



onecourse

ONE APP

ALL OUR CHILDREN

NUMERATE

AND WITH A

LOVE

OF READING

onecourse

handbook

by onebillion

onebillion learners is a registered charity in England and Wales N° 1159480

onebillion.org

CONTENTS



01/	summary	05
02/	an overview of onecourse – summarising the two different versions – onecourse for schools and onecourse for communities	07
03/	learning	11
04/	reading – pedagogy, structure and content, and sample activities from the onecourse reading material	13
05/	stories – importance of engaging, culturally appropriate stories to ensure comprehension	23
06/	writing – pedagogy, structure and content, and sample activities from the onecourse writing material	28
07/	numeracy – pedagogy, structure and content, and sample activities from the onecourse numeracy material	32
08/	play zone – a short summary of our approach to the Play Zone and some sample games	38
09/	design – our approach to the imagery, screen layout and design of onecourse	42
10/	technology – the development of the software and how it scales to new languages and contexts	55
11/	evidence for efficacy - a summary of evidence from trials and pilot tests which were carried out in several countries	65
12/	appendices – in depth research on the efficacy of onecourse, language documentation and sample list of library stories.	71

01



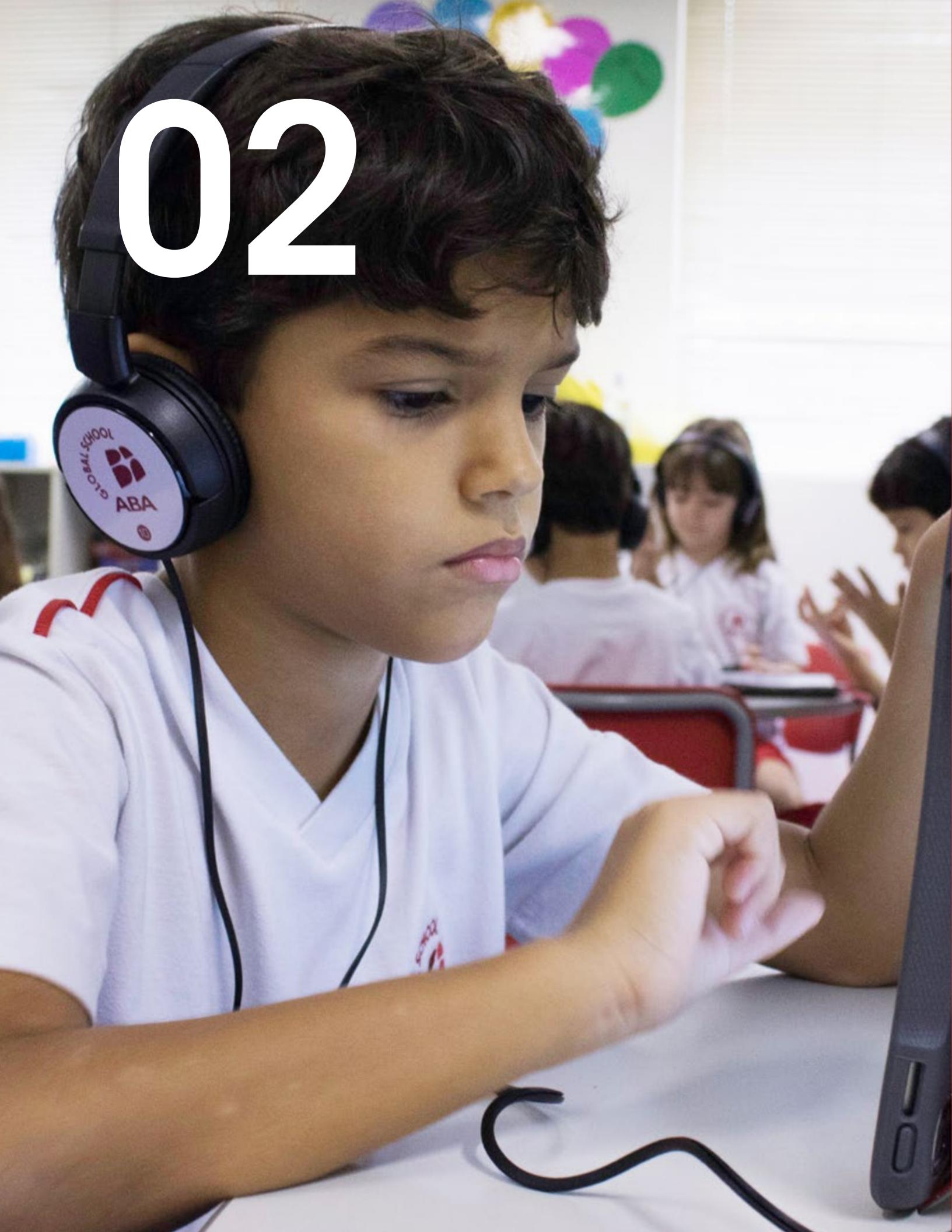
onecourse

one app designed for every child

- in the child's own language
- for use in both schools and in a wider community setting
- works on tablets and smartphones, both iOS and Android
- built by international non-profit **onebillion**, based in London
- designed to take a child from zero fluency to reading with comprehension
- delivers numeracy and a love of reading

This handbook gives a more detailed view of the content of **onecourse**, and the growing evidence base that shows significant learning outcomes.

02



An overview of onecourse

onecourse is our response to the global education challenge: a comprehensive, personalised learning software, which enables children anywhere in the world to become literate and numerate in their own language.

Onecourse software is adaptable to different contexts and cultures, and compatible with tablets and smartphones running both iOS and Android operating systems.

The two versions

There are two versions of onecourse: onecourse for schools and onecourse for communities.

1. onecourse for schools

onecourse is implemented in a school environment with support from the Ministry of Education.

Key Features

- Teachers register and group children according to age or ability, as in a normal classroom.
- Literacy and numeracy are presented as separate strands. Lessons in each are planned and allocated by qualified teachers and teaching assistants.
- Children's progress is monitored via a low-powered local server.
- An administrative tool allows teachers to track progress and give instant support.

The numeracy material is presented in the form of graded topics. The literacy material is divided into ten levels. Children work through short learning units at their own pace.

onecourse schools version is being used under the Unlocking Talent initiative; a joint programme between onebillion and Voluntary Service Overseas (VSO International).



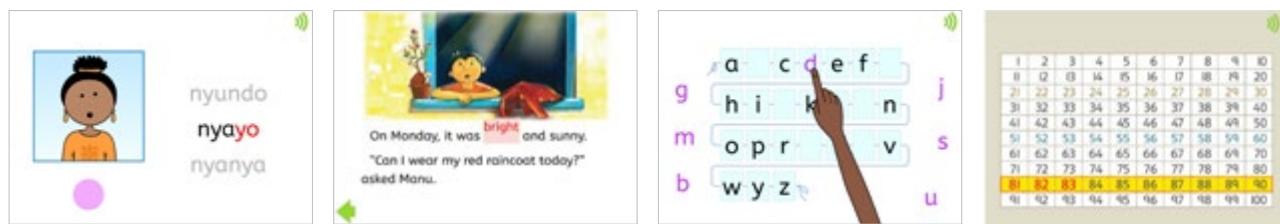
2. onecourse for communities

onecourse is designed for children who have limited access to formal education, for example in remote villages and refugee camps.

The course material in this version falls into two key areas:

The Study Zone

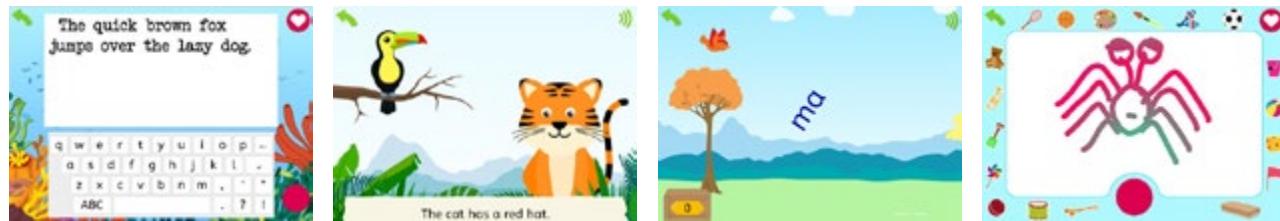
In the Study Zone, we combine literacy and numeracy. Each day, children are presented with a set of short learning units to work through – some for literacy and some for maths.



The Play Zone

Once the child has completed that day's units in the Study Zone, they then gain access to the Play Zone. Here the child can choose from a wide range of activities, which include playful practice and quick tests of concepts met in the Study Zone, as well as creative and collaborative activities.

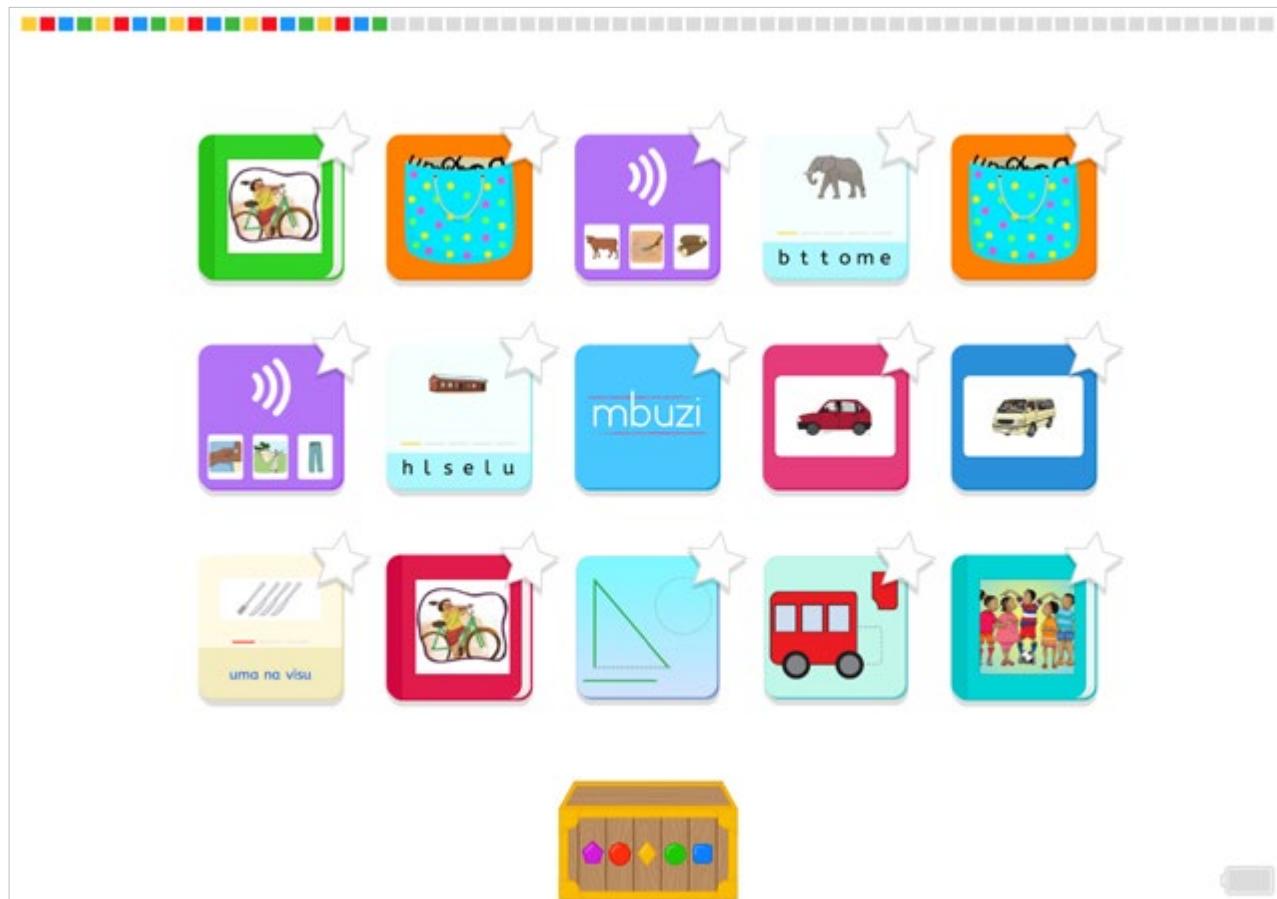
There is minimal instruction in the Play Zone; children must work out how to use each component. The activities are engaging, and act as a creative and playful treat after completing study units.



Community mode

Children can switch between the Play Zone and ‘community mode’.

Community mode allows children to choose to do any of the units again for practice, and allows other members of the community to practice them too. This fosters an environment of collaborative learning and sharing, and can benefit illiterate adults in the community as well.



Community mode menu.

03



Learning

We use a direct teaching approach in all of our material, to help the child learn as efficiently and effectively as possible. Our reasons for taking this approach:

- Children may spend little or no time in school. Their time is precious.
- Not all children will benefit from indirect teaching, for example through discovery learning, or games.
- Repetition and spaced practice are essential in achieving numeracy and literacy. Key learning units, syllables and words are brought back time after time.

04



Reading

The child works through an ordered set of learning units covering reading, writing and numeracy. In the onecourse for communities version, this material falls within the Study Zone.

Pedagogy

A grasp of letter/sound correspondence is key in learning to read. Children quickly start to recognise some words by sight, but they need the tools to decode unknown words. This is particularly important for children learning more than one language, as some are more ‘transparent’ than others. For example, Swahili is considered to be a more ‘transparent’ language than English, despite having words of 8 or more letters at the lowest of reading levels.

Phonics, therefore, plays an important part in **onecourse**. Letters and their sounds are introduced one by one, systematically, with reasonable intervals between them. We introduce them in an order which allows us to build simple words as soon as possible, through blending.

However, phonics is only a means to an end. Enabling the child to read automatically and acquire a love of reading are the ultimate goals.

This is where our stories come into play. The child meets stories from the first day. Initially they are read to the child, with only the story title in text. Gradually we move through different story modes, until finally the child can read alone with the option to touch and hear words they find difficult.

We also spend time on morphology (word structure). For example, looking at how tenses are formed. This is helpful in languages with long, agglutinate words like Swahili.

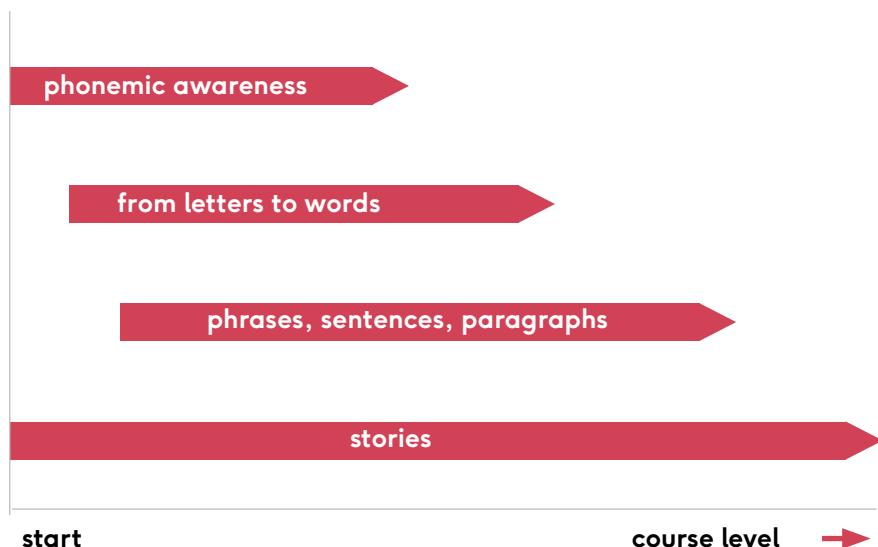
Structure and content

The reading material has four strands:

1. Phonemic awareness.
 2. From letters to words.
 3. Phrases, sentences, and paragraphs.
 4. Stories.

These strands run in parallel for most of the course, as shown below:

Reading: our four strands



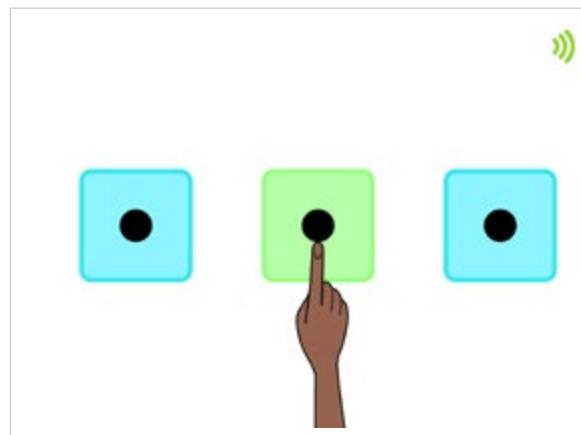
Now we will look at each strand in turn.

1. Phonemic awareness

The ability to distinguish between sounds is critical in learning to read.

The ‘phonemic awareness’ strand features most prominently early in the course, but carries on through several weeks. The child identifies ‘same’ and ‘different’ sounds, and picks out objects whose names start with, end with, or contain, specific phonemes.

In identifying ‘same’ and ‘different’ spoken sounds, we start with words, move on to syllables and finish with individual phonemes. This mirrors the order in which young children begin to grasp spoken language.



The sound boxes play all kinds of other sounds, including animal noises.

2. From letters to words

This strand consists of core lessons, followed by practice using a range of activities.

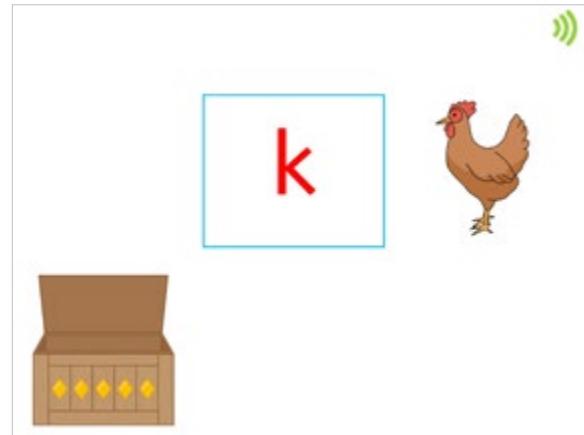
Core lessons

These are: *Meet the letters*, *Make syllables*, *Make words*, and *The alphabet*. The first three are based on our letter box.

Meet the letters

The child meets the letters and their sounds, in an order which depends on the language. The letters fly out of the letter box.

- In Swahili, we present the vowels first – since almost all of its syllables end in vowels – and then the consonants in order of frequency of occurrence. We used textual analysis to determine this.
- In English, we present the letters in the order recommended in the UK's National Literacy Strategy¹. The first six letters are **s,a,t,n,i,p**.



From single letters, we move on to graphemes with two or more letters. Later we deal with common non-phoneme consonant pairs and clusters, for example **mb** and **nj** in Swahili. Again we present them in order of frequency, so as to use them in common words as soon as we can. Our approach is pragmatic: to accustom the child to permissible letter combinations.

Make syllables

- In Swahili, with vowels met, we quickly move to making syllables for each new consonant. From now on, the focus is on syllables. These will become the building blocks for words.
- In English, we leave syllables until the child has had plenty of practice with monosyllabic words. We can then build compound words such as **cobweb**, **sunset**, and **seaside**, and move on to longer words.



The screen above right shows how we build the syllable **pa** in Swahili. The red 'listening button' jumps from letter to letter. The child touches it to hear the letter sounds. Then the letters blend, and the child can hear the syllable.

¹ <https://www.gov.uk/government/publications/national-curriculum-in-england-english-programmes-of-study>

Make words

Because of the order in which we present letters, the child can start making and reading words long before all the letters have been met. For example:

- In Swahili, once **n**, **m**, **k**, and their syllables have been met, the child can make and read words such as **kaka** (brother), **kina** (monkey), **kuku** (chicken), **kuni** (firewood), **kukua** (to grow), **mama** (mum), **maua** (flowers), **nane** (eight), and **neno** (word).
- In English, once the first six letters have been met, the child can make, and read, a range of two- to four-letter words, including **at**, **an**, **in**, **as**, **ant**, **sat**, **nip**, **sip**, **tap**, and **pant**.



Making a word by blending syllables in Swahili.



Making a word by blending letters in English.

The alphabet

We introduce the alphabet – the list of letters by name – only after the work on letter/sound correspondence. The alphabet is presented in a grid which is adaptable for any language.



The Swahili alphabet: 24 letters.



The English alphabet: 26 letters.

Practice activities

We use a variety of activities to put the core lessons into practice. They approach the work from different angles. They allow us to re-present target letters, syllables and words time after time in different contexts.

Build syllables or words by choosing from a grid

Children build syllables or words in response to audio, by selecting letters or syllables from a grid.



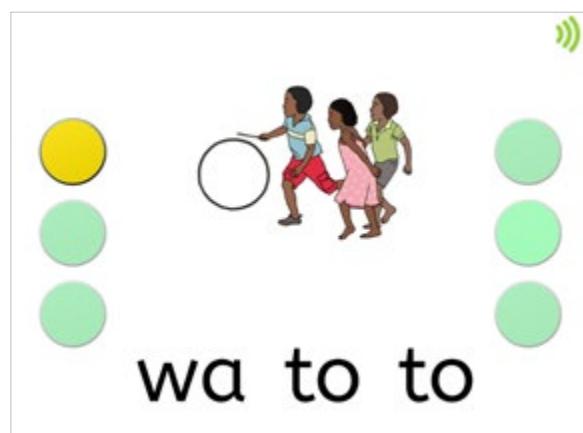
Make the word you hear

Children make the word they hear, by dragging its letters or syllables into place in the right order. (This is a precursor of spelling.)



Segment and blend

At the touch of a button, a word appears, with its corresponding image. The word segments and blends, synched to audio. For English, it will segment to graphemes.



Match what Lisa said

Children choose the letter, syllable or word which matches what the talking head said.

When the activity is about words, the word is segmented into its syllables (in Swahili) or letters (in English) as part of the feedback.

nyundo
nyayo
nyanya

Record yourself in audio or video

Children record themselves reading text, in audio or video. Their recording is played back, followed by model audio. A word may be segmented and blended as part of feedback.

For audio recording, the image for the word appears as part of the feedback.

penseli

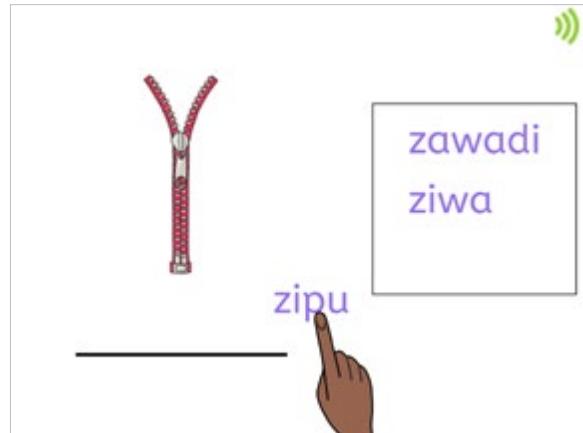
Match word cards

Children find two word cards that match. The cards merge and the image appears. Segmenting and blending is part of the feedback.

wimbo	mdudu	punda
rangi		wimbo
punda		mpira
		rangi

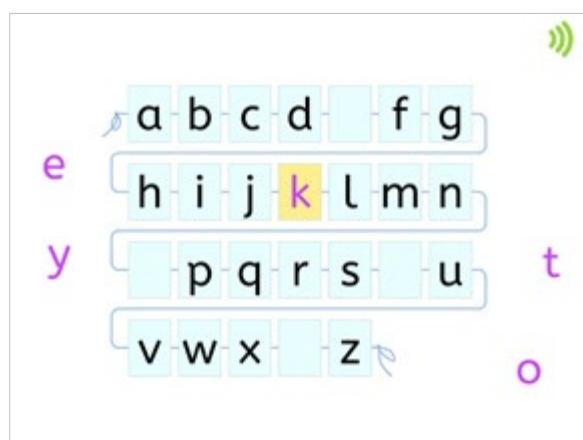
Drag the label

Children drag the correct label to an object, with no audio until feedback. This tests ability to decode.



Complete the alphabet

This is revision of the alphabet. In the final feedback, the letters are named in order.



Quick pick

Children pick out graphemes, syllables or words to match audio, from a random arrangement in a grid.



3. Phrases, sentences and paragraphs

This strand is the bridge between single words and stories.

In this strand the child:

- learns about reading from left to right, and from the first line down.
- learns the function of capital letters, and punctuation.
- assembles phrases and sentences from words, to match audio.
- practises high-frequency words for that language in context – including words which have limited letter/sound correspondence.
- develops morphological awareness, for example about how tenses and plurals are formed.

The work on morphology is important in English, and even more so in other languages. In Swahili, for example, different noun classes form different plurals, and verb stems can add on up to four markers (for subject, negative, temporal/conditional, and object).

It is also important to encourage the child to read with comprehension. Lack of comprehension can be a big issue, even for children who can readily decode. This strand also provides comprehension activities from an early stage. For example, the child will fill in the blanks in a sentence or paragraph by choosing appropriate words. We also provide mini stories, no longer than a paragraph, and ask comprehension questions about them in audio.



paka _

meza chini ya

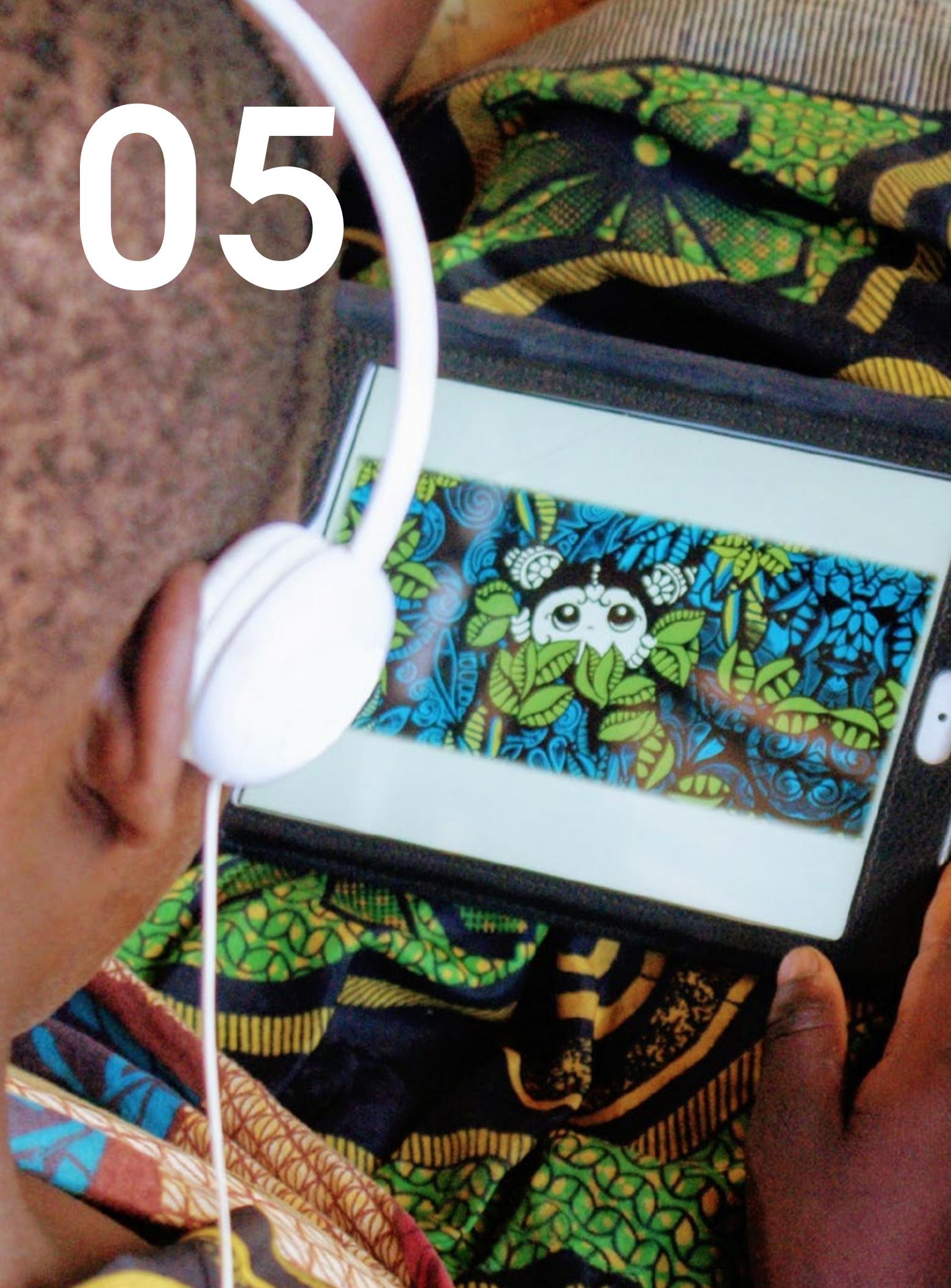
Building a phrase to match audio, in Swahili.



The boy put his dog in
a big red bag.

A unit about sentences, which focuses on the use of initial capital letters, and full stops.

05



Stories

Our goal is to enable children to read fluently, with comprehension. All the work on reading leads to the stories. We currently have approximately 370 stories across different graded reading bands.

Some stories are specially written, to bring in familiar situations from everyday life and to tackle specific cultural issues.

The others are Creative Commons stories from African Storybook, StoryWeaver and Book Dash which we have edited. Most are heavily illustrated.

The reading bands

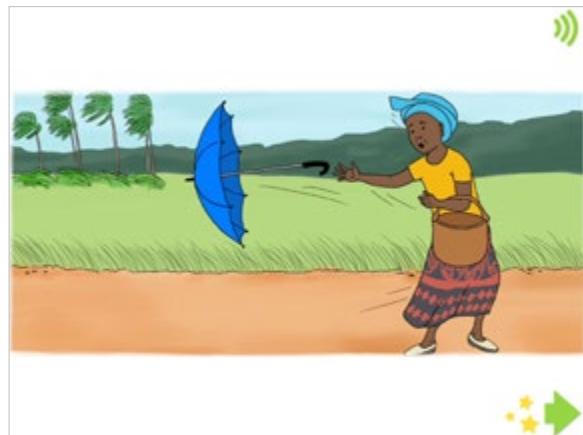
The stories are divided into reading bands **R1 – R5**, as shown in the table below. They generally increase in complexity with length, while font size decreases overall.

Level	Extent	Sentences per page	Font size
R1	8	1	large
R2	10	2	large
R3	10-12	2-3	medium
R4	12-14	2-4	medium
R5	14-16	4+	small

The story modes

Children love listening to stories. They also benefit from hearing, and reading, the same story several times. So each story can appear in up to six modes:

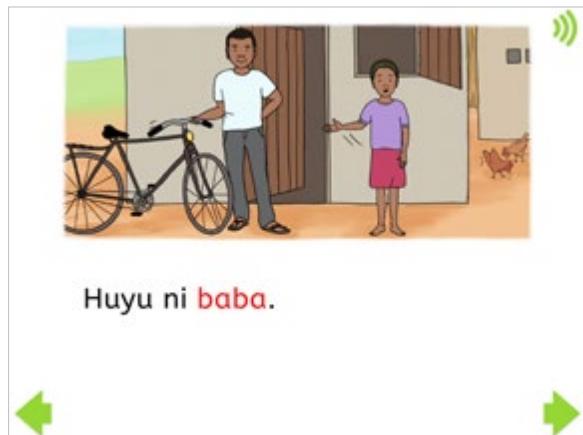
Mode	Description
1	Read to me; the only text on display is the story title.
2	As for Mode 1, but with in-page comprehension questions in audio.
3	Read to me: all text is shown; the words highlight in sync to audio, which helps to confirm the direction of reading.
4	Touch all the words: the child touches the words in order, and hears the audio for each word; this prepares the child for touching unfamiliar words in mode 5.
5	Read by myself; now the child is reading alone – but with scaffolding; for reading bands R1 – R5, the child can touch any word to get help, and will hear it spoken; for R1 and R2 stories. Where appropriate the child can receive a syllable breakdown.
6	Record myself; children can record themselves reading the story in audio, and hear their recording, followed by the model audio.



A screen from a story in Mode 1, 'Read to me'.
The textless story is read aloud.



In Mode 2, Anna asks questions to check comprehension. Here the child touches a button to answer a binary-choice question.



Huyu ni baba.



On Monday, it was **bright** and sunny.
"Can I wear my red raincoat today?" asked Manu.

In Mode 3, the words in a story highlight one by one, while the story is read out.

In Mode 5, when a child touches a word in the story it jumps up, highlights, and its audio plays.

Making the most of each story

The story modes allow us to make the most of each story, reusing it in different weeks in the course. Until the child has done key work on phrases and sentences, the stories are presented in Modes 1 and 2 – they are read to the child. A smaller number of stories then appear in Mode 3, followed by Mode 4. Thereafter, Modes 5 and 6 are the most common.

Even after children have begun reading by themselves, we still include stories in Mode 1 at intervals, as a treat.

Reading with comprehension: the ultimate goal

Our goal is to enable the child to read with fluency and comprehension. The child's working memory is key to this – and the working memory is limited in capacity.

To understand text, the child must decode the words, and then make links with areas of memory where meaning is stored. We help the child with this complex task in several ways.

We:

- present target words very frequently across learning units, to enable automatic recognition, and hence free up capacity in the working memory.
- extend the child's vocabulary across the course, with images to give meaning.
- start work on comprehension early, in the 'Phrases, sentences and paragraphs' strand.

Within the stories themselves, we:

- use short sentences, and repeated words and phrases, in lower-level stories.
- provide audio help at the touch of a word.
- provide illustrations on every page, for most stories.
- allow the child to page back through the story.
- repeat a story several times and in different modes – initially in audio only.
- focus specifically on comprehension in story mode 2.

06



Writing

Pedagogy

Familiarity with letter shapes is a prerequisite for decoding. We display each new letter in a large font size, and repeatedly show how it is formed. Only then do we move to tracing. Tracing with the final familiar shape in mind is more effective.

After tracing, the child has the chance to write letters freehand. Once several letters have been met, the child can write simple words. Writing now becomes more meaningful.

In early writing, we build the letters stroke by stroke in the correct sequence, rather than in one continuous movement. This helps to establish the motor plan in the child's mind. Later in the course, we introduce continuous strokes.

When the child has moved from sounding out letters to using their names, we also introduce a keyboard, as appropriate for the target language. At this stage, the focus has moved to spelling.

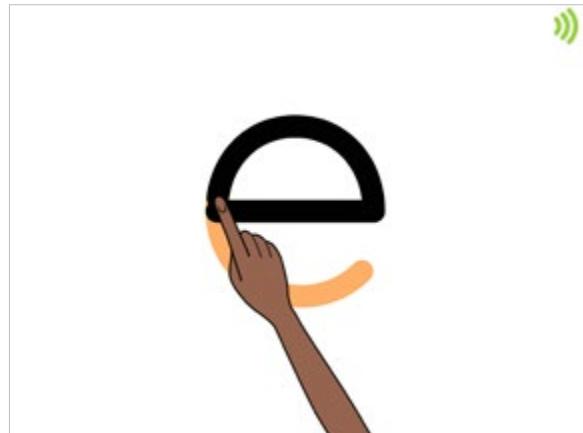
Structure and content

We interpret ‘writing’ widely, to include numerals as well as letters and words.

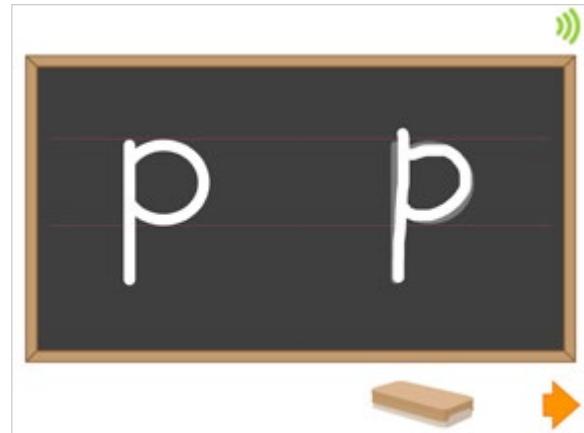
We are including spelling too. At a certain point, when writing letters becomes automatic, the ability to spell becomes key.

The child:

- begins with pattern work for lines and curves, as preparation for writing letters and numerals.
- initiates animations where perfect letters form, to increase familiarity with their shapes.
- traces letters, digraphs, and numerals, and then write them freehand.
- traces short words, supported by audio and an image.
- writes words, and numbers, in response to audio only (hints available).
- writes words in response to images only (hints available).
- practises writing with continuous strokes.
- practises spelling by typing words, phrases and sentences in response to audio and images.



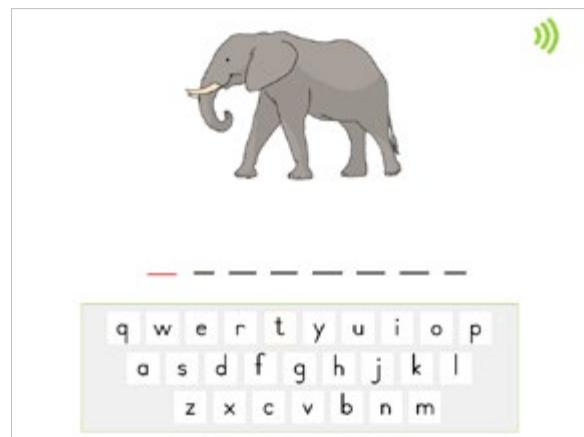
Showing how the letter e is formed.



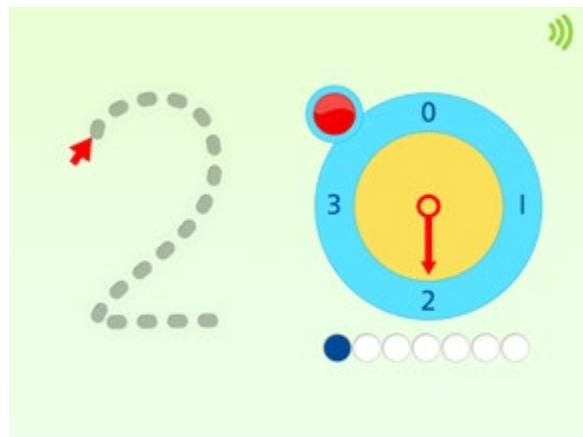
Tracing the letter p. Next we will show the child's tracing with the grey 'model' letter removed.



Writing a simple word in onecourse English. The child can rub out with the duster.



We gradually build up to using a full keyboard, and eventually to typing sentences. The letters q and x will be blanked out for Swahili.



We will use our blackboard for writing numbers too. The child will also trace numbers, as shown here, in the numeracy section.

07



Numeracy

Pedagogy

To achieve basic numeracy, children must first learn to count concrete objects in words, and then match the words to numerals. They must become familiar with the numerals. They must understand, for example, that 31 is a larger number than 29, which in turn requires an understanding of place value. Finally, they must recognize the abstract nature of numbers, for describing the quantity of a thing, which allows us to carry out number operations.

For everyday situations that require numeracy, children must understand addition and subtraction, and the related symbols. Multiplication will be a very useful tool. Most importantly, they must be able to apply what they have learned to real life situations.

These concepts and skills build on each other, with the level of difficulty steadily increasing. It is harder to count to 20 than to 10. It is harder to find the answer to $47 + 12$ than to $5 + 2$. It is harder to multiply than to add.

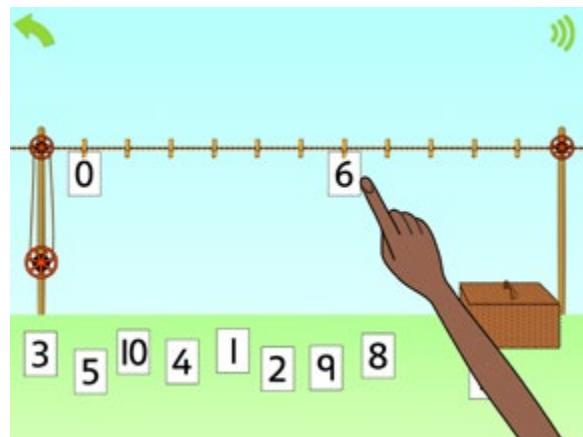
Structure and content

Enabling children to achieve basic numeracy on their own is a big challenge. Our response is to build up the work very slowly and carefully. We use images of concrete objects for counting, and later, for introducing the number operations.

The numeracy content of onecourse is universally valid. Here we look in more detail at different aspects of the content, and our approach to it.

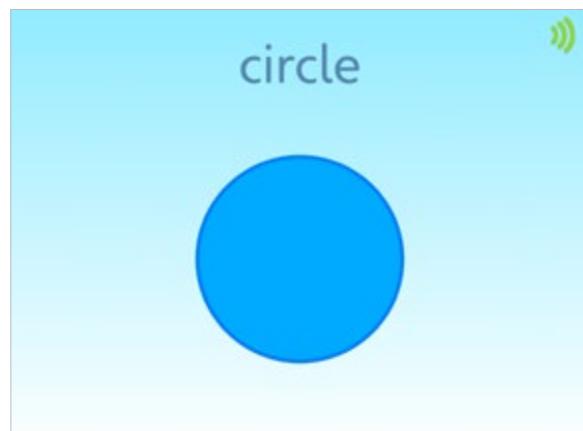
Direct instruction

As elsewhere in the Study Zone, Anna shows the child 'how to' at the start of each numeracy learning unit.



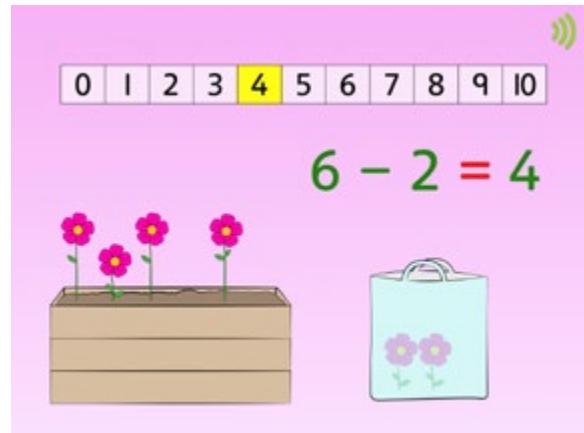
No reliance on reading

For most of the numeracy work, we show no text on the screen, so reading ability is not an issue. Instructions are in audio. The infrequent text is restricted to labelling. At higher levels we introduce more text, and specifically in word problems, but we keep it very short and simple.



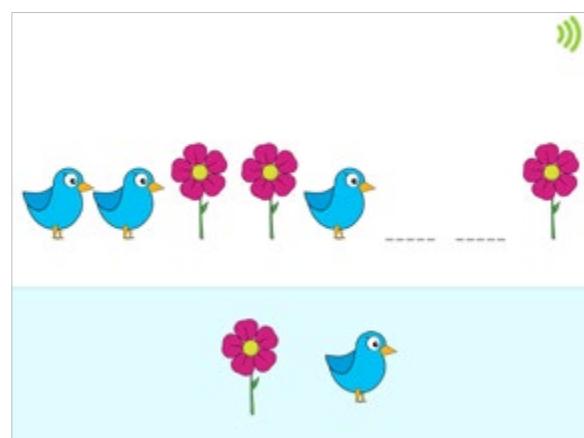
From concrete to abstract

As far as possible, we use objects for establishing concepts. For example children count, and add, and take away, apples and insects and fish. At higher levels, we move to manipulation of abstract numbers.

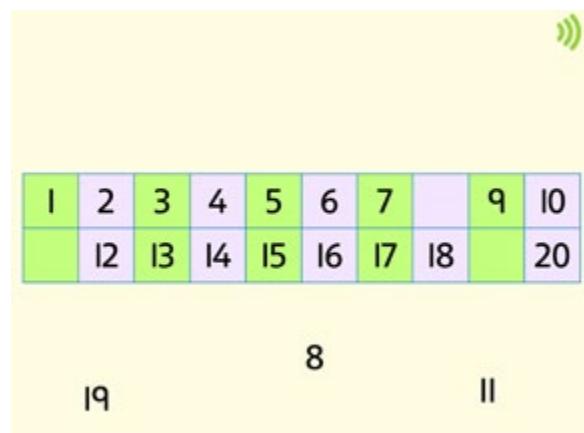


Establishing patterns

Mathematics is based on patterns. So the preparatory work includes filling in missing items in patterns, and colouring in patterns, and completing patterns, as well as sorting and matching objects.

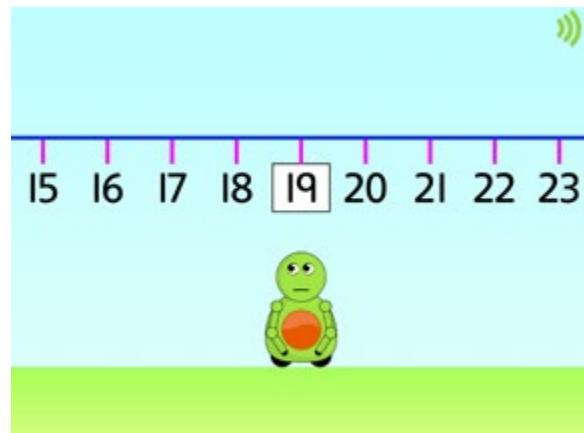


Later, the child works on number patterns, for example by putting numbers in the correct sequence, filling in the missing numbers in a sequence, and identifying patterns in the 1–100 number grid.



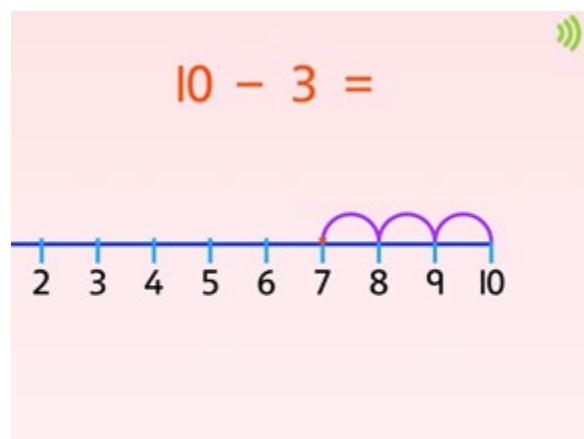
Using number lines

We include number lines for number recognition, number sequencing, skip counting, as well as for addition and subtraction.

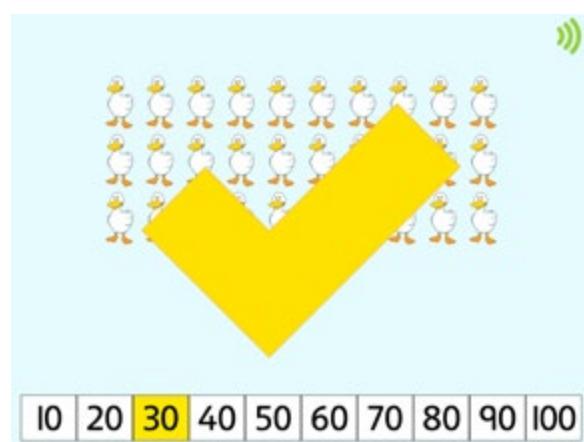


Gradual progression

We build up gradually in difficulty. For example by the time children meet vertical (columnar) addition and subtraction, they will already have done a lot of work with linear expressions ($8 + 4 = 12$), and added and subtracted using number lines. They will also have done the appropriate work on place value.

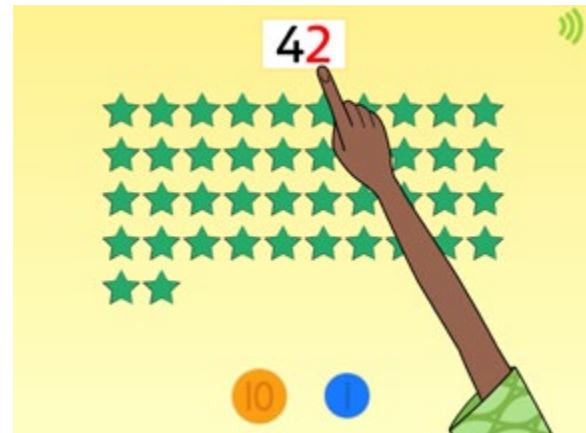


In the same way, we approach multiplication gradually, via counting in multiples of 10, 5, and 2, and by adding ‘the same again’. Once the concept of multiplication has been firmly established, we move on to multiplication tables, which are essential for rapid multiplication in everyday situations.



The concept of place value

We use different strategies to help the child grasp this concept. For example in the activity shown on the right, the child places objects on the screen using a '10' button and a '1' button, to match a given number.



Rote learning and spaced practice

Rote learning plays an important part in numeracy.

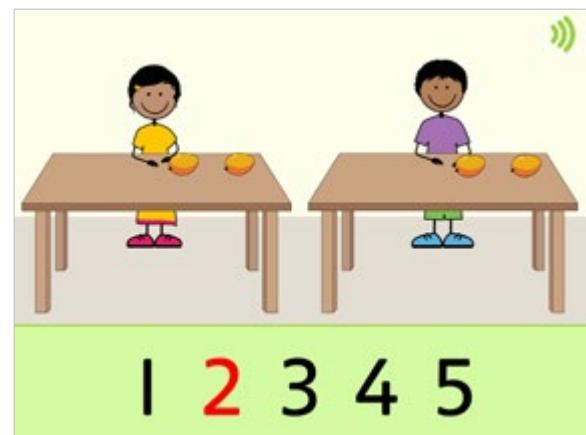
For example by the end of **onecourse**, the child should be able to count dependably to over 1000, at least. So we bring counting units back many times, at intervals.

We repeat other key units too, for example on addition and subtraction, to provide spaced practice.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Word problems

Children often have difficulty in transferring learning to other situations. We introduce word problems early on. These recur throughout the course.



08



Play Zone

The Play Zone in the onecourse for communities version offers discovery learning and creative play. Children choose from a wide range of engaging and fun activities; these include creative and collaborative games, playful practice and quick tests of concepts met in the Study Zone.

Material created in the Play Zone can be saved and shared with friends, family, and the wider community.

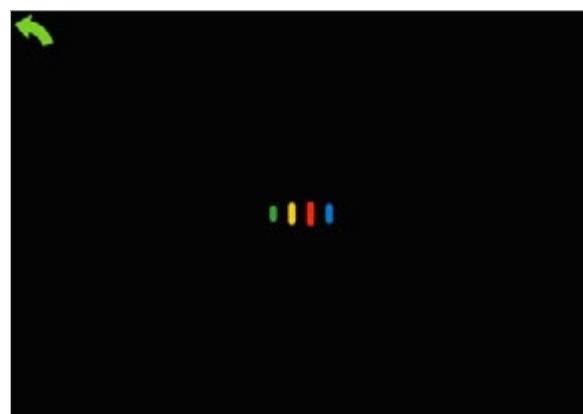
Video library

A collection of short clips including animals in the wild; cityscapes; rocket launches; and how-to-draw demos. These clips help to put the child's learning in context and inspire their creativity.



Audio story

An audio story selected from our collection of entertaining commissioned stories, between 5 and 10 minutes long. There are currently two original series, plus a large collection of traditional tales from around the world, retold for a modern audience and localised.



Story library

All the books encountered in the literacy units are included here. The child can select their favourite – or find a new story – to enjoy by themselves or with others



Doodle pad

A blank canvas for the child to enjoy 'painting'. The child can save their creations to look at later, or to show their family and friends.



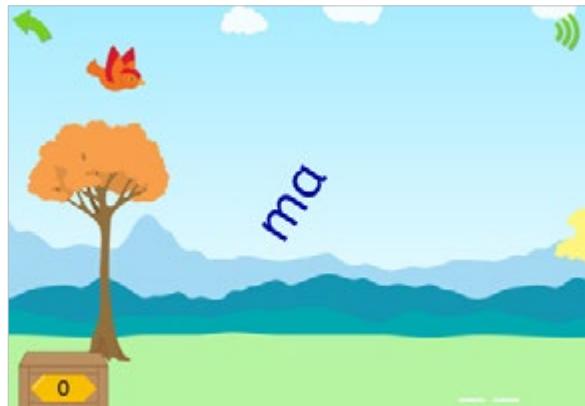
Make a video

Another activity encouraging the child to get creative – they can make short video clips of themselves, family, friends, animals – whatever takes their fancy!



Flappy words

An exciting game challenging the child to keep the bird flying, by collecting letters to form words.



Bubblewrap

A fun activity to spark the child's interest in their world. The child pops the bubbles to reveal a photo and caption. A globe shows where in the world the photo comes from. It could be an animal, a work of art, a building or an inspirational person.



Talk to the tiger

Prompted by a friendly toucan, the child can talk to the tiger and hear the tiger speak back to them in their voice. Later, children are encouraged to read confidently by reading words and sentences to the tiger.



09



Design

onecourse is designed to be child-friendly, effective, and easily localised. In this chapter we focus on its design, under these headings: Usability, Engagement, Personalisation, and Localisation.

Usability

The child will essentially work alone, in the Study Zone, and may have no access to help from peers or adults. We have taken steps to ensure that the child does not get confused, overwhelmed, or stuck for any reason.

Clarity of instruction

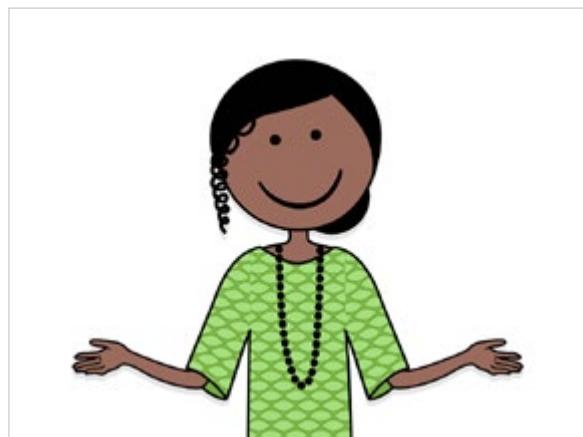
The child must always know what to do next.

Guidance from Anna

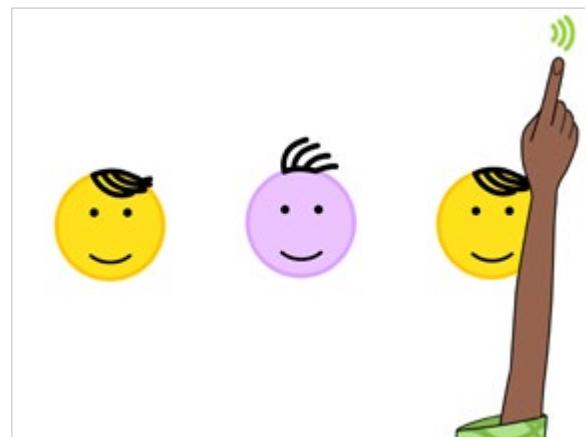
Our digital teacher, Anna, guides the child every step of the way. She appears on screen herself, or as a pointing hand. For each new activity, she shows ‘how to’. Her instructions are short, simple, and clear.

Repeat instructions

If the child fails to respond within a certain time, an instruction is repeated. The child can also press the ‘Repeat audio’ button to hear the instruction again.



*Anna guides the child at each step.
(In Swahili she is called Mahira.)*



Anna points out the ‘Repeat audio’ button.

Clear feedback

Response to the child’s input is immediate, and clear. We have sound effects for correct and incorrect answers. If the answer is wrong, the child is asked to try again. If the answer is correct, the child receives a tick, and moves onto the next item.

Ease of input

We make it easy to input an answer.

A starter lesson

onecourse may be the child's first experience of using a touch-based device. So the first unit introduces the two main gestures needed for working through the course: lightly tapping on the screen to make choices, and sliding a finger around the screen to drag items. We also introduce the two main buttons: the 'repeat audio' button, and the forward arrow.

Generous hot areas

To ensure that selecting is easy, the 'hot' area for an item (the area of the screen that responds to touch) is larger than the item being selected.

Allowing for poor motor control

Some children may have difficulty with longer continuous movements, for example when tracing. So, we allow tracing to be completed in stages. If the child's finger is lifted close to the end, the tracing completes automatically.

Likewise, when dragging an item, the child may drop it short of the target destination. We provide a generous hot area for the destination. If the item is dropped too soon, but overlapping the hot area, it will automatically slide into place.

Typography

We have developed two child-friendly typefaces: **onebillion reader** and **onebillion writer**.

onebillion reader is based on an existing open-source typeface. We use it for all the reading matter. The characters are rounded and friendly, and these features further enhance legibility:

- relatively long ascenders and descenders, easy to spot
- clear distinction between capital **i** and lowercase **l**
- single-storey **a** and **g**.

Each new letter is introduced in **onebillion reader**. But children get practice in recognising letter shapes in other typefaces too.

onebillion reader

ABCDEFGHIJKLMNOPQRSTUVWXYZ

abcdefghijklmnopqrstuvwxyz

1234567890

onebillion reader typeface.

onebillion writer is our own typeface, for use where the child forms and traces letter shapes. It has:

- very clear, simple, letters
- clear joins between constituent parts of a letter, indicating the separate strokes.

onebillion writer

ABCDEFGHIJKLMNOPQRSTUVWXYZ

abcdefghijklmnopqrstuvwxyz

1234567890

onebillion writer typeface.

Screen layout

Our style is to keep screens uncluttered, with no unnecessary graphic elements, to help the child focus on the learning. In the numeracy units, objects to be counted and numbers to be manipulated are carefully sized and positioned. In the reading units, we avoid dense text: the font size, leading, and quantity of text are all carefully controlled.

In particular, the story editors follow guidelines about font size, layout, and number and length of sentences per page, for each reading band. Pages can be rapidly previewed in our online ‘story mock-up’ tool.



Pitala ndi wokondwa kwambiri, sakutha kugona.
Akuganza zokwera basi kupita ku tauni. Sanakwere-po basi.

The 'story mock-up' tool is accessible on onebillion.org/ting/story/

Use of colour

We use colours in a consistent way throughout the course. Red is the highlighting colour. The tick for ‘correct’ is yellow. Colours are generally lively, but not brash. We take care to ensure that colour combinations work for children who are colour-blind.

In the reading units, we use a white background to enhance the uncluttered look, and increase contrast with text. It is widely held that pastel backgrounds, rather than white, help children with dyslexia. If evidence shows it is beneficial, changes can be made to accommodate those children with special learning needs or disabilities.

Engagement

We want the child to return to **onecourse** eagerly day after day, and stick with it to the end. We have designed in many features to enhance engagement.

Engaging activities

We offer a wide variety of activities for the child. Taken together, they are multi-sensory: they involve listening, looking, speaking, touching, and dragging items. They are generally short, to keep the child stimulated.

Games are engaging, so a number of practice activities in both numeracy and reading have elements of gaming.

A wealth of imagery

We have a large and growing library of single images, in addition to the plentiful illustrations in the stories. Images are in themselves engaging, and enliven the course, but we also use them for pedagogical reasons:

- The child may have a very limited vocabulary, and be unfamiliar with words we use. The corresponding images will aid understanding, and help to extend vocabulary.
- Associating a word with an image will later aid comprehension in reading.
- In numeracy, it is essential to begin work on counting and number manipulation using images of real and familiar objects.

The images in the image bank are drawn in a fairly realistic style, to help children unused to interpreting cartoons. The illustrations in the stories, however, have a range of styles.



A small selection of images from our image bank.

Motivating feedback and rewards

Feedback and rewards help to engage and motivate, as do visible signs of progress. We want children to know where they are in the course, but without creating anxiety around slow progress, or the amount left to do. We do not want the course to become a burden.

The child receives encouraging feedback throughout the course, and rewards which lightly signal progress. The child receives:

- ticks and positive sound effects after correct answers in a learning unit.
- a shooting-star finale at the end of each learning unit; it follows a very short summary of what has been learned or practised.

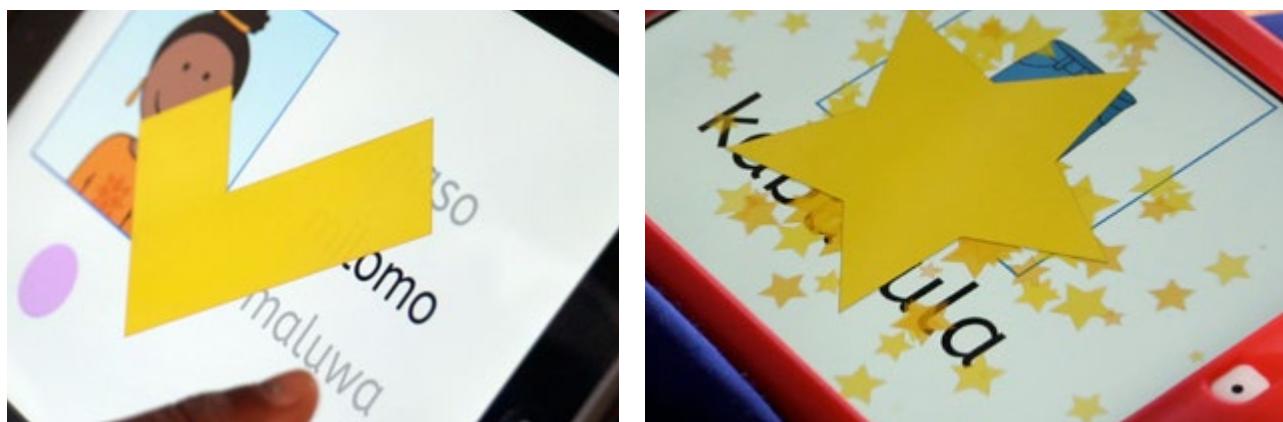
Anna, an engaging teacher

Anna, our digital teacher figure, is the friendly face of onecourse. She provides continuity, and a form of social interaction for the child working alone. Her enthusiasm and animation set a playful tone.

She has many friendly functions in addition to instruction. She:

- welcomes the child each day ... “Welcome back! Let’s see what we have for today.”
- gives praise ... “Very good. You practised counting to fifty!”
- indicates when time is up ... “That’s enough for today! See you tomorrow!”

To enhance the child’s engagement with Anna, we choose voice-over artists carefully, with easily-understood accents and pleasant tones. Anna’s name and appearance can also be localised depending on the language she speaks.



The child gets big yellow ticks within a unit, and a ‘shooting star’ finale at the end of the unit.

Personalisation

Ideally, a learning app will adapt to what the child knows already, and the child's subsequent progress. There are also other ways to personalise the child's relationship with the tablet, both across the day and throughout the course.

Limited Daily Access

In **onecourse** for communities, we limit how long a child can spend on the tablet each day. Limited daily access helps to personalise the child's relationship with the tablet. However, our reasons for imposing time limits are more fundamental:

1. The learning in the Study Zone is highly focused. We want to prevent overload, and a subsequent loss of enthusiasm, and allow the child time to process what has been learned.
2. Letter/sound correspondence is at the heart of learning to read. It is widely accepted that letters should not be taught too fast, to avoid confusion: ideally no more than one a day, with revision days at intervals.
3. There are concerns around the world about the length of time children spend looking at screens. Screen time has been linked to a range of physical and mental problems, including obesity, attention disorders, and addictive behaviour.

For the **onecourse** school version, access is decided by the teacher(s).

Diagnostics

Once a week we have a short diagnostic test to identify areas in which the child is struggling. Based on the outcome of the test, the child is given units selected by the software over two days to give them additional scaffolding in areas where they need extra support.

Localisation

Our software is adaptable to different languages and cultures.

Efficient, streamlined localisation is a function of:

- the underlying architecture of the software
- the design of the learning activities
- the localisation process itself

The underlying architecture of the software

onecourse is designed so that the language pack – which contains the database of words, phrases, sentences, paragraphs and stories, and their audio – is completely separate from the learning activities. The translated material for a new language is then simply plugged into each activity.

The design of the learning activities

Most of the learning activities in **onecourse** are designed with different modes. For example, in an activity for building words, Mode 1 allows word-building from graphemes, and Mode 2 allows word-building from syllables.

When localising for a new language, we can quickly select the appropriate mode. For example, in Swahili, children build their first words from syllables, so we select Mode 2 for that activity. For first words in English, we select Mode 1. We then plug in appropriate data from the language pack.

The Localisation process

The localisation process is a balancing act of automating as much as possible, while allowing for linguistic and cultural adjustments. We go through a set of 8 steps, working with local experts at each stage:

1. Analyse target language

Examine the target language, and build a clear description of it, including: linguistic structure, alphabet, phonetic structure, order and frequency of graphemes, list of high frequency words, set of common first and last names.

2. Cross check target language

Check the description of the new language against our existing learning activities. Develop new components or modes, if beneficial to the child.

3. Story selection

Select appropriate stories from our extensive book library, and write or curate further stories as required.

4. Translation

Translate the full database of words, instruction scripts for each activity, chosen stories, and numeracy learning units.

5. Writing

If there is any additional material required for the target language, such as simple phrases and sentences, it will be written at this stage.

6. Images

In-house designer creates any new images required for learning units and stories.

7. Recording

Record all audio material required, using several voice artists.

8. Final build

With all assets prepared, build the child's onecourse in the new target language.

Translations can be done remotely. For our numeracy software, we use online translation platform Memsource, and a largely automated workflow. Adapting the reading material is more involved, so we use Word templates to give our local experts more flexibility.

Audio is usually recorded in our in-house studio, with occasional recording being done in-country. With advice from our local experts, we choose the voice-over artists carefully, with attention to accent, clarity of diction, and tone of voice.



Brighton and Sarah recording Swahili audio for our stories and Anna. Sarah recording English.



A girl reading the 'Moon and the cap' story.

Adapting to different cultures

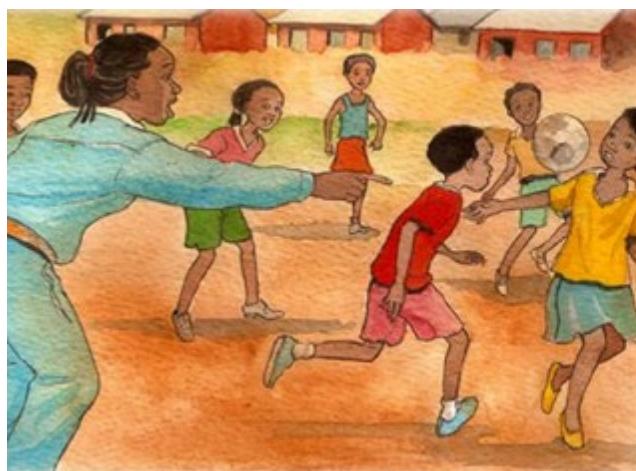
We take care to ensure that the database of words, and the corresponding images, are culturally appropriate for the target language.

The stories in **onecourse** come from many cultures. Specially-written stories featuring situations familiar to the child are mixed with stories from other cultures, to broaden the child's understanding of the world around them.

We make extensive use of Creative Commons stories to offer a diverse and interesting library. We edit the stories to ensure they match our reading bands, and work for a wide audience. The modular design of **onecourse** means stories can be taken out or added, as appropriate, for every new language.

Empowerment through stories

Stories are a powerful tool for empowerment and change. Working with local experts, we build in empowering and motivating stories for all children. We have stories with strong female role models, and work with local experts on stories about specific local issues, if they think appropriate. The attitude to albinism in Malawi is one example.



A woman coaching the football team in the story 'Football'.



An albino radio presenter in 'No Problem'.

10



Technology

onecourse enables children anywhere, in any situation, to learn. For this to work, customisability, device/OS portability, code transparency and resiliency are of critical importance. This chapter covers these and other technical aspects of **onecourse**.

Software architecture

The software has been developed in the Java programming language and targets the Android SDK. It is rendered to the screen using OpenGL ES.

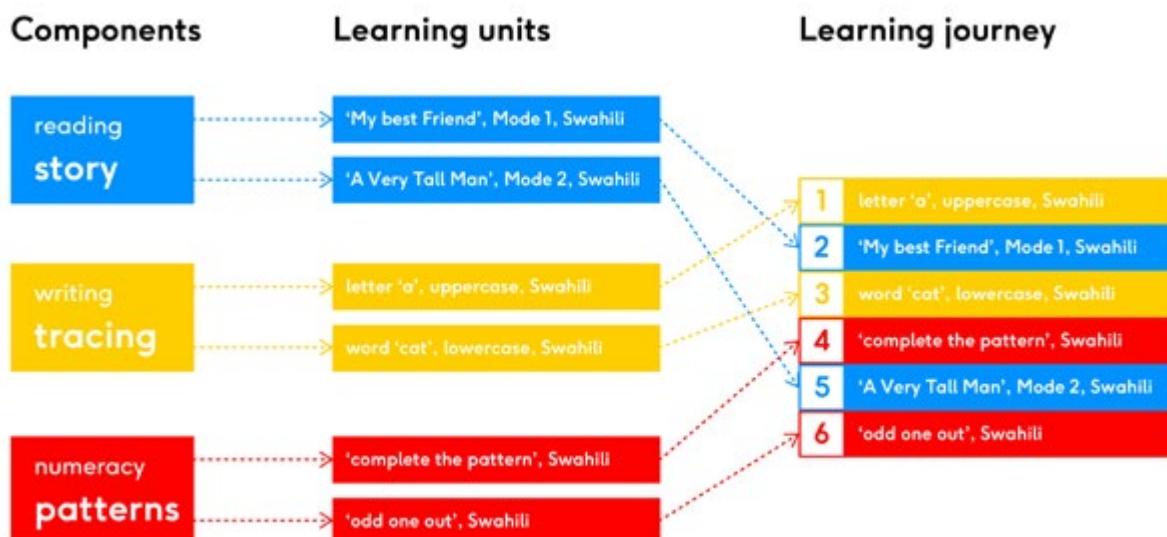
Components and learning units

Conceptually, **onecourse** consists of a set of learning activities or **components** for numeracy, reading and writing. A component may offer different **modes**. For example, a component for segmenting and blending has one mode for segmenting into syllables, and another for segmenting into graphemes. For stories, we offer six different modes. A component may also offer options, for example 'demo on/off' or 'pictures on/off'.

When the parameters for the component are specified (e.g. language, mode, word list), and options chosen, the result is a learning unit. Each learning unit retrieves data from the underlying language pack, as well as visual, audio, or configuration assets.

The learning journey

The child's learning journey is an ordered set of learning units to be worked through. These can easily be reordered if required. Look at the model:

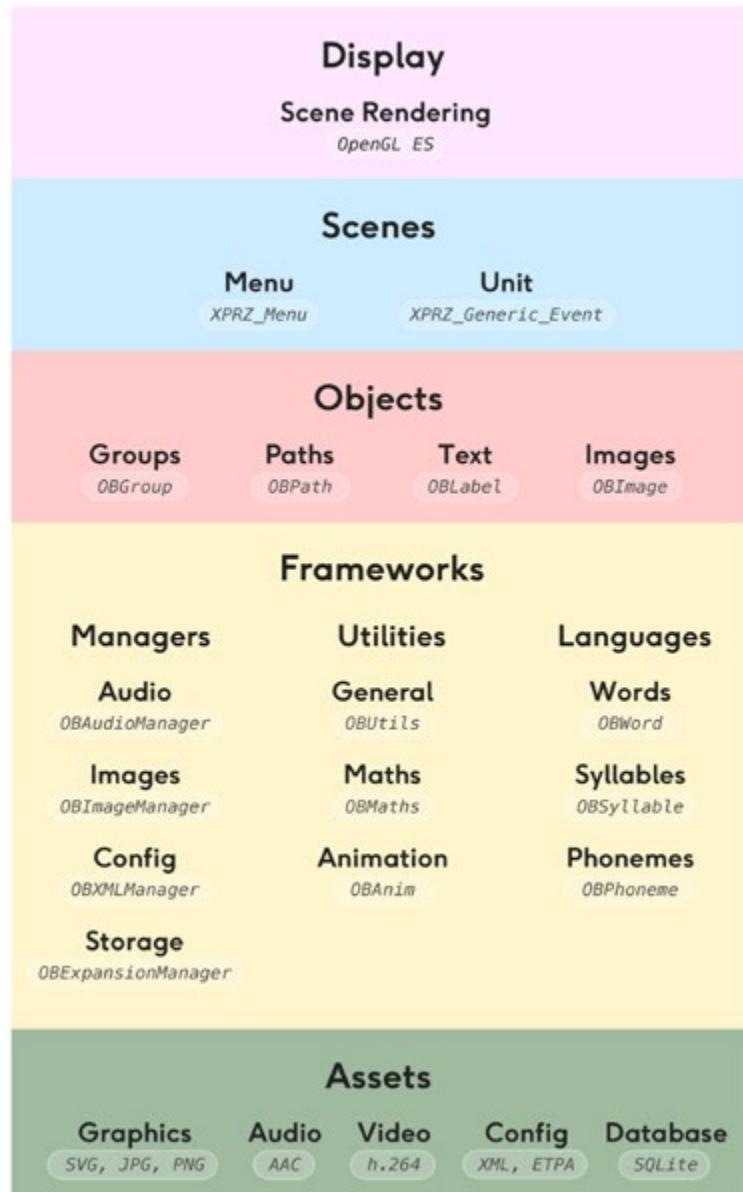


A child's learning journey is made of a set of units, themselves derived from a set of components.

Technical architecture

Architecturally, **onecourse** consists of five key blocks sitting atop one another.

- **Display** - rendering to the screen.
- **Scenes** - the behavioural logic of learning units and menus.
- **Objects** - the elements that constitute a scene.
- **Frameworks** - abstraction and loading of assets, helper utilities.
- **Assets** - audio, video, images; localisation, configuration and user databases.



Customisability

The software design of **onecourse** makes it easy to customise. The course can be adapted to the needs of any target audience. New components are easily added. Shared use of tablets is catered for too.

Customising to different locales

A locale is a pairing of a language and a location (e.g. Tanzanian Swahili, British English). In **onecourse**, the language pack is completely separate from the components, which means the course can be readily customised to different locales. The numeracy learning units have so far been versioned into 50 different locales, including several English variants (American English, Australian English, British English). Literacy units have been versioned into Tanzanian Swahili, British English, and Chichewa for Malawi.

Language packs

The language pack for a particular locale consists of four elements:

1. an XML representation of the individual characters that constitute the language's alphabet.
2. an XML representation of the key phonemes, consonant clusters and syllables present in the language. It also contains a database of high-frequency and culturally specific words, as well as phrases and sentences.
3. a set of audio files recorded by native speakers.
4. localised versions of the stories that form the graded library.

Customising the learning journey

The learning journey can be customised for different target audiences and purposes, even within the same locale. For example, we could provide only reading units, or only stories, or only numeracy units, if required.

The journey can also be personalised to suit the individual child's needs. The diagnostic assessment at the start of the **onecourse** for schools version will assign the child to a specific track. A younger child may need a 'slower' track than an older child who has spent several years at school.

Adding new components

onecourse is designed to be easily extendable by adding new components, from **onebillion** or third parties, to enable further customisation. For example, they could be components to deal with the specific difficulties of a particular language. Third parties can use as much or little of the **onecourse** frameworks as they choose, but there is considerable benefit in ‘porting’ content for greater integration.

Device sharing

onecourse allows for both standalone and multi-user device scenarios.

Progress data can be stored on a child’s own tablet.

Alternatively, where a device is used by many children, data can be stored on either a local or remote network server. In our [Unlocking Talent](#) initiative in Malawian schools, for example, up to 10 different children use a single tablet every day. Their progress data is stored locally. (No internet connection is required.)

The customisation process

We have built supportive tools to automate significant parts of the process of creating both language packs and learning journeys. This means that **onecourse** can be customised efficiently and correctly by local language experts into different locales.

We have optimised our own translation and recording system to get the highest-quality localisations (although it is possible to use other standard translation tools and recording facilities to localise **onecourse** content). The audio recording system uses custom-developed tablet software that allows a sound engineer to check each recording as it is spoken by the voice artist, as well as to demark the sounds/syllables within a word where necessary. Audio analysis algorithms automatically trim the silence from the beginning and end of each recording. These translation and recording systems can be used remotely, so that localisations can be done with local in-country partners.

Improving on existing technology

Performance and energy consumption

We have paid great attention to two critical issues: performance and energy consumption.

The experience of using the tablet must be as smooth as possible (no lagging or stuttering). The child must receive instant audio or visual feedback on interacting with the device. Making **onecourse** as performant as possible has the added benefit of minimising energy use, and maximising the tablet's battery life. This is important where power may be erratic, or access to it difficult.

OS integration and modifications

For **onecourse**, we have carried out some modifications to the underlying Android system, to make it as child-friendly and child-proof as possible. Specifically:

1. Android is locked to **onecourse**, which becomes the default 'launcher' app. This means children cannot tinker with system settings, or delete the app itself.
2. Android system notifications and navigation (the status bar, back and home buttons) are all either hidden or intercepted by **onecourse**. For example, instead of a 'battery low' system notification, children will receive an audio message in their own language telling them to plug the tablet in to charge.

Device / OS portability

Operating system

onecourse was prototyped on iOS in Objective-C, and then ported - by the same developers - to Android. As a consequence of this approach, all core functionality has minimal dependency on system libraries. In fact, the port to Android has been accelerated through custom source-to-source transpilation.

Form factor

onecourse is designed to work seamlessly across touch devices with different physical screen sizes and resolutions. This is achieved through:

- rendering to the screen using a device's 3D hardware, using OpenGL ES 2 and a set of short fragment shaders.
- adapting the placing of elements on screen to the ratio of the display dimensions. This means **onecourse** displays just as well on widescreen devices as on square ones. We have customised the view layer for display on smaller devices such as smartphones, where screen space is at a premium.
- providing most graphical assets in the SVG (Scaleable Vector Graphics) format. This results in the sharpest possible image. There are also benefits in terms of file size, and the ability to work with layers. We have written a custom SVG render to enable frame-based animation of SVG graphics, which allows us to change colours and shapes on-the-fly. For example, rather than having three PNG files of a ball, each coloured differently, we can use a single SVG and make it any colour we wish.

Code transparency

For software which will be added to and widely customised by onebillion, code transparency is of critical importance.

The way we work guarantees code transparency. The technological design of onecourse is based on four key principles:

- 1. Modularity** - encapsulating the idea of components.
- 2. Reusability** - abstraction of shared elements allows them to be re-used across different components.
- 3. Simplicity** - onecourse is not bloated, and does not suffer from excessive abstraction.
- 4. Clarity** - the codebase is well-documented, with a clear and natural hierarchy.

In order to produce software that is performant, extendable and reliable, our developers work in an extremely collaborative fashion. This is aided by the use of distributed version control (git) not only for source control, but also for bug reporting and documentation. Interfaces between frameworks are well-defined, and inheritance is used liberally in defining the logic of components.

Resiliency

It would be very unfortunate if the children's tablets stopped working. We take very seriously the ability of **onecourse** to recover from unknown states.

Self-healing

The single biggest concern is corruption of the child's progress database. We implement consistency checking and database rollbacks, should corruption occur. In the most extreme circumstances, the database will automatically reset. We achieve this by using a background watchdog to carry out scheduled health checks, and recover the app if it is not functioning correctly.

Resilient

Missing or corrupted assets are also potential causes of failure, causing the child to get stuck in a unit. **onecourse** is designed to cope with this scenario. It will simply move the child beyond the malfunctioning unit. Exceptions are handled silently, and the child receives no error messages.

Debuggable

As a standard Java application, it is fully debuggable using the standard Android Studio debugger. This is aided by the addition of a collection of useful logging functions. During testing, **onecourse** features a debug interface for the testers. This allows them to see an overview of the child's learning journey, skip to specific units, repeat units, and test the time-based functionality of **onecourse**.

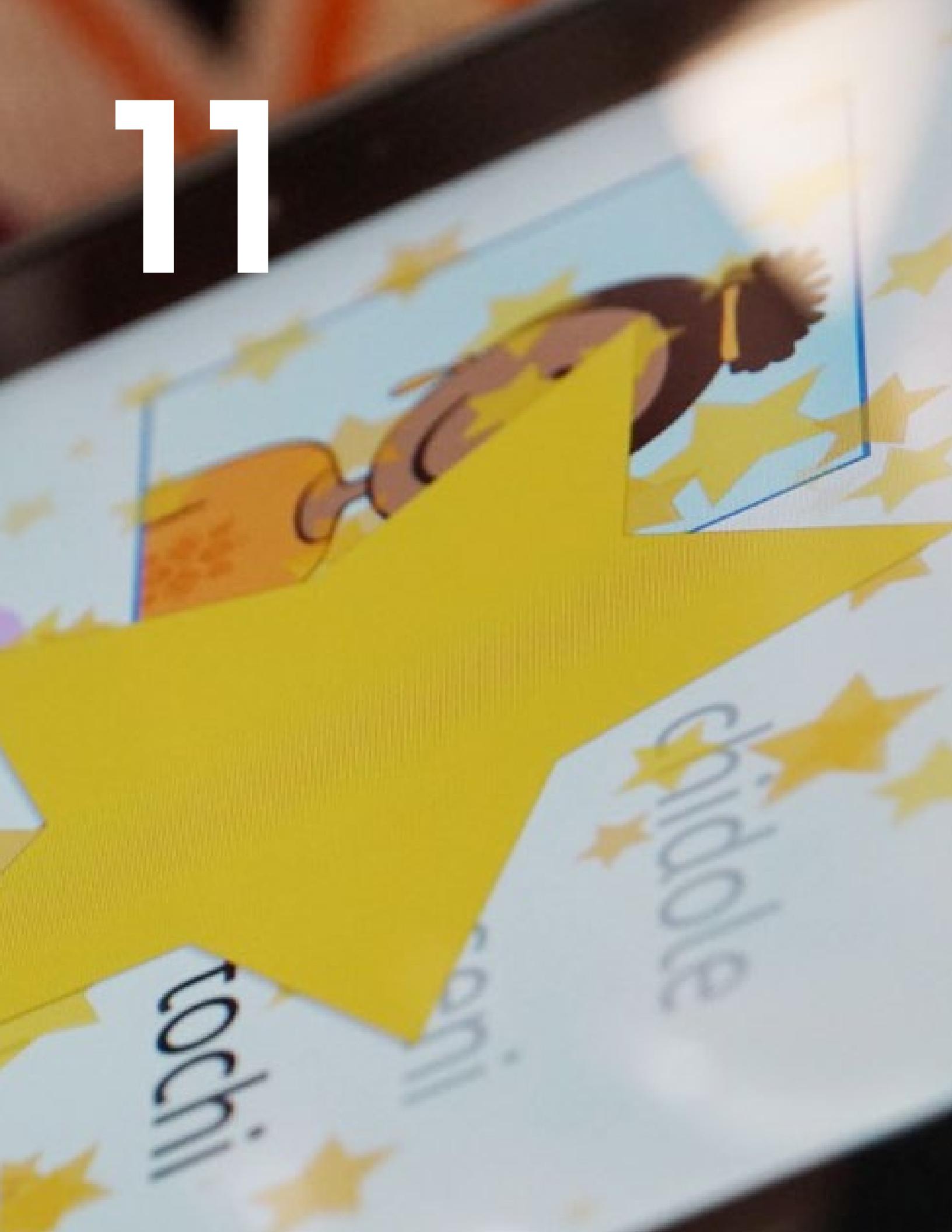
Tested

onecourse has been fully tested by our highly experienced QA (Quality Assurance) team, and by in-country testers. We use Github's issue-tracking system to report, assign and keep track of both functionality and content bugs. Each phase of testing is against a defined milestone.

The numeracy units have been tested by thousands of children in Malawi, Uganda, South Africa and Brazil as part of the Unlocking Talent initiative. We also have a 'testing by teachers' scheme running in Malawi whereby each new software iteration is tested for localisation issues.

We have developed methodologies for automated user interface testing to ensure quality assurance.

11



ochi

on

Evidence for efficacy

onebillion is committed to producing the best possible software to enable children to learn. We are also committed to working with partners to deliver it effectively.

How do we measure our success? We look for evidence. Through formal evaluation and informal observation, we obtain feedback which leads to continual improvement.

Efficacy of onecourse

To ensure children are learning from **onecourse**, the software is continually tested and trialled.

Our numeracy software, which is now part of **onecourse**, has been extensively trialled in Malawi, Brazil, South Africa and the UK. Our reading/writing software, which was developed more recently, is being trialled with children in Tanzania as part of the Global Learning XPRIZE competition, and in Malawi as part of the Unlocking Talent initiative.

Numeracy

In 2013, a randomised controlled trial (RCT) and a pilot study of our numeracy software were carried out in Malawi and the UK respectively, led by Dr Nicola Pitchford from the University of Nottingham, UK.

In Malawi, the trial involved 283 children in Standards 1–3, in Biwi Primary School in Lilongwe. It lasted for eight weeks.

After just 8 weeks of using the intervention children tripled their specific maths curriculum knowledge, with Standard 2-3 children raising attainment levels to a higher level than the average shown by Standard 4 with normal pedagogical practice.

Dr Nicola Pitchford, University of Nottingham

In the UK, the pilot study involved 26 children in Dunkirk Primary School in Nottingham. It lasted for six weeks.

Results showed foundation pupils' learning gains made in curriculum knowledge were equivalent to 18 months of standard pedagogical practice.

Laura Outhwaite, University of Nottingham

A larger evaluation with 389 children has recently been completed in the UK. The intervention ran for 12 weeks and the learning gains were comparable to those for the children in the Malawi RCT of 2013.



A child being registered by Dr Pitchford before pre-testing at Biwi School.

Reading/writing

Trials of the reading/writing software have focused on Tanzania and Malawi.

In August 2016, the University of Dar es Salaam, in partnership with the University of Nottingham, conducted a small-scale trial of the reading/writing software from **onecourse** Swahili at Msasani Primary School in Dar es Salaam. The trial ran for five weeks. 38 kindergarten children were involved, aged 4–7.



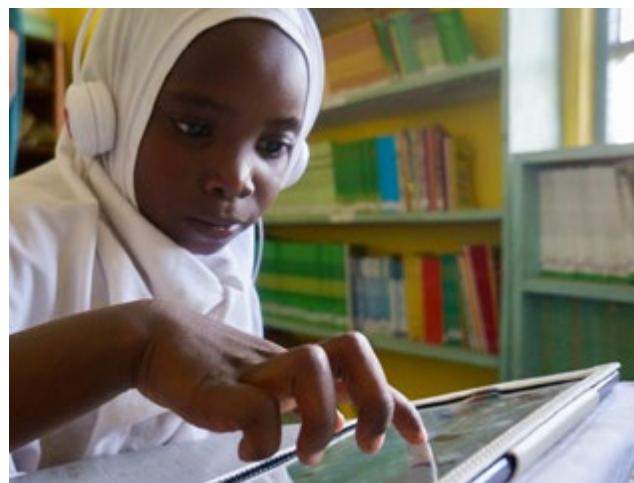
An intervention group
using the numeracy apps.

The report concluded:

*There is evidence for the app's effectiveness. Results showed children using the tablets & app improved by more than those receiving normal practice for these two sub-tests: syllables and **onebillion** key words. The findings warrant further research over a longer period of time, with a larger group of children, preferably in the first year of formal schooling in Tanzania.*

Dr Nicola Pitchford, University of Nottingham

This small-scale trial provided data and observations which have already been fed back into **onecourse**.



A child in the intervention group at Msasani School in Dar es Salaam listening to a story.



Another child being post-tested by Edith Lyimo of the University of Dar es Salaam.

Effectiveness of scaling

We already have substantial experience of scaling, and the challenges involved. In Malawi, we partner with VSO in an initiative called Unlocking Talent.

This initiative has now reached over 30,000 learners in 100 schools, and is still growing. Over 300 schools will join the initiative over the next 3 years. All children in Unlocking Talent in Malawi are learning to become numerate and to read in Chichewa.

Through VSO in Malawi we have gained a better understanding of how children with special needs interact with the tablets, and what challenges they face. VSO has organised learning groups for students who struggle with fine motor skills. These children are incredibly engaged and determined to complete activities, in spite of their difficulty in touching the screen lightly.

In addition, the use of onecourse by organisations in South Africa, Brazil, Lesotho and Canada is providing us with evidence on both the effectiveness of our numeracy software and the form of intervention.



Special needs children using our numeracy apps in South Africa.

Our scaling partners



Norwegian Embassy



Scottish
Government
gov.scot



12



Appendices

A. Evidence for onecourse	74
B. onecourse library	82

A. Evidence for onecourse

The material in **onecourse** has been, and is being, widely trialled, to evaluate its effectiveness. The numeracy software has been trialled separately from the reading/writing software, which was developed more recently.

The numeracy and reading/writing software is now combined in **onecourse**.

1. A summary of key findings

The key findings of the trials conducted by the University of Nottingham are summarised below.



A. Malawi: the numeracy software

2013

Proof that onebillion's numeracy software is effective was obtained in an RCT (randomised control trial) with 283 children from Standards 1 – 3 in Biwi Primary School in Lilongwe. Use of the numeracy apps for 8 weeks significantly raised learning outcomes compared to standard practice, with children's maths ability extended by up to 18 months. Low achievers made the most gains. Girls responded to the numeracy apps just as well as boys did.

2015 – 17

An efficacy trial is currently being conducted in Malawi through a cluster RCT. It covers fourteen schools across the country, in seven districts, with one intervention school and one control school per district. To date over 1200 Standard 1 and 2 children have taken part, with the intervention applied to half of this sample for between 1 and 3 months. Low-achieving pupils receiving the intervention have made significant learning gains, compared to low achievers receiving standard practice.

The trial forms part of a holistic evaluation taking place in Malawi. To date 68 schools are involved in the evaluation. We have conducted interviews with pupils, teachers, school leaders, and primary education advisors, and plan to interview government officials, in order to identify and understand the barriers to implementing digital technology in primary schools in Malawi.

B. Malawi: the reading/writing software

2017

Starting in January 2017, an RCT is being conducted in two primary schools in Malawi to evaluate the effectiveness of the reading/writing software in Chichewa. Results are expected in June 2017.

C. UK: the numeracy software

2013 – 2016

Pilot studies have been conducted with over 150 primary schools in the UK. These studies have demonstrated that the numeracy apps are effective in raising early maths skills, especially for low-achieving pupils. Children with poor memory skills made the highest learning gains.

2016¹

An RCT with 389 foundation pupils (aged 4–5) has recently been completed. The intervention ran for 12 weeks. Results showed that children exposed to the numeracy apps made greater gains over that period than children receiving standard practice. This result was strongest with low-achieving pupils. In particular, the apps supported conceptual and reasoning skills. The gains were comparable to those for the children in the Malawi RCT of 2013.

D. Tanzania: the reading/writing software

2016

A small pilot study was conducted in Tanzania with 38 pupils aged 4 – 7, to investigate the effectiveness of the reading/writing software in Swahili. 19 pupils received the app for 5 weeks, and 19 received standard practice. The former showed significant gains in reading aloud key words taken from the app, compared with those who received standard practice. The study indicated that the app could be effective in developing literacy skills, if implemented over a longer period of time.

¹ The full report of the first pilot study (2013) is available at: onebillion.org/downloads/dunkirk-primary-final-report.pdf

Raising learning outcomes

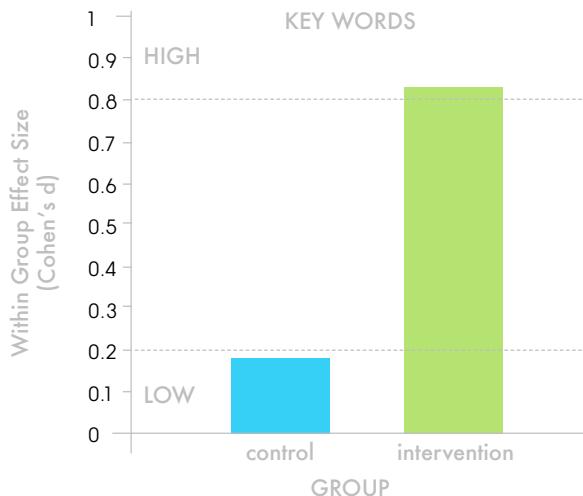
READING

Tanzania

- small pilot study
- 38 children, aged 4-7 years
- treatment & control groups
- teacher-led implementation
- 5 weeks, beta software

- apps improved recognition of syllables and key words more than normal practice

Mobiles for Education Alliance



From presentation by Dr Nicola Pichford at the mEducation Alliance Symposium in Washington DC, October 2016:
onecourse Swahili – Literacy Trial outcomes.

E. South Africa: the numeracy software

2016

In a collaboration with onebillion and VSO, iSchool Africa introduced the onebillion numeracy apps, in English, in 32 schools in South Africa through 2016. Baseline assessments were carried out, with follow-up assessments in 16 of the schools 4 – 7 months later.

The impact of the apps on numeracy skills was encouraging. In addition, teachers reported many other positive impacts on the children, including increased confidence and increased engagement in classroom activities.

2. The numeracy RCT in Malawi, 2013

The 2013 RCT for the numeracy software was reported in the journal *Frontiers in Psychology* in 2015. Below is an extract from the report.

 **frontiers**
in Psychology

ORIGINAL RESEARCH
published: 23 April 2015
doi: 10.3389/fpsyg.2015.00485

Development of early mathematical skills with a tablet intervention: a randomized control trial in Malawi

Nicola J. Pitchford*

School of Psychology, University of Nottingham, Nottingham, UK

Evaluation of educational interventions is necessary prior to wide-scale rollout. Yet very few rigorous studies have been conducted on the effectiveness of tablet-based interventions, especially in the early years and in developing countries. This study reports a randomized control trial to evaluate the effectiveness of a tablet intervention for supporting the development of early mathematical skills in primary school children in Malawi. A total sample of 318 children, spanning Standards 1–3, attending a medium-sized urban primary school, were randomized to one of three groups: maths tablet intervention, non-maths tablet control, and standard face-to-face practice. Children were pre-tested using tablets at the start of the school year on two tests of mathematical knowledge and a range of basic skills related to scholastic progression. Class teachers then delivered the intervention over an 8-weeks period, for the equivalent of 30-min per day. Technical support was provided from the local Voluntary Service Overseas (VSO). Children were then post-tested on the same assessments as given at pre-test. A final sample of 283 children, from Standards 1–3, present at both pre- and post-test, was analyzed to investigate the effectiveness of the maths tablet intervention. Significant effects of the maths tablet intervention over and above standard face-to-face practice or using tablets without the maths software were found in Standards 2 and 3. In Standard 3 the greater learning gains shown by the maths tablet intervention group compared to both of the control groups on the tablet-based assessments transferred to paper and pencil format, illustrating generalization of knowledge gained. Thus, tablet technology can effectively support early years mathematical skills in developing countries if the software is carefully designed to engage the child in the learning process and the content is grounded in a solid well-constructed curriculum appropriate for the child's developmental stage.

Keywords: tablets, technology, primary school, mathematics, intervention, evaluation, randomized control trial

OPEN ACCESS

Edited by:
Robert Samuel Savage,
McGill University, Canada

Reviewed by:
Peter Rich,
Brigham Young University, USA
Claire Marie Fletcher-Flint,
University of Auckland, Australia

***Correspondence:**
Nicola J. Pitchford,
School of Psychology, University of Nottingham, University Park,
Nottingham, UK
nicola.pitchford@nottingham.ac.uk

Specialty section:
This article was submitted to
Educational Psychology,
a section of the journal
Frontiers in Psychology

Received: 30 October 2014
Accepted: 02 April 2015
Published: 23 April 2015

Citation:
Pitchford NJ (2015) Development of early mathematical skills with a tablet intervention: a randomized control trial in Malawi.
Front. Psychol. 6:485.
doi: 10.3389/fpsyg.2015.00485

Introduction

Research with digital educational software has shown increased motivation (Rosas et al., 2003) and promotion of positive attitudes (Ke, 2008) toward mathematics in primary school children. However, a recent study has concluded that although technology is used in many classrooms in the West, its potential to support learning is often underutilized due to limitations in its design and content (Yelland and Kilderry, 2010). Consequently, findings regarding the attainment benefits of

Frontiers in Psychology | www.frontiersin.org

1

April 2015 | Volume 6 | Article 485

The full report is available at <http://journal.frontiersin.org/article/10.3389/fpsyg.2015.00485/full>

3. The reading/writing trial in Tanzania, 2016

An evaluation of the reading/writing software from **onecourse** Swahili was carried out by the University of Nottingham and University of Dar es Salaam. (The software is referred to as 'the literacy app' in this report.)



The trial was conducted by

University of Nottingham

Dr. Nicola Pitchford - Associate Professor, School of Psychology

Dr. Paula Hubber - Postdoctoral Researcher, School of Psychology

University of Dar es Salaam

Dr Ernesta E. Mosha - Director, Institute of Kiswahili Studies

Dr Edith B. Lyimo - Head, Department of Literature

Prof Aldin Mutembei - Associate Professor

Summary

This study evaluated the tablet-based Swahili Literacy app, developed by onebillion, in supporting the acquisition of literacy skills in young children in Tanzania.

A matched-sample study was conducted in a kindergarten in the urban Msasani area of Tanzania. 40 children were allocated to one of three intervention groups, based on pre-test literacy levels: a normal practice group; a group which received the intervention for one 45-minute session each day; and a group which received the intervention for two 45-minute sessions each day, with a short break between.

The children were pre-tested using six subtests from the Early Grade Reading Assessment for Kiswahili (EGRA) and an additional subtest designed by onebillion to test the ability to read key words which feature in the app. The intervention was delivered for 5 weeks and 2 days by classroom teachers at the school, with support from Voluntary Service Overseas (VSO). Children were post-tested using the same assessment as the pre-test.

A matched sample of 38 children was analysed to investigate the effectiveness of the onebillion Swahili Literacy app, and to evaluate whether two 45-minute sessions each day were more beneficial than one 45-minute session.

Results showed that children using the app improved by more than those receiving normal practice for two of the subtests: Syllables and onebillion Key Words. These results support theories of language and literacy acquisition.

There was also evidence that the longer time using the app led to improved performance on the Syllables and onebillion Key Words subtests.

The findings of this study warrant further investigation over a longer period of time, and with a larger sample size.



Dr. Nicola Pitchford



Dr. Paula Hubber

School of Psychology
University of Nottingham



The full report is available at
<https://onebillion.org/downloads/evaluation-of-onebillion-kiswahili-literacy-app.pdf>

4. The iSchool Africa report, 2016

The details below are from a report by iSchool Africa in November 2016.

Some teacher feedback

"The learners have improved academic results, learners are enjoying school. Even those who generally struggle feel cared for, despite their own issues."

Harold Nxele, Edendale PS

"My children were so engrossed in what they were doing, they didn't want to stop. It was the first time I have ever seen my whole class completely focussed on the task. Absolutely wonderful for education."

Dolores Koopman Grade 2

Assessment results

Baseline assessments in 8 of the 32 schools were carried out in May 2016 with the support of University of Nottingham. Follow-up assessments in October 2016 showed encouraging results:

School	Grade	Baseline - Date	Baseline test %	Follow up test - date	Follow - up test %	Increase
Nomnekane PS, GP	3	May 2016	73	October 2016	87	14
Mkhambeni PS, EC	3	May 2016	48	October 2016	86	38
Tabase PS, EC	3	May 2016	58	October 2016	83	25
Lugongozo PS, EC	3	May 2016	76	October 2016	84	8
Dysselsdorp PS, WC	3	May 2016	78	October 2016	85	7
PJ Badenhorst PS, WC	3	May 2016	79	October 2016	92	13
St Konrad PS, WC	3	May 2016	82	October 2016	90	8
Muyexe PS, LP	3	May 2016	70	October 2016	76	6

Learner impact

The report listed these impacts on the children who used the apps.

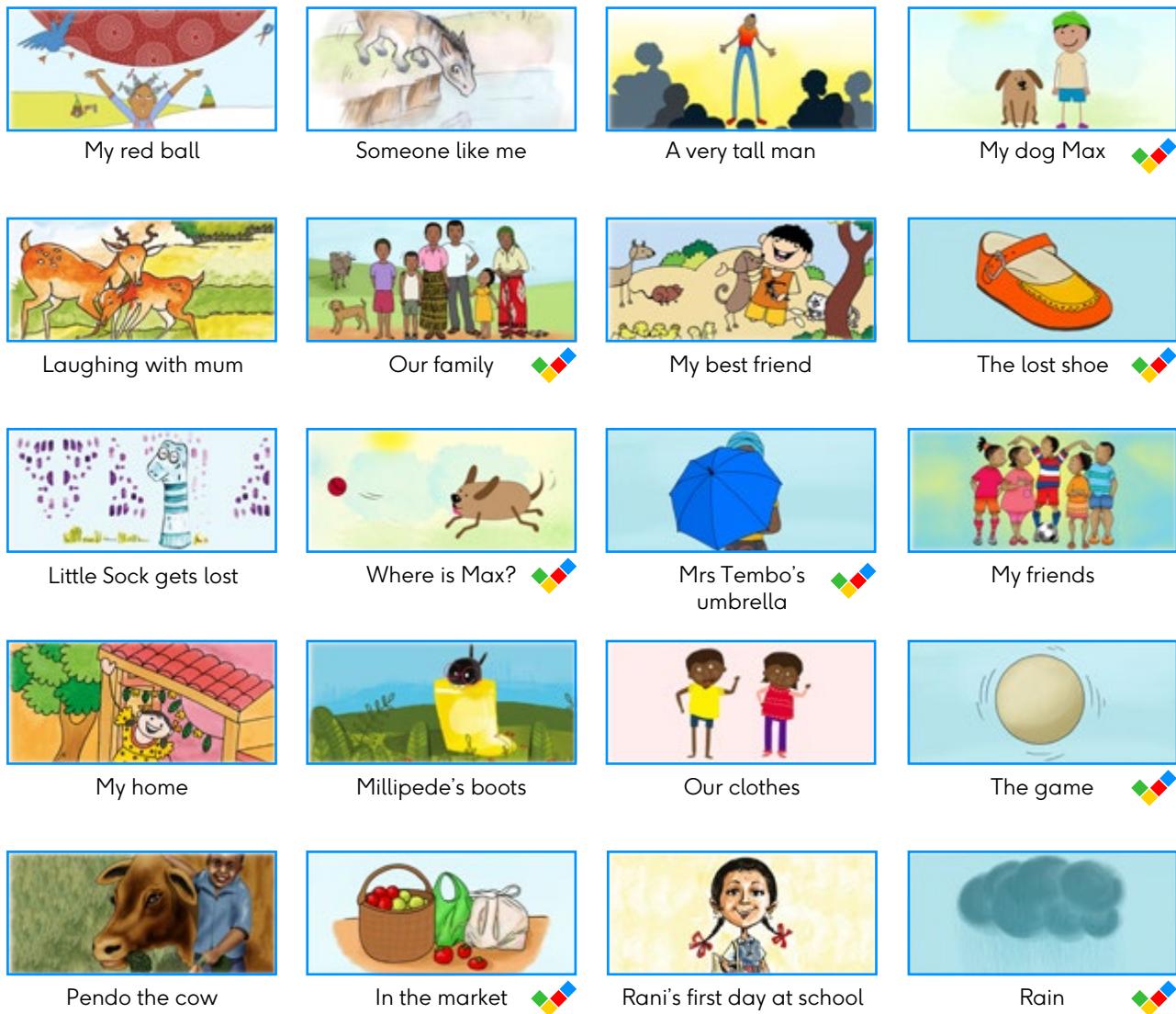
- **Increased numeracy skills** – consolidation of the basic numeracy skills needed to catch up with actual grade requirements.
- **Increased tech literacy** – learners are able to navigate through the apps easily.
- **Increased confidence** – learners gained confidence as they grasped concepts not understood before. The one-to-one engagement with the content, immediate feedback, and constant encouragement and praise built into the app, affirms to the learner that he/she is capable of doing more than he/she had ever realised.
- **Increased engagement in classroom activities** – as the learners gain confidence they're more willing to take part in class activities and contribute to class discussions.
- **Improved concentration** – learners with concentration problems are able to channel their energy when they concentrate on the app and use the headphones. It helps them to focus and not get distracted by other learners and influences.
- **Improvement in overall attitude and behaviour** – teachers have noticed an improvement in the overall attitude towards learning, and classroom behaviour.
- **Love for learning** – using technology helps learners experience learning in a non-threatening way. The one-to-one engagement helps learners to concentrate on their own learning experience in a fun way, which cultivates a new love for learning.

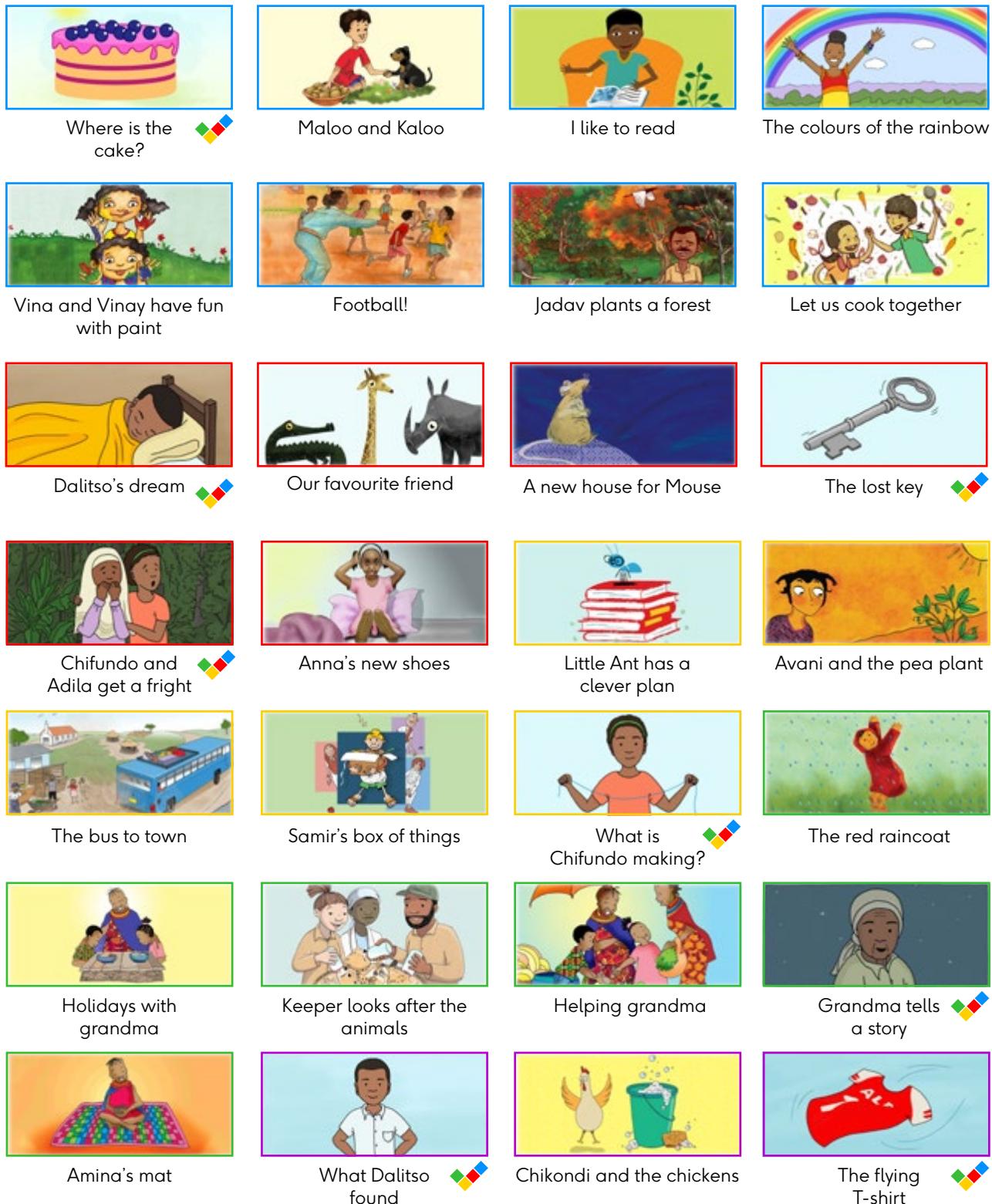
B. onecourse library

onecourse contains a growing library of graded stories. It comprises:

- **onebillion stories** - written by our author, illustrated by our graphic designer.
- **Creative Commons stories** - text and illustrations carefully edited by us.

Below is a sample of just some of the stories in onecourse, arranged by reading bands from 1-5.





one**course**

