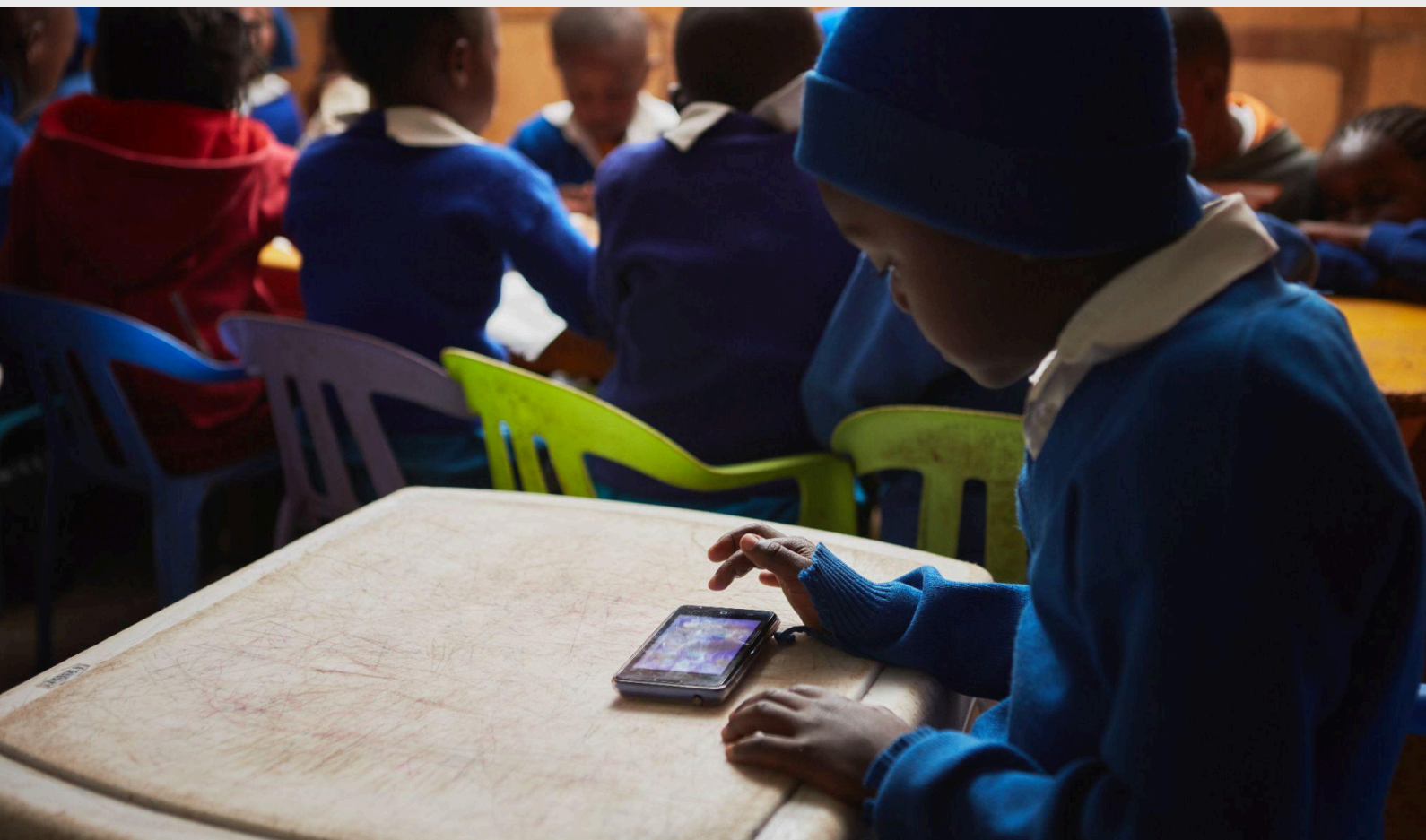# Optimising Session Duration on Digital Personalised Learning Tools for Early Grade Learners

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At a glance

Research question ❓

What is the optimal number of minutes for pre-primary learners on a classroom-integrated digital personalised learning tool to optimise learning outcomes?

The A/B/C test 🧑🏾‍🔬

94,813 pre-primary learners allocated to three experiment groups: 5, 7 and 9 minutes of access to the DPL tool per user session.

Key findings 🔍

Overall, shorter session durations on the DPL tool appear to lead to improved literacy and numeracy outcomes.

About the Evidence Briefs

EdTech Hub has been co-designing and testing software interventions to explore how DPL tools might be optimised to support learning and teaching in early grade classrooms. *Designing DPL Software for Classrooms* is a series of evidence briefs which share results from four A/B/n software tests conducted as part of this research partnership with EIDU — a provider of digital personalised learning technology (DPL) in Kenya. This is Evidence Brief #1.

Other briefs in this series

#2: *Testing Digital Timer Tools to Support Early Grade Lesson Delivery.* DOI: 10.53832/edtechhub.1047.

#3: *Investigating the Impact of Content Repetition on Digital Personalised Learning Tools for Early Grade Learners.* DOI: 10.53832/edtechhub.1048.

#4: *Designing Digital Notifications to Support Teacher Uptake of Data Dashboards.* DOI: 10.53832/edtechhub.1049.

Introduction

The Evidence Brief series reports on four A/B/n software tests, which explore how digital personalised learning (DPL) tools can be enhanced using data generated by digital assessments to optimise personalisation and inform teachers' lesson planning and instruction. These tests are part of the multi-strand EdTech Hub study 'Digital Personalised Learning to Improve Literacy and Numeracy Outcomes in Kenyan Classrooms'.[1] This is the first of four briefs in the series.

What question does this brief ask?

The following research question informed the design of the A/B/C test reported on in this brief:

> **?**   **What is the optimal number of minutes for pre-primary learners on a classroom-integrated digital personalised learning tool to optimise learning outcomes?**

What do we know about the impact of session duration on learning outcomes?

Research about session duration tends to focus on the impact on children's physiological and psychological well-being.

- The ⬆World Health Organization (2019) has established that there is very low-quality evidence about the relationship between sedentary screen time and motor and cognitive development. However, the WHO nonetheless recommends that children aged 3–4 years spend no more than 1 hour per day on screens.

- A systematic scoping review by ⬆Oswald et al. (2020) found that high levels of screen time appear to be associated with unfavourable psychological outcomes, and suggest that future research should distinguish between passive and interactive screen activities.

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[1] To find out more about the study, see https://edtechhub.org/evidence/edtech-hub-research-portfolio/improve-numeracy -outcomes-in-kenyan-classrooms/. Retrieved 16 December 2024.

- ↑Domingues-Montanari (2017) discusses the positive and negative effects of screen time on the physiological and psychological development of children, noting that screen time has been negatively associated with the development of physical and cognitive abilities.

Meta-analyses of studies which assess the impact of digital learning tools on learning outcomes tend to focus on intensity of use (i.e., the amount of time learners spend on a tool per week), with varied results:

- A meta-analysis by ↑Cheung & Slavin (2013) of mathematics applications used in K–12 classrooms in the United States found that more than 30 minutes per week had a larger effect size than less than 30 minutes per week, although this may be affected by low implementation (i.e., usage guidelines not being followed).

- A meta-analysis of digital personalised learning tools in low- and middle-income countries by ↑Major et al. (2021) revealed no statistical difference between studies categorised based on the intensity and duration of the intervention.

SEARCHING FOR EVIDENCE 🔍

In our literature review, we used different combinations of key search terms, including "education technology", "digital learning", "session duration", "usage time", "screen time", and "time on task". This brief provides an overview of some of the most relevant returns rather than a comprehensive literature review.

What is digital personalised learning?

Personalisation is a common feature of everyday school practice, as teachers and learners continuously adjust to each other's shifting needs, aims, and preferences (↑Beetham, 2010; ↑Holmes et al., 2018). Advancements in technology have led to an expansion of tools which aim to support different aspects of a personalised learning approach (↑UNICEF, 2022). Following ↑Van Schoors et al. (2021), we define *digital personalised learning* (DPL) as tools which feature a digital learning environment that adapts to the individual learner, aiming to optimise individual and/or collaborative learning processes to enhance cognitive, affective, motivational, metacognitive, or efficiency outcomes.

EIDU[2] is a provider of a DPL tool in Kenya. The EIDU tool comprises an application with both a teacher-facing and learner-facing interface for early grade teaching and learning. This application is pre-installed on a low-cost Android device, with one to two devices distributed per classroom and used during the school day. Learners access digital content for numeracy and literacy and assessment exercises (aligned with the Kenyan curriculum) via individual user profiles, with the software personalising content sequencing for each user. The tool also offers teachers access to digitised lesson plans and a dashboard indicating learners' weekly usage time and digital curriculum progress.

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[2] See https://eidu.com/. Retrieved 16 December 2024.

A/B/n test design

This study has employed A/B/n testing — a controlled experimental approach randomly assigning participants to different software versions to assess each design's comparative effectiveness (↑Friedberg, 2023). This section provides an overview of the methods employed for the A/B/C test, which focused on optimising session duration.

WHY A/B/n TESTS? 🧑🏿‍🔬

The A/B/n testing method is particularly useful for evaluations of different software versions: the randomised approach can both minimise bias to ensure comparability and avoid direct interruptions to regular teaching activities (↑Savi et al., 2018). It also enables an at-scale approach to education technology research, whereby software design is optimised through continuous iterations and refinements involving a large dataset (↑Friedberg, 2023).

Sample

The test involved 94,813 pre-primary learners: 41,425 from pre-primary 1 (PP1, aged 4–5), 46,968 from pre-primary 2 (PP2, aged 5–6), and 6,420 from mixed-grade classes (combining PP1 and PP2). These learners are from 2,061 schools across Mombasa County, Kenya.

A/B/C groups

Three groups were involved in the experiment. The default duration of a single-user session (i.e., the length of time each learner was given access to the digital learning content before their learner profiles were timed out) was 5 minutes. The other two groups had session durations of 7 minutes and 9 minutes. Classes were randomly assigned to either of the three groups, with a final distribution of 32,508 learners in the 5-minute group, 31,612 in the 7-minute group, and 30,693 in the 9-minute group.

Duration

In January 2023, a Beta test was held with a small sample of 30 schools with teachers who had been trained in providing feedback to EIDU on software changes. Following analysis of user feedback, the software

experiment was released to the full sample for 12 weeks from 22 January to 20 April 2023 — during the first term in the Kenyan academic year.

Data collected

Learning outcomes were measured as the scores recorded by the EIDU tool each time learners interacted with the digital learning units, calculated as the percentage of correct answers within each unit. Learners' literacy and numeracy scores were calculated as the average of all relevant learning unit scores recorded during the 12-week experiment. We note that not all learners would have completed the same number and selection of units.

Analysis

Analysis of Variance (ANOVA) was conducted to investigate differences in learner scores between the three experimental groups. Post hoc Tukey tests were used to investigate pairwise group comparisons. The analysis was conducted based on different grade levels: PP1, PP2, and mixed-grade classes.

Ethical considerations

Consent was obtained from teachers for anonymous learning data to be collected by the EIDU tool, for A/B/n testing on the tool, and for the data to be shared with third-party research groups to improve the software and the learning experience. Teachers gave consent by signing a data usage policy, both on their own behalf and as gatekeepers for the students in their classrooms. The research was also approved by national and institutional ethical approval bodies.

Key findings

The impact of session duration on learning outcomes

The A/B/C test revealed different levels of session duration impact on literacy and numeracy outcomes, with the findings for numeracy dependent on grade level.

Literacy scores

Results indicate that the longer session duration (9 minutes) was the least effective in optimising literacy outcomes for all pre-primary learners:

- Learners in the 5- and 7-minute groups significantly outperformed those in the 9-minute group in both PP1 and PP2.

- In mixed-grade classes, literacy outcomes were significantly higher in the 7-minute group than in the 5- and 9-minute groups.

Table 1. *Mean literacy scores and pairwise group comparisons of three A/B/C test groups by grade*

Literacy scores		PP1	PP2	Mixed grade classes
Mean literacy scores (M)	**5 minutes**	0.776 (0.17 SD)	0.793 (0.14 SD)	0.826 (0.15 SD)
	7 minutes	0.780 (0.17 SD)	0.792 (0.15 SD)	0.837 (0.15 SD)
	9 minutes	0.770 (0.17 SD)	0.784 (0.15 SD)	0.819 (0.15 SD)
Pairwise group comparisons of mean literacy scores (p)	**5 vs 7 minutes**	0.162	0.911	0.047 *
	5 vs 9 minutes	0.009 **	0.009 **	0.398
	7 vs 9 minutes	< 0.001 ***	0.008 **	0.001 ***
N.B. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.				

Numeracy scores

Results indicate that different session durations have varied effectiveness on numeracy outcomes depending on pre-primary grade level, with shorter session durations benefiting younger learners.

- PP1 learners in the 5-minute group significantly outperformed those in the 7-minute and 9-minute groups.

- PP2 learners in the 7-minute group significantly outperformed those in both other groups, while those in the 9-minute group outperformed those in the 5-minute group.

- In mixed-grade classes, learners in the 5- and 7-minute groups significantly outperformed those in the 9-minute group.

Table 2. *Mean numeracy scores and pairwise group comparisons of three A/B/C test groups by grade*

Numeracy scores		PP1	PP2	Mixed grades
Mean numeracy scores (M)	**5 minutes**	0.850 (0.1 SD)	0.816 (0.11 SD)	0.855 (0.11 SD)
	7 minutes	0.846 (0.1 SD)	0.829 (0.1 SD)	0.859 (0.1 SD)
	9 minutes	0.839 (0.11 SD)	0.821 (0.11 SD)	0.844 (0.11 SD)
Pairwise group comparisons of mean numeracy scores (p)	**5 vs 7 minutes**	0.002 **	< 0.001 ***	0.532
	5 vs 9 minutes	< 0.001 ***	< 0.001 ***	0.004 **
	7 vs 9 minutes	< 0.001 ***	< 0.001 ***	< 0.001 ***
N.B. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.				

What next?

Evidence should inform decision-making. This section outlines:

1. How this A/B/C test led to changes in the implementation of EIDU's DPL tool.

2. Recommendations for other DPL providers and/or researchers.

Iterating the EIDU tool

Prior to the A/B/C test, 5 minutes had been the default session duration on the EIDU DPL tool. The results were taken by EIDU to validate this as an effective length. Therefore, after the conclusion of the test, all learner profiles were reset to the default session length of 5 minutes.

Recommendations for other DPL providers and researchers

Interpreting these results for other contexts

We recommend considering the following points:

→ While results suggest that shorter session duration may benefit younger learners' learning outcomes, this may be due to factors such as the type of content, personalisation software, and classroom context. For this reason, similar tests should be considered to assess the applicability of these findings in other programmatic contexts.

→ This study focuses on the impact of different session durations on a DPL tool on learning outcomes. Decisions about designing and implementing DPL tools for pre-primary learners should also take into account other measures, such as the impact of screen time duration on physiological and psychological well-being.

Conducting future research

The evidence base on this topic could be further strengthened by investigating the following areas:

→ Whether adjusting session duration by grade has a positive impact on learning outcomes, considering the provisional indications of differences between PP1 and PP2 in this test.

→ The relationship between session duration (i.e., the length of a single interaction with a DPL tool) and intensity (i.e., the amount of time spent on a DPL tool per week) in terms of learning outcomes.

→ The impact of session duration both on foundational learning and other key outcomes, including learners' physiological and psychological well-being.

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Acknowledgement

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