotted lines	***Yellow dotted lines***	***Red dotted lines***	***Green dotted line***
Lottery text	**May 16th**		**June 12th**	**July 10th**
	Black dotted line			