



Assessing the Impact of

# Literacy Learning Games for Syrian Refugee Children

An executive overview of Antura and the Letters and Feed the Monster Impact Evaluations

John Comings

March 2018



**DL4D**  
DIGITAL LEARNING  
FOR DEVELOPMENT



Norad



INTEGRATED  
from insight to impact



Center for Research and Evaluation of Advanced Technologies in Education



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### **Published by**

World Vision, Inc. and Foundation for Information Technology Education and Development, Inc.

World Vision, Inc.

300 I Street NE

Washington, D.C. 20002 USA

All Children Reading: A Grand Challenge for Development (ACR GCD)

[www.allchildrenreading.org](http://www.allchildrenreading.org)

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Digital Learning for Development

[www.dl4d.org](http://www.dl4d.org)

This research was conducted under the Digital Learning for Development (DL4D) project of the Foundation for Information Technology Education and Development (FIT-ED) of the Philippines, jointly funded by the International Development Research Centre (IDRC) of Canada, the Department for International Development (DFID) of the United Kingdom, and All Children Reading: A Grand Challenge for Development (ACR GCD)—a partnership of the United States Agency for International Development (USAID), World Vision, and the Australian Government. The views expressed in this work are those of the authors and do not necessarily represent those of the funders.

### **Recommended citation:**

Comings, J. (2018). *Assessing the impact of literacy learning games for Syrian refugee children: An executive overview of Antura and the Letters and Feed the Monster impact evaluations*. Washington, DC: World Vision and Foundation for Information Technology Education and Development.

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# Abstract

This report provides an executive overview of the impact evaluations of two winning literacy apps, Antura and the Letters and Feed the Monster, in the EduApp4Syria competition. The impact evaluations had three goals:

1. Assess the impact of each game on players' literacy skills;
2. Assess the impact of each game on players' psychosocial wellbeing;
3. Assess each game's ease of use and ability to engage children.

To answer these questions, the evaluations employed a quasi-experimental design that used both quantitative and qualitative methods. The findings for the impact on the first two research goals provide weak but encouraging evidence that smartphone learning games can build basic Arabic literacy skills and improve the psychosocial wellbeing of Syrian refugee children. The positive findings for both literacy and psychosocial wellbeing serves as a proof of concept for using smartphone apps for teaching literacy to refugee children and other children who do not have access to effective instruction. Findings for the third goal show that older children scored higher on the oral reading fluency subtest, but younger children showed higher rates of change on all subtests. Boys made larger gains on all subtests except for oral reading fluency, while girls scored the same with Antura and the Letters and higher with Feed the Monster. In addition, parents supported use of the apps, saying their children were learning and that playing the apps made their children happy. Children reported that they enjoyed playing the games and that the games made them happy.

More information about these games and their full impact evaluation reports can be found at [all-childrenreading.org](http://all-childrenreading.org). The games in their updated versions can be downloaded by searching for "EduApp4Syria" on Google Play or the Apple App Store.

## Introduction

The violent conflict in Syria harms not only the security and stability of millions of people; it risks leaving the education of more than 2.3 million children behind. These children are primarily displaced within Syria; living as refugees in Turkey, Lebanon, Jordan, and Iraq; or in transit camps in countries like Greece and Italy. Many Syrian children have endured multiple traumas and high levels of stress, affecting their ability to learn. In addition, Syrian refugee children, who are attending school in a new country, are often being taught in a language they do not speak or understand. These complexities and others stress the urgency for finding innovative, scalable solutions to this education crisis.

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Motivated to ensure Syrian refugee children have an opportunity to learn to read in Arabic, the Norwegian Agency for Development Cooperation (Norad), All Children Reading: A Grand Challenge for Development (ACR GCD), the Norwegian University of Science & Technology (NTNU), Orange, and the Inter-Agency Network for Education in Emergencies (INEE) formed the EduApp4Syria partnership. The partners conducted an international innovation competition, funded by the Norwegian government, to incentivize the development of open source smartphone learning games that build basic literacy skills in Arabic and improve the psychosocial wellbeing of Syrian refugee children. In March 2017, two games were announced winners of the competition and launched as open beta versions: *Antura and the Letters* (Developed by a consortium led by Cologne Game Lab – TH-Köln in Cologne, Germany) and *Feed the Monster* (Developed by a consortium led by the Apps Factory in Bucharest, Romania).



## The Games

**Antura and the Letters** requires at least 36 hours to play all six levels of game play. Players enter the game by creating a profile before starting level one. The game asks for the age of the player but does not adjust for skill or literacy level. The six levels are:

1. Introduction of letter names in groupings of two or three and reinforcement through an alphabet song, letter naming, and shape matching;
2. Introduction of letter shapes and how letters change shape at the beginning, middle, and end of a word for the first half of the alphabet;
3. Introduction of the second half of the alphabet;
4. Introduction of the main diacritics and their placement in whole words and reinforcement of previous material;
5. Introduction of more specialized diacritics, articles, and vocabulary and reinforcement of previous material;
6. Introduction of common phrases (such as greetings) and common vocabulary (such as weather, days of the week, months, years, and colors) and reinforcement of previous material.

Each of the six levels consists of 45 stages, in which players engage in one, two or three mini-games per stage, while Antura (a dog) marks the place the player has reached on a map. Players must complete each stage within a level in its designated order and all mini-games before moving to the next level. Players receive up to three bones upon completion of each mini-game, depending on performance. Player game completion and performance unlocks accessories for Antura to wear, enabling customization of the dog to be paid for with bones.

The game begins by demonstrating both game play and examples of correct answers. Corrective feedback is given by a red X appearing for incorrect answers and a green check mark appearing for correct answers. Most mini-games give three opportunities to self-correct, though some have no limit.

**Feed the Monster** is a shorter game that can be completed in as little as three hours by players who have beginning reading skills. The game does not assess or adjust for the player's level of literacy skill.

Children enter the game by choosing an animal avatar. Feed the Monster divides the Arabic alphabet into small clusters of five to six letters each. In each cluster, the child:

1. Is introduced to the letter and its sound, and then must feed the monster the correct letter based on matching the letter to a copy of the letter and its sound;
2. Is introduced to the letter with vowel symbols (diacritical markings) and its sound, and then must feed the monster the correct letter/vowel combination upon hearing the sound;
3. Is introduced to the letter in the written form of a syllable segment with its sound and then must feed the monster the correct syllable upon hearing the sound;
4. Is introduced to the single letter, letter/vowel combination, syllable, or letter sequence within a word with its sound, and then must feed the monster the correct letter, letter/vowel combination, syllable, or letter sequence;
5. Is introduced to a word using the letters and its sound in the cluster and previous clusters, and then must feed the monster the letters of the word in the correct spelling order.

When these tasks are completed, the child moves on to the next letter grouping and repeats the 5-step cycle.

When the player answers correctly, the monster is happy. The player can earn one to three stars per level, depending on performance. The player earns points through speed and accuracy throughout the game. Furthermore, the monsters are given to the player in an egg shape and evolve through four stages to a fully-grown state. For each monster, there are also special items to feed to the monster that can help the player progress in the game. This includes a freezing symbol that slows down the countdown speed of the given task, or a matchstick that reduces the number of incorrect letters or syllables displayed. If the player answers all questions incorrectly or stops playing for a long duration, the monster displays a negative emotion, such as sadness. There are also mini-games outside of main game play, including a game that allows the player to pet and comfort one of the monsters as well as letter drawing exercises and a word and picture memory game.

Corrective feedback is given by the monster spitting out an incorrect answer. There is no opportunity to self-correct except by re-playing the level, and the game does not demonstrate the correct answer when an incorrect one is given. In some game play, the choices offered are all correct. In all the above tasks, players can progress through the game with only two correct answers out of the five challenges per level, meaning that progress might sometimes be based on mere guessing.





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# Evaluation Design

ACR GCD and Development and Digital Learning for Development (DL4D) took on the responsibility to fund and manage a field evaluation of the two games. INTEGRATED International, in partnership with New York University's Consortium for Research and Evaluation of Advanced Technologies in Education (CREATE), was chosen to implement the evaluation. New York University's involvement was funded by UNICEF Innovation. The evaluation had three goals:

1. Assess the impact of each game on players' literacy skills;
2. Assess the impact of each game on players' psychosocial wellbeing;
3. Assess the ability of each game to engage children and each game's ease of use.

The evaluation employed a longitudinal, quasi-experimental design that compared growth in literacy and psychosocial wellbeing outcomes for children using the apps to children who did not use the app. All the children had little or no schooling and lived in the Azraq refugee camp in Jordan. The evaluation employed qualitative and quantitative methods. The full impact evaluation reports for Antura and the Letters and Feed the Monster can be found at [allchildrenreading.org](http://allchildrenreading.org).



## Limitations

The evaluation faced two limitations: (1) sample retention and (2) dosage. At the beginning of the evaluation, treatment and control groups were over-sampled so each group of 300 children could experience a 25% dropout rate and still provide a sample large enough for the study. However, the dropout rate was 35.5% among children. The causes of this high dropout rate included families leaving the camp to return to Syria or to move to another part of Jordan, the draw of a different educational program that produced a time conflict, and movement of families to other parts of the camp.

Each child was scheduled to use one of the apps for 31.5 hours in total. The evaluation design team would have preferred 60 hours, but religious holidays and other environmental factors made that impossible. Actual dosage was 27 hours for children playing Antura and the Letters and 22 hours for Feed the Monster. The high dropout rate lowered the possibility of having a statistically significant finding, and the low dosage limited the size of the gains in both literacy skills and psychosocial wellbeing. These limitations resulted from the complexities of evaluating an intervention in a highly volatile refugee camp setting, within the time and funding constraints imposed on the evaluation team. The lessons learned during this evaluation can inform the design of future evaluations within a conflict context.

The findings for the impact on the first two research goals, therefore, provide weak but encouraging evidence that smartphone learning games can build basic Arabic literacy skills and improve the psychosocial wellbeing of Syrian refugee children. A future evaluation of the updated games, with a larger sample size and increased dosage, is likely to find significant impact (See Game Improvements Made Since Beta Versions).



# Findings for Literacy

Literacy was assessed using the *Letter Sound, Syllable Reading, Invented Word Reading, and Oral Reading Fluency* subtests of the Early Grade Reading Assessment<sup>1</sup> (EGRA) instrument developed in Arabic by the Research Triangle Institute. The EGRA instrument design is based on the current evidence-based theory of how children learn to read, which defines reading as a set of component skills that can and should be learned separately; yet, once learned, those component skills should be integrated to perform tasks (such as reading for entertainment, for answering a question, for engaging in a discussion with others, or for completing a work activity) with print or digital text. The component skills are: (1) phonological awareness, (2) decoding, (3) word recognition, (4) vocabulary knowledge, (5) oral reading fluency, and (6) comprehension. Together, these components enable readers to make meaning from text.

The letter sound and syllable reading subtests measure phonological awareness, which is the understanding that letters and syllables represent sounds and the knowledge of letter/sound correspondence. The invented word reading subtest is a measure of decoding, which is the ability to sound out a whole word. The oral reading fluency subtest, which measures speed and accuracy, is a measure of how automatically a child can decode words and the number of words they can read without decoding.

The study reported the baseline scores (how well children scored before the study began), skill gains (how much better children scored at the end of the study), percentage gain (the gain as a percentage of the baseline score), effect size (a measure of the magnitude of the difference in gain, in which an effect size under 0.5 is considered small, 0.5-0.75 is considered medium, and above 0.75 is considered large), and statistical significance at the .05 level (the likelihood that the gain was a random occurrence is less than 5%). However, a recent World Bank review of the evidence from multiple impact evaluations of early-grade reading improvement programs in African and Asia<sup>2</sup> considers any effect size over 0.25 as substantial. This standard is based on the advice of the U.S. Department of Education's Institute of Education Sciences for research assessing the impact of educational interventions. The results are presented for Antura and the Letters and Feed the Monster, and a combination of data from both assessments.

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Findings for the impact on the first two research goals, therefore, provide weak but encouraging evidence that smartphone learning games can build basic Arabic literacy skills and improve the psychosocial wellbeing of Syrian refugee children.

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1 RTI International. (2015). "Early Grade Reading Assessment (EGRA) Toolkit, 2nd Edition." Washington, DC: USAID.

2 Graham, J., & Kelly, S. (2018). "How effective are early grade reading interventions: a review of the evidence." Policy Research Working Paper 8292. Washington, DC: World Bank. (p.9). <http://documents.worldbank.org/curated/en/289341514995676575/How-effective-are-early-grade-reading-interventions-a-review-of-the-evidence>

## Antura and the Letters

For each subtest, the treatment group gains were greater than the control group. Even though the gains were small, the percentage gains by the treatment group were much higher than the control group. The effect size was low, and only two subtest gains were statistically significant. Table 1 presents the data for Antura and the Letters.

**Table 1:** Subtask Results for Antura and the Letters

| Subtask              | Group Type | Baseline (Mean) | Total Gain | % Gain | Effect Size |
|----------------------|------------|-----------------|------------|--------|-------------|
| Letter Sound         | Treatment  | 7.72            | 2.59       | 34%    | 0.14        |
|                      | Control    | 13.10           | 0.02       | 0%     |             |
| Syllable Reading     | Treatment  | 4.42            | 2.25       | 51%    | 0.17        |
|                      | Control    | 7.85            | 0.59       | 8%     |             |
| Invented Word        | Treatment  | 0.90            | 0.73       | 81%    | 0.24*       |
|                      | Control    | 2.54            | -0.29      | -11%   |             |
| Oral Reading Fluency | Treatment  | 3.42            | 2.42       | 71%    | 0.31*       |
|                      | Control    | 6.43            | 0.03       | 0%     |             |

\*= 95% confidence level

Given the small dosage, the percentage gains and effect sizes are encouraging and suggest a larger dosage might produce meaningful gains. The invented word and the oral reading fluency subtest findings were statistically significant. Improvement in these two subtests may indicate that students were making progress on automating the decoding process and increasing the number of words they could read without decoding.

## Feed the Monster

For each subtest, the treatment group gains were greater than the control group. Even though the gains were small, the percentage gains by the treatment group were much higher than the control group. The effect size was low, and only two subtest gains were statistically significant. Table 2 presents the data for Feed the Monster.

**Table 2:** Subtask Results for Feed the Monster

| Subtask              | Group Type | Baseline (Mean) | Total Gain | % Gain | Effect Size |
|----------------------|------------|-----------------|------------|--------|-------------|
| Letter Sound         | Treatment  | 13.21           | 2.52       | 19%    | 0.12        |
|                      | Control    | 13.10           | 0.02       | 0%     |             |
| Syllable Reading     | Treatment  | 9.18            | 3.78       | 41%    | 0.25*       |
|                      | Control    | 7.85            | 0.59       | 8%     |             |
| Invented Word        | Treatment  | 2.83            | 0.69       | 24%    | 0.17        |
|                      | Control    | 2.54            | -0.29      | -11%   |             |
| Oral Reading Fluency | Treatment  | 6.71            | 2.61       | 39%    | 0.24*       |
|                      | Control    | 6.43            | 0.03       | 0%     |             |

\*= 95% confidence level

Given the small dosage, the percentage gains and effect sizes are encouraging and suggest that a larger dosage might produce more meaningful gains. The findings from the syllable reading and oral reading fluency subtests were statistically significant. Improvement in these two subtests may indicate that students were making progress on automating the decoding process and increasing the number of words they could read without decoding.

## Combined Data

Combining data from the evaluation of both apps provides a larger sample size and an opportunity to assess the impact of providing either of the two smartphone apps. This helps to address the problem of sample size but does not address the problem of dosage. For each subtest, the treatment group gains were significantly greater than the control group. Even though the gains were small, the percentage gains by the treatment group were much higher than the control group. The effect sizes were low, but three of the four subtest gains were statistically significant. Table 3 presents the combined data.

**Table 3:** *Subtask Results for Combined Data*

| Subtask              | Group Type | Baseline (Mean) | Gain  | % Gain | Effect Size |
|----------------------|------------|-----------------|-------|--------|-------------|
| Letter Sound         | Treatment  | 10.44           | 2.56  | 25%    | 0.13        |
|                      | Control    | 13.10           | 0.02  | 0%     |             |
| Syllable Reading     | Treatment  | 6.78            | 3.01  | 44%    | 0.22*       |
|                      | Control    | 7.85            | 0.59  | 8%     |             |
| Invented Word        | Treatment  | 1.86            | 0.71  | 38%    | 0.20*       |
|                      | Control    | 2.54            | -0.71 | -11%   |             |
| Oral Reading Fluency | Treatment  | 5.05            | 2.51  | 50%    | 0.26*       |
|                      | Control    | 6.43            | 0.03  | 0%     |             |

\*= 95% confidence level

Given the small dosage, the percentage gains and effect sizes are encouraging and suggest that a larger dosage might produce meaningful gains. The subtest findings for syllable reading, invented word, and oral reading fluency were statistically significant. Improvement in these three subtests may indicate that students were making progress on automating the decoding process and increasing the number of words they could read without decoding.

## Zero Scores

Tables 4 and 5 present the number of students who scored zero at baseline and endline for each subtask.

**Table 4:** Zero Scores for Antura and the Letters

| Subtask              | Treatment |         | Control  |         | Difference |         |
|----------------------|-----------|---------|----------|---------|------------|---------|
|                      | Baseline  | Endline | Baseline | Endline | Treatment  | Control |
| Letter Sound         | 137       | 125     | 107      | 110     | -12        | 3       |
| Syllable Reading     | 139       | 121     | 117      | 111     | -18        | -6      |
| Invented Word        | 169       | 162     | 149      | 150     | -7         | 1       |
| Oral Reading Fluency | 146       | 123     | 128      | 120     | -23        | -8      |

**Table 5:** Zero Scores for Feed the Monster

| Subtask              | Treatment |         | Control  |         | Difference |         |
|----------------------|-----------|---------|----------|---------|------------|---------|
|                      | Baseline  | Endline | Baseline | Endline | Treatment  | Control |
| Letter Sound         | 77        | 101     | 107      | 110     | 24         | 3       |
| Syllable Reading     | 87        | 93      | 117      | 111     | 6          | -6      |
| Invented Word        | 125       | 135     | 149      | 150     | 10         | 1       |
| Oral Reading Fluency | 104       | 109     | 128      | 120     | 5          | -8      |

Zero scores consistently went down for Antura and the Letters, as was expected, but went up for Feed the Monster. One possible explanation for the higher endline zero scores for Feed the Monster is that, when it teaches letter sounds, it does not provide adequate instruction on the differences between letters in their original form and with diacritics, as well as differences between letters depending on their position within a word. These are all complications in Arabic that do not exist in English. For those who scored low on any of the subtasks at baseline, this lack of instruction may have caused confusion, which led to higher zero scores.

On his blog, Dr. Tim Shanahan addressed a similar phenomenon, in which early reading learners in the United States scored lower on beginning level skills after they had been introduced to higher level skills. He suggests the brain pathway that held the older skill had not yet become permanent and the introduction of similar but different skills may have caused initial confusion. He notes that students must be provided with clear instruction and sufficient reinforcement to build strong brain pathways that sustain a new skill. If instruction and practice of the higher-level skill is insufficient, the previous correct pathway may be disrupted, causing a student to score lower than previously. Dr. Shanahan also notes this should not cause alarm, as it may be a natural part of a learning process as higher-level skills are introduced.<sup>3</sup> The increase in zero scores for Feed the Monster, therefore, may support the need for clearer and more complete instruction; for slowing down the introduction of new letters, syllables, and words; and for increasing repetition to make stronger pathways that will be less affected by the introduction of new skills.



<sup>3</sup> Shanahan, T. (2009). "Why It Sometimes Looks Like Teaching Does Harm." Shanahan on Literacy blog. Retrieved from <http://www.shanahanonliteracy.com/blog/why-it-sometimes-looks-like-teaching-does-harm#sthash.VYrckXDVJlGn2vUi.dpbs>

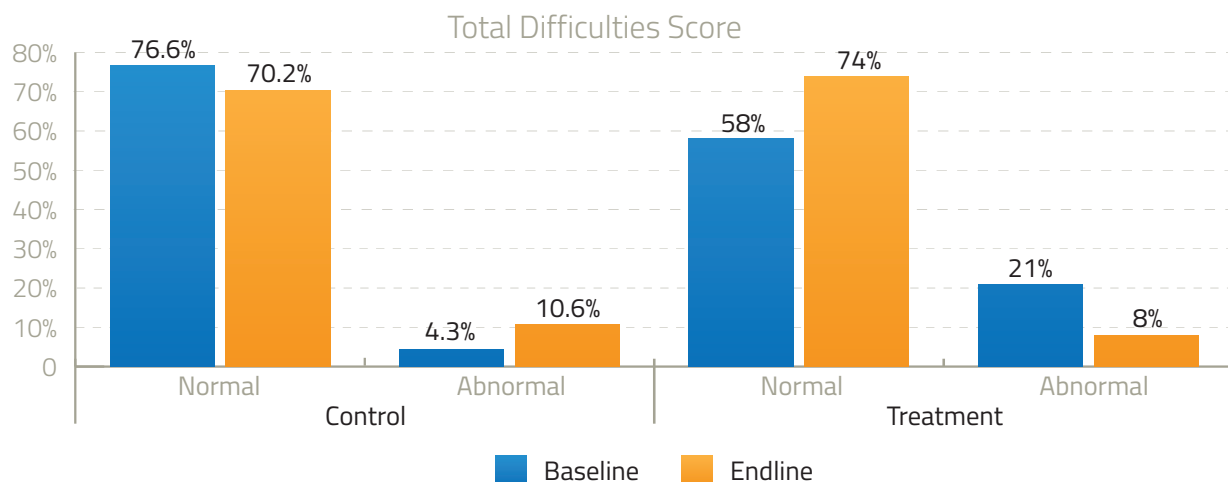
# Psychosocial Outcomes

Psychosocial outcomes were assessed with the Strengths and Difficulties Questionnaire (SDQ), which is designed to measure children’s strengths and weaknesses within five domains: (1) emotional symptoms, (2) hyperactivity/inattention, (3) prosocial behavior, (4) conduct problems, and (5) peer relationship problems. The SDQ provides scores for strengths (labeled normal) and difficulties (labeled abnormal). The tool was administered to parents, who were asked to provide an assessment of their treatment or control group children at the pretest and post-test phases. All parents were invited to participate.

## Antura and the Letters

For Antura and the Letters, 123 control and 127 treatment parents agreed to participate at baseline, and 47 control and 53 treatment parents participated at endline. Overall, the children in both control and treatment groups displayed normal scores for most of the five categories assessed by SDQ at baseline. However, total normal scores of the treatment group improved between baseline (58.5%) and endline (73.6%), as compared to a decrease in total normal scores among the control group between baseline (76.6%) and endline (70.2%). In addition, abnormal scores of the treatment group declined between baseline (21%) and endline (8%), as compared to an increase among the control group between baseline (4.3%) and endline (10.6%). These scores indicate an improvement in psychosocial wellbeing for children who played Antura and the Letters, compared to control group children who experienced a decline in psychosocial wellbeing over the same period. Figure 1 presents the SDQ data.

**Figure 1:** Total SDQ Scores for Antura and the Letters

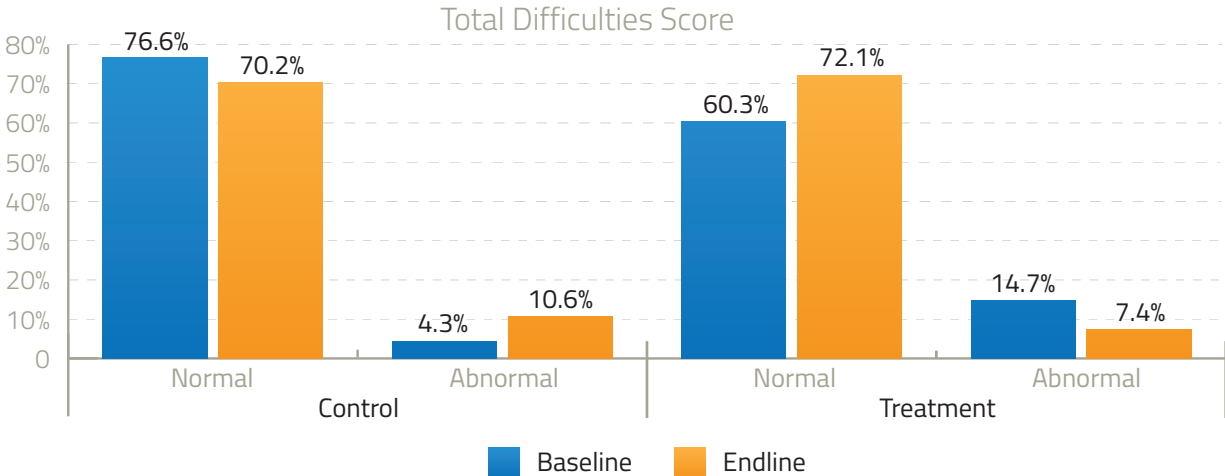


## Feed the Monster

For Feed the Monster, 123 control and 125 treatment parents agreed to participate at baseline and 47 control and 65 treatment parents participated at endline. Overall, the children in both the control and treatment groups displayed normal scores for most of the five categories assessed by SDQ at base-

line. However, total normal scores of the treatment group improved between baseline (60.3%) and endline (72.1%), as compared to a decrease in total normal scores among the control group between baseline (76.6%) and endline (70.2%). In addition, abnormal scores of the treatment group declined between baseline (14.7%) and endline (7.4%), as compared to an increase for the control group from baseline (4.3%) to endline (10.6%). These scores indicate an improvement in psychosocial wellbeing for children who played Feed the Monster, compared to control group children who experienced a decline in psychosocial wellbeing over the same period. Figure 1 presents the SDQ data.

**Figure 2:** SDQ Scores for Feed the Monster



## Engagement and Ease of Use

Many of the insights gained by examining engagement and ease of use provided useful advice to the teams developing each app. In addition, some insights may be useful to any app development team focused on improving the literacy skills and psychosocial wellbeing of children.

A regression analysis (that linked student attributes to learning outcomes) across subtasks found that, for both games, older students and students who self-reported an ability to read alone scored higher on oral reading fluency. Nevertheless, younger students showed higher rates of change (percentage improvement) across all subtasks. This indicates that, should this rate of change be sustained over a longer dosage period, younger children might catch up to older children. This may also indicate that apps addressing the beginning skills of reading, such as decoding and building whole word reading skills, can be beneficial to students with a wide range of schooling and self-reported reading ability.

A critical issue in education for Syrian refugee children is lower access to schooling for girls, and digital learning might provide a way to increase access. The evaluation found a mixed story on the impact of the two apps on girls. For children in the Antura and the Letters treatment group, boys scored higher than girls on all subtasks at baseline, except letter sounds. Boys also made larger gains on all subtasks as well as higher rates of change, though gains for oral reading fluency were strong for both. For children in the Feed the Monster treatment group, boys scored higher than girls on all subtasks at baseline and made larger gains for all subtasks except oral reading fluency, though the difference in gains

for syllable reading and invented word reading were small. However, girls made larger rates of change for syllable reading, invented word reading, and oral reading fluency. Data on both apps shows girls are making gains, particularly in oral reading fluency, which is a strong predictor of reading comprehension. This may indicate that smartphone apps could provide girls, who are denied other opportunities, a chance to acquire and improve literacy skills.

In focus groups, most parents stated their children were improving their reading skills with the apps and were supportive of their children using them. Parents also said children

came home happy after having played the games. The evaluation also found a high percentage of children lived in a family that had a smart phone or access to one. Parental support and access to smartphones in the home suggests that effective literacy learning apps will find their way to children, even refugee children living in camps. In addition, at least one mother said she also used the app to improve her own reading skills, and a relative of one of the children sent a web link to a relative in a camp in Turkey, who downloaded the app for use there. These two examples suggest that effective reading apps could find an audience outside of any project-related use.

In focus groups, children said they found the games fun to play and enjoyed the challenge of moving through levels and acquiring prizes. Children also expressed that playing the games made them happy. However, some children expressed that they began to become bored once they had mastered the game. This suggests that games offer more variety of content. Children should also be encouraged to practice their literacy skills as much and as often as possible on simple texts.

Even though the games were designed to be played by individuals, children reported they would often play with their friends and enjoyed sharing tips on gameplay with classmates. In addition, parents reported that when siblings were part of the study, they would discuss the game when they came home. Children also may have conveyed their new knowledge to siblings and parents. This type of interaction can be highly valuable for retention of learning and continuation of the learning process. This may indicate that learning through games always has a social component, and that enhancing such social components could extend learning.

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# Conclusions

The evaluation faced many implementation obstacles that placed limits on the strength of any conclusions that could be drawn from this data. Regardless, the positive findings for both literacy and psychosocial wellbeing for both games mean the evaluation provides proof of concept for using smartphone apps for teaching literacy to refugee children and other children who do not have access to effective instruction. The evaluation appears particularly promising given that the findings were used to improve the games. With smartphones widely available, these apps can provide effective literacy learning opportunities to Syrian and other Arabic-speaking children.

## Game Improvements Made Since Beta Versions

### Antura and the Letters

Based on testing and evaluation findings, the following key updates have been made:

#### 1. Pedagogical changes

- The game now has a phoneme based approach instead of a letter names approach.
- Children now learn a few letters and start to read simple words relatively quickly instead of learning the entire alphabet first. This enables children to see the usability of what they are learning sooner. It also reduces the game's duration, which was too long in the first version, causing children to lose motivation in completing the game.

#### 2. Overall difficulty reduced

- It is now easier for children to reach better scores and to progress from one mini-game to another. This can increase their motivation and sense of accomplishment.
- Several of the most difficult mini-games have been deleted, reducing the risk of children becoming demotivated.

#### 3. General flow improved

- Player guidance has been improved and features are introduced more progressively.
- The main screen has been changed to a scrolling map, allowing greater readability, more information on screen, and easier navigation.
- The button positions, signs, and feedback symbols have been redesigned to improve usability.

#### 4. Features to improve player retention

- While playing, children are rewarded with bones as currency which can now be spent in a shop to buy toys and furniture for Antura. The feature is reinforced by a daily reward feature that motivates children to return to the game for additional play.
- The game sends a notification if it has not been used for several days, to encourage players' regular use of the game.

### Feed the Monster

Based on testing and evaluation findings, the following key updates have been made:

#### 1. Improved tutorials

- A new character serving as a tutorial guide is introduced at the beginning of the game to demonstrate key features of game play.

#### 2. Smoother pedagogical progression

- 18 'Name Letter' levels and 18 'Syllable Recognition' levels have been added to the game, to increase both the repetition of letters and syllables and to create a more gradual pedagogical progression for the player. The game now has 120 levels.

#### 3. More diversified game play

- To diversify the flow and gradual progression of players in the game, six letter-writing and six memory puzzle mini-games have been integrated as levels in the map. These levels are identified with a special red mushroom icon.

#### 4. Increased engagement

- Levels that unlock new monsters have been rearranged to increase player motivation and retention.
- The amount of points each monster requires to evolve has been revised to increase player motivation and retention.
- Players can now decorate the look and feel of each monster in their collection with a set of stickers and pets. Stickers and pets are rewarded once certain levels have been completed.







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