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Building Human Capital in Conflict-affected Countries: Evidence from a Large-Scale Adult Literacy Program in Afghanistan

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Abstract

The number of armed conflicts is increasing globally, with the mechanisms shifting from traditional inter-state conflicts to more recent internationalized domestic conflicts. In this study, we used large individual panel data collected in 2009 and 2010, before and after the implementation of the adult literacy classes provided by the United Nations Educational, Scientific and Cultural Organization (UNESCO) Enhancement of Literacy in Afghanistan (ELA) project in 45 districts of nine provinces in Afghanistan, to estimate the shock of conflict on adult learning outcomes (numeracy skills). We attempted to estimate the magnitude of the shock of conflict on adult learning outcomes. Contrary to initial expectations, we did not find a direct effect of conflict shocks on numeracy scores, but we did find interesting interactions, such as the start time of the classroom (morning or afternoon), marital status, and employment status affecting learning outcomes in conflict areas, but differently for males and females. This study interprets these results from the perspective of people in conflict situations and in the particular context of Afghanistan. The study contributes to the development of policies for adult literacy education in conflict-affected countries.

Keywords: Armed Conflict, Adult Literacy Education, Afghanistan, Difference-in-Differences Approach

1. Introduction

In conflict-affected societies, human capital is the most fundamental asset for recovery. Schooling plays a vital role in creating and maintaining this asset. A growing body of literature has analyzed the long-term effects of conflict on education, with particular attention to the stock of human capital (Blattman & Miguel 2010) and educational attainment (Akbulut-Yuksel 2014; Akresh et al. 2012; Blattman & Annan 2010; Leon 2012; Shemyakina 2011). However, the literature on short-term

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Please note that the research and analysis in this paper was initiated before the Taliban took power in August 2021, and the term “the Afghan government”, “the Ministry of Education”, and “the Central of Statistics Office”, etc. mentioned in this paper refer to organizations under the previous government that existed before the Taliban seized power in August 2021. In addition, the social conditions in Afghanistan described in this paper are those prior to the Taliban taking control in August 2021.

effects of conflict on the educational achievements is still sparse, with studies using the data during the conflict-affected situation (Brück et al. 2019; Monteiro & Rocha 2017) and estimating the conflict impact on the short-term educational outcomes (Bertoni et al. 2019; Di Maio & Nandi 2013) and only a few other studies. Given that adult literacy and numeracy education is a very different schooling than formal schooling or vocational training, and it is often closely linked with immediate job opportunities and reinsertion (Blattman 2010), understanding the mechanisms that unveil the types of short-term damages and experiences caused by the conflict, and the types of individuals and groups affected, is essential not only in shaping effective adult literacy and numeracy programs, but also in formulating national literacy and numeracy education policies in countries affected by armed conflict.

This study brings unique evidence to the field of conflicts and adult literacy education by assessing the short-term effects of the Afghanistan war on adult numeracy test scores. We examine numeracy test and demography data from the United Nations Educational, Scientific and Cultural Organization (UNESCO) Enhancement of Literacy in Afghanistan (ELA) program, a large-scale adult literacy and numeracy education program started since 2009. We exploit a unique feature of this data collected from about 18,000 adults (aged 15 years and above) who joined the ELA program from 45 conflict affected and non-affected districts. Using a plausible spatial variation in the timing and intensity of conflict and propensity score weighted regression with the difference-in-differences approach, we identified and estimated the interesting interactive negative effects between conflicts and characteristics of literacy class and learners on numeracy test scores, with larger magnitudes for female learners.

The study builds on and contributes to a series of recent papers examining the long-run effects of conflicts on education and documenting negative effects in three important ways. First, we use micro data collected during conflict whereas most of the existing studies used quasi-experimental data based on past exposure to conflicts during childhood. This allows us to reveal the immediate effects of conflict. Second, while the existing literature has focused on educational attainment, we extend our analysis to consider the effects on test scores. Third, we study heterogeneity in the effects depending on the learner's gender. The large heterogeneities we find provide a deeper insight into designing educational policies in situations of unpredictability, such as during armed conflicts.

This paper reviews the adult literacy education and conflict at section 2. Section 3 explains the context of this study, the Afghan conflict situation over the past two decades, and the status of adult literacy and numeracy in Afghanistan. Section 4 and 5 present the data and identification strategy for the analysis of this study, while section 6 presents and discusses the findings. Section 7 provides the conclusion of this paper.

2. Adult Literacy Education and Conflict

Although the effects of literacy education in developing countries were not clearly demonstrated

until the early 2000s (Carr-Hill et al. 1991; Torgerson et al. 2003), research in this area has gradually increased since then, showing that participants are more motivated to use literacy skills in their daily lives, that female participants are more confident and willing to participate in community decision making (The World Bank 2001), and that literacy education programs impact “students’ lives, not just their learning” (Handa et al. 2009). More recently, literacy education programs have begun to use a variety of educational tools and theme, that initiated related research been widely conducted including evaluating the effectiveness of adult education using cell phones in Niger (Aker & Ksoll 2011), effective adult literacy education in a multilingual environment in East Timor exploring teacher characteristics (Boon 2011), and a systematic review of the effectiveness of non-formal education for street youth in Jordan, Egypt, and Ethiopia (Shephard 2014).

Among the various themes on the adult literacy education, the relation between adult learning and armed conflict is one of the significant themes in the field of international educational development studies. In 2000, the World Education Forum reconfirmed the importance of the educational reconstruction of post-conflict countries and gave global attention to adult learning because of the crisis of formal education during conflict. The long-lasting unstable education system in the country eventually results in the production of low-literacy and numeracy skilled generations in the country over time (UNESCO 2006). The chronic conflict in Timor-Leste since 1975 and the 1999 conflict for the independence that destroyed more than 70% of formal schools, caused continuously low rates of adult literacy and numeracy in Timor-Leste, which marked only 58% for Tetum and 42% for Bahasa Indonesia even 10 years after the end of the 1999 conflict (Democratic Republic of Timor-Leste and UNICEF 2014). The literacy rate (which encompasses numeracy skills) in Afghanistan is only 40% even in the highest during the past decades, obviously due to the prolonged conflict and lack of quality education. In addition, the situation where the Taliban regime, which returned to power in August 2021, is once again restricting girls’ education is expected to set Afghanistan’s literacy rate back even further in the future. In South Sudan, the civil war that lasted for 20 years reduced literacy and numeracy rates, especially among women, to only 8% at independence, and as of 2018, seven years after independence, the rate is still 29% (UIS Statistics 2018; USAID 2020). At the regional level in Africa, conflict-affected countries in sub-Saharan Africa have adult literacy rates of only 55%, compared to an average of 85% in countries not affected by conflict (UNESCO 2011b). At the global level, almost half of the countries with the lowest adult literacy rates in the early 2000s experienced conflict in the most recent period (Hanemann 2006).

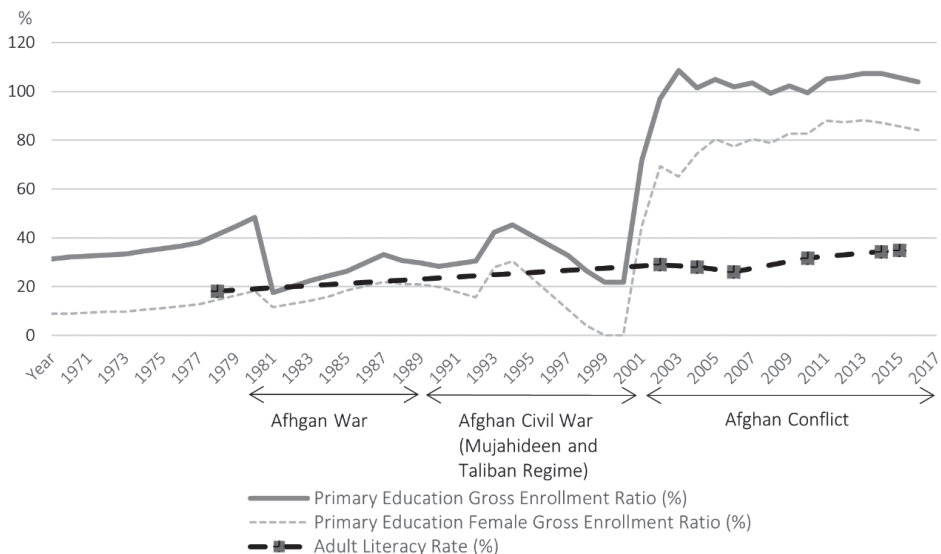
As armed conflict severely challenges the maintenance of education for children within a country, it also largely affects the operation of adult education during and after the conflict. Adult education learners in fragile countries typically face the challenge of how to keep “their ability or willingness to attend adult literacy classes” (Smith et al. 2009). It is common for people who seek to fill their primary needs for things like food, shelter, medicine, and job to put aside adult education. This situation

demotivates not only learners, but also teachers and supervisors of the adult education program. In addition, security concerns easily become the reason for local community leaders and authorities to stop implementing adult education courses, especially for females. Implementing agencies struggle to provide the basics of creating a conducive learning environment with the collaboration of such local authorities. As seen in the adult literacy and numeracy project in Afghanistan, engaging local authorities for administrative support, under the bureaucratic and underdeveloped administrative system of the local authority with its confusion rooted in insecurity of the field, severely sets back the operation of the project. This includes the provision of appropriate pre- and in-service training for literacy teachers, regular monitoring of each class for progress, and even prompt remuneration for literacy teachers and field staff (UNESCO 2006).

3. Situation of Adult Literacy in Afghanistan

The history of modern Afghan conflict precisely reflected the educational situation in Afghanistan. Since 1990s, the Taliban regime violently suppressed its own people by restricting most human rights, particularly women’s rights. Education was one of the most severely restricted activities under the Taliban regime in this time. The Taliban closed all girls’ schools and restricted female access to all forms of education. Boy’s education was closed or transformed into *madrasas*, teaching only Arabic and the Holy Qur’an and Hadith. (Baiza 2013; Jones 2008). As shown in Figure 1, the gross enrollment

Figure 1 Trends of Primary Education Gross Enrollment Ratios and Adult Literacy Rates in Afghanistan



Source: Author, based on CSO and UNICEF 2003, 2013, CSO and EU 2009, The World Bank 2017a, CSO 2016.

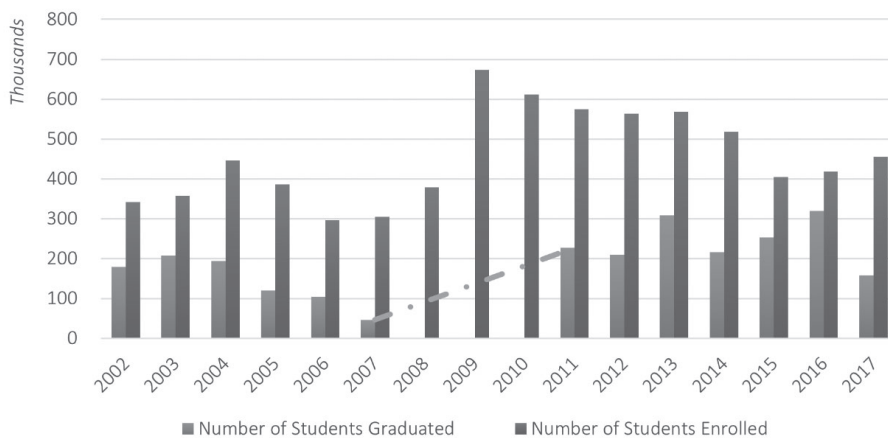
ratio for primary education remained low until the collapse of the Taliban regime. Especially the female ratio notably marked at 0% in 1999 and 2000.

With the end of the Taliban regime in 2001, the gross enrollment ratio drastically increased and reached almost 100% within three years of the inauguration of President Karzai’s new administration (The World Bank 2017b), but the adult literacy rate in Afghanistan remained low. The continuous conflicts and collapse of the education system, ongoing for decades until 2001, have taken away many generations’ opportunities for basic education. Consequently, the literacy rate in Afghanistan was only 34% even in 2015; this was one of the lowest adult literacy rates in the world (Pouras Consult Aps 2016).

Since 2002, the Afghan MoE began providing nine months of formal adult literacy courses (six months basic literacy and three months post-literacy courses), along with the resumption of the education system. According to data from the Afghan Central Statistics Organization (CSO), the MoE continued providing these courses even during the deteriorating security situation of 2005, but the enrollment and graduation numbers continuously declined until 2007 (CSO 2009) (see Figure 2).

After reaching its lowest point in 2007, the number of adult literacy learners have drastically increased since 2009, and classes have maintained over 400,000 enrollments every year. One of the reasons for this sudden increase might be that UNESCO initiated a large-scale adult literacy program (ELA) from 2008, together with the other large-scale literacy program operated by UN-Habitat. With the collaboration of the Literacy Department of the MoE, UNESCO aimed to provide literacy classes to 600,000 adult illiterates in 6 years (ELA 1st and 2nd Phase).

Figure 2 Number of Learners in Adult Literacy Courses by MoE in Afghanistan (2002–2017)



Note: The number of graduates between 2007 and 2010 are missing from the statistical yearbooks.
 Source: Author, based on CSO 2009.

Contrary to an increase in the total number of learners in literacy courses, however, the proportion of learners who completed and graduated the adult literacy course among the enrolled learners was low throughout the entire period. Around half of the learners who enrolled in the literacy course eventually dropped out, except in 2015 and 2016. The lowest rate of graduation was 15.2% in 2007, and the average rate was 44.7% between 2002 and 2017. Apart from the daily activities of adult literacy learners, which interrupts their studies, LIFE (2008) explains the reason for this high dropout rate as being due to the lack of a “highly skilled, well qualified and keenly motivated ToT [Training of Trainers] team” in the Literacy Department of MoE (LIFE 2008).

4. Data

4.1. UNESCO’s Programme for ELA and Adult Literacy and Numeracy Assessment Data

Adult numeracy assessment data collected during the implementation of the ELA program was used in this empirical analysis. ELA program started providing their literacy courses in March 2009, administered by UNESCO and the Ministry of Education, and initially launched in nine provinces of Afghanistan (Badakhshan, Balkh, Bamiyan, Daikundi, Ghor, Nangarhar, Paktika, Samangan, and Wardak provinces) with the aim of providing nine-month literacy courses to 300,000 adult learners over three years in 50 districts.

The first batch of the ELA program began with a 6-month basic literacy course from June to September 2009, providing 3,696 classes to 100,000 learners in 45 districts, and completed a 3-month post-literacy course by June 2010. During this period, up to 90,428 learners participated in the ELA course and 84,636 completed the post-literacy course (UNESCO 2010, 2011a).

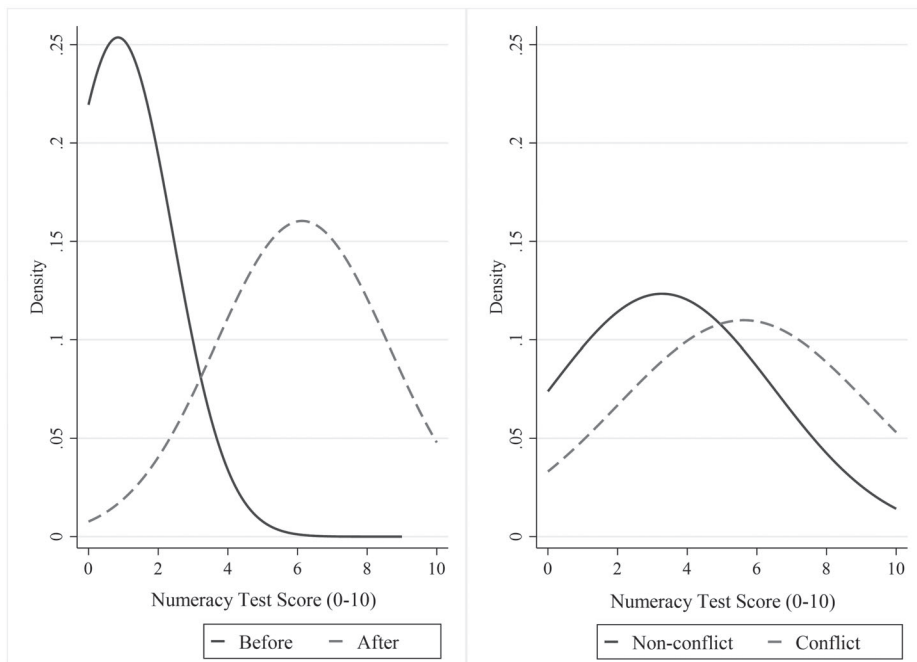
The UNESCO Kabul Office, in collaboration with the MoE, conducted an evaluation survey of the participants’ literacy and numeracy skills during this period. This assessment survey consisted of basic learner information and literacy and numeracy test components aligned with the official proficiency levels for literacy in Afghanistan at the time, both developed by the literacy department of the MoE with the support of the UNESCO Kabul Office. The numeracy test consists of 10 questions: five multiple choice questions of addition, subtraction, multiplication, and division, and five complex calculation questions. The reading and writing test also consists of a total of 10 questions: 5 simple writing questions using the alphabet and selecting multiple letters to form words, and 5 questions that require changing the order of multiple words to form sentences. All questions are worth one point, and the total score is determined by the number of correct answers.

Five learners were randomly selected from each class and assessed at the beginning of the basic literacy course (pre-test), and the same five learners or newly selected learners if any of the first five dropped out were assessed again at the end of the course (post-test). As a result, 18,240 of the initial 90,428 learners at the beginning and 18,230 of the final 84,636 learners at the end of the literacy

and numeracy course participated in the assessment, respectively. Since the pre-test and post-test data were not systematically bracketed by the same participants or by newly selected participants, the authors performed systematic matching using the first name, last name, and father’s name of participants in the same district to construct panel data for the pre-test and post-test participants. This matching ultimately yielded data on 8,507 individuals. However, after careful examination of the test results, we found the systematic pattern of answers in the reading and writing test such as responses to question were identical or varied systematically across many adjacent lists of participants in a given district or province, this study excluded the reading and writing components and used only the numeracy component for which no such problems were found.

As shown in Figure 3, the mean score of the numeracy test in post-test (“After”) is clearly higher than that of the pre-test (“Before”), marking 6.1 points on a 10–point scale, compared to 0.8 points for the pre-test. The mean test score by conflict and non-conflict areas shows the higher scores in the conflict districts compared to the non-conflict areas by 5.5 points and 3.3 points, respectively, the opposite of what was initially expected.

Figure 3 Distribution of Numeracy Test Scores by Pre- and Post-Test and Non-conflict and Conflict Areas



Note: Distribution is calculated based on the gaussian kernel density method.
 Source: Author created based on the UNESCO ELA’s Adult Literacy and Numeracy Assessment Data.

Other basic individual information in the combined panel data from the beginning and end of the literacy course as well as the conflict and non-conflict areas is shown in Table 1 below.

Table 1 Summary of Participant’s Individual and Family Characteristics by Conflict Exposure and Before/After the Literacy Courses

Variable	Values	Non-Conflict (1)			Conflict (2)			Mean (2)- Mean(1) with t-test results
		N	Mean	S.D	N	Mean	S.D	
		Score of numeracy test	0-10	14,419	3.3	3.23	1,928	
Sex	0-1	14,687	0.3	0.47	2,305	0.4	0.48	0.04***
Age	12-91	14,661	26.0	8.46	2,305	22.4	8.00	- 3.63***
Married	0-1	14,687	0.6	0.48	2,305	0.4	0.48	- 0.29***
Morning class	0-1	14,687	0.6	0.49	2,305	0.6	0.50	- 0.05***
Unemployed	0-1	14,687	0.3	0.44	2,305	0.4	0.49	0.12***
Urban area	0-1	14,683	0.9	0.25	2,305	0.6	0.49	- 0.35***
Literacy Level	1-3	14,644	1.3	0.52	2,305	1.1	0.34	- 0.16***
Length of literacy courses	1-4	14,605	1.9	1.15	2,305	1.7	0.94	- 0.24***
Years in School	0-4	14,687	1.0	1.12	2,305	0.1	0.37	- 0.89***
Number of people living together	0-40	14,656	8.5	4.19	2,303	10.5	4.52	1.99***
TV in the house	0-1	14,616	0.3	0.47	2,304	0.4	0.49	0.06***
Radio in the house	0-1	14,610	0.8	0.40	2,304	0.9	0.32	0.09***
Number of books in the house	0-278	14,591	13.5	29.19	2,281	18.4	19.75	4.86
Minutes to take to literacy class	0-120	14,641	11.4	10.95	2,297	7.7	7.05	- 3.66***
Do you like to go to literacy class	0-1	14,612	1.0	0.14	2,304	1.0	0.05	0.02***

Variable	Values	Pre-Test (1)			Post-Test (2)			Mean (2)- Mean(1) with t-test results
		N	Mean	S.D	N	Mean	S.D	
		Score of Numeracy	0-10	7,982	0.8	1.57	8,365	
Married	0-1	8,496	0.6	0.49	8,496	0.6	0.49	0.003
Unemployed	0-1	8,496	0.2	0.38	8,496	0.4	0.49	0.22***
Urban area	0-1	8,494	0.9	0.32	8,494	0.9	0.32	0.35***
Literacy Level	1-3	8,476	1.1	0.31	8,473	1.4	0.59	0.35***
Length of literacy courses	1-4	8,454	1.2	0.57	8,456	2.5	1.16	1.33***
Number of people living together	0-40	8,474	8.8	4.38	8,485	8.8	4.21	0.05
TV in the house	0-1	8,479	0.3	0.47	8,441	0.3	0.47	0.007
Radio in the house	0-1	8,478	0.8	0.41	8,436	0.8	0.38	0.03***
Number of books in the house	0-278	8,458	10.3	14.43	8,414	18.0	36.75	7.62***
Do you like to go to literacy class	0-1	8,480	1.0	0.14	8,436	1.0	0.12	0.005

Note: Descriptive Statistics before and after literacy courses only show the time-variant variables. The value labels in the table is as follows: Sex (0: female, 1: male), Literacy Level (1: Illiterate, 2: Semi-Literate, 3: Literate), Years in School (0: Never, 1: 1 yr, 2: 2 yrs, 3: 3 yrs, 4: more than 3 yrs), Length of literacy courses (1: Never, 2: 1-3 months, 3: 3-6 months, 4: 6-9 months), Dummy var (0: no, 1: yes).

Source: Author created.

4.2. Uppsala Conflict Database

The presence or absence of conflict shocks in each ELA learner was determined based on the conflict database of Uppsala Conflict Data Program (UCDP 2020), which collects the global conflict information, including the number of civilian and non-civilian deaths per battle from each conflict and detailed information on each insurgent group since 1946. From the UCDP database, we determined the total number of battles recorded in Afghanistan from the beginning of January to the end of May 2009 in the district where the ELA learners lived as their experience with conflict and level of exposure to the conflict before the ELA literacy classes started. Similarly, the total number of battles recorded from the beginning of June to the end of June 2010 was assigned as the conflict experience and level of exposure to the conflict during the ELA literacy classes.

In this study, we adopt an objective measure of the amount of conflict in the smallest administrative area (district in this study) similar to existing studies measuring conflict shocks (Justino et al. 2014; Verwimp & Van Bavel 2014), and constructed a binary variable that equals 1 if the ELA learner lives in a district where at least one conflict victim is recorded and also a continuous variable corresponding to the number of battles in the district where the EEA learner lives.

5. Identification Strategy

Our identification strategy exploits difference in differences strategy with two-way fixed effects using time and individual fixed effects (Clarke & Schythe 2020; Goodman-Bacon 2021). Specifically, we use the fact that some districts were exposed to highly intense conflicts during the adult literacy and numeracy program, and compared learning outcomes between learners in a conflict-affected district and a non-conflict district, before and after the adult literacy and numeracy program.

However, because our data is a panel structure that collects information from the same learners before and after ELA literacy classes, we decided to follow Rüter and Martin's (2021) analysis and start with random-effect model that includes individual time-invariant characteristics before conducting the difference-in-difference analysis with the two-way fixed effect, and conduct the Hausman test to check the existence of correlation between the unique errors and independent variables. Our starting random-effect model is described as follows:

$$y_{i,s,d,t} = \alpha + \tau_t + \beta_1(Conf_{i,d,t}) + \gamma(Class_s) + \lambda X_i + (\mu_i + \nu_{i,s,d,t}) \quad (1)$$

where $y_{i,s,d,t}$ is a test score for individual i in literacy classroom s in district d at time period t . τ_t is a time-effect before literacy class started or after literacy class ended. $Conf_{i,d,t}$ is a dummy variable, equal to one if the districts where individual i resides experienced any conflict at time period t . β_1 is our initial interest of analysis showing the impact of conflict exposure on the learning outcome (numeracy test score). $\gamma(Class_s)$ is time-invariant literacy classroom characteristics including the classroom

period (morning time or afternoon time), distance from home to the classroom, etc. λX_i is both time-invariant individual learner's characteristics, such as learner's age (converted to natural logarithm), sex, rural residence, highest education level, as well as time-variant individual characteristics, including marital status, occupation status, number of family members, books, TV and Radio at home, and perception of going to literacy class. μ_i is an unobserved individual specific effect and ν_{iy} is the error term for each case.

Our fixed-effect model is specified as follows:

$$y_{i,d,t} = \delta_i + \tau_t + \beta_1(Conf_{i,d,t}) + \lambda X_{i,d,t} + \varepsilon_{i,d,t} \quad (2)$$

In the fixed-effect model, we inserted the time fixed effect (τ_t) and individual fixed effect (δ_i) as well as the conflict exposure ($Conf_{i,d,t}$) to construct difference-in-difference structure using two-way fixed effect. Since we use the individual level panel data and added individual fixed effect as a treatment indicator, $Conf_{i,d,t}$ becomes the indicator of post-literacy class period for individual i who was exposed to the conflict in the difference-in-difference structure (Callaway & Sant'Anna 2019). Both time-invariant literacy classroom characteristics $\gamma (Class_s)$ and time-invariant individual learner's characteristics (part of λX_i) are absorbed into the individual learner's fixed effect δ_i . However, since $Conf_{i,d,t}$ is actually measured based on upper level (district) information and apply it to the individual conflict exposure, the standard errors were clustered at the district level in the analysis. $\lambda X_{i,d,t}$ is a vector of observable time-variant characteristics which changes during the period of ELA literacy program.

As a result of Hausman test showing the preferable to the fixed-effect model (chi2=150.1, df=9, $p < 0.000$), we have decided to use the fixed-effect model for this analysis and further added interaction terms between $Conf_{d,t}$ and $\gamma (Class_s)$ as well as $\lambda X_{i,t}$ in the fixed-effect model to seek the detailed mechanism of the impact of conflict on the learner's outcome shown as below. Here, the interaction terms with $\gamma (Class_s)$ and $\lambda X_{i,t}$ include both time-variant and invariant variables because time-invariant variables can also constitute interaction terms with other time-variant variables (conflict exposure in this case) without main effects.

$$y_{i,s,d,t} = \alpha + \delta_i + \tau_t + \beta_1(Conf_{d,t}) + \beta_2(Conf_{d,t} * Class_s) + \beta_2 (Conf_{d,t} * \lambda X_{i,t}) + \varepsilon_{i,s,d,t} \quad (3)$$

The difference-in-differences estimator controls for the differences between the treated and control areas. However, the nature of the conflict in Afghanistan could potentially generate selection bias errors due to the non-randomness of the conflict. To further address the bias (because selection includes preexisting differences between conflict and non-conflict areas), we use an alternative specification that employs the frequency weights obtained from propensity score matching to deduce a weighted estimator that allows us to reconstruct the counterfactual between conflict and non-conflict samples during the pretreatment period. Our baseline matching procedure uses a probit model with

location (urban–rural) and demographic composition (age, gender) as well as the socio-economic situation (employment, number of family members, possession of TV and radio, preference to go to literacy class).

6. Findings and Discussion

In Table 2, Column 1 reports the row difference in total test scores before and after the ELA literacy course, and between conflict and non-conflict districts where the learner lives, including the individual learner’s fixed effect which controls the time-invariant learner’s characteristics. Column 2 provides

Table 2 Linear Regression Estimates of the Effect of Conflict Shocks on the Adult Education Numeracy Test Score – Fixed Effects Models

<i>Dependent Variable: Numeracy Test</i>						
<i>Score Type of Conflict Variable</i>	Living in Conflict District (=1)			Number of Combats in District		
	(1)	(2)	(3)	(4)	(5)	(6)
Conflict Exposure	1.52 (2.56)	1.54 (2.49)	1.02 (2.54)	1.16 (1.21)	1.21 (1.19)	1.15 (1.21)
Post-test period (=1)	5.16*** (0.67)	5.01*** (0.74)	5.38*** (0.85)	5.04*** (0.67)	4.88*** (0.74)	4.84*** (0.61)
Number of books at home		0.02*** (0.00)	0.02*** (0.01)		0.02*** (0.00)	0.03*** (0.00)
Do you have TV (=1)		0.01 (0.64)	1.02** (0.50)		– 0.11 (0.56)	0.79 (0.60)
Do you have Radio (=1)		0.10 (0.44)	0.20 (0.56)		0.14 (0.46)	0.47 (0.57)
Married (=1)		1.41** (0.58)	1.77** (0.77)		1.36** (0.59)	1.57** (0.75)
Unemployed (=1)		0.11 (0.60)	0.44 (0.39)		0.05 (0.59)	0.27 (0.42)
Number of people living together		– 0.04 (0.04)	– 0.10* (0.05)		– 0.03 (0.04)	– 0.07 (0.05)
Do you like to go to school (=1)		– 0.77 (0.52)	– 1.63 (0.98)		– 0.76 (0.55)	– 1.22 (0.88)
Observations	16,347	16,075	56,633	16,347	16,075	56,633
R-squared	0.72	0.75	0.83	0.73	0.76	0.84
Number of Learners (learner ID)	8,495	8,453	5,530	8,495	8,453	5,530
Individual Fixed-Effect	Yes	Yes	Yes	Yes	Yes	Yes
Propensity Score Weighted Regression	No	No	Yes	No	No	Yes

Note: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors clustered at the district level in parentheses
Source: Author created.

the results, where learner's time-variant characteristics are included in the regression and Column 3 presents the results when we added the individual frequency weights based on the propensity score. Column 4 through 6 present the estimation results under the same conditions, replacing the definition of conflict with the number of battles in the learner's district of residence.

Overall, no statistically significant changes in test scores were observed between conflict and non-conflict areas, a result contrary to our initial belief that conflict has a significant negative impact on test scores in adult education, when the negative impact on the learning outcome of official school age children are often reported (Bertoni et al. 2019; Brück et al. 2019; Di Maio & Nandi 2013; Shemyakina 2011). However, the numeracy test scores increased by about 5 points between pre- and post-tests throughout the columns, indicating that the literacy courses in the ELA program were relatively robust to the conflict situation in Afghanistan and may have functioned to some extent in building literacy skills among learners at the time. The adult education learners in conflict districts where are relatively low number of deaths or battles (as is the case of our sample districts) may have potential opportunities to learn literacy skills at the classes as much as the learners living in the non-conflict districts in Afghanistan.

One of the key innovations of this paper is to explain the detailed mechanism of the negative effects of conflict on learning outcomes by focusing on the interaction of conflict conditions with literacy classroom and learner's characteristics. As shown in Table 3, the results for the series of interaction terms in columns 1 through 6 are strikingly indicative of the hidden effects that conflict exposure has on literacy outcomes.

First, we found that when learners lived in conflict areas, the impact of distance from home to classroom on numeracy scores was significantly lower than for learners living in non-conflict areas. On the other hand, the morning classes and the fact that the learners were male both had a positive effect on numeracy test scores in conflict areas. Given that security generally deteriorates in conflict areas in the afternoon to evening (Center for Civilians in Conflict 2013; Open Society Foundations 2011), and that kidnapping and intimidation were prevalent in Afghanistan at the time, especially in Taliban-controlled areas, it is not difficult to imagine that people in Afghanistan's conflict-affected districts or provinces were less willing to attend literacy classes in the afternoon than in the morning, and that female learners were at a much higher risk than their male counterparts of attending literacy classes, regardless of the time of day. Given these unique circumstances in conflict areas, one might imagine that learners would not find it easy to attend literacy classes regardless of distance, and as a result, the effect of distance on scores might be relatively smaller in conflict areas. As Brück et al. (2019) discuss the role of students' psychological well-being as the main transmission mechanism for the impact of conflict on educational achievement, the above findings suggest that mental health and general fear may also affect achievement among adult literacy learners.

Although the changes in marital status and employment status indicated as interaction terms were

Table 3 Linear Regression Estimates of the Interaction between Conflict Shocks and Class and Learner's Characteristics on the Adult Education Numeracy Test Score – Fixed Effects Models

<i>Dependent Variable Numeracy test score</i>						
<i>Type of Conflict Variable</i>	Living in Conflict District (=1)			Number of Combats in District		
	(1)	(2)	(3)	(4)	(5)	(6)
Conflict Exposure	0.35 (2.39)	0.28 (2.39)	− 0.07 (2.42)	0.48 (1.22)	0.44 (1.22)	0.50 (1.21)
Post-test period	4.96*** (0.75)	5.04*** (0.75)	5.43*** (0.84)	4.79*** (0.75)	4.87*** (0.75)	4.72*** (0.53)
Married (=1)	1.41** (0.60)	1.33** (0.60)	1.84** (0.67)	1.40** (0.59)	1.33** (0.59)	1.71*** (0.55)
Unemployed (=1)	0.01 (0.70)	− 0.07 (0.68)	0.08 (0.70)	0.00 (0.68)	− 0.09 (0.67)	− 0.12 (0.58)
Number of books at home	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.03*** (0.00)	0.03*** (0.00)	0.03*** (0.00)
<i>Interaction with Conflict Var</i>						
* Distance to classroom	− 0.33*** (0.01)	− 0.34*** (0.01)	− 0.34*** (0.01)	− 0.20*** (0.04)	− 0.20*** (0.04)	− 0.20*** (0.04)
* Morning class (=1)	0.33*** (0.06)	0.33*** (0.06)	0.32*** (0.05)	0.12** (0.05)	0.11** (0.06)	0.11** (0.05)
* Male (=1)	1.37*** (0.41)	1.36*** (0.39)	1.49*** (0.39)	0.78*** (0.15)	0.77*** (0.14)	0.80*** (0.13)
* Married (=1)	− 0.00 (1.93)	0.05 (1.87)	0.40 (1.23)	0.22 (0.43)	0.21 (0.44)	0.27 (0.30)
* Unemployed (=1)	1.04 (2.29)	1.06 (2.21)	0.42 (1.97)	0.27 (0.43)	0.31 (0.42)	0.24 (0.45)
* Number of Books at home	0.09*** (0.00)	0.09*** (0.00)	0.09*** (0.00)	0.05*** (0.01)	0.05*** (0.01)	0.05*** (0.01)
Observations	16,197	16,031	56,458	16,197	16,031	56,458
R-squared	0.75	0.75	0.83	0.76	0.76	0.86
Number of Learners (learner ID)	8,441	8,427	5,516	8,441	8,427	5,516
Individual Fixed-Effect	Yes	Yes	Yes	Yes	Yes	Yes
Other Individual Vector	No	Yes	Yes	No	Yes	Yes
Propensity Score Weighted Regression	No	No	Yes	No	No	Yes

Note: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors clustered at the district level in parentheses. Other Individual Vector includes “Do you have TV”, “Do you have Radio”, “Number of people living together”, and “Do you like to go to school”, which are all insignificant. Variables in interaction terms but not show as the independent variable are all time-invariant variables.

Source: Author created.

not statistically significant overall, the increase in literacy opportunities at home, as indicated by the number of books at home, had a strong positive effect on the numeracy scores in the conflict areas. This clearly indicates that the learning opportunities at home are important in conflict areas, where going out is associated with a high risk of being involved in conflict.

After establishing the effect of conflict on literacy, we turn to the heterogeneity of this effect across gender. Earlier research suggested that much of the conflict's effects on various outcomes may be attributable to differences in gender (Buvinic et al. 2013; Singh & Shemyakina 2013; Verwimp & Van Bavel 2014). In this regard, we explored heterogeneity by gender as a case of Afghanistan by rerunning specification of column (3) and (6) of Tables 3. The estimation results shown in Table 4 again did not confirm the statistical significance of direct effect of conflict regardless of the gender of the learner, but the interaction term between conflict exposure and distance to literacy course from home showed larger negative coefficient in female than in male. This suggests that the aforementioned interpretation that distance from home to literacy classes has a relatively lower effect on the number test score for learners living in conflict areas due to various difficulties related to the conflict may apply to an even greater extent to female learners, indicating the vulnerability of women in conflict areas. Like Bertoni et al. (2019) presented the difficulty for older children to continue schooling due to high opportunity costs in conflict, and Di Maio and Nandi (2013) showed that increased child labor reduces school attendance in conflict, it is possible that female adults in Afghanistan face a similar situation in terms of increased domestic work and lack of understanding of their surroundings in terms of cost and security under conflict, and thus may not be able to satisfactorily attend literacy classes. Efforts should be made to either provide robust security not only for female literacy classes, but also for broader-range environment for the general female learning in the conflict areas, including the people's mind on the female activities in the conflict areas.

On the other hand, the interaction terms with morning class, marital status, and employment status showed statistically significant opposite coefficients between male and female learners. The negative coefficient for morning classes for male learners in conflict areas may be due to their strong preference for daytime work (mainly farmers) for safety reasons, making their participation in literacy courses more difficult; conversely, female learners may be more sensitive to the hours of operation of literacy classes for the same safety reasons and tend to attend literacy classes more actively in the morning. This interpretation can be also inferred from the fact that the effect of the number of books at home is highly potent for female learners in the conflict districts or provinces. Unlike the finding by Verwimp and Van Bavel (2014) that conflict reduces gender disparities in formal schooling, our findings reveal that female's access to literacy classes in conflict areas is generally more difficult than male's, especially in Afghanistan, and activities such as distributing additional educational materials to the homes of female learners may be strongly effective in improving adult literacy outcomes in conflict areas.

Table 4 Linear Regression Estimates of the Conflict Shocks on the Adult Education Numeracy Test Score by Learner's Sex – Fixed Effects Models

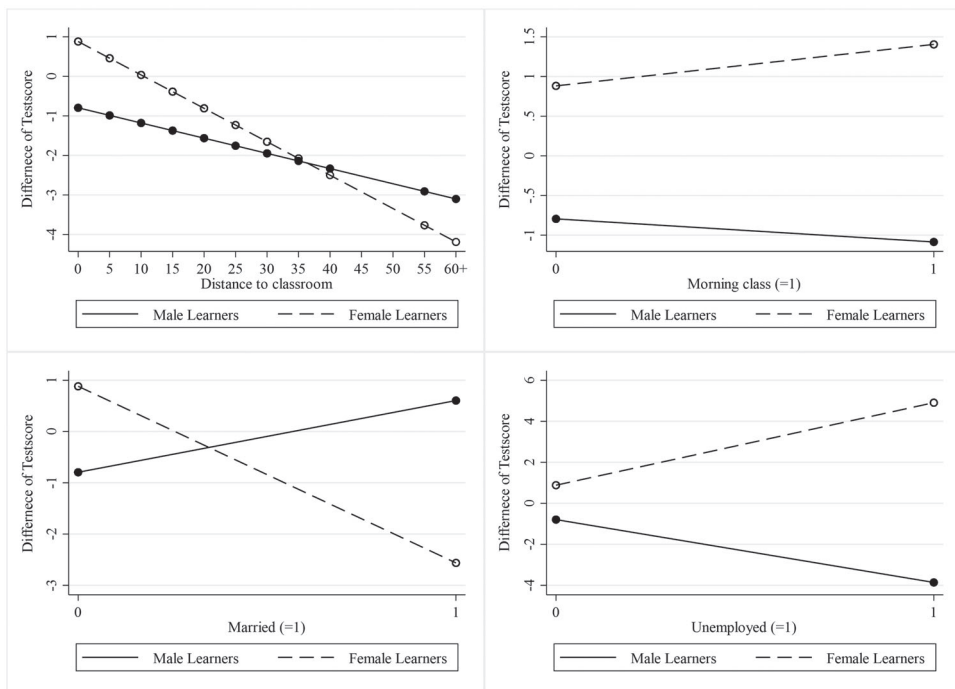
<i>Dependent Variable Numeracy test score</i>	<i>Type of Conflict Variable</i>			
	Living in Conflict District (=1)		Number of Combats in District	
	Female (1)	Male (2)	Female (3)	Male (4)
Conflict Exposure	0.47 (2.32)	1.63 (2.60)	0.70 (1.19)	1.53 (1.05)
Post-test period (=1)	5.41*** (0.79)	5.47*** (0.95)	4.76*** (0.50)	4.65*** (0.68)
Married (=1)	2.70** (1.19)	1.40 (0.90)	2.75** (1.14)	1.16* (0.61)
Unemployed (=1)	-0.89 (0.66)	2.52 (1.68)	-0.69 (0.58)	2.21 (1.49)
Number of books at home	0.03*** (0.00)	0.02* (0.01)	0.03*** (0.00)	0.02*** (0.01)
<i>Interaction with Conflict Var</i>				
* Distance to classroom	-0.42*** (0.08)	-0.19** (0.07)	-0.22*** (0.01)	-0.14 (0.08)
* Morning class (=1)	0.52*** (0.03)	-0.29*** (0.06)	0.23*** (0.04)	-0.20** (0.08)
* Married (=1)	-3.44*** (1.05)	2.39* (1.39)	-1.02*** (0.36)	1.03*** (0.32)
* Unemployed (=1)	4.02*** (0.56)	-3.06* (1.71)	1.19*** (0.41)	-1.33** (0.49)
* Number of Books at home	0.08*** (0.02)	0.09 (0.06)	0.04*** (0.00)	0.05 (0.03)
Observations	38,152	18,306	38,152	18,306
R-squared	0.84	0.85	0.87	0.87
Number of Learners (learner ID)	3,684	1,832	3,684	1,832
Individual Fixed-Effect	Yes	Yes	Yes	Yes
Other Individual Vector	Yes	Yes	Yes	Yes
Propensity Score Weighted regression	Yes	Yes	Yes	Yes

Note: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors clustered at the district level in parentheses. Other Individual Vector includes “Do you have TV”, “Do you have Radio”, “Number of people living together”, and “Do you like to go to school”, which are all insignificant. Variables in interaction terms but not show as the independent variable are all time-invariant variables.

Source: Author created.

The estimated results of the interaction terms with marital and employment status seem more difficult to interpret in the context of Afghanistan at the time. The results indicate that unmarried and unemployed female learners tend to acquire higher numeracy test scores, especially in conflict areas. One possible interpretation is that married female learners living in conflict areas must devote more time to their children and families from a security perspective, and leaving their families at home to attend literacy classes may be very difficult. In Afghanistan, where the culture is deeply rooted in which women are responsible for the majority of household chores and childcare in the home (Zand 2011), it would not be easy to gain the consensus within families about continuing to attend literacy classes especially in conflict areas, compared to the unmarried women. On the other hand, the positive effect of women’s unemployed status in conflict areas may be explained by the fact that such women’s willingness to learn may be higher in conflict areas. In conflict areas, society is generally unstable and available activities are limited, and furthermore, women may tend to be particularly restricted in conflict areas, both in terms of safety and their family situation. For women who are not employed in such circumstances, participation in literacy classes is one of the few activities that they can participate in, and one can imagine that they have many hopes that having the skills may improve their situation in the future.

Figure 4 Interaction of Conflict Shocks and Classroom/Learner’s Characteristics on Numeracy Test Scores



Source: Author created based on the UNESCO ELA’s Adult Literacy and Numeracy Assessment Data.

The differences in the fitted lines by gender for the conflict areas using each of the four interaction terms (specifications (1) and (2) in Table 4) are shown in Figure 4. As can be seen, the direction of the coefficients is reversed for three of the four variables, indicating that expected policy implementation differs for men and women.

7. Conclusion

Given the importance of human capital for growth and sustainable development, it is paramount to understand the incentive to build human capital in conflict-affected countries, where data collection is risky. This study aimed to exploit an adult literacy education program implemented in Afghanistan to estimate the effect of armed conflict on learning outcomes. This program introduced a quasi-experimental variation in learning outcomes across districts affected by conflict with varying levels of intensity, as measured by the number of battles based on UCDP data. Our identification strategy thus relies on the timing of the armed conflict and the spatial variation in armed conflict intensities to account for unobserved differences across districts. The results did not confirm the significance of the direct effects of armed conflict, but instead found that changes in various literacy course's and individual learner's characteristics interacted with the conflict to change test scores. The coefficients and directions of each interaction clearly explain how difficult it is for learners in conflict areas to attend literacy classes, resulting in lower test scores.

An interesting aspect of these interaction variables is that, with the exception of the distance to the classroom, the directionality of the variables varies by gender. While interpretations of these differences may require further debates, the policy implications for increasing the effectiveness of adult literacy education in conflict situations will need to be carefully considered on a gender-specific basis. Besides providing environmental- and time-conscious literacy classes for women, additional special consideration such as provision of intermittent and long-term literacy education or distance literacy learning should be given to female adult learners who are under the certain conditions.

There are also several limitations in this study. Since ELA program was implemented relatively safer provinces, there is a possibility that the conflict's negative effect might be underestimated in this study. Another important limitation of our analysis is that it only pertains to the participants of the ELA program; nevertheless, the variation in the pre- and post-test results vary widely as it is arguably important to identify the effect of an exogenous shock, such as an armed conflict. Lastly, the data used in this study only covers the learner's characteristics and their household situations and other relevant factors such as local community environments, teachers' characteristics, or learners' feelings, fears, and prospects for the future, were not considered in the analysis, yet they should affect the learner's learning outcomes at the literacy course.

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