LEARNING BRIEF

#02

How Can Implementers Apply Digital Personalised Learning in Schools?

EdTech Hub

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Contents

Why this question matters

The current debate about digital personalised learning (DPL) is vibrant, ranging from its definition to its potential impact in improving learning outcomes. A recent review of trends in DPL by UNICEF provides insight into the issue of definition, presenting the basic features of DPL tools as including:

- The ability to capture learner traits (i.e., their abilities or understanding of a particular topic or subject)
- Logic to connect the learner through these traits to relevant content
- A user interface that enables learner interaction with that content.[1]

EdTech Hub's own work on the topic led us to define DPL as "the use of technology to facilitate learning which is tailored to individual learner characteristics, interests, and needs through responsive and/or adaptive mechanisms."[2]

There is recent promising evidence of the impact that DPL can have on learning. In many instances, DPL tools have been shown to enable a moderate positive impact on the learning of maths, science, and literacy.[3] DPL tools, which were evaluated as a part of the Global XPrize, also showed a similar impact on learning outcomes.[4]

While the potential of DPL tools to improve learning outcomes is promising, the question of how they might be implemented at scale within schools remains. This is particularly important from the perspectives of practicality, cost-effectiveness, and affordability among low- and middle-income country (LMIC) contexts in particular. While it is clear that well-designed and effectively implemented DPL software can lead to improvement in certain learning outcomes, this is likely to only be effective at scale where adequate infrastructure, teacher preparation, and availability of hardware are made available.[5]

So what should implementers consider when deciding whether or not to introduce DPL tools in schools? What have we learnt from existing implementation models about the most effective ways to do this? What are the remaining evidence gaps that should be further examined by researchers and practitioners? This brief responds to each of these questions.

First, let's look at four essential points regarding DPL implementation:

1. 'Teaching at the right level', through personalisation is an important aspect of DPL success

The ability of DPL tools to support 'teaching at the right level' (TARL), enabling learners to learn according to their current proficiency, has been highlighted as one of the most promising aspects of DPL, and one of the likely reasons for its success.[6] There is evidence to suggest that the more 'personalised' or 'adaptive' a tool is, i.e., the more it can adapt its content to a learner's level and the greater the impact will be in improving learning outcomes.[7]

2. DPL tools have mostly been implemented as a supplement to classroom instruction, though efforts of alignment with curricula are also common

DPL tools can be used to supplement teacher-led instruction, allowing learners to engage in education content separately from classroom teaching.[8] For example, in Kenya, EdTech Hub studied the implementation of the **Oppia DPL tool**,[9] in which Grade 5 learners engaged with the software through mobile phones in an after-school programme. Supplementary use of DPL tools is the most common mode of application, alongside efforts to align with the curriculum.[10]

DPL tools can be applied in ways that are more integrated, or closely aligned with the curriculum and lesson plans, with the

teacher playing an active role in this alignment. In this approach, the intention is that the teacher and technology complement one another in enabling the same curriculum to be taught, with the teacher facilitating and reinforcing the learning process through DPL tools. In some instances, integrated approaches may also allow the teacher to use feedback data from the tool to adjust classroom instruction. The extent to which DPL tools can align with curricula varies, with many simply mapping pre-designed content to curriculum standards. Nevertheless, attempts to map software content to curriculum standards and classroom lessons are deemed to result in more meaningful personalisation.[11]

3. Hardware and connectivity requirements for DPL interventions can vary, but most tools require at least a smartphone and some online connectivity

DPL tools can vary significantly in the technology components they require. Most tools can be installed and used across device types (for instance, both on desktop and mobile devices) but only a small minority can be used on feature phones.[12] EdTech Hub's own **DPL research portfolio**[13] reflects the diversity of DPL tools: currently, DPL research in Kenya includes a desktop and mobile tool (Oppia), a smartphone tool (EIDU), and an SMS-based feature phone tool (M-Shule). Some DPL tools offer offline functionality, with products like M-Shule, CG Slate, and Read Along allowing specific features to be used offline, and the entire **onecourse app**[14] developed by the non-profit onebillion being designed specifically for offline use. But these constitute less than half of the DPL tools we know about. The lack of offline functionality is a major challenge to implementation in LMICs where 53% of the population does not have internet access.[15]

4. DPL has shown promise in closing learning gaps by supporting marginalised learners, but it is not yet a solution that can reach all learners equally

There are examples of DPL tools producing promising results among lower-attaining learners.[16, 17] Some impact has also been captured among other marginalised learner groups, including:

- Improving literacy and numeracy outcomes for out-of-school learners[18]
- Narrowing learning gaps between rural and urban learners[19]
- Mitigating expected gender differences in early learning outcomes[20]
- Promoting numeracy learning outcomes for children with mild to moderate learning challenges from special educational needs and disabilities (SEND).[21, 22]

However, many learners remain underserved by this technology, including ethnic minorities and children with SEND whose diverse needs are not adequately met by these tools.[23]

The four points outlined above highlight both the promise and the challenge of DPL use in LMIC settings. They emphasise the importance of effective, context-specific implementation of these tools within education settings in order to realise the potential benefits.

Key insights to improve practice

Beyond the typologies and background knowledge about DPL implementation described above, there are emerging insights about how these tools might be most effectively applied in school settings, with a focus both on effectiveness and scalability.

Teachers should play a role as facilitators and users of DPL, ideally co-designing their role and professional development

The role of teachers as crucial facilitators of DPL has been widely noted in evidence reviews.[24, 25] Many teachers have positive perceptions of DPL tools, although these impressions do not always translate to consistent or effective use of these tools.[26] Most DPL tools are intended for use within institutional settings and include a role for teachers that ranges from facilitators and/or monitors of DPL engagement to hands-on instructors.[27] Furthermore, teachers are often targeted users of DPL tools: most DPL tools offer a teacher portal to enable teacher access and use. Many DPL tools also support teachers in monitoring learner performance and in some cases can help facilitate instruction.[28]

The specific role of teachers in facilitating DPL use in school settings can vary depending on the kind of intervention and the extent to which it is integrated into classroom instruction. However, across implementation contexts, evidence demonstrates that teachers should be adequately equipped to play their respective roles through professional development focused on how to use the DPL effectively. This is particularly true in cases where DPL requires teachers to gain new digital skills and/or depart from their usual teaching practice.[29]

One way to ensure teachers' roles are contextualised, and their professional development is implemented coherently, is to co-create DPL tools with teachers themselves.[30] Participatory approaches to implementation design (which includes the co-creation of teachers' roles) have been adopted by a number of DPL implementers to ensure their effectiveness in school settings.

In the Dominican Republic, EdTech Hub partnered with the World Bank to conduct qualitative research on the World Bank's implementation of the **ALEKS**[31] tool (a DPL tool used on laptops and smartphones to provide Grade 9 curriculum learning and practice for learners). In this context, the role of teachers was to monitor progress, motivate students, and provide additional explanation and support. Local education leaders, ranging from school principals to pedagogical coordinators and teachers, played key roles in contextualising the tool's approach in their respective school settings.[32] The most relevant takeaways from this research are:

- The importance of co-designing school-based DPL programmes with school personnel, making sure these crucial stakeholders are involved from the beginning.
- Ensuring the implementation model reflects the realities of the school environment.
- Ensuring programme goals are relevant, and an adequate support infrastructure is in place to aid implementation.[33]

In Kenya, EdTech Hub partnered with the educational platform **EIDU**[34] to understand the impact of smartphones containing both digitalised structured pedagogy (in the form of the **Tayari**[35] programme) and digital personalised learning (onebillion's onecourse) in pre-primary classrooms. In this

instance, the teacher has a central role in facilitating the use of the tool, including:

- Allowing for a dedicated space within their class.
- Time for learners to engage individually with the EIDU device.
- Monitoring the transition of that device from learner to learner.

Furthermore, the tool's combination of structured pedagogy and DPL features creates an implementation model that is more deeply integrated into classroom instruction. The DPL tool content aligns with the lesson plans, and teachers have the opportunity to choose strands of learning on the DPL tool which relate to what they have been teaching that day.[36]

As a part of the study design, EdTech Hub conducted design-based research to explore the integration of this DPL tool into classroom practices, and also to collaborate with teachers, headteachers, early childhood district education officers, and implementing partners. The research methodology included:

- Holding a series of iterative implementation workshops.
- A co-learning lesson study approach (a professional development method including planning, implementation, analysis, and reflection).
- Co-creation of user journey maps for teachers implementing EIDU.
- A sandbox phase to co-create tools and methods to support teachers to ensure learners have equal access to EIDU devices.[37]

Emerging findings from this evaluation suggest the tool is being implemented effectively and producing positive learning outcome shifts.[38] The importance of co-creation demonstrated in the two examples mentioned above (including co-designing the implementation model, teachers' roles in it, and their support structure) in creating adequate buy-in and effective implementation of DPL in school settings has been echoed elsewhere.[39, 40, 41, 42]

Teachers are much more likely to effectively use DPL tools if given a meaningful role in deciding how they are introduced to their classrooms.

A 1:1 ratio between a device and a learner should not be assumed to be the most cost-effective approach

It is clear that part of the effectiveness of DPL is linked to the value generated from a learner having individual engagement with the tool in question. However, ensuring enough devices are available to enable a 'one-per-child' model is an expensive proposition and unaffordable in many contexts. Further, recent models show there may be nuances to the assumption about needing a 1:1 ratio between devices and learners. Implementers are finding creative ways to maximise the variety of ways devices are used, and exploring ways of improving learning outcomes by leveraging peer learning.

EIDU's implementation in pre-primary schools in Kenya demonstrates that learning outcomes can be improved even in classrooms with only one or two devices by creating an implementation model which rotates the devices among users.[43] The approach involves creating a dedicated 'EIDU corner' within a classroom and designing the software to prompt learners to pass on the device to their peers once their session is over. Of course, this retains a 1:1 ratio in DPL engagement by learners but showcases how implementers can creatively make the most of working with fewer devices. In addition to evaluating the impact of this model, EdTech Hub and EIDU teams have conducted a sandbox to gauge whether the model effectively facilitates equal access to the device within a classroom.[44]

EdTech Hub's randomised controlled trial with the Oppia tool in Kenya goes further, demonstrating that the 1:1 ratio during DPL engagement may not be required. The research tested the potential of peer learning to impact DPL use, comparing learning outcomes from traditional individual DPL tool engagement against two distinct paired learning approaches: learners sitting in pairs with their own devices, and sitting in pairs

sharing a device. It found the peer learning component to be the strongest mediator of learning, leading to significantly improved outcomes in both 'paired' approaches and hypothesising that student activity may have increased on devices when working collaboratively.[45]

Forthcoming research by Pitchford and Lurvink[46] has also explored implementation of onecourse with implementing partner VSO using a similar 'tablet sharing' modality. The intervention has produced learning gains in both numeracy and literacy compared to children receiving standard whole-class instruction. The same study saw a smaller (but positive) effect size for a 'projector modality' in which specific content from onecourse was selected by teachers to be shared with the whole class via a solar-powered projector. This was particularly important for listening comprehension, an important aspect of literacy skill development. Another forthcoming study on this projector approach based on implementation in Malawi has led to more mixed results.[47]

The exact benefits of 1:2 or 1:many approaches to DPL use are still being investigated. Meanwhile, when considering how to maximise the effectiveness of DPL applications in school settings, implementers and researchers alike should consider the potential of modalities requiring lower-tech investment, and therefore more affordable cost-per-child approaches, to produce improved learning outcomes.[48]

Work with national and local education leaders to define how DPL tools will fit into the school schedule, space, and curriculum

DPL tools require adequate infrastructure, space, and time for incorporation into education systems, and these are scarce in LMICs.[49] The work of EdTech Hub has demonstrated that defining these aspects of the implementation model of DPL tools is crucial, and that designing them in partnership with local and national education leaders is paramount.

This high level of coordination was evident in the Dominican Republic, where local school leaders had to be intimately involved in implementation, including making significant management decisions in order to implement the ALEKS tool successfully. School principals played a key role in coordinating resources and human capital, pedagogical coordinators conducted monitoring of teachers' facilitation of the tool's use.[50] In Kenya, EdTech Hub and EIDU's design-based research helped us to better understand the 'co-create the implementation' approach with core decision-makers. We developed a clearer understanding of the users' journeys through the EIDU intervention, and based on this, have proposed recommendations for the implementation model and software design — to be implemented before the model scales.[51]

A helpful example of this coordination is the current roll-out of onecourse to all primary schools in Malawi through the **BEFIT**[52] programme. This programme builds the **Unlocking Talent (UT)**[53] programme, which provides a dedicated space in schools (learning centres). Learners step out of standard classes to rotate through this space at different times of the day to engage with the DPL tool on tablets. The UT model has been evaluated and indicated improvements in learning outcomes.[54, 55, 56] However, the infrastructure investment required was costly, including additional classrooms built to serve as 'learning centres' as well as the need to install solar panels and charging stations for tablets, which were not affordable for a realistic national-level scale-up.

Seeking to address this challenge, onebillion worked with EdTech Hub on a sandbox to get teachers' perspectives on new implementation model ideas that were less cost-intensive and consider the cost-effectiveness and logistics of these different approaches. Again, we found that co-creating a dissemination model with teachers and local stakeholders was instructive: removing the potential for an at-home DPL model or a classroom-integrated model, and instead focusing on making the UT model leaner and more efficient.[57]

From here, onebillion and their implementation partners Imagine Worldwide and VSO, worked directly with the Malawi government through the Directorate of Open Distance and E-Learning to develop a model which would effectively and sustainably fit into the education system at scale. In doing so, they arrived at a model that uses classrooms as the 'learning centres' with a set of school tablets being rotated around the school. A separate (smaller) space within schools can be used to store and charge tablets, and solar-powered electricity could be installed here. Additionally, the implementation team worked with ministry leaders to embed time for DPL use in the school timetable and provide technology training at every level of the school system. This partnership goes beyond the set-up of the intervention. While the plan is to scale the programme to all primary schools in the country, with support from implementing partners, it is being led by the Ministry of Education through the Programme Implementation and Management Unit. The government plans to sustain it financially once the first phase of philanthropic support has been finalised.[58]

Effective large-scale use of DPL tools within education settings cannot happen without extensive coordination and buy-in from relevant decision-makers. As much as possible, implementers of DPL should look to engage with education system decision-makers early, meaningfully, and often.

Areas for further exploration

How can DPL tools support and improve teacher instruction?

The application of DPL tools within a classroom setting to support and improve classroom teaching is still an underexplored question. As we have noted, the role of the teacher is vital, but research on how these tools could support teachers most effectively is sparse.

For instance, DPL tools could potentially facilitate assessment-informed instruction by creating actionable feedback for teachers on students' learning levels.[59] Some programmes have started to implement teacher-facing data dashboards within DPL tools. One example of this is Mindspark's DPL software in India. Mindspark has explored leveraging the algorithms for analysing student performance to provide more relevant and timely feedback to teachers.[60] Chimple (another DPL tool and X-Prize finalist), has a teacher-facing app providing a view into student learning which helps teachers make connections between DPL assessment data and classroom instruction.[61] Currently, EdTech Hub's work with EIDU in Kenya is also exploring how to provide teachers with usage and progress data from the tool to allow them to make informed decisions in the classroom.[62] Effective use of DPL tools to collect learning data or conduct formative assessments with little additional effort from teachers could add significant value by allowing these educators to focus more of their time on providing learners with targeted instructional support.

Some research has explored other ways that DPL tools could make classroom instruction more effective and efficient, freeing up teachers to focus on aspects of education where they have a comparative advantage over technology.[63] For instance, research by Lurvink and Pitchford[64] included an implementation modality they called the 'Split Class Model', which allowed the teacher to work with half the class while the other half engaged in DPL learning on tablets. Models like these could in theory allow a teacher to provide more individual support to learners, potentially making large classroom sizes more manageable. Emerging evidence suggests that DPL tools may also be able to help teachers improve their understanding of key concepts, or expand their ability to explain these to learners.[65] Tools like **Oppia**[66] include a lesson creation dashboard for teachers to create and share lessons with a broader community.

As DPL tools become more integrated into school settings, their role as tools for teachers in overcoming capacity and instructional challenges should be investigated thoroughly.

What DPL tool to choose? How should cost implications and sustainability at scale inform this choice?

A number of DPL tools have shown they can have a positive impact on learning outcomes. However, deciding which tools are most appropriate for a particular education setting is not simple. Tools can vary in features, tech specs, adaptability, and reach, all of which should be considered when selecting a tool for an education system. As a part of its analysis of DPL trends in LMICs,[67] UNICEF applied a product rubric considering product attributes related to:

1. Design (including content, pedagogy, and tech specs)
2. Use (implementation and evaluation)
3. Inclusivity (ability to reach students equitably and sustainably)

Thorough consideration of this kind of the key affordances of DPL tools can provide implementers with guidance in seeking appropriate tools.

Implementers should ensure they consider whether tools can adapt to the existing school curriculum: many of the successfully implemented tools cited in this brief have previously been translated into the appropriate language of instruction, adapted to fit national curricula, and reviewed by local education experts.

Sustainability of a tool's application should also be considered, including a better understanding of infrastructural requirements and related cost implications. The seminal Global Education Evidence Advisory Panel 'Smart Buys' report[68] notes that a key caveat to the promise of DPL is the need for significant tech infrastructure and the associated costs. Most education systems in LMICs lack the pre-existing devices, and adequate infrastructure (electricity, internet, servers, and chargers) to make at-scale use of DPL tools a consistent reality. It is also important to account for ongoing costs—economic and environmental—associated with DPL, such as maintaining, updating, and replacing devices.[69] Finally, implementers should consider the use and cost of DPL tools relative to other interventions and programmes targeting similar outcomes. It may be possible to increase cost-effectiveness by leveraging technology across programmes.

These are substantial barriers to the use of DPL, particularly in the most marginalised settings, and the challenges are highly context-specific. Again, the importance of co-creation between technology providers and education system actors is paramount, as is a robust, pre-implementation cost-effectiveness analysis, plus the externalising of lessons and evidence to ensure others can learn from existing DPL implementation.

Who should own DPL implementation, including software and data?

Unlike many EdTech modalities (education management information systems and learning management systems, for instance), DPL implementations are rarely developed within the country where they are being used or rarely owned by public education actors from the beginning. Most DPL tools are currently proprietary and do not follow open principles.[70] This is to be expected in an emerging field with a large potential for revenue. However, it does present significant limitations to the reach of DPL, particularly in its ability to reach those most marginalised learner communities in a manner that is sustainable and equitable. There are noteworthy ways this challenge is being tackled on a case-by-case basis as tools are scaled up. For instance, the BEFIT model in Malawi has come about through a partnership between onebillion and the Ministry of Education, allowing free licensing of onecourse in perpetuity through an appointed licence distributor (in this case Imagine Worldwide).[71] However, more work needs to be done to investigate and disseminate best practices around DPL implementation at scale, including the role of public-private partnerships. This includes

asking tough questions pre-implementation, and requiring answers about licensing and ownership of software, as well as massive datasets that will increasingly be collected as a part of DPL implementation, and how they should be stored, managed, and used.

How will artificial intelligence impact the implementation of DPL tools?

Recent developments in artificial intelligence, particularly the rapid growth of large language models (LLMs) and integration with machine learning, are likely to have a major impact on DPL. Most DPL tools already include some form of AI, primarily as a means of adapting learning pathways based on learner input/performance. As these technologies are further developed, we are likely to see even more sophisticated adaptation and personalisation being made available to learners. As one example among many, generative AI may be able to address one of the core current criticisms of DPL, its reliance on creating 'behavioural' learning paths, which focuses on repetition and positive reinforcement at the expense of developing critical thinking skills. It is also likely to enable rapid progress in relation to how DPL tools can provide genuinely personalised learning pathways that are linked to the level of the individual learner and support teachers with relevant lesson content. For example, Google.org recently invested[72] in EIDU to expand the AI functionality of its DPL tool to provide catered learning materials to teachers and personalised tutoring for primary school learners in Kenya. The expansion of AI has significant potential for improving the learning outcomes that can be gained through DPL, but it is also challenging. As yet, much is still unclear about how such dynamic tools might best fit into educational settings and the role of educators in facilitating their integration.

Resources

Resources providing an overview of DPL in LMICs

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Resources providing case study examples of impactful DPL use

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