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THINKPIECE

Complexity and Considerations in Delivering Adaptive Learning Digital Services

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Notes

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Contents

Abbreviations and acronyms

LMICs	Low- and middle-income countries
VSO	Voluntary Service Overseas
SAAS	Software As A Service
SEND	Special Educational Needs and Disabilities

1. Context

Many groups are optimistic about the potential of education technology (EdTech) to rapidly improve learning outcomes in low- and middle-income countries (LMICs). This piece will look specifically at the potential of **adaptive learning software** and considerations for taking this to scale. Adaptive learning software adjusts content to match the level of the learner — incorporating both assessment and instruction — often mixed with gamification. In most low- and middle-income contexts, this type of software is delivered to schools in what can be called an 'adaptive learning digital service' — which includes everything needed for the software to be used, such as hardware, training, and management.

There is now growing evidence to show that this type of adaptive learning digital service can improve learning. The Mindspark digital service in India is an example that has been shown to improve learning by a significant margin (Muralidharan, et al., 2019). Moreover, these improved learning outcomes have been shown across genders, so the technology doesn't necessarily worsen inequality as some education interventions have (Pitchford, et al., 2019). However, there are questions as to whether now is the right time for investment in this type of software at scale, especially concerning value for money, inclusion, and capacity.

2. Complexities for scaling

The issue is that getting this type of intervention working at scale is 'complex', as defined by the Cynefin framework (Kurtz & Snowden, 2003). This complexity means that the interventions cannot be fully planned at the beginning because there are too many unknowns. We have seen many of these interventions fail and that is not surprising, given that the complexity of implementation often requires a fundamental change in approach after the intervention has begun. This section outlines some of the key structural issues that organisations providing these digital services have noted.

2.1. Centralised vs decentralised education systems

Working in a decentralised system, where decisions are made at a school or teacher level, requires an entirely different operating model from that in a centralised one. In a decentralised system, EdTech services often need to be sold directly to schools, requiring the seller to have a retail commercial and service delivery model. In a more centralised structure, the services need to be provided by the government or through large-scale procurement. The UK has

decentralised decision making, so an adaptive learning digital service can be sold direct to schools, teachers or pupils. An example of this is Seneca Learning, which started just two years ago and provides a service directly to 2.2 million pupils and 85,000 teachers (Broad, 2019). In a country where this decision making is not devolved to schools, a different approach is required. An example is the Unlocking Talent partnership between Voluntary Service Overseas (VSO), onebillion, University of Nottingham, and the government in Malawi, where VSO implements a programme in schools with the direction and permission of the central ministry. The level of (de)centralisation of a system is a critical factor when pursuing any change at scale; with EdTech it is particularly salient because it determines who is buying (or building) the technology, the scale at which it is initially rolled out and the ease of changing the technology selected.

2.2. Governance and contracting model

Often, different organisations deliver different aspects of the service. For example, you may have one software provider of a Software As A Service (SAAS) product, with a separate 'implementer' — as in the case of Unlocking Talent. There may be an aspect of 'in house' delivery within a ministry, or this might be done by a separate NGO. Indeed, the entire service may be carried out by one single tech provider who draws on many SAAS products and external consultants. In addition, there may well be considerations about whether to choose an Open Source product or something that is proprietary. At scale, these variations have implications for costs and coherence.

2.3. Existing elements of any digital service

In most lower-income contexts there is not much hardware in classrooms. A very different service needs to be provided if the hardware needs to be provided in addition to the software. In the Seneca example highlighted above, the company can simply provide a web app to start selling this to schools or teachers because they already have the required hardware. The only requirement is to ensure their app is interoperable across devices used in the UK. If there is little digital infrastructure, often the case in education in LMICs, then more aspects of the service need to be considered, such as digital literacy, hardware, infrastructure, connectivity, and capacity.

2.4. In-school delivery model

If you are running a digital service in a school, then you will need to work with teachers, the school timetable, the curriculum and existing policies. There are many different approaches to delivering this digital service, and each decision

is critical to the success and the cost. Do you run it during the school day or after school? Do you take children out of the class selectively? Should you be making these choices? At scale, questions arise about whether the model needs to be consistent across all school contexts, or whether it can be adapted to local needs and capacities.

2.5. Defining the problem the service is trying to solve

Is the service trying to support teachers in delivering more effective teaching? Is it something that is designed to help children learn outside of the classroom or at home? Is it supporting specific children with remedial education to help them catch up to the learning level of the class? The software, the hardware, the pedagogy, and the implementation model are necessarily different in each of the cases above. So defining the problem at the start, and solving that specific problem well is crucial. Too often we see services that don't work for the user because they are trying to do too much and haven't focused enough to deliver for anyone. An absolute requirement is undertaking user research throughout the process to understand the problem from a real-world perspective.

These complexities are vast — and they present the real difficulty with most approaches to EdTech in LMICs. Being able to combine internet-era digital approaches with rigorous education research to inform their implementation is vital to navigate towards a positive outcome.

3. Conclusions and reflections

The above considerations imply a requirement for different responses in different locations. When running an adaptive learning digital service it is necessary to provide the service from an 'end-to-end' perspective, taking into account the wider education system. Any part of the service chain breaking means the entire thing will not work. If you have good software and hardware but no electricity, then the entire service is null and void. If you haven't thought through how the service adds value to teachers, then it doesn't matter how technically 'good' the service is because it won't be used. This is something that the field of global education is learning slowly — that it doesn't matter how many dollars are pumped into hardware (or any one aspect of an intervention); if the digital service doesn't work for the user, then it doesn't work at all. A number of needs become evident, from a systems perspective.

Need 1: internet-era approaches, structures, and governance to scale EdTech, using existing education research as a basis

Using a systems lens and an internet-era agile approach involves multi-disciplinary teams delivering iteratively with a focus on their users. An iterative approach allows learning to take place in responsive ways before, during, and after scaling. At the same time, it is crucial to base these interventions on evidence, using the research that exists, including the evidence relating to pedagogy as well as to the introduction of technology. For example, the adaptive learning digital services highlighted above are building on principles of 'teaching at the right level' (Banerjee, et al., 2016). We need to be cautious of technology being introduced without this base of evidence and research. If pedagogical interventions don't work without technology, then they won't work with technology.

Need 2: a whole-system perspective on value for money

However, even if we can start moving towards good digital delivery then the question becomes whether this is the time to roll it out. The big issue is value for money. Excluding teachers' salaries and recurrent expenditure, the annual spending per learner is only $1.50 at primary level in Malawi (Hall & Mambo, 2015). The cost of this type of adaptive learning service, run as an end-to-end service, often costs at least $10 per child — something that is not affordable at a national scale within given budgets. It is a highly questionable use of funds to be cutting teachers from schools with already oversized classes to pay for this type of digital service. Organisations need to keep working on these services until the cost comes down to a point that it becomes practical and beneficial to scale, perhaps in the order of $1 per learner per year in Malawi. Scaling beforehand could be a waste, and damaging to any potential being realised. Although there may be the temptation to scale once there is the promise of these interventions working, there are good reasons to stay small until you have the difficult problems cracked. Across LMICs we have seen digital solutions that show promise being scaled but which then fail because they haven't solved the considerations above (Cristia, et al., 2012) (Warschauer & Ames, 2010). This is superbly captured in the Lean Impact approach put forward by Anne May-Chang (Chang, 2019, pp. 31, 131).

Need 3: understand wider implications and unintentional consequences when scaling

Finally, it is critical to understand the potential unintended consequences of an intervention like this. For example, is it displacing a teacher from a classroom, because the teacher is spending time fixing the software and

hardware? Is it so distracting that it is disrupting other classes, which are not included as they are not measured for the specific numeracy and literacy gain? And possibly most importantly, is the software disadvantaging pupils with Special Educational Needs and Disabilities (SEND), or based on gender and background? If you haven't addressed these areas, then it is probably too early to consider scaling.

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