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EIDU

Designing Digital Notifications to Support Teacher Uptake of Data Dashboards

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At a glance

Research question ❓

To what extent does the provision of notifications to pre-primary teachers to view data dashboards on a classroom-integrated digital personalised learning tool impact on:

- learner device usage?
- learning outcomes?

The A/B/C test 

4,487 schools allocated into three experiment groups: 'no notification', 'daily notification', and 'weekly notification'.

Key findings 🔍

No impact was observed on device usage and negligible impact on learning outcomes. This suggests that accompanying data dashboards with notifications did not influence pedagogical practice in a way which impacted on learning.

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 #4.

Other briefs in this series

#1: *Optimising Session Duration on Digital Personalised Learning Tools for Early Grade Learners*. DOI: 10.53832/edtechhub.1046.

#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.

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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 fourth 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:

To what extent does the provision of notifications to pre-primary teachers to view data dashboards on a classroom-integrated digital personalised learning tool impact on:

- **learner device usage?**
- **learning outcomes?**

What do we know about providing notifications to prompt teacher engagement with data dashboards?

While there is a lack of evidence about how best to prompt teachers to engage with data dashboards, research does indicate that engagement with data dashboards can positively impact teaching and learning:

- ↑Hase & Kuhl's (2024) systematic review identified evidence that teachers implement actions to differentiate and individualise teaching in response to viewing learning data.
- ↑Knoop-van Campen et al.'s (2023) study in primary education provides indications that dashboards can reduce teachers' bias in

[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.

providing different types of feedback to students with different abilities.

- ↑Van Schoors et al.'s (2023) study with primary and secondary education teachers revealed positive perceptions towards dashboards, with teachers viewing all features to be important.
- ↑Molenaar et al.'s (2017) study highlights that dashboards influence teachers' pedagogical actions, but there was great variation among teachers regarding consulting dashboards during lessons.

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 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 numeracy and literacy digital content 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.

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 testing digital notifications to support teacher uptake of data dashboards.

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 4,487 pre-primary schools across 10 counties in Kenya, comprising 12,223 pre-primary 1 (PP1), pre-primary 2 (PP2), and mixed-grade classes.

While the full sample was allocated to the three experiment groups and analysed for impact on learner device usage, only a subset of the sample was analysed to assess the impact on learning outcomes. This is because the digitised summative assessment tests are not delivered to PP1 learners. This subset of the sample, therefore, comprised 67,025 PP2 and mixed-grade learners from 4,120 schools.

A/B/C groups

There were three groups in the experiment: 'no notification', 'daily notification', and 'weekly notification'. Teachers in the control group did not receive any notifications on the DPL tool. The two experimental groups received a notification, operationalised as a red dot which appeared next to the 'progress' icon on the home screen, indicating that new messages were waiting for review. This notification encouraged teachers to view the dashboard, which presented them with a ranking of learners' usage hours

on the DPL tool for the current and previous week and via which teachers could select to view individual learner profiles. The only difference between the two experiment groups was that one received the notification daily and the other weekly. Schools were randomly assigned to either of the three groups, with a final distribution of 1,458 schools in the control group (i.e., no notification—140,785 learners), 1,539 schools in the daily notification group (150,352 learners), and 1,490 schools in the weekly notification group (141,888 learners).

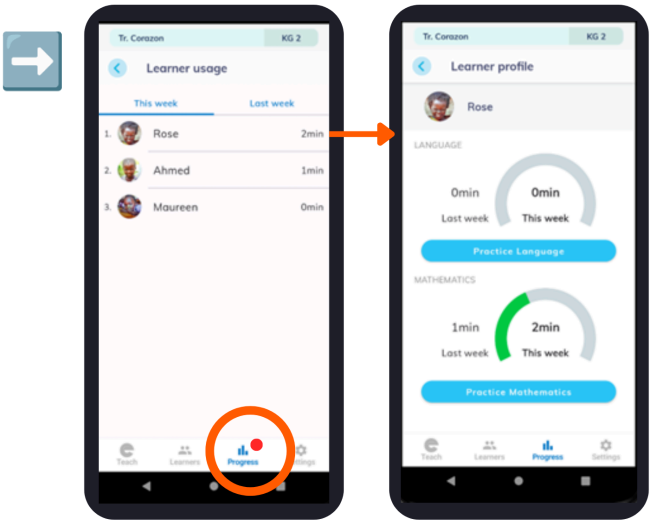

Figure 1. *Image showing visualisation of the notification, prompting teachers in the experimental groups to view the 'learner usage' dashboard (and embedded 'learner profile' dashboards).*

Image credit: EIDU & EdTech Hub

Duration

A Beta test took place in October 2023 among 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 10 weeks from 24 January to 5 April 2024—during the first term in the Kenyan academic year.

Data collected

The EIDU tool recorded learners' usage of the device per session, calculated as the length of time during which an individual learner was interacting with the tool before it switched to a different learner profile. Average learner device usage was calculated at the school level as the average session length of all sessions recorded per school during the 10-week experiment.

Learning outcomes of PP2 learners were also measured through summative assessment tests deployed on the EIDU tool, comprising six digitised literacy and numeracy test items from the Early Grade Reading Assessment (EGRA),[2] Early Grade Mathematics Assessment (EGMA),[3] and Measuring Early Learning Quality and Outcomes (MELQO)[4] tools. Percentage correctness of exercises within each test item is used as the summative assessment score. Learners' final test scores during the 10-week experiment were used to indicate learning outcomes.

Analysis

Mixed-effects models were run to analyse the differences in usage data between the experimental groups by predicting monthly usage. Additionally, non-parametric tests (Kruskal-Wallis) were conducted for each test unit to compare differences in summative assessment scores between the groups, since assumptions for conducting regression analysis were violated.

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.

[2] See https://shared.rti.org/content/early-grade-reading-assessment-egra-toolkit-second-edition Retrieved 18 December 2024.

[3] See https://shared.rti.org/content/early-grade-mathematics-assessment-egma-toolkit. Retrieved 18 December 2024.

[4] See https://unesdoc.unesco.org/ark:/48223/pf0000248053. Retrieved 18 December 2024.

Key findings

The impact of notifications on learner device usage

Results indicate that providing notifications to teachers did not impact pedagogical practice in a way that influenced learners' device usage:

- There was no significant difference between the control and experimental groups in terms of the time spent by learners on the DPL tool.
- Neither was there a significant difference between the daily and weekly notification groups.

Table 1. *Mean total device usage (in hours) and mixed-effects model results of the three A/B/C test groups*

Learner device usage		
Mean learner device usage (hours)	**No notification**	78.56 (49.74 SD)
	Daily notification	78.10 (49.12 SD)
	Weekly notification	77.93 (47.99 SD)
Mixed-effects model (the second partition being the reference group)	**No vs daily notification**	β = 0.501, p = 0.755
	No vs weekly notification	β = -0.118, p = 0.941
	Weekly vs daily notification	β = 0.118, p = 0.941

The impact of notifications on learning outcomes

Results found that learning outcomes only differed between the three groups in the 'Word sounds short' assessment unit. However, these findings were inconsistent with the hypothesis that providing teachers with notifications to view the usage dashboard influences pedagogical practice, thereby enhancing learning outcomes, since neither notification group performed better than the control:

- Learners in the 'no notifications' group significantly outperformed those in the 'weekly notification' group (p = 0.005).

- There was no statistically significant difference between the 'no notification' and 'daily notification' groups ($p > 0.1$).
- Learners in the 'weekly notification' group significantly outperformed those in the 'daily notification' group ($p = 0.008$).

Table 2. *Mean summative assessment scores and Kruskal-Wallis test results for the three A/B/C test groups per assessment unit*

Learning outcomes		No notification	Daily notification	Weekly notification
Mean summative assessment scores (M)	**Initial sound identification**	0.356 (0.297 SD)	0.355 (0.295 SD)	0.352 (0.295 SD)
	Letter sounds short	0.183 (0.146 SD)	0.184 (0.144 SD)	0.183 (0.143 SD)
	Number discrimination	0.507 (0.241 SD)	0.505 (0.241 SD)	0.502 (0.240 SD)
	Number identification	0.131 (0.220 SD)	0.128 (0.218 SD)	0.130 (0.219 SD)
	Word sounds short	0.227 (0.189 SD)	0.225 (0.185 SD)	0.219 (0.180 SD)
	Word sounds Swahili	0.180 (0.166 SD)	0.179 (0.166 SD)	0.175 (0.157 SD)
Kruskal-Wallis test	**Initial sound identification**	H = 1.62 $p = 0.445$		
	Letter sounds short	H = 1.60 $p = 0.450$		
	Number discrimination	H = 3.57 $p = 0.168$		
	Number identification	H = 3.39 $p = 0.184$		
	Word sounds short	H = 12.44 $p = 0.002$**		
	Word sounds Swahili	H = 2.67 $p = 0.264$		

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

Given the lack of impact, EIDU did not implement the feature after the test.

Recommendations for other DPL providers and researchers

Interpreting these results for other contexts

We recommend considering the following points:

- ➔ Prior research indicates that data dashboards can be important tools for informing teachers' pedagogical practice. However, the lack of observed impact of the notification prompt in this test indicates that further work is needed to find effective ways to enhance teachers' engagement with data dashboards.

Conducting future research

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

- ➔ How teachers consult data dashboards as part of regular classroom practice, and whether different digital design features can support this process.
- ➔ How teachers interpret data dashboards and how this informs their pedagogical practices and classroom behaviours.

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