

The Value of Literacy Beyond Reading: Empowering Adult Women Through Knowledge and Confidence

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Abstract

Adult female literacy, in developing countries, is often associated with improved socio-economic outcomes, motivating governments around the world to institute large scale adult literacy programs. However, evidence on the effects of such programs is scant due to lack of data. Using the random assignment of about 230 rural Indian women to receive an adult literacy program with a novel behavioral experiment, we estimate the causal effect of female adult literacy on knowledge, confidence about this knowledge and ability to update this knowledge. We find that literacy improves knowledge of politics, health and education. As few of the knowledge question asked are directly covered in the adult literacy program, we attribute this increase in knowledge to an increased ability to reason and a larger network from which to source information. However, contrary to what we had expected, we find that this increase in knowledge is not associated with an increase in confidence (measured as the willingness-to-pay to see the answers from another woman followed by the opportunity to revise one's own answers). On the contrary, preliminary evidence suggests that newly-literate women are less confident, compared to illiterate women, but display more rationality in their approach to combine new information with prior beliefs.

1 Introduction

Literacy refers to an individual's ability to read and write. In 2010, there were 775 million adults in the world who lacked this apparently basic ability, of which a disproportionate two-thirds (493 million) were women. The lowest adult literacy rates are observed in sub-Saharan Africa, West and South Asia, with more than half of the global illiterate population in the latter two regions. (Unesco, 2013). India, being the largest country in South Asia, is a natural area of focus, both because of the depth and spread of the problem, as well as the fairly long history of policies and programs to raise literacy levels. The adult female literacy rate in India is 51 percent, whereas for males it is over 75 percent (WDI, 2006). While India has been successful in raising the primary enrollment rates of boys and girls through targeted programmes, the progress on increasing adult literacy has been comparatively limited (Kapur and Murthi, 2011), a story that is consistent with the international experience (Romain and Armstrong 1987; Abadzi 1994, 2003; Oxenham et al. 2002; Ortega and Rodriguez 2008).

Why should this be a matter of concern? This is because the value of literacy might be two-fold. One, literacy might have an intrinsic value, in that it can promote self-worth and personal development. Two, it might also have an instrumental value: female literacy, in particular, is known to be associated with lower fertility, improved health, hygiene and education of the woman and the family, better saving practices and increased gender equity (Senauer et al. 1988; Thomas 1990; Hopkins et al. 1994; Strauss and Thomas 1995; Handa 1999; Masset and White 2003; Paxson and Schady 2007; Gakidou et al. 2010). Despite its immense importance for larger developmental goals, the actual causal adult impact of literacy on individual decision-making, improved household-level and individual outcomes is poorly understood, mainly due to lack of data, not in the least because the effects of child literacy and adult literacy might differ, i.e., making a child literate through school education versus making an adult women literate in an adult literacy program might have differential effects on their respective (future) families.

In addition, we have little knowledge on the exact pathways or mechanisms through which female adult literacy might affect outcomes. Blunch (2012) examines the link between maternal participation in adult literacy programs and child mortality in rural Ghana to find significant effects in reducing the latter. He argues that such programs are extremely cost-effective, given their tremendous beneficial impact. He attributes the effect to improved health knowledge. Banerjee et al (2013) conduct a randomized control trial in India and divide illiterate mothers into four groups: one, that received adult literacy classes; two, that got training on how to enhance their children's learning at home; three, a combination of the two; and four, no treatment (the control group). They find that mothers in the first three groups not only perform better than the control on language and mathematics tests, but also had a positive effect on their children's mathematics scores, with the largest effect in

the third group. They suggest that interventions increased women’s empowerment, mothers’ participation in child learning, and increased the presence of educational assets in the home.

This paper is one part of a larger study that attempts to fill this gap in the literature. The overall project examines the impact of adult female literacy on a range of individual and household-level outcomes, and disentangles the channels through which these effects take place. In this paper, we focus on the effect on knowledge and confidence (hypothesizing that a change in confidence might drive a change in bargaining power, and both knowledge and bargaining power might affect choices and hence outcomes).

Our study utilizes the random assignment of illiterate adult women to receive a computer-based adult literacy program in the north Indian state of Uttar Pradesh, called the “Tara Akshar Literacy Program” (TA, hereafter), a collaborative effort between the UK-based social enterprise Readingwise Ltd., and an Indian NGO Development Alternatives (DA). This is one of the three instruction methods recognized and sponsored by the Indian government for adult literacy under its National Literacy Mission (NLM). TA is implemented by minimally trained, computer-aided instructors in an interactive group-based manner. It runs for two hours a day for 35 days for the literacy component, and for 49 days, including the numeracy component. The target population for TA is adult females in Hindi-speaking states, and it typically attracts large numbers from the historically disadvantaged Scheduled Castes (SCs) and Scheduled Tribes (STs). Since its inception in 2006, TA has made 60,000 such women literate.

We use this RCT to assess the impact of literacy and numeracy instruction on three broad parameters: individual decision-making (this includes preference consistency, risk aversion and knowledge and confidence); household decision-making (this includes household efficiency and bargaining power); and household outcomes (this includes educational and health inputs and outcomes of children). The larger study analyses two phases of the intervention separately and builds a unique panel data that would allow us to identify, for the first time, the causal effects of a female adult literacy program not only on literacy, but also on wider socio-economic outcomes.

This paper, which is one component of the larger study, we examine the causal effects of the literacy program on women’s general knowledge, confidence and the manner in which they process new information. We utilise the data from the “knowledge and confidence” section of Phase I of the intervention, where we asked the women a set of questions on general knowledge, logic, and basic mathematics questions. These were asked both to the women who received the adult literacy program (the treatment) and those who did not (the control). We then compared the answers, and further, tested the women on confidence about their answers by asking them if they were willing to pay a price to revise their answers on being shown the answers of a literate (or illiterate) woman from the same village. We find

that literacy improves the knowledge of politics, health and education. As few of the knowledge question asked are directly covered in the adult literacy program, we attribute this increase in knowledge to an increased reasoning ability and a larger network from which to source information. However, contrary to what we had expected, we find that this increase in knowledge is not associated with an increase in confidence (measured as the willingness-to-pay to see the answers from another woman followed by the opportunity to revise one’s own answers). On the contrary, preliminary evidence suggests that newly-literate women are less confident about what they know, compared to illiterate women, but are more rational in their approach to combine new information with prior beliefs. Phase II of the intervention is currently underway, the results of which will enable us to further explore these interconnections.

The rest of the paper is organized as follows: Section 2 introduces the Tara Akshar program and Section 3 describes the data collected. Section 4 sets up a simple model and Section 5 describes and discusses the results. Section 6 concludes.

2 Tara Akshar program

The Tara Akshar literacy program is an innovative, interactive, groupbased, e-learning program building on insights from cognitive psychology and memory tricks, e.g. to teach the alphabet, the shape of the letter is turned into a cartoon that looks like the object that begins with that letter. For instance, to help students remember the consonant “Ta” which is also the first letter of “tamatar” (Hindi for tomato) students are encouraged to associate the shape of “ta” with that of a tomato. The program recently added a numeracy component, extending the program to 49 days.

Unlike other existing programs, TA boasts a “success rate” of over 90 percent (i.e., these many participants are able to pass a basic literacy and numeracy test developed by the Government of India to assess functional adult literacy). However, this success rate has never been independently verified, corrected for baseline rates and sample selection into the program (e.g., only the more motivated women might decide to join). In our evaluation of the effect on literacy and numeracy, we find that TA learners can read, on an average, 13 letters, 7 consonant-vowel combinations, 5 words and 3 nonsensical words more per minute compared to those who did not participate in the program. Out of 64 words in a grade 1 level paragraph (i.e., a level equivalent to a primary school grade 1 level text), TA participants were able to read, on average, 8 words whereas the control group could read only 4, on average. TA participants also did better when reading grade 2 level paragraphs, but their overall level is still low: 6 words out of 64, on an average. Finally, TA participants did significantly better in terms of understanding what they were reading, for both grade 1

and grade 2 level paragraphs. In terms of numeracy, we find that, on average, number identification (single digit) improved by 86%, counting by over 100%, addition by over 300% and subtraction by over 200%. Some absolute numbers: TA learners recognise, on average, 7 out of 10 written single-digit numbers. While TA learners have improved substantially in terms of addition and subtraction, there is scope for improvement in this area.

We conducted phase I in 2013 among 227 individuals (called “learners”) in six villages in Bhadoli district in the northern state of Uttar Pradesh (UP), with a female literacy rate of 60 percent according to the 2011 Census. TA had been operational for several months in these six villages before the baseline took place, thus their program was familiar to the villagers. Our sample was selected randomly from women interested in joining the program. Thus, it is not a random sample of all illiterates. We assigned 94 learners to the control group and 133 learners to the treatment group. The sample is also not an exact half-and-half division between the treatment and the control group, as the number of learners per class are fixed by DA. Typically, illiterate women are sprinkled across households, in other words, it is very common to find literate as well illiterate women within the same household. In the baseline, we noted a slight difference in average age (the treatment was slightly younger, 29 versus 31 years on average) and in time spent on household chores and work outside the house (the treatment group works slightly less). We however found no statistically significant difference between the treatment and control individuals at baseline in terms of number of children, family size, marriage status, year of marriage, asset ownership, social activities and personal expenditures.

The baseline survey was administered in September 2013 and the endline in December 2013. The treatment group (133 women) received the program in October-November 2013, and the control group (94 women) received the program in 2014.

3 Data collected

The Phase I household questionnaire had demographic details of the household members, including their education, asset details of the household, and a non-comprehensive time use module. In addition, there are three measures of cognitive ability on which the learners were tested: a) rapid automatic numbering (RAN) that requires the learners to name the colour of a series of patches as quickly as they can. The measure is assumed to tap lexical access speed and the engagement-disengagement dynamics of attention involved in reading sentences; b) Wechsler Forward Digit Span (WFDS) requires the learner to recall as many digits as possible. The measure is assumed to capture working memory and to play a role in reading comprehension; and c) Wechsler Non-Verbal Aptitude (WNVA) hat requires the learner to complete sequences of geometric figures. This measure is assumed to capture de-

ductive reasoning powers. Finally, we included detailed measures of literacy and oral/written numeracy.

In addition to the household survey, we conducted behavioral "games", one of which was on "Knowledge and Confidence", which is the subject matter for this paper. All the games were incentivised with actual payouts.

3.1 Measuring knowledge and confidence

Each learner was asked twelve factual questions (listed in Appendix A) testing local general knowledge, specific education and health knowledge. The learner was rewarded with one pencil - valued at Rs. 2.5 - for each correct answer, and was allowed to exchange these pencils at the end of the game for other educational items, such as notebooks, erasers. Before the number of correct answers were computed, the learner was given an opportunity to see the answers of someone else and then revise their answers, but this revision came at a price. We had pre-interviewed two individuals in each village: a literate woman and an illiterate woman and collected their answers. We call these people "matches". Each "learner" was randomly presented with an envelope which contained the answers of either the literate or illiterate match. We then asked the learner their Willingness-to-Pay (WTP), in terms of pencils, to see the answers of this match. It ranged from 0 to 5 pencils. We then drew a random price and if this price was less than the learner's WTP, then the respondent got to see (hear) the answers and revise their own answers. Once the learner revised her answers, we computed the number of correct answers based on her revised answers and compensated the learner accordingly. For the woman whose WTP was below the randomly drawn price, we computed the number of correct answers based on her first responses and compensated her accordingly.

3.2 Descriptive statistics

All the women interviewed were Hindu. 9 percent of women belonged to the upper/general caste, 72 percent to the Other Backward Castes (OBCs) and 18 percent to the Scheduled Caste category). 91 percent of the women were married, 6 percent unmarried, and 2 percent were widowed during the time of the survey. No women in the sample reported to be separated or divorced. 99 percent of the women had never been to school, or just attended nursery (pre-school) level schooling. Only 3 women received a few years of elementary education. Half the women reported that household activities are their primary occupation. Of these, 29 percent reported that agricultural work on their own farm is their main occupation, and about 7 percent reported themselves to be agricultural laborer. 3 percent reported themselves to be sharecroppers or cultivators.

Table 1 reports the descriptive statistics of selected variables. The average household size is 6.5, with large variability (some households have as many as 20 members). On average, three members are below 18, and 40 percent of households have at least one infant under 5 years. On average, households own 10 “bissa” land (1 bissa=80 square meters), but land ownership varies widely, with approximately 27 percent of households landless. Majority of households own a bicycle (72 percent), and mobile phone (80 percent).

We calculated an "India out of Poverty Progress Index", measuring asset ownership. A PPI of 20 corresponds to a roughly 90 percent chance of being under the poverty line using the international 2USD/day/person criterion. The average PPI value for our sample was 22, and 22 percent of our sample reported to have a BPL card.

The results of the cognitive ability tests were as follows. On the Weschler Non Verbal Aptitude Test (score out of 41), the average was 6. The Weschler Forward Digit Span (score out of 16) had an average of 4.44, which corresponds to recalling three numbers. In the Rapid Automatic Naming with Colors (score out of 48, with highest worst), the total number of errors made was on average 2.3, with 55 percent of women making no errors at all.

4 A simple model

Qualitative surveys preceding the pilot had indicated that the effects of the adult literacy program extended beyond just increasing reading and writing. Women claimed to have become more confident, self-aware, and claimed to be enjoying increased respect and bargaining power. They become more mobile and increased investment in education and health of their own children. Hence, the model aims at providing a framework to these the following hypotheses: The TA program (i) increases the knowledge score by increasing knowledge base, enhancing cognitive capacity and increasing one’s network, and (ii) increase confidences, which, as we will derive below, will result in a decrease in the willingness-to-pay (WTP) for the answers of the matches. In addition, we expected that (iii) literate matches are more valued than illiterate matches, and, hence, the WTP for these matches should be larger than for the illiterate matches. Our model focusses on (ii) and (iii).

Denote the respondent i by subscript i . When asked a knowledge question k , respondents are endowed with a (prior) signal for the response which we denote by τ_{ik} , and state τ_{ik} as their best guess for the question asked. For convenience, we assume that τ_{ik} follows a normal distribution around the true value μ_k with variance σ_{ik}^2 . We assume that respondents are aware of these distributional specifications. Note that these distributional assumptions simplify our set-up as it only extends to the analysis of knowledge questions which have a continuous answer range.

If the respondent gets to view (or hear) the matches’ answers, she receives a second signal.

This match may be literate ($L = 1$) or not ($L = 0$). Let us denote these signals by τ_{0k} and τ_{1k} , respectively, i.e., these are the answers given by the matches. Note that these signals are fixed for each village (for simplicity we omit a subscript for village). We again assume the signals are centered around the true value, and that they follow a normal distribution. We assume that the respondent is aware of the precision of knowledge of the literate and illiterate women, denoted by σ_{0k}^2 and σ_{1k}^2 , respectively.

If the respondent receives the second signal, she will update, weighting signals with the inverse of the variance¹. In the case of literate match, the posterior belief can be shown to be updated as follows:

$$\tau_{post,0} = \tau_i * \frac{1/\sigma_{ik}^2}{1/\sigma_{ik}^2 + 1/\sigma_{0k}^2} + \tau_0 * \frac{1/\sigma_{0k}^2}{1/\sigma_{ik}^2 + 1/\sigma_{0k}^2} \quad (1)$$

In the case of an illiterate match, the posterior belief is:

$$\tau_{post,1} = \tau_i * \frac{1/\sigma_{ik}^2}{1/\sigma_{ik}^2 + 1/\sigma_{1k}^2} + \tau_0 * \frac{1/\sigma_{1k}^2}{1/\sigma_{ik}^2 + 1/\sigma_{1k}^2} \quad (2)$$

Hence, the distribution of the posterior belief will be centered around the true value μ and will have variance equal to:

$$\frac{1}{1/\sigma_{ik}^2 + 1/\sigma_{Lk}^2} \quad (3)$$

where $1/\sigma_{Tk}^2$ denotes the inverse of the variance (i.e., the precision) of the match L .

Since the stakes over which we implement this knowledge game are relatively low, we make the simplifying assumption that participants are risk-neutral over these stakes. This means they maximize payoffs. We also, for the time being, ignore the question as to aggregate the various questions.

In the experiment, an answer was considered correct if it was not more than x units away from the correct value. This means that the willingness to pay for the additional answer should be equal to the $\Delta prob_k * R$, where R is the value of the pencil and $prob_k$ denotes the probability of having a correct answer. It is easily shown that as σ_{ik}^2 increases (i.e., the respondent's own signal is less informative), the willingness to pay for viewing another answer increases. Equally, as σ_{Tk}^2 increases (i.e. the other women's signal is less informative), the willingness to view their answer decreases. The cross derivative can be shown to be positive.

$$\frac{\partial WTP}{\partial \sigma_{ik}^2} > 0 \quad (4)$$

$$\frac{\partial WTP}{\partial \sigma_{Tk}^2} < 0 \quad (5)$$

¹It is easily shown, by minimizing the variance that this is the optimal weight for a mean.

$$\frac{\partial^2 WTP}{\partial \sigma_i^2 \partial \sigma_T^2} > 0 \quad (6)$$

If participating in the TA program decreases σ_{ik}^2 , then we can expect the WTP of TA participants to decrease compared to non-participants. For both non-participants and participants, we assume that $\sigma_{0k}^2 > \sigma_{1k}^2$. Meaning, the basic regression specification is:

$$WTP_i = \alpha + \beta_1 T_i + \beta_2 LIT_i + \beta_3 T_i * LIT_i + \epsilon_i \quad (7)$$

Where T = treatment and LIT = literate match. And our model translates to the hypotheses that: $\beta_1 < 0$, $\beta_2 > 0$ and $\beta_3 > 0$

5 Results and discussion

First, we present some basic descriptive results. Table 2 presents the mean (standard deviation) of the number of answers the “match” had correct. The literate match had, on average, 4.02 (out of 12) questions correct, while the illiterate match had, on average, 4.59 questions correct. While this difference is not statistically significant, it seems odd that the literate match did not have more questions correct. This might be due to the nature of the selection: the average literate woman in these villages is young, living in a joint family, while the average illiterate is older, and has lived in the village since a while, often in a nuclear family. Hence the latter might have more local knowledge as well as education and health knowledge.

In Table 3, we compare the number of questions the respondent had correct before and after the matches’ answers were revealed. Appendix A details how to classified an answer as correct or incorrect. Note that not all respondents had the opportunity to state their posterior beliefs, only the ones whose willingness-to-pay was higher than the randomly drawn price. Prior to the revelation of the matches’ answers, the respondents had, on average, 4.1 questions (out of 12) correct (standard deviation 1.8). After the revelation of the matches’ answers, the respondents had, on average, 5.2 questions (out of 12) correct (standard deviation 1.8). This difference is statistically significant at the 1% level, and hence we may conclude that hearing the matches’ answers improved the respondents’ knowledge score.

Table 4 tests our first hypothesis: the Tara Akshar Program increases the knowledge score. The first column presents the simple linear regression (with robust standard errors). The second column presents the specification in which we add the following control variables: age respondent, land owned (acreage), number of household members and number of children and the results of the three cognitive ability tests. This second column also includes village-fixed effects. We note that we have a fair bit of missing values for age of respondent, reducing

the number of observations in the second column. While overall, there is no treatment effect, in the second column, the coefficient estimate of 0.4 is almost statistically significant at the 10% level. The average willingness-to-pay is 2.75 pencils (standard deviation 1.57, recall the range allowed is 0 to 5).

Figure 1 presents the histogram of the willingness-to-pay to see (hear) the matches' answers by treatment status. The panel on the left presents the control group (illiterates). The panel on the right presents the treatment group (newly literates, i.e., TA learners). One can visually see that there is not much difference between the two histograms. Figure 2 further divides up the groups according the literacy status of the match. A t-test confirms what we see in Figure 2: the respondents in the control group do not, on average, make a distinction between a literate and illiterate match when stating their willingness-to-pay. The respondents in the treatment group are willing to pay a little more for a literate match than an illiterate match but this difference is not statistically significant. Table 5 confirms this lack of treatment effect on the willingness-to-pay.

Table 5 tests the second hypothesis: the Tara Akshar program increases confidence and hence decreases the willingness-to-pay to see (hear) an alternative answer. Columns one to three present the results without the controls. Columns four to six presents the results with controls. Columns two and five include the literacy status of the match while columns three and seven also include the interaction term between literacy status of the match and treatment status of the respondent. Note that the number of observations decreased compared to Table 4. This is due to the fact that not all respondents were able to comprehend the willingness-to-pay question and/or refused to answer. We note that, across the board, the treatment effect is not negative, as hypothesized, but might even be positive. Neither does the literacy status of the match appear to matter. While we had hypothesized that the respondent would value the literate matches more, as we had expected them to have more questions correct, the selection bias in selecting the matches which resulted in the literate matches knowing not particularly more compared to the illiterate matches might have played a role in this last null result: the respondent were aware of this lack of distinction and hence did not offer to pay more for the literate matches' answers.

Tables 6 and 7 analyze the effects of Tara Akshar on the way respondents form their revised beliefs after they have heard the alternative answer. Table 6 captures the effect on the ability to update correctly (meaning to change your answer from the incorrect to the correct answer) while Table 7 captures the effect on the ability to correctly not update (meaning stick to your own correct answer even when facing an incorrect answer of a match). Table 6 has as dependent variable: the number of answers the respondent had correct after seeing the alternate answers as subset of the number of answers the match had correct and the learner had incorrect before seeing the alternate answers (expressed in percentage terms).

Table 7 has as dependent variable: the number of answers the respondent had correct as a subset of the number of answers the respondent had correct and the match had incorrect before seeing the alternate answers (expressed in percentage terms). Using these dependent variables, we test the second hypothesis in an alternative manner: if participating in the TA program increases confidence, TA participants should be less likely to update to the alternative answer (in that case of a discrete answer question), or respond with a posterior answer that is closer to their own prior than to the alternate answer (in the case of a continuous answer). Meaning, the treatment effect would be expected to be negative in Table 6 and positive in Table 7. If respondents value the value the responses of literate matches more than illiterate matches, in the sense of the model in the previous section, the coefficient on a literate match can be expected to be positive in Table 6 and negative in Table 7. We find that the treatment effect is not significantly different from zero in Table 6, but that participating in TA might decrease the percentage correctly not updated (Table 7, treatment effects almost statistically significant at the 10% level). Excluding the multiple answer questions (7, 11 and 12) from the analysis — which are arguably difficult to code in terms of whether they are correct or incorrect, results in a positive, and significant effect (at the 10%) level in Table 6.

Hence, we conclude that preliminary evidence suggests that newly literates are more likely to update, contrary to our hypothesis. In addition, respondents are less likely to correctly not update when seeing the answer of a literate match versus an illiterate match (coefficient on literate match is negative in Table 7, and significantly different from zero at the 1% level). This is consistent with our hypothesis. Glancing at the descriptive data, it appears that respondents do not follow the same updating rule across questions. The approach is question-based: for some questions they would alter their answer while for others they would stick to their guns. This would make sense if respondents form a belief about the likelihood to be correct for each question separately. Relatedly, just focusing on the questions which have a continuous answer, over 90% of the respondents uses a 0/1 rule in terms of updating: either stick to their own prior answers, or take over the response of the match. This is somewhat odd — as a traditional Bayesian model would imply that the posterior answer should be a linear combination of the two answers, weighted by their respective precision. Cognitive limits might play a role, as updating in a 0/1 fashion is likely easier as one answers the question: “who is more likely to be correct, me or the match?”

To conclude this section: we find weak evidence that TA increases the knowledge score, but do not find any evidence that TA increases confidence of its learners: TA participants are not willing to pay less to see the alternate answers. When being confronted with the alternative answers, TA participants are more likely to change their views in the direction of the alternate answer, whether or not this alternate answer is correct. While this might

suggest an improvement in the ability to update, the lack of sophistication in the way one updates — using a 0/1 rule — appears to speak against this interpretation. One way to reconcile these results could be the following: TA decreases confidence of its learners, but increases their ability to combine information and update one’s beliefs. The combination of these effects could result in a null effect on willingness-to-pay to see (hear) the alternate answer and in indiscriminately updating (unsure about one’s own answer, one copies the other one).

6 Conclusion

This paper presents the first results of research project on the effects of adult literacy program targetted at women. First, we aim to establish to causal effect on household behavior and outcomes regarding health and education. Second, we seek to establish the mechanisms through which female adult literacy affects household behavior. For instance, does the program result in increased confidence? A change in beliefs and knowledge? A change in preferences regarding health and education? Or does it affect the bargaining power? As noted in the introduction, this paper presents a small subset of our overall results: on knowledge and confidence.

While we do not find any evidence that TA increases the confidence of its learners, despite the weak evidence that TA increases the knowledge score, we should note that the sample size in the Phase I is small, and the stakes are measured in pencils, not in money. While pencils are useful to women with children, the stakes might assume a different meaning (and consequently affect the WTP) if the women were trading cash instead of kind. It is also possible that the WTP concept was not understood equally well by everyone. In the next phase of our study, we are aiming for a larger sample and have also revised some of the questions, in order to see if these results hold or are overturned.

We believe that our research could inform vital areas of policy. The success rates of most traditional adult literacy programs have been disappointing. In the Indian context, this has been attributed to large class sizes, inflexible schedules, poorly designed curriculum and, as a consequence, low participation (Karlekar 2000). Through this project, we could not only provide results on the effectiveness of an innovative, computer-based program, which would be relevant for India, and also for the rest of South Asia and sub-Saharan Africa, but also provide greater insights into the pathways that link female literacy to a variety of desirable outcomes for the learners and their families.

Appendix

Part I

Now we will ask you 12 questions, some related to your village and some related to health and education. For every correct answer, you will get a pencil that costs Rs 2.5. In the end, you can exchange the pencils for other things like rubber, ruler, sharpener or a notebook. (Note to enumerator: show them all these items. After reading out each question, write down the answer of the respondent in the first column. If they say that they do not know, ask them to make a guess and if that also fails, then you can write "D.K.")

These are the 12 questions. 1. What is the number of villages in your Gram Panchayat? (exact number is the only correct answer). 2. When was the last Panchayat elections held? (exact year is the only correct answer). 3. What is the current wage rate under MN-REGA in your state? (correct answer Rs. 142) 4. What is the total number of households in your village? (range of 20%, plus or minus, is acceptable as an answer) 5. You have Rs 20 to purchase onions and tomatoes. You purchase onions for Rs 12. How much money do you have to spend on tomatoes? (exact answer) 6. You have Rs 100. How many Rs 10 notes will you need to replace your Rs 100? (exact answer) Education 7. What did your child get to eat in the public school yesterday? (exact) 8. What is the minimum level of education required to become an ASHA (Accredited Social Health Activist) worker? (exact) 9. What is the monthly salary of an Anganwadi worker? (exact) Health 10. For how many months should a child receive only breastfeeding? (six months) 11. What should be done if there is deficiency of blood? (spinach, meats, eggs, jaggery and nuts) 12. What should be done to clean dirty water? (boil, filter, water purification tablets).

Part II

Note to the enumerator: pick one die out of the bag. If the die is "green", choose the answer sheet of a literate woman (from the village, who would have filled out the questionnaire earlier). If the die is "blue", choose the answer sheet of an illiterate woman. Then make the following announcement to the respondents. (Please mention) Literate or Illiterate-

Now, if you want, I can show you the answers of a literate (illiterate) woman. But, you will have to pay a certain price for it. You can revise your answers if you want after having a look at the answers. What is the maximum number of pencils that you are willing to give up to see her answers? 0?1?2?3?4?5?

Note down this Willingness to pay(W) -

Note to the enumerator: at this stage the respondent might insist on knowing the price. However, it is important that you get the maximum pencils they are willing to pay FIRST. Then make the following announcement and leave the space. Now, I will tell you the actual price for these answers. If price is less than or equal to the willingness to pay, I will get the answers for you, but, if that is not the case, then I will not get the answers.

Go somewhere and roll the die IN SECRET. Number 6 on the die represents zero and all other numbers are themselves. For instance, if one appears, it means 1, two means 2 etc. The number on the die is the price, P, for seeing the alternative answers. Then go back to the woman and say the following. If the number on the die (which is the price, or P) is less than or equal to the price the woman quoted (willingness to pay, or W), then announce P and tell her you got the alternative answers. If P is greater than W, then tell her the price is too high and she keeps her own answers. (Please mention) Price(number on the die, P)-

First scenario: if P is less than or equal to W. Make the following announcement: You said that you are willing to give up __ pencils. I asked the price and it is ___ pencils. So, I have brought the answers of a literate (illiterate) woman for you.

Second scenario: P is greater than W. Make the following announcement: You said that you are willing to give up __ pencils. I asked the price and it is ___ pencils. So, I could not bring the answers of a literate (illiterate) woman for you.

Note to enumerator: if the woman did not get to see alternative answers, then that is the end of the game. You will add the total number of correct answers and make the payout (that number of pencils). Please do not tell the respondent which of their answers was correct — just give the total number of correct answers.

Back to the first scenario: read out, for one question at a time, the woman's own answer and the alternative answer. Then ask her if she would like to change her answer to any other answer, not necessarily the alternative answer, or stick to her own answer.

For each question separately ask the following:

The first question was †. Your answer was †. The other female's answer was †† Do you want to change your answer? It is not necessary that you give the answers given by the other female. You can either stick to your answer, revise your answer to a new answer or take the answer of the other female.

Second question was ††.

Note to the enumerator: write the revised answers in the second column. After all the revised answers have been filled out, count the number of correct answers in THE SECOND COLUMN and provide the net payout (pencils). Net payout is equal to the total number of correct answers MINUS the price, P. If the woman chooses not to revise a particular answer, then copy her original answer in the relevant cell of the second column.

If net payout is negative, pay zero.

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1 The program is a combination of basic literacy and numeracy, but for brevity and convenience, we refer to it as a "literacy" program.

2 Phase II is currently ongoing, with the baseline completed in May 2014 among 800 individuals in twelve villages in Bhadoli district of UP. Endline is planned for May 2015. The treatment group will receive the program in June 2014, and the control group will receive the program in 2015. In Phase II we focus on the effects of literacy on household decision-making and child health and educational outcomes.

Table 1: Basic Descriptive Statistics

	Number of observations	Mean	Std. Dev.	Min	Max
Farmland (acreage)	223	8.30	13.18	0	80
Age of learner	207	30.71	8.50	14	65
PPIScore	227	22.14	12.60	0	75
Number of family members	227	6.44	2.26	2	16
Number of children	227	2.93	1.56	0	7
<i>Results of cognitive tests</i>					
FDS score	223	4.44	1.43	1	8
Wechsler score	227	6.11	4.00	0	17
RAN_time completed (seconds)	221	73.62	24.09	25	194
RAN_number of errors	221	2.21	4.40	0	24

Table 2: Number of correct answers (out of 12) of literate/illiterate "matches"

	Number of observations	Mean	St. Dev.	Min	Max
Literate match	232	4.02	1.66	2	7
Illiterate match	232	4.59	3.16	0	9

Note: The difference between the two means is not statistically significantly different from zero

Table 3: Number of correct answers (out of 12) - before and after the matches' answers were revealed

	Number of observations	Mean	St. Dev.	Min	Max
Correct answers (prior)	232	4.1	1.8	1	10
Correct answers (posterior)	119	5.2	1.8	0	9

Note: The difference between the two means is statistically significant at the 1% level

Table 4: Effect of Tara Akshar on Prior Knowledge

Linear Regression : dependent variable: number of answers correct (prior)

	# Correct	# Correct
Treatment (1=treatment, 0=control)	0.256 (0.251)	0.431 (0.277)
Constant	4.000*** (0.193)	3.591*** (1.022)
Controls included	No	Yes
Observations	227	195

Notes: Table 4 presents the effect of the TA literacy program on the knowledge score (out of 12). The first column presents the results without the controls. The second column presents the results with controls. Robust standard error is in parenthesis below the coefficient estimates. *** = statistically significant at the 1% level. Controls include age learner, village fixed effects, results of cognitive ability tests, land (acreage), number of household members and number of children.

Table 5: Effect of Tara Akshar on Willingness-to-Pay*Linear Regression : dependent variable: willingness-to-pay*

	WTP	WTP	WTP	WTP	WTP	WTP
Treatment (1=treatment, 0=control)	0.243 (0.218)	0.246 (0.218)	-0.017 (0.333)	0.228 (0.239)	0.228 (0.239)	0.062 (0.359)
Literate match (1=literate;0=illiterate)		0.052 (0.218)	-0.230 (0.334)		0.086 (0.243)	-0.094 (0.369)
Treatment * Literate match interaction			0.467 (0.440)			0.307 (0.486)
Constant	2.616*** (0.165)	2.586*** (0.207)	2.750*** (0.252)	0.675 (0.891)	0.636 (0.890)	0.765 (0.914)
Controls included	No	No	No	Yes	Yes	Yes
Observations	214	214	214	183	183	183

Notes: Table 5 presents the effect of the TA literacy program on the willingness-to-pay to see (hear) the matches' answers. Columns one to three present the results without the controls. Columns four to six presents the results with controls. Robust standard error is in parenthesis below the coefficient estimates. *** = statistically significant at the 1% level. Controls include age learner, village fixed effects, results of cognitive ability tests, land (acreage), number of household members and number of children.

Table 6: The Effect of Tara Akshar on Correctly Updating (Part I)

	Percentage correctly updated		
Treatment (1=treatment, 0=control)	7.636 (8.152)	-3.428 (11.483)	8.479 (14.621)
Literate match (1=literate;0=illiterate)		-4.111 (12.366)	-0.018 (14.147)
Treatment * Literate match interaction		19.261 (16.180)	16.257 (17.725)
Constant	41.623*** (6.103)	44.111*** (9.255)	64.753 (39.844)
Controls included	No	No	Yes
Observations	91	91	82

Notes: The dependent variable of Table 6 is: the number of answers the respondent had correct after seeing the alternate answers as subset of the number of answers the match had correct and the learner had incorrect before seeing the alternate answers (expressed in percentage terms. Columns one and two present the results without the controls. Column three presents the results with controls. Robust standard error is in parenthesis below the coefficient estimates. *** = statistically significant at the 1% level. Controls include age learner, village fixed effects, results of cognitive ability tests, land (acreage), number of household members and number of children.

Table 7: The Effect of Tara Akshar on Correctly Updating (Part II)

	Percentage correctly not updated		
Treatment (1=treatment, 0=control)	-5.544 (8.467)	-19.594 (13.459)	-14.209 (13.994)
Literate match (1=literate;0=illiterate)		-24.784* (13.709)	-33.490** (14.783)
Treatment * Literate match interaction		23.594 (17.128)	26.866 (18.891)
Constant	67.698*** (6.867)	82.451*** (10.783)	86.589*** (29.944)
Controls included	No	No	Yes
Observations	103	103	91

Notes: The dependent variable of Table 7 is: the number of answers the respondent had correct after seeing the alternate answers as subset of the number of answers the match had incorrect and the learner had correct before seeing the alternate answers (expressed in percentage terms. Columns one and two present the results without the controls. Column three presents the results with controls. Robust standard error is in parenthesis below the coefficient estimates. *** = statistically significant at the 1% level. Controls include age learner, village fixed effects, results of cognitive ability tests, land (acreage), number of household members and number of children.

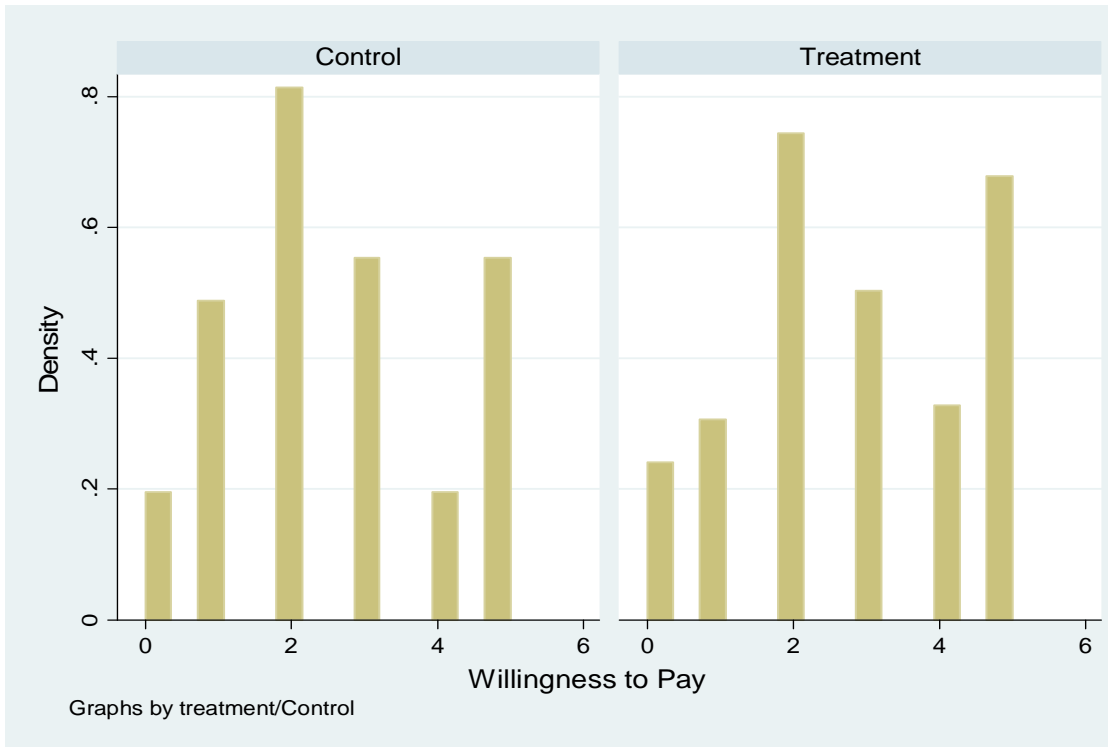


Figure 1: This Figure presents the histogram of the willingness-to-pay to see (hear) the matches' answers by treatment status. The panel on the left presents the control group (illiterates). The panel on the right presents the treatment group (newly literates).

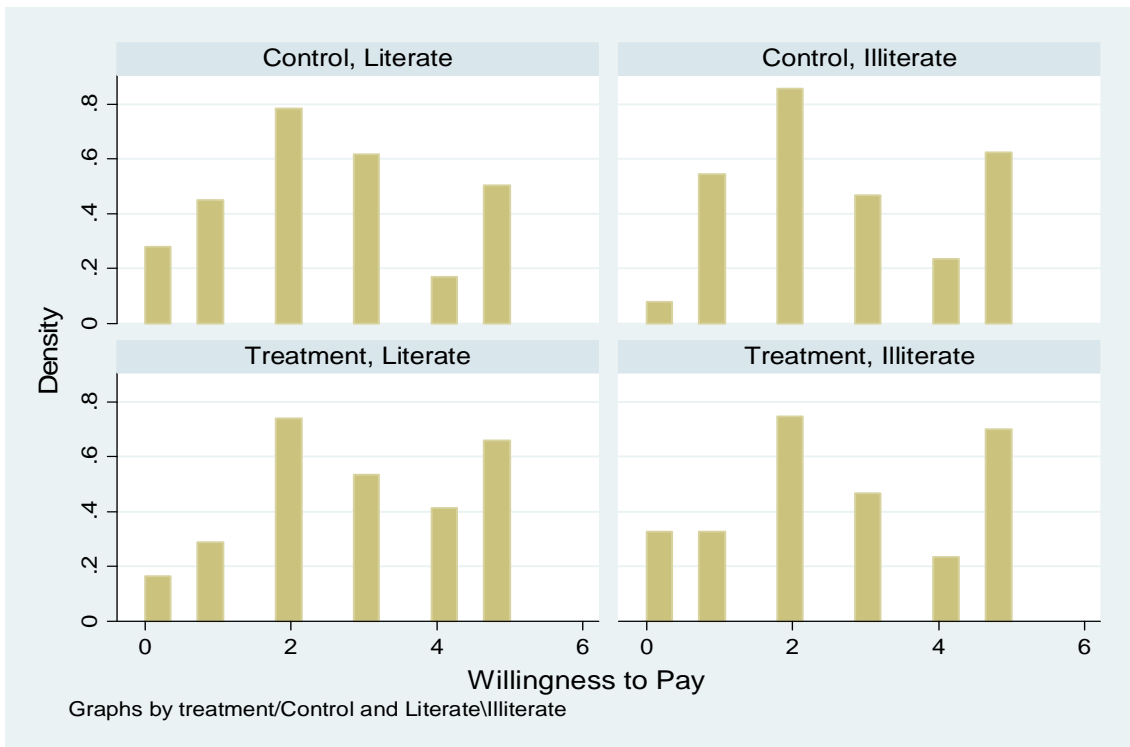


Figure 2: This figure presents the histogram of the willingness-to-pay to see (hear) the matches' answers by treatment status. The top panel presents the control group (illiterates). The bottom panel presents the treatment group (newly literates). The left hand side refers to the literate match while the right hand side refers to the illiterate match.