Evaluating the effectiveness of Can't Wait to Learn in formal education in Uganda

Can't Wait to Learn: Uganda

Research protocol

Version 4.0

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GENERAL INFORMATION

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RESEARCH TEAM

Role	Name	Affiliation
Principal investigator	Prof. Dr Mark J.D. Jordans	University of Amsterdam; War Child Holland
Co-principal investigator	Dr Nikhit D'Sa	University of Notre Dame, IN
Co-investigator	Jasmine S. Turner	War Child Holland University of Amsterdam
Co-investigator	Dr Felicity L. Brown	War Child Holland University of Amsterdam;
Co-investigator	Victo Kyobutungi	War Child Holland-Uganda
Co-investigator	Parwez Anis	War Child Holland-Uganda

ADJUSTMENT:

Victo Kyobutungi was the research coordinator on the broader research programme during development of this protocol and prior to hiring a research coordinator for the cRCT. However, it was agreed that when a new research coordinator for the cRCT was recruited, he/she would replace Victo Kyobutungi as the Co-investigator. Jamal Anan has replaced Victo Kyobutungi as Co-investigator.

ACRONYMS AND ABBREVIATIONS

AEP	Accelerated education programme
cRCT	Cluster Randomised Controlled Trial
CWTL	Can't Wait to Learn
DSMC	Data safety management committee
FCDO	Foreign, Commonwealth and Development Office (of the UK)
FGD	Focus group discussion
GPE	Global Partnership for Education
IDRC	International Development Research Centre
IRR	Inter-rater reliability
IT	Information technology
KII	Key informant interview
KIX	Knowledge and Innovation Exchange
M&E	Monitoring and evaluation
PI	Principal investigator
VfM	Value for Money
UNCST	Uganda National Council for Science and Technology
WCH	War Child Holland
WEMWBS	Warwick-Edinburgh Mental Wellbeing Scale

INTRODUCTION

The education systems of refugee-hosting countries, such as Uganda, are under enormous pressure, with insufficient funding for adequate space, facilities and qualified teachers (Karam and Zellman, 2017). In classrooms, teachers can be overburdened, with few resources and large classes of children who vary greatly in age, prior learning and time spent out of school (Burde et al., 2017; UNESCO, 2019). In the current climate of increasingly prolonged conflict and forced displacement, the need for cost-effective, scalable and sustainable solutions to increase access to quality education is evident.

Increasingly, education technology ('EdTech') is being explored to support learning and educational needs, given the limited resources and traction for a more traditional response to the aforementioned challenges. Some EdTech programmes show promise; a systematic review by McEwan (2015) found that computer and instructional technology interventions in low- and middle-income countries had the largest effect on learning compared to other types of school-based interventions outcomes. Furthermore, randomised controlled trials of an add-on tablet-based programme in Malawi and an afterschool technology-aided programme in India have shown significant improvements in learning outcomes (Pitchford, 2015; Muralidharan, Singh and Ganimian, 2017). Recently, Tauson and Stannard (2018) critically reviewed EdTech programmes in humanitarian settings and, while they ultimately conclude that there is scope for EdTech within humanitarian education, they recommend increased consideration of existing evidence during programme design. This is particularly in relation to the importance of the role of the teacher/facilitator, pedagogical design, national curriculum integration, adapting to learners' levels, ensuring teacher and parental buy-in, and providing the supportive implementation infrastructure necessary for such programmes to function successfully.

Can't Wait to Learn (CWTL) is an EdTech programme developed by War Child and partners. It is a curriculum-aligned, adaptive learning programme delivered on a tablet, designed to address some of the many challenges of access to quality education in conflict-affected settings, and employs a serious gaming approach and non-specialist facilitators. CWTL was first developed in Sudan for children living in areas where formal education infrastructure was unavailable, and evaluated with a quasi-experimental pilot which indicated significant learning gains in numeracy over 6 months (Stubbé *et al.*, 2016). WCH built upon these findings with national and international partners, to further develop the programme design and research tools, and adapt the programme to other countries and contexts. The combined gaming application and programming approach form an implementation package that includes hardware, software and data management systems, and facilitator training. CWTL for mathematics and reading is available in Arabic and English and is currently implemented in Lebanon, Jordan, Sudan, Uganda and Chad. In Uganda, CWTL has been implemented since 2018 in Accelerated Education Programme (AEP) and formal primary school Primary 3 (P3) classes in the West Nile and South West regions of Uganda, predominantly in refugee settlements.

To date, multiple mixed-methods research studies on CWTL have been completed and show promising results. We found significant gains in mathematics and literacy competency in two non-controlled, pre-post evaluations in Lebanon and Jordan (Turner *et al.*, under review; Riyadh *et al.*,), within-group gains in mathematics and literacy competency in a quasi-experimental study in Jordan in formal schools (de Hoop *et al.*, under review), and in a quasi-experimental study in Sudan comparing state-provided education and CWTL for out-of-school children, we found significantly larger improvements in mathematics and literacy competency for CWTL compared to control condition (Brown *et al.*, 2020). Qualitatively, benefits to children's psychosocial wellbeing have been reported, including increased hope, self-esteem and self-confidence, motivation, social interaction and collaboration, and reduced emotional and behavioural problems, which were supported by quantitative data (de Hoop *et al.*, under review; Turner *et al.*, under review).

In August 2020, War Child and the Ugandan Ministry of Education and Sports (MoES) launched a pilot of CWTL in a public school in Luwero. As schools were closed at the time due to Covid-19, children participated in group lessons led by teachers. Baseline and endline data were collected from this school and a comparison school and indicated positive trends. Due to the widespread school closure, CWTL was a way to sustain quality implementation and now will be investigated as a potential form of catch-up education. In the present research, we aim to empirically evaluate the effectiveness of CWTL integrated within formal education compared to education-as-usual (EAU) in schools.

STUDY AIM AND OBJECTIVES

Aim:

A) To assess the feasibility of the intervention and study (cRCT) methods
B) To evaluate the effectiveness of CWTL in improving reading and numeracy outcomes of children in Primary 3 (P3),
C) To assess the value for money of CWTL and other factors for EdTech programme scale-up

The specific objectives of the present research studies are:

1) To validate the primary outcome measurement tools
2) To test the appropriateness, acceptability and feasibility of the programme and research tools and procedures
3) To evaluate the effectiveness of CWTL on reading and numeracy competency, as well as psychosocial wellbeing, when integrated within education-as-usual (EAU)
4) To evaluate the value for money of CWTL compared to EAU
5) To identify the pivotal factors and players in policy development, endorsement and implementation for the scale up of an EdTech programme.

JUSTIFICATION FOR STUDY

(1) We first complete a feasibility study to test each of the research procedures, in an underpowered controlled study. Specifically, we will assess the feasibility and acceptability of the CWTL intervention in the study setting, assess feasibility and acceptability and validity of outcome measures.

(2) The main research study is designed to evaluate the effectiveness of the Can't Wait to Learn (CWTL) programme and support its scale-up in Uganda and other CWTL countries, using a cluster randomised controlled trial (cRCT) design. RCTs are widely recognised as the most appropriate study designs for achieving this aim and determining causality. The trial will be a cluster design because it is not possible for ethical reasons or the risk of contamination to randomly assign children to CWTL and EAU within the same class. Outcomes will be measured at the child level however, as the CWTL programme content is tailored and designed to increasing the academic competency of the individual child. Furthermore, our previous research and existing literature suggest that CWTL and EdTech programmes more broadly have differential effects according to factors such as demographic characteristics, baseline competencies, attendance and prior education, which vary significantly within a classroom. Therefore, measuring outcomes at the class or school level would risk masking the effects of the programme and would reduce the opportunity of doing sub-analyses to better understand how the programme works for different children, and what changes are required for its effects to be more equitable.

(3) Pairing the cRCT with a value for money (VfM) analysis will make an important contribution to the small evidence base on the cost-effectiveness of EdTech programmes.

(4) Finally, the policy network analysis (the methodology for objective 5) will complement the evidence generated by the cRCT and VfM by further informing the scale-up of CWTL from a policy perspective.

RESEARCH QUESTIONS

Feasibility study:

i) Are the outcome measures appropriate, acceptable, valid and relevant, in terms of their content, sensitivity, length and language?
ii) Are the research procedures feasible and acceptable to participants and key stakeholders?

Cluster Randomised Controlled Trial:

Primary research question

i) What is the effect of CWTL combined with education-as-usual (EAU) on reading and numeracy outcomes, compared to EAU alone?

Secondary research questions

ii) What is the effect of CWTL on children's psychosocial wellbeing outcomes compared to that of education-as-usual?

iii) What is the user and key stakeholder experience and perceived impact of CWTL?

Value for Money:

i) What is the value for money of CWTL with EAU, compared to EAU alone?
ii) How does the cost per child, cost per completer, cost-effectiveness and cost per harder-to-reach child for CWTL compare to that of education-as-usual?
iii) How does the cost-effectiveness of CWTL compare to that of other EdTech programmes?

Policy Network Analyses:

i) Who are the key stakeholders involved in EdTech policy development in Uganda, and what are the power dynamics between them?
ii) What are the factors that influence and inform EdTech policy development?
iii) What are the opportunities and obstacles concerning EdTech policy implementation?
iv) What are the key factors and drivers in the uptake, implementation and scaling up of EdTech programmes within the Ugandan education system?

ADJUSTMENT:

Added: STUDY HYPOTHESIS

Hypothesis: Children doing Can't Wait to Learn integrated in formal education will demonstrate larger gains in numeracy and reading competency compared to children doing education-as-usual.

METHODOLOGY

Interventions

Can't Wait to Learn

The CWTL curriculum-based reading and numeracy games are delivered on a tablet and have three main components: the game world, instructional videos, and mini-games. The game world provides a setting and story for the child. Within the game world, children play mini-games and watch instructional videos. Instructional videos of local children and adults explaining the concepts and tasks precede the mini-games. Students engage with mini-game content in several ways: for example, multiple choice, matching and arranging, ordering, and writing. A (in-game) game guide begins each mini-game by instructing on the task at hand. Progress through the game is based on performance: as children master concepts and get above a pre-determined proportion of questions correct, they progress to more difficult concepts and mini-games. Children each have their own account and progress at their own pace and receive in-game rewards to keep them motivated. The game world, characters and storyline were co-created with targeted children, resulting in an interface that reflects children's reality and aspirations.

The game is offline and individually paced. As a result, each child must always play on the tablet assigned to her/him across all sessions. To guide this process, the tablets are marked with a colour and number, and children receive a sticker to remember their individual colour-number combination. Children are organised into smaller groups of six and one child from each group, the group leader, is in charge of getting all tablets with the same colour out of the storage. After the session, the group leaders are in charge of returning the tablets from their colour group. Teachers are trained beforehand to work with this classroom organisational system.

Trainings and technical support

Induction, training, and on-going support are all integral parts of Can't Wait to Learn's roll out and implementation processes. Induction sessions, including an introduction to the programme, the game, roles & responsibilities, are held with the school education personnel, district authorities and other relevant stakeholders. Subsequently, headteachers and all school teachers participate in a 5-day teacher training which covers:

- General information about Can't Wait to Learn
- How to use the game and tablets
- Headteachers' and teachers' roles and responsibilities

- How to trouble shoot in the case of simple hardware or software issues
- Managing the learning session and learning environment
- Using problem-solving approaches to develop independence
- Child-friendly approaches to running the programme

In both trainings, manuals are distributed and used throughout the trainings so that teachers and staff have a clear reference material. In addition, the support/service mechanism for teachers and staff are agreed upon (i.e. reporting mechanism for issues/feedback). Following the trainings, teachers receive on-going support from the War Child and partner Education/programme officer, who is responsible for conducting observations and providing subsequent feedback and follow up with teachers. In Uganda, teacher refresher training also takes place either as new elements are added to the programme or simply to ensure that teachers feel comfortable and have the materials fresh in mind. The Head Teachers are also participating in the trainings to ensure a "whole school approach", whereby their ownership of the programme is increased, which ultimately leads to more support for the teachers. A child protection and child safeguarding training is conducted separately.

In-school implementation model: CWTL and EAU

Education as usual (EAU) consists of 1 hour per day of numeracy and 1 hour per day of literacy, both in English. In addition, classes like sports and art are usually replaced with catch-up classes for numeracy and literacy, led and designed by the class teacher. In some schools, phonics lessons replace sports and art. As EAU will therefore vary somewhat by school, the dosage of literacy and numeracy classes (including catch up) will be tracked.

CWTL will replace the catch-up classes in the intervention schools. Each child will complete three sessions of CWTL numeracy and three sessions of CWTL reading per week. Taking tablet collection and storage time into account, 45 minutes of gameplay is expected per session. Classes are divided into groups, with a maximum of four groups per class. Children in one group do CWTL while the remaining groups follow regular education. A rotational system is followed so that each group completes six lessons (three maths, three reading) of CWTL per week.

ADJUSTMENT:

The CWTL numeracy and reading sessions (three per week per game) replaced maths and English lessons, respectively. Some disruptions during the intended implementation period (May-December), including teacher strikes and early school closure due to an outbreak of Ebola, led to the modification of the number of sessions per game per week from three to four in order to keep the overall dosage of CWTL close to the originally intended and designed dosage. See p. 27 & 28 to see an overview of the intended and actual dosage.

Home/community-based implementation model: CWTL and EAU

Adapted implementation models for CWTL have been developed and used during school closures as a result of the Covid-19 pandemic. Given the ongoing instability with the pandemic, there is a chance that schools will be closed when the cRCT is planned to start in which case we would adapt to the home-based or community-based approach. Under the home-based approach, teachers visit communities and homes to raise awareness on the pandemic, provide sanitizers and create a safe space for home learning. Depending on the level of restrictions, a community-based approach can also be undertaken, in which children play CWTL in small groups in their community. For either approach, children will play the numeracy and reading games for one hour per day per game, five days per week. Teachers support children and caregivers by bringing, cleaning and charging the tablets. Moreover, caregivers are provided with support materials for home learning, which are based on a visual approach to mitigate caregiver illiteracy, where applicable. Within the community-based approach, the CWTL Programme is expected to be able to reach the same number of children as it would have had it been implemented in schools.

The Government's education response – considered here as 'education-as-usual' – during school closures was to distribute learning packs, which included writing materials and workbooks, and conduct radio lessons. It is assumed that this will be the same response if schools are closed again. In any case, what children in control schools receive will be carefully documented.

Study design

Feasibility study

The feasibility study will include a variety of quantitative and qualitative research methods to evaluate the acceptability, appropriateness, relevance and feasibility of the study processes and tools. The study will be conducted from October 2021-March 2022. Specifically, it will involve:

1. Assessment of feasibility, acceptability, and psychometric properties of measures and interview guides for use with children, teachers, and to assess the teacher training;
2. Feasibility, acceptability, and effectiveness of random selection and randomisation procedures;
3. Feasibility and acceptability of outreach, enrolment, and consent procedures;
4. Feasibility and reliability of the observation tool used to assess fidelity of sessions;
5. Satisfaction with and effectiveness of teacher training and research assistant training;
6. Feasibility of data collection and management procedures and quality assurance and safety mechanisms.

For more detail on the methodologies for the above, please see the Procedures section.

Cluster randomised controlled trial

A cluster randomised controlled trial (cRCT) will be used to evaluate the effectiveness of CWTL integrated in formal education compared to education as usual (EAU). Random selection and allocation will be done at the cluster level, i.e. the school (see the School Selection section below for the procedure). The whole P3 class of the selected schools will do the condition allocated and a sample of children will be randomly selected to participate in the research. The evaluation will utilise quantitative data on demographics, numeracy and reading competency and psychosocial wellbeing. In addition, qualitative data will be gathered via focus group discussions and key informant interviews. Routine data on attendance and lesson observations will also be collected and analysed. The cRCT will be conducted from May 2022 until November 2022.

Value for money (VfM) analysis.

The VfM analysis will follow the UK's Foreign, Commonwealth and Development Office (FCDO) 4E VfM framework (DFID, 2011). It includes analysis of three dimensions of VfM – economy, efficiency and effectiveness – as well as sub-analysis of these dimensions from an equity perspective. For the present research, the dimensions of VfM are conceptualised as the following:

- Economy: cost per programme participant per year
- Efficiency: cost per programme completer per year, or cost per year completed
- Effectiveness: cost per competent programme completer
- Equity: cost per child from marginalised or harder-to-reach group(s)[1] per year

The analysis will model the above for CWTL and EAU using enrolment rates, attendance data, change in learning outcomes, and financial data. These data (except the financial) will come from the cRCT. A sensitivity analysis on the results of the above will be performed using the demographic data for the equity component.

Policy network analysis (PNA)

The policy network analysis design is a combination of a social network analysis, policy document analysis, and key informant interviews.

Setting

The feasibility study and cRCT will be conducted in public schools in southwest Uganda. We intend to limit the geographic location to Kyegegwa district, assuming that there are sufficient schools for the two studies that meet our selection criteria. Two schools are required for the feasibility study (1

[1] Such as girls, children with disabilities, over-age students, and any other groups that are indicated to be marginalised in the implementation settings.

intervention, 1 control) and 30 schools required for the cRCT (15 intervention, 15 control). If there are too few schools in Kyegegwa, the studies will be conducted in Isingiro district.

The parameters used for our sample size calculations for the cRCT were informed by relevant literature from the EdTech evidence base (McEwan, 2015; Pitduratchford, 2015; Muralidharan, Singh and Ganimian, 2017; De Hoop *et al.*, 2018; Evans and Yuan, 2020; Global Education Evidence Advisory Panel, 2020), previous CWTL research (Brown *et al.*, 2020) and parameters used in a cRCT evaluating the effectiveness of a literacy programme in South West Uganda (NORC at University of Chicago, 2017). Based on the parameters below, 30 clusters are required, with 60 children per cluster.

Parameters	Modelled	Rationale
Intra-cluster correlation (ICC)	0.14	Based on that used by NORC at University of Chicago (2017)
Power	0.8	Comparable and acceptable for education RCTs
Effect size	0.4	Evans & Yuan (2020) found a median effect size of 0.1 on learning for education interventions in low- and middle-income countries, in a meta-analysis of RCT and quasi-experimental evidence. However, there is also evidence that EdTech programme and education programmes with content targeted at the academic level of the child produce larger effect sizes (McEwan, 2015; Global Education Evidence Advisory Panel, 2020). In a 2018 quasi-experimental evaluation of CWTL in Sudan, the effect sizes for numeracy and literacy were 0.91 and 0.99, respectively (Brown *et al.*, 2020). Therefore, 0.4 was agreed to be an appropriate effect size for our calculations, based on the above information.
Number of children per cluster	60	The class size, on average, is 100-150 children. 20 children per cluster necessitated much higher number of clusters (and therefore the implementation cost) and there was little difference between number of clusters required for 60 and 100, so 60 was selected for ease and financial feasibility.
Variance explained by covariates at the cluster level; R^2	0.3	Based on that used by NORC at University of Chicago (2017)
Cluster attrition	0%	As the cRCT will be in formal schools and significant efforts made in preparation to inform and include school and education authorities, we consider attrition at the school level a very low possibility.

ADJUSTMENT:

The number of children selected per cluster was reduced to 50 to increase the number of eligible schools, as very few met the criteria with 60 pupils per class. This does not significantly impact the power.

School selection

The feasibility study will include 2 schools: one intervention school and one control school. The cRCT will include 30 schools: 15 control schools and 15 intervention schools.

The below inclusion and exclusion criteria will be applied to existing lists of all schools within the district, leaving the sampling frame. To reduce the risk of contamination, we will only include schools

that are at least 6km apart. Two schools will be randomly selected for the feasibility study and the intervention condition randomly allocated to one school. The other will be the control school. These schools will then be removed from the sampling frame. For the cRCT, 30 schools will be randomly selected from the sampling frame, and randomly assigned the control or intervention condition. Randomisation will be carried out using a computer-generated randomisation sequence, conducted by the lead statistician, based in the Netherlands.

School inclusion criteria:

(1) Must be a public primary school
(2) Outside of the refugee settlements
(3) Where education staff are willing to accept research conditions and responsibilities, namely:
    a) Will receive visitors
    b) Host data collection and lesson observations
    c) Agreement to random allocation of condition
    d) Regularly submit attendance data
    e) Report on adverse events
    f) Adhere to child protection and child safeguarding standards
(4) For intervention schools only:
    a) Has sufficient storage space for tablets
    b) Has a classroom dedicated to the P3 class
    c) It is possible to install solar panels

School exclusion criteria:

(1) NGO-aided, private or community schools
(2) Prior digital learning programme[2] implemented in the school
(3) School is less than 6km away from existing CWTL implementation or another school selected for the research
(4) More than 120 students enrolled in P3
(5) For the cRCT only: school included in the feasibility study

ADJUSTMENT:

In the school exclusion criteria; 'Less than 55 learners enrolled in P3' was added as a criterion. This criterion was adapted to exclude schools with an insufficient number of learners, i.e. that would not have enough for the required sample size from the sampling frame.

The criteria on distance between school was changed; initially it was suggested that there should be a 6km distance between eligible schools to reduce the risk of contamination, however, this distance was reduced to 4km upon advice of the War Child Education technical advisor based in Uganda.

Participants

Research participants will include children, their caregivers, education staff (e.g. headteachers, teachers) and key actors in education policy development and implementation.

Children

For the feasibility study, a total of 140 children will be recruited: 70 children from each of the two schools. 10 children per school will do the cognitive interviews for the outcome measures. 60 children per school will do the assessments. A subsample of 10 children will be invited to join focus group discussions (FGDs).

For the cRCT, a total of 1,800 children will be recruited: 60 children from each of the 30 schools. Data on numeracy and reading competency and psychosocial wellbeing will be collected from these children. A subsample of 40 children will be invited to join four FGDs exploring their experiences of

[2] Defined as a programme that uses a digitised game or content to teach children reading or numeracy

CWTL/education-as-usual and its perceived impact. 10 children who dropped out of education over the course of the research will be invited to participate in key informant interviews.

The inclusion criteria for these children are:

(1) Assents to participating in the research
(2) Caregiver consent is obtained.
(3) Is enrolled in grade P3.

The exclusion criteria are:

(1) Hearing, vision, and speech impediments that significantly impair the child's ability to listen to or watch a video on a tablet, see images on a screen, and/or participate in assessments.
(2) Children unable to understand pedagogical explanations for reading or numeracy
(3) Behaviour that poses risks to the safety of other children or pedagogical materials.
(4) Resides in a child-headed household, i.e. head of household is under 18 years old.

These exclusion criteria will not specifically be assessed prior to commencement of the study, however if it is known (following information from the school) that a child meets one or more of these criteria, they will not be included in the study. Research assistants will be provided with instructions to speak to the research coordinator if they suspect/detect any of these exclusion criteria during the consent or baseline assessment process with the child or caregivers. Likewise, teachers will be provided with directions to speak to the research coordinator if they suspect/detect any of these exclusion criteria once the study has commenced.

ADJUSTMENT:

Due to the change in target sample per school from 60 to 50 to increase the number of schools from which to randomly sample for selection, the total number of children and caregivers targeted for the study was 1500 of each. An additional 5 children per class for each of the 30 schools were randomly selected from the class lists to form a 'waitlist'. The waitlist participants were used to replace selected participants within the main sample who could not be interviewed due to their absence, or lack from the caregivers consent for their participation in the research, among other reasons. A 'waitlist' participant was only interviewed when the team's effort to engage a selected participant within the main sample has totally failed.

Education personnel

For the feasibility study, at least four education personnel will be included in the research: the headteacher and P3 class teacher from each school. If there are multiple P3 teachers, all will be invited to participate. They will be invited to complete cognitive interviews, the demographics and wellbeing assessments, and join an FGD.

For the cRCT, at least 60 education personnel will be invited to participate in the research: all P3 teachers and the headteacher for each school. 20 teachers will be invited to join FGDs (two for intervention schools; two for control schools), and four headteachers will be invited to key informant interviews.

Inclusion criteria:

(1) Willing to participate in the research
(2) Works at, or represents, a school selected for the research
(3) Teachers only: teaches P3.

Caregivers

'Caregivers' refers to the individual(s) responsible for the daily care and upbringing of the child.

All demographic data for the children will be collected from their caregivers, therefore the sample size will match that of children. Up to 10 caregivers per school will do the cognitive interviews for the outcome measures. 60 caregivers per school will do the assessments. A subsample of 10 caregivers will be invited to join FGDs.

For the cRCT, a total of 1,800 primary caregivers will be recruited: 60 caregivers from each of the 30 schools. A subsample of 40 caregivers will be invited to join four FGDs exploring their impressions of CWTL/education-as-usual and its perceived impact.

Inclusion criteria:

(1) Consents to participate in the research
(2) Has a child participating in the research

Education policy stakeholders

For the policy network analysis, six key informant interviews (KIIs) will be conducted with six relevant education stakeholders. The stakeholders will be selected and approached based on their relevance to education policy development and implementation, with particular focus on stakeholders who are involved in the inclusion of EdTech in policy development and implementation. The interviewees will be approached via email and invited to participate in the KII, which will be conducted by Policy Network Analysis specialists hired by War Child.

Inclusion criteria:

(1) Willingness to participate in the research.

ADJUSTMENT:

The cognitive interviews for the outcome measures were done in a neutral school (i.e. a school that was not eligible for inclusion in the RCT) as opposed to the suggested feasibility study schools. The reason for this was to avoid prior interaction and familiarity of the feasibility study participants with the outcome measures that would have affected the authenticity of the feasibility study.

Participant recruitment

Prior to the start of the research studies, inception meetings will be held with representatives from the district and sub-country authorities, schools and communities. The rationale, aims, methods and participant recruitment procedures for the studies will be presented, with opportunity for discussion. The meetings will also aim to generate buy-in and endorsement for the research. These meetings will provide an opportunity for attendees to ask questions and voice concerns, if any are had. The number of participants of these meetings will adhere to national guidelines and Covid-19 restrictions at the time.

Cognitive interviews

Participants for the cognitive interviews will be purposively selected to represent the variation in the target group. Teachers and headteachers will be asked to advise on participant selection. Caregivers of the selected children will be invited to consent to their child's participation and subsequently the child will be requested to assent, as per the consent and assent procedures described below (p. 15).. For the demographics questionnaire, caregivers of both boys and girls will be selected, and those with varying socioeconomic status and education levels.

Quantitative data collection (feasibility study and cRCT)

For the schools allocated the intervention condition, all children in the P3 class will do the CWTL programme. Using the P3 class enrolment lists (with children who completed the cognitive interviews excluded), 60 children will be randomly selected from the class. Their caregivers will be contacted and invited to an information meeting. If caregivers are unreachable or do not agree to attend the meeting, the random selection process will continue until 60 caregivers have agreed to attend. As this means that the selection is not entirely random, we will report the number of caregivers who are unreachable or do not agree to participate, but do not foresee that this will influence the results. As described previously, this process will be tested in the feasibility study.

The rationale, aims, methods and participant recruitment procedures for the studies will be presented, with opportunity for discussion and questions. Subsequently, caregiver consent for their child's participation will be sought followed by the assent procedure with the child (see the Procedures section for details on consent and assent).

If schools are closed at baseline, the same process as above will be followed to recruit the study sample. Subsequently, the P3 classes will be formed into groups for community-based CWTL, ensuring that the research children are grouped together.

Qualitative data collection (KIIs and FGDs)

Participants for the qualitative research will be purposively selected to represent the variation in the target group. Teachers and headteachers will be asked to advise on participant selection. For example, both high- and low-achieving children will be recruited, and those who are judged to participate in and enjoyed CWTL/EAU to varying extents. Similarly, caregivers and education personnel who are judged to have been engaged to different extents, or who have had more positive and more negative experiences with CWTL/EAU will be recruited.

Policy Network Analysis

PNA consultants will compile a list of key individuals who influence or are involved in education policy development and/or implementation, based on information and advice from the War Child-Uganda education advisor. The six most relevant individuals will be invited to interviews, based on their judged capacity by the consultants and advisor to provide the breadth and depth of information required to answer the research questions. If an individual declines or does not respond, the next most relevant individual will be invited, and so on.

Data collection tools

English versions of all measures are attached in Annexes A to K.

The measures will be translated into the minimum languages needed to ensure that issues of comprehension do not introduce bias into the data. Most likely, this will include Runyankore and Swahili, and will be checked during the inception meetings. The exception is the reading assessment which will only be conducted in English, as that is the language of instruction. The items will be adapted based on feedback gathered during the cognitive interviews. The measure adaptation will follow the cultural adaptation process outlined in Van Ommeren *et al.* (1999), including forward and backward translation.

ADJUSTMENT:

The data collection tools were only used in Runyankore and English, as we found during the cognitive interviews that these met the needs of our target population. The numeracy assessment was entirely in Runyankore, the instructions of the reading assessment were in Runyankore and the questions were in English,

Demographics questionnaire (caregivers) and home learning environment

Demographic information about the child, caregiver(s) and household will be collected, including child gender and age, child functioning/disability, caregiver education and occupation, household composition, and socioeconomic information. Data on the home learning environment will also be collected, which includes items on the application of academic skills outside of the school by the child alone or with family members. These data will be collected from caregivers. (See Annex A for the demographics survey)

Academic assessments (primary outcome)

The Early Grade Mathematics Assessment (EGMA) and Early Grade Reading Assessment (EGRA) will be used. EGMA is composed of 72 items and tests on the following topics: number identification, addition and subtraction, word problems, multiplication and division. EGRA consists of 91 items and tests on: letter sounds and names, segmenting words, vocabulary, reading and comprehension. These data will be collected from children. The EGRA and EGMA have been used previously in Uganda (for example, NORC at University of Chicago, 2017), including the CWTL pilot study with the Ministry of Education and Sports. See Annex B for EGMA and Annex C for EGRA tools.

Stirling Children's Wellbeing Scale (secondary outcome)

The Stirling Children's Wellbeing Scale (Liddle and Carter, 2015) is a positively worded measure of emotional and psychological wellbeing developed specifically for children. It consists of 12 items scored on a 5-point Likert scale, along with 3 items forming a social desirability scale. In a validation study in the UK, it has demonstrated good internal reliability (Cronbach's alpha= .85), good concurrent validity with other measures of self-esteem (r = .69) and wellbeing (r = .74), and good test-retest reliability at one-week (r= .75). See Annex D for the survey questions.

Caregiver engagement questionnaire

The caregiver engagement questionnaire consists of 49 items compiled from the 2012, 2015 and 2018 versions of the Programme for International Student Assessment (PISA). It is a measure of caregiver engagement in their child's education, including attitudes towards education, interaction and relationship with the school and teacher, and barriers to engagement. The questionnaire has recently undergone translation into Runyankore and Swahili, cognitive interviewing, and back-translation (See Annex E). Large-scale testing of the measure is planned, and findings will inform its use in the present research.

ADJUSTMENT

This measure was not used in order to reduce the data collection burden on participants. Only demographics and the data on the Home Learning Environment was collected from caregivers.

Demographics questionnaire (teachers)

Demographic information about the teachers' age, gender, education, and teaching experience will be collected from teachers. See Annex F.

Warwick-Edinburgh Mental Wellbeing Scale (WEMWBS)

The WEMWBS is a 14-item self-report scale of measure mental wellbeing that uses a 5-point Likert scale, and has been shown in UK populations to have good content validity and internal consistency ($\alpha = 0.91$) (Tennant *et al.*, 2007). Cognitive interviews will be conducted with teachers on the WEMWBS and if the tool is judged to have low relevance to the target population, only the relevant items will be retained or another wellbeing measure will be selected and the cognitive interviews repeated. These data will be collected from teachers. See Annex G.

Observation forms

Observation forms designed specifically for the CWTL programme will be used to assess implementation fidelity (See Annex H). Research assistants will carry out the observations on a random sample of 5% of CWTL lessons.

ADJUSTMENT:

The CWTL session observations were done by CWTL project officers as the observation sessions are followed by mentoring/coaching sessions to the teacher, and the project officers have the technical capacity and responsibility to conduct this activity while research assistants do not.

Topic guides

The topic guides that will be used for semi-structured focus group discussions and key informant interviews are annexed to this protocol (See Annex I). The key questions for the different participant groups are outlined and will be further adapted to the different target groups.

Attendance data

Class registers will be used as the measure of attendance, assuming the feasibility study indicates that they are sufficiently accurate. If it does not, an alternative method for collecting attendance data will be devised, such as inputting the data directly into Kobo.

Log data

Log data are generated from the game and stored in a log file whenever an activity occurs, e.g. a video watched or mini-game opened. These data include the mini-game, the level and outcome (i.e. successful or unsuccessful), date and time, and event duration. The log data can be used to calculate aggregate measures, such as game level reached, amount of time played (minutes), number of days played, number of minigames won and lost.

Costing data

The cost data used for the VfM analysis will consist of delivery costs, i.e. those for direct programme delivery and programme management. Direct programme delivery costs include teacher training, hardware (tablets, solar power and charge stations), software (game and management portal maintenance) other delivery costs (e.g. assessments, managing e-waste). Programme management costs include WCH head office costs, in-country management staff and induction trainings. Cost data will come from CWTL financial reports and governmental reporting or estimation for EAU, depending on what is available.

Policy documents

Key documents concerning or relevant to education technology policy in Uganda will be identified based on a rigorous internet search and input from War Child education advisors. Approximately 8 of the most relevant documents will be selected for analysis.

PROCEDURES

Training and supervision of research assistants

For the feasibility study, a team of 10 research assistants will be recruited, trained and supervised by the research coordinator. For the cRCT, an additional 30 research assistants will be recruited. Four of the research assistants trained for the feasibility study will become field supervisors for the cRCT. The research coordinator will be responsible for data quality monitoring and assurance.

The research assistant training will be 5 days long, followed by a practice day. Short, tailored refresher trainings will be conducted as needed.

The training will include:

- Research objectives and questions
- Quantitative and qualitative data collection skills and procedures
- Research ethics, including confidentiality, the informed consent process, child safeguarding, dealing with emotional responses, data management, and recognition and reporting of adverse events.
- Risks and mitigation of bias in data collection.

ADJUSTMENT:

For the cRCT baseline, an additional 21 research assistants were recruited for a total of 31 RAs. Five of the research assistants trained for the feasibility study became field supervisors for the cRCT.

Informed consent and assent procedure

Adults (aged 18 years old and above)

Voluntary, informed consent will be obtained from research participants by trained research assistants. (See Annex 10. for the informed consent form). Research assistants will discuss the research methods, assessment procedures, confidentiality, data protection, and the right to withdraw with participants. This will be done verbally so that illiteracy is not rendered a barrier to comprehension or participation, although an information sheet will also be provided.

Adult participants will be able to confirm their consent via signature or verbally with a witness. The witness can be any adult (aged 18+) who the participant is comfortable having present during consent, is literate and is not a member of the research team.

Children (aged under 18 years old)

After a caregiver has consented to their child's participation, research assistants will discuss the research with the child and request their agreement to participate. This agreement will be recorded on an assent form. (See Annexes 11 and 12 for the informed caregiver consent for children and assent form). Assent is in addition to caregiver consent and does not replace it. In order for a child to participate in the research activities, both consent and assent must be obtained. As with adults, the child is free to withdraw from the study at any time.

Randomization and masking

Randomization for the cRCT will be done based on the list of eligible schools, following the above-mentioned inclusion and exclusion criteria, using a computer-generated randomization sequence. Randomization will be conducted by the lead statistician, based in the Netherlands. Given the nature of the intervention (use of tablets, and solar panels for charging) it will not be possible to blind participants and research staff in Uganda. The lead statistician will remain blind to group allocation.

Data collection

In our experience of conducting research studies in Uganda, we have not found it necessary to match the sex of the research assistant and child. Therefore we do not intend to do so for the present research however will accommodate such a preference, if expressed by a participant (adult or child).

All data collection will respect national health and safety guidelines. Research assistants will be provided with masks and hand sanitizer. Participants who do not have a mask will be provided with one.

Cognitive interviews

Cognitive interviews will be conducted one-to-one with research assistants. (See Annexes 13 and 14 for the informed consent and assent forms for cognitive interviews). The research assistant will go through a measure, asking the respondent for feedback on the comprehensibility, relevance and sensitivity of the items and answer options, and suggestions for improvement. Participants' feedback will be recorded and then collated. Participants and research assistants will comply with health and safety standard operating procedures.

Focus groups discussions (FGDs) and key informant interviews (KIIs)

FGDs and KIIs will be held at a set time and location and will be conducted by the research assistants. Each FGD will last for approximately one hour. Two research assistants will conduct each FGD; one responsible for moderating the discussion and the other for note-taking. One research assistant will conduct each key informant interview. They will be held in a private space to ensure confidentiality. The questions asked will follow a semi-structured interview guide. Discussions will be audio-recorded. Participants and research assistants will comply with health and safety standard operating procedures.

Survey data (demographics, academic assessments, wellbeing measures)

An electronic data collection tool, Kobo Toolbox, will be installed on tablets and used to collect survey data. All survey data will be collected one-to-one by trained research assistants, who directly input participant responses into the tablet. Surveys will be completed in a quiet and private space. Participants and research assistants will comply with health and safety standard operating procedures.

Routine data (Log, attendance, observation and fidelity data)

IT/M&E officers will download the log data from the tablets on a fortnightly to monthly basis. The Education/M&E officers will collect attendance sheets on a weekly basis. Observations occur on a monthly or fortnightly basis, conducted by the Education or M&E officer using Kobo. These data are summarised in reports and monitored by the programme manager and the global team. The data are triangulated to check accuracy and reliability.

ADJUSTMENTS:

Attendance data was collected on a fortnightly basis by research assistants. They reflected the manual attendance recorded by teachers in class registers in an electronic Kobo form.

Feasibility study: data collection details

- The appropriateness of the inception meetings and comprehensibility of information shared will be assessed through FGDs with invitees following the inception meetings.
- Following random selection and allocation of the feasibility study schools, the acceptability and practicalities of random selection of schools and their random allocation to the intervention group or control group will be assessed qualitatively via focus group discussions (FGDs) with key stakeholders (incl. district officials, headteachers and caregivers), and feedback from the research team.
- The acceptability of random selection of students will be assessed through focus group discussions with key stakeholders (incl. teachers, caregivers and children). We will also track the number of caregivers that we need to approach in order to achieve a sample of 60 children per school, which is the number of children required per cluster as per our sample size calculations.

- The appropriateness, relevance and acceptability of the academic and wellbeing assessments will be evaluated through cognitive interviews with children. The assessments will also be conducted with 120 students to determine their psychometric properties. The timing and logistics of data collection using the assessments will be recorded to inform the RCT data collection planning.
- The appropriateness, relevance and acceptability of the demographics survey will be evaluated through cognitive interviews with caregivers. The demographics survey will also be conducted with the caregivers of 120 students.
- The appropriateness of the consent and assent procedures and the comprehensibility of information shared will be assessed through FGDs with children and caregivers. Feedback from research assistants on the process length and questions asked by participants will inform improvements for the RCT.
- The appropriateness, validity and reliability of the observation form will be evaluated through analysis of the observation data collected and feedback from the observers. The acceptability of the observations themselves will be assessed through FGDs with teachers and observers.
- The CWTL teacher training will be evaluated through feedback survey data from participants, feedback from the trainers, and monitoring of the teachers' implementation of CWTL during the feasibility study.
- The appropriateness of two measurement tools will be tested during the CWTL teacher trainings, one tool measuring attitudes towards EdTech, the other measuring knowledge of the CWTL programme, game design and implementation. The tools will be administered to training participants and assessed via FGDs with the teachers and trainers and analysis of the data collected.
- The appropriateness, relevance and acceptability of the teacher demographics survey and wellbeing assessment will be evaluated through cognitive interviews with teachers.
- The research assistant training will be evaluated through feedback survey data from participants, feedback from the research coordinator, and monitoring of the research assistants' performance of their responsibilities during the feasibility study.
- The availability and accuracy of routine attendance data (i.e. class registers) will be checked via random spot checks by research assistants to the schools, where they will collect attendance data and compare it to the class register.
- The feasibility of data submission and quality assurance processes will be tested through tracking any and all issues faced and recording the steps and time taken to resolve them.
- The feasibility of quality assurance mechanisms for the CWTL programme implementation will be evaluated through monitoring any and all issues faced and recording the steps and time taken to resolve them.
- The appropriateness, relevance and acceptability of the FGD and KII topic guides for the RCT will be evaluated through cognitive interviews with the representatives of the respective target groups (i.e. children, teachers/headteachers).
- To assess the feasibility of establishing a data safety management committee (DSMC), adverse event recognition and reporting, and child safeguarding reporting, a committee will be established and mock adverse events and child safeguarding issues will be raised to assess the reporting and response of relevant personnel.

ADJUSMENT:

No FGDs were conducted during the feasibility study. Feedback was received through question and answer sessions after every activity.

DATA MANAGEMENT

This proposed research follows the data management guidelines of War Child Holland's R&D department (available upon request). All electronic data files will be stored on a password protected

cloud server (SharePoint), accessible only on password protected and encrypted laptops. Access to this data will only be available to the core research team. Research assistants and transcribers will sign a confidentiality clause. The detailed WCH Data Management Policy will serve as guidance on all data management and data sharing issues.

All survey data will be collected via Kobo Toolbox. Research assistants will upload data to the Kobo server at the end of each data collection day. Only the core research team will have access permissions to edit the questionnaires and download the data from the Kobo server. Data will be downloaded from the Kobo server every day and stored as a backup on a secure data server of the R&D Department of WCH. This server is password protected and accessed from password protected and encrypted laptops.

Log data files are downloaded from the tablets into the CWTL management portal by field-based monitoring and evaluation staff on a bi-weekly to monthly basis. These data files are de-identified, encrypted and are only accessible by password to team members for whom access has been activated.

At the end of data collection for each sub-study, the complete data file will be downloaded at the WCH head office from the Kobo server and the master-file will be saved securely on a separate server and uploaded into relevant software for data analysis. All data cleaning and analysis processes will be tracked through saved syntax from data analysis software.

Any hardcopies of data, including informed consent forms, will be stored in a dry, lockable cabinet. Data sets will be accessible by the WCH core research team members. WCH has, in all cases, ownership of the research data, except where there is an alternative contractual relationship between WCH and an individual research committee member organisation.

When a child is registered in the CWTL management portal, s/he is assigned a unique participant ID (8-digit) number. These same ID numbers will be used for research purposes to pseudonymize the data and link respondents' responses at multiple time points, when necessary. Children in the control group will be assigned 8-digit ID numbers. Caregivers will be assigned their own ID number, and family codes created so that caregivers can be linked to their child(ren)'s data. Other participants – facilitators, teachers, programme staff – will also be assigned unique IDs. IDs for regions and implementation settings will also be created. The ID numbers will be integrated into the master code sheet that links participant names and contact details.

All recording devices will be stored directly after data collection in a locked cabinet. For the cognitive interviews and feasibility study KIIs and FGDs, audio recordings will be made and referred to as and when needed, but not transcribed. For the cRCT data, audio recordings will be transcribed verbatim in the language spoken during the FGD/KII, and then translated to English by a professional translator. A portion of transcriptions and translations (approximately 10%) will be checked by a bilingual research team member. Pseudonyms will be used in transcripts instead of names, and other identifiable information will be removed from the transcriptions. Audio recordings will be deleted once the data analysis is complete and the reports written.

DATA ANALYSIS

Feasibility study

Most processes evaluated will be assessed via analysis and discussion of the feedback in the feasibility study. Excel sheets will be developed to collate all feedback which will be reviewed by the research and CWTL programme teams. The teams will then discuss and decide on any changes prior to the cRCT.

For the cognitive interviews, feedback will be collated and reviewed by the research team, which will be discussed and any changes to be made decided on. Wording adaptations and edits will be checked via back-translation by translators.

All relevant psychometrics of the academic assessments will be analysed, including inter-rater reliability, internal consistency, discriminant and convergent validity, and construct validity.

cRCT

In order to compare the changes over time for the intervention and control groups, an intention-to-treat analysis will be carried out, and a per protocol analysis conducted as well. Prior to the

completion of data collection for the cRCT, a comprehensive data analysis plan will be developed and can be shared with the REC if desired.

The primary analyses will test for statistically significant changes on outcome measures over time between the CWTL group and control group, using a mixed model with children nested in schools. The independent variable is nominal (control vs experimental group), the dependent variable will be the difference between baseline and endline scores, control vs. manipulation will be a fixed effect and covariates at the child and school level will be included (and will be articulated in the data analysis plan). Effect sizes will be presented as risk ratios for binary outcomes, and as standardized mean differences for continuous outcomes; 95% confidence intervals (CI) will be given for both.

Additional analyses of intervention moderators may be conducted to generate hypotheses for later studies (e.g. age, gender, psychosocial wellbeing and academic competency at baseline, frequency and duration of interaction with game, etc). Additional regression analyses may be conducted to explore whether improvements in educational outcomes are associated with improvements in psychological functioning.

ADJUSMENT:

See the signed statistical analysis plan (published on ISRCTN or available upon request) for the detailed and final analysis plan. The above-reference to the 'per protocol' analysis is renamed a 'completer analysis. A completer is defined as a child who has 80% school attendance or higher for the student implementation period, and has completed both baseline and endline assessments.

Value for Money (VfM) analysis

The DfID 4E approach will be used to analyse the VfM of CWTL. A way of conceptualising value for money is through three key metrics:

- Cost per programme participant per year (economy)
- Cost per programme completer, or cost per year completed (efficiency)
- Cost per competent programme completer (effectiveness)
- Cost per harder-to-reach, or marginalised, groups, per year (equity)

Cost per programme participant encapsulates the economy and efficiency of procurement and programme design, for example facilitator salaries (economy) and teacher- or facilitator-to-class size ratios (efficiency). Cost per programme completer takes this figure and divides by percentage of participants who complete the programme[3], (i.e. one minus the percentage). This second figure could be termed the cost-efficiency metric as it fully incorporates all (standard) economy and efficiency aspects of a programme. Cost per competent programme completer[4] takes this figure and divides by the percentage who achieve minimum proficiency. This figure is the cost-effectiveness metric and the ultimate measure of value for money. Also considered is cost per game level progressed: this is the cost per completer divided by the average number of game levels progressed. The benefit of this measure is that it captures more of the learning that is taking place (as opposed to discarding those who fall below the benchmark). To take equity into consideration, sub-group analyses of each of the above indicators are conducted, including only the data of harder-to-reach groups of children, such as girls, children with disabilities, over-age learners and children who work. Regression-based analyses will be conducted to identify the drivers and drainers of VfM.

Policy network analysis

In order to uncover the pivotal factors, networks, actors, and relationships that contribute to the development and implementation of education policy in each country, we will develop separate case studies of Uganda, Chad and Sudan. Each case study will offer insights on broad themes around education systems and policy development, particularly on EdTech, including the impact of crisis, roadblocks that hinder policy uptake, and ways to mitigate such barriers. Cross-case analyses will synthesize data and findings to offer recommendations for EdTech scale-up across the three countries. Each case study will include a social network analysis of key actors and organizations

[3] The definition of what constitutes completing the programme will be co-developed at a later stage, with input from relevant staff members and review of log data.

[4] The definition of what constitutes a 'competent completer' will also be co-developed, as above.

embedded in each. The team will construct a social network dataset with information on actors relevant to educational technology in the three countries and the connections that exist between these actors. Data on social networks will be constructed from policy document analysis, thematic analysis of key informant interviews, and further web-based data collection on partnerships and collaboration in EdTech. The network analysis findings will contribute to each case study via triangulation with findings from the policy document analyses and key informant interviews.

ETHICAL CONSIDERATIONS

Four committees (Ethics; Data safety management; Research; Implementation) will be responsible for ensuring ethical practice in all research studies. The roles and membership of the committees can be seen below.

Committee	Role	Members
Data safety management	Monitor adverse events reports. Take appropriate action to safeguard research participants; Has the mandate to stop the study in case of unreasonable risks to research participants and/or staff.	External to CWTL research team (to be identified)
Research management team	Oversee the research agenda in Uganda; Monitor the conduct and progress of the research and ensure that protocol is adhered to. Take appropriate action to safeguard the quality of the trial.	Principal investigators Investigators Research coordinators
Implementation	Ensure coordination between research and programme implementation.	Principal investigators Investigators Research coordinators CWTL programme manager CWTL programme coordinator

Adverse events and child safeguarding

Adverse events reported by participants or observed or suspected by members of the research or programme team, will be reported according to the CWTL-Uganda Adverse Events Reporting Procedure ((Annex J). Serious adverse events include:

- Physical, sexual, emotional abuse, neglect or exploitation of a research participant, programme team member or research team member.
- Any child safeguarding concern or case, including any form of abuse and excessive verbal or physical punishment.
- Participant disclosure of any of the 6 Grave violations of Children During Armed Conflict (Recruitment and use of children in armed groups, Killing and maiming of children, Sexual violence against children, Attacks against schools and hospitals, Denial of humanitarian access).
- Disclosure of current or recent intimate partner violence between adults.
- Suicidal ideation, plan or attempt of a research participant or member of the research of CWTL team.
- Death of a research participant.
- Injuries or accidents that occur on the route to research activities.

Adverse events will be reported to the Data Safety Management Committee (DSMC) using the *Incident Reporting Form* (Annex K). Immediate response, referral, and child safeguarding/child protection reporting process for each kind of adverse event will be determined based on the specific local context, prior to commencement of the study in collaboration with the local team. However, the principal investigators will be responsible for ensuring appropriate response to all adverse events.

The DSMC will regularly review all reports and follow-up of adverse events on a monthly basis and make decisions on further actions to be taken. Adverse events will be reported by the PI to the relevant ethical committees providing oversight, as per their reporting procedures. Any adverse events relating to child safeguarding and child protection (e.g. domestic violence, child sexual, physical or emotional abuse, or neglect) will be reported by the implementation team to local child safeguarding focal points for appropriate investigation if this has not already occurred. These are the WCH/partner organisation child safeguarding focal points in CWTL sites.

Given the educational nature of the CWTL programme, we do not expect serious adverse events to arise from the programme. Nonetheless, research assistants completing the assessments will have some experience with child protection and be rigorously trained in sensitive interviewing techniques, responding to distress, and protocols to follow in the unlikely event of significantly increased distress. Before being deployed, research assistants will be made aware of the potential stressful nature of the job and will receive information on self-care strategies.

All partners in CWTL have committed to adhering to War Child Holland's Child Safeguarding Policy (available upon request) which are based on international child safeguarding standards, developed by Keeping Children Safe. Staff will be required to adhere to the Child Safeguarding policy of their organization, which must in turn adhere to these standards and will follow associated reporting procedures and emergency response plans. Teachers and/or facilitators (in the case of community-based implementation) will be trained in child safeguarding and adverse events detection and reporting, as part of their training on implementation of Can't Wait to Learn. Any adverse events will be reported as outlined above.

Confidentiality and data privacy

Data collection will be conducted in a private space in or near the school so that participants' answers cannot be overheard or identified by the school principal. For instance, an empty classroom or under a tree. If data collection in conducted in community settings, a quiet, private space outside will be identified by the research team and respondents.

Participant confidentiality is protected at all times and WCH data collection, storage and analysis are all General Data Protection Regulations-compliant. In the case of a participant requiring specialist mental health care or protection services due to imminent risk of harm, research and programme staff are trained to take the appropriate steps to maximise participant confidentiality, whilst protecting participant safety and ensuring that adequate care is received. This is explained to participants during consent sessions.

See the section on Data management for detail on the measures taken to protect participants' data privacy.

Potential risks and mitigation strategies

Participants' concerns related to sharing personal data

Participants will be assured of the confidentiality of their data and also that they can withdraw from the study at any time with no negative implications for them. At the participant's request, their data will be destroyed. Responding to these concerns will be part of the research assistant training.

Health related risks

The Covid-19 pandemic continues to add an element of uncertainty to the nature of the implementation. The aim is to conduct the cRCT in schools, however, during school closures over the past year and a half, CWTL has been implemented in a community/home-based approach, thus ensuring the continuation of children's education. Preparations will be made for both scenarios, according to the restrictions in place. The teams are therefore continuously monitoring guidelines from the Ministry of Health and thus the guidelines from the Ministry of Education. Consequently, the most significant health related risk stems from the COVID-19 pandemic however, the teams are also monitoring authorities' guidelines of other health-related issues, particular after the 2018-2020 Ebola

outbreak in the Democratic Republic of Congo, which had a minor spill over into the South Western part of Uganda.

Political instability and security concerns

Close monitoring of Uganda's socio-political situation, and advice from WCH Uganda, will help to mitigate the impact of political instability on the CWTL programme and research. Partnerships with the humanitarian network and local entities ensure that WCH is warned and supported in case of security risks. Lastly, stakeholders and local communities are often concerned about the safety of the equipment that makes up the programme (tablets, solar panels, accessories). Community sensitisation is key to cementing the understanding that the equipment is for educational purposes only, in that the tablet is locked so that it can only be used for Can't Wait to Learn. This reduces the perceived value of the tablets and thereby the risk of theft.

Teachers' perceptions of CWTL

CWTL is meant to aid teachers by providing an opportunity for children to revise and learn at their own pace. While teachers are generally excited to implement the EdTech programme following the teacher training, teachers have sometimes become overwhelmed in the past when it comes to the implementation of the programme. Teachers are therefore supported by War Child staff and various channels for them to share their feedback are instated. This includes support sessions with staff during the activity observations as well as larger review meetings. Moreover, War Child is currently setting up a new Feedback, Complaints & Response Mechanism.

OUTPUTS AND DISSEMINATION

Outputs will include:

- *Academic journal articles*: The cRCT results will be published in a peer-reviewed, preferably open-access journal; publications and authorship arrangements will adhere to the WCH R&D publication policy.
- *Conferences*: Results will be presented in at least two international conferences, which will be selected based on relevance of the research findings.
- *Workshops*: Workshops will be held with key stakeholders at relevant timepoints over the course of the research study.
- *Value for Money report:* Results of the value for money analysis will be written up in a detailed report and either published as a standalone journal article or combined with the other value for money analyses conducted as a part of the KIX research programme.
- *Policy network analysis:* A case study on the EdTech policy landscape for Uganda will be written, including details on the opportunities and obstacles for the inclusion, endorsement and implementation of EdTech programmes in the country. This will contribute to a comparative analysis using data and findings from Chad and Sudan.

Dissemination of results:

- *Local community:* Community meetings will be held before and after the feasibility study and cRCT
- *Global education in emergencies community:* Research reports will be shared widely, and presentations given at key conferences, meetings, and sector working groups.
- *International development community:* Research reports will be shared widely, and presentations given at key conferences, meetings, and sector working groups.
- *Academic Community:* Results will be disseminated widely through the academic community through publication of peer-reviewed journal, and presentation of results at international conference(s).

WORKPLAN

See Annex L for the workplan.

BUDGET

See Annex M for the budget.

RISK MANAGEMENT PLAN

See Annex N for the risk management plan

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Number of weekly CWTL sessions: intended and actual

					Teacher strike 13th June - 6th July																				Endline data collection				
	Tablet shortage, 3:1 child:tablet ratio in 7 schools											EXAMS		School holidays												EXAMS		
	16-May	**23-May**	**30-May**	**06-Jun**	**13-Jun**	**20-Jun**	**27-Jun**	**04-Jul**	**11-Jul**	**18-Jul**	**25-Jul**	**01-Aug**	**08-Aug**	**15-Aug**	**22-Aug**	**29-Aug**	**05-Sep**	**12-Sep**	**19-Sep**	**26-Sep**	**03-Oct**	**10-Oct**	**17-Oct**	**24-Oct**	**31-Oct**	**07-Nov**	**14-Nov**	**21-Nov**	**28-Nov**	**05-Dec**
School 1	2	2	2	2				1	3	3	3						3	4	4	4	4	4	4	4	4	4	4			
School 2	2	2	2	2	2	2	2	2	3	3	3						3	4	4	4	4	4	4	4	4	4	4			
School 3	2	2	2	2	2	2	2	2	3	3	3						3	4	4	4	4	4	4	4	4	4	4			
School 4	2	2	2	2				1	3	3	3						3	4	4	4	4	4	4	4	4	4	4			
School 5	2	2	2	2				1	3	3	3						3	4	4	4	4	4	4	4	4	4	4			
School 6	2	2	2	2				1	3	3	3						3	4	4	4	4	4	4	4	4	4	4			
School 7	2	2	2	2				1	2	2	2						2	2	2	2	4	4	4	4	4	4	4			
School 8	3	3	3	3				1.5	3	3	3						3	4	4	4	4	4	4	4	4	4	4			
School 9	3	3	3	3				1.5	3	3	3						3	4	4	4	4	4	4	4	4	4	4			
School 10	3	3	3	3				1.5	3	3	3						3	4	4	4	4	4	4	4	4	4	4			
School 11	3	3	3	3				1.5	3	3	3						3	4	4	4	4	4	4	4	4	4	4			
School 12	3	3	3	3	3	3	3	3	3	3	3						3	4	4	4	4	4	4	4	4	4	4			
School 13	3	3	3	3				1.5	3	3	3						3	4	4	4	4	4	4	4	4	4	4			
School 14	3	3	3	3				1.5	3	3	3						3	4	4	4	4	4	4	4	4	4	4			
School 15	3	3	3	3				1.5	3	3	3						3	4	4	4	4	4	4	4	4	4	4			
INTENDED DOSAGE	3	3	3	3	3	3	3	3	3	3	3						3	3	3	3	3	3	3	3	3	3	3			

	INTENDED DOSAGE	ACTUAL DOSAGE	
		TOTAL SESSIONS	**% completed**
School 1	66	53	80%
School 2	66	60	91%
School 3	66	60	91%
School 4	66	53	80%
School 5	66	53	80%
School 6	66	53	80%
School 7	66	43	65%
School 8	66	57.5	87%
School 9	66	57.5	87%
School 10	66	57.5	87%
School 11	66	57.5	87%
School 12	66	68	103%
School 13	66	57.5	87%
School 14	66	57.5	87%
School 15	66	57.5	87%
		AVERAGE	85%