Reimagining EdTech beyond Traditional Learning Spaces

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ABSTRACT

EdTech is booming and appears to be a rising trend. However, the issue of how EdTech can live up to its many potentials and promises remains. With the rise of technology integration in education, much of EdTech's success is measured based on how it improves student learning outcomes and experiences in EdTech-supported classrooms and entirely online-based education settings, where basic access (e.g., to a reliable network connection and to laptop computers or smartphones) is implicitly assumed. Similarly, a large majority of the conversation about EdTech is dominated by notions of potential for enhanced education quality, more efficiency for teachers and administrators, and increasingly detailed learner data to inform quick decision-making. The pandemic has served as an impetus for rethinking or reimagining learning outside the traditional school or classroom setting. However, much of the ongoing EdTech discourse evolves within traditional education settings, such as schools and classrooms, and we argue that this confinement limits EdTech's implementation and achievements. More so, most positive EdTech findings originate from small studies with small sample sizes, which overemphasize achievement scores and are conducted by the tech designers themselves, with minimal comparisons between settings to set forth principles for evaluation and implementation. Based on a discussion of both existing research as well as EdTech practices, we argue that the notions of context, inclusion, and access are dramatically underrepresented within the EdTech conversation and that in order to reinterpret what success could (meaningfully and should) mean for EdTech, we need to: (1) reframe our understanding of 'tech' away from a focus on the latest high-tech towards a holistic concept of 'tech'; (2) reframe our expectation of EdTech to include aspects of widening access and inclusion of previously excluded learners, and (3) take the conversation beyond traditional education settings like schools and classrooms so that EdTech can actually achieve more than just incremental improvements for those who already had access to education in the first place. As such, EdTech can be reframed from its current implicit notion of technology in education, which implies leaving education mostly as it is and plugging technology into education, to the notion of technology for education, which we see as an understanding of technology as a way not just to enhance, but fundamentally change education. With this paper, we aim to contribute to the still relatively small critical voice and perspective on education technology in a field dominated by an overall optimistic - if not euphoric - tone of potential and promise.

INTRODUCTION

EdTech (Education Technology) has been a hot topic for many years, be it in practitioner, academic, or policy circles. Commonly understood as “an array of efforts to design, develop, and use technology geared at achieving several educational outcomes,

such as improved learning and teaching, increased access and retention, reduced costs, or more effectiveness and efficiency"[1], EdTech is frequently looked at and praised as the answer to most (if not all) issues education is facing. Against the backdrop of Sustainable Development Goal 4, "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all", it would appear that technology should hold great potentials for tackling some of the obstacles we face on our path to achieving SDG 4. In this paper, however, we argue that EdTech suffers two major interconnected confinements, which – unfortunately – also limit EdTech in what it can achieve and where it can achieve.

Firstly, EdTech is a booming industry with projections of tremendous growth potentials, and with an ever-growing number of companies competing for learners as customers, giving the entire EdTech movement and industry a first and foremost money-driven character with governments, institutions, and learners (be it students or their families) investing ever-increasing amounts of money into the latest apps and gadgets, driven by an EdTech conversation with an overall tone of promise, potential, and excitement[2]. We argue that this money-driven development of EdTech as an industry results in a limitation or confinement of EdTech to what is 'fundable', in other words, what is fashionable, new, and exciting.

Secondly, EdTech is heavily confined to traditional school settings, with the classroom as a physical space for teaching and learning the most prominent context for development and application of EdTech's latest and fanciest manifestations. The number of applications to enhance schools and classrooms through technology are overwhelming, and - closely related to the previous point - the majority of these schools and classrooms where EdTech really gets to shine, are in well developed regions of the world, where access to the most common EdTech prerequisites, such as electricity, broadband internet, or smart devices, is taken for granted.

In the following sections, we briefly discuss these two confinements EdTech commonly suffers, and what that means for contexts which don't fit these picture-perfect descriptions. Based on this review and discussion, we then move on to attempt to reframe our way of thinking about EdTech in a way that might allow EdTech to achieve more than what it currently does.

EDTECH'S CONFINEMENT TO MONEY AND FEATURES

The global education industry is forecast to reach an industry value of 10 trillion USD by 2030, however, as an industry, education is lagging behind in terms of digitalization, with a forecast for 2025 of only 4.4% of overall expenditures going to technology and digitalization, up from 2.6% in 2018[3]. This combination of a high industry value with a low degree of (and great hunger for more) digitalization means tremendous room for growth

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[1] George Veletsianos and Rolin Moe, "The Rise of Educational Technology as a Sociocultural and Ideological Phenomenon", last modified April 10, 2017, https://er.educause.edu/articles/2017/4/the-rise-of-educational-technology-as-a-sociocultural-and-ideological-phenomenon.

[2] Salomey Tardy Hackman and Stefan Reindl, "Challenging EdTech: Towards a More Inclusive, Accessible and Purposeful Version of EdTech", Knowledge Cultures 10, no. 1 (April 2022).

[3] Holon IQ. "Education in 2030: Five scenarios for the future of learning and talent", accessed June 21, 2022, https://www.holoniq.com/2030/.

in EdTech development. The result is a booming and fast growing landscape of EdTech providers, mapped for example by Holon IQ for 2021 with over 60,000 organisations, 500,000 applications, and three million schools, colleges and universities, in 55 clusters across ten segments of learning and talent innovation[4]. Along with a booming industry comes funding for this industry. With an additional push due to the COVID-19 pandemic, EdTech's global capital venture investments have more than doubled from around 7 billion USD in 2019 to over 16 billion USD in 2020[5]. In such a setting, with large numbers of competing providers competing for a slice of the pie through a myriad of new apps, gadgets, and applications constantly being developed, it is only common sense that individual EdTech products and services have to compete through their features, "with one learning tool after another promising to do everything better (more effectively and more efficiently) than all those before"[6]. So, with this money orientation of EdTech automatically also comes an over-emphasis on tech (rather than ed), as investor (as well as donor) money tends to favor "what's new and exciting" rather than what may make the most sense[7].

As a result, the current conversation around EdTech is heavily dominated by the shiny bells and whistles of what the most sophisticated and latest technology makes possible. These possibilities are typically created for, and apply to, learners in well-developed and wealthy settings, who are already participating in (formal) education, and whose education is further enhanced through these various EdTech implementations in their existing learning settings. These improvements to existing (and typically well-functioning) learning settings, however, are not what is relevant, feasible, and meaningful for the majority of disadvantaged contexts, making the bulk of EdTech providers' and products' promises of inclusion and widened access and participation mere feel-good narratives in what really boils down to selling tech-based educational upgrades to those (governments, institutions, learners,…) with the deepest pockets.

EDTECH'S CONFINEMENT TO CLASSROOM SETTINGS

In an earlier review on EdTech success[8], we have shown that different notions of how EdTech applications, programs, and investments are being evaluated show a consistent pattern of embeddedness in traditional education settings. Puentedura's widely used SAMR (substitution, augmentation, modification, and redefinition) framework [9] for planning and evaluating technology integration into learning serves as an example, as it evaluates EdTech implementations in terms of to what extent they modify existing (non-

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[4] Holon IQ. "2021 Global learning landscape: Mapping the future of education", accessed June 21, 2022, https://www.globallearninglandscape.org/.

[5] Holon IQ. "Education in 2030: Five scenarios for the future of learning and talent", accessed June 21, 2022, https://www.holoniq.com/2030/.

[6] Salomey Tardy Hackman and Stefan Reindl, "Challenging EdTech: Towards a More Inclusive, Accessible and Purposeful Version of EdTech", Knowledge Cultures 10, no. 1 (April 2022): 11.

[7] Michael Trucano. "Using ICTs in schools with no electricity", last modified October 19, 2011, https://blogs.worldbank.org/edutech/off-the-grid.

[8] Salomey Tardy Hackman and Stefan Reindl, "Contesting EdTech Success", Current Studies in Comparative Education, Science and Technology 8, no. 1-2 (December 2021).

[9] Ruben R. Puentedura. "Transformation, technology, and education" accessed June 24, 2022, http://hippasus.com/resources/tte/.

tech) learning and teaching. The references – be it implicit or explicit - always appears to be the classroom. Similarly, research statements of publications investigating EdTech's efficiency and effectiveness tend to define their research scope and findings in terms of what a effect a specific EdTech intervention, product, or service has on learning goals in schools and classrooms.

[Illustration to be added]

A simple Google search on the current conversation on and around EdTech illustrates EdTech's confinement to traditional learning settings. While a general search for the term *EdTech returns* around 120m results, refined searchers for the term in combination with *online*, *school*, or *classroom* return 65.2m, 44.9m, and 37.7m results respectively. Impressive numbers which show what the bulk of the buzz on EdTech is about. The picture looks quite different, however, once we turn to searches of *EdTech* in combination with terms relating to the promise of access and inclusion. Such combined searches with the terms *inclusion*, *offline*, or even *access to education* only return 13.3m, 2.8m, and 122k results respectively, representing just around 10%, 0.022%, and less than 0.001% of overall search results on EdTech. The same picture reflected in this general discourse on Google can also be found within the academic discourse, where corresponding searches on the Web of Science (for example for the last 20 years) return about 11700 publications on EdTech in general, 3940 on *EdTech* + *classroom* or *schools*, and 3100 on EdTech + *online* or the *internet*. However, a search for publications on *EdTech* in combination with the term *offline* only returns 44 results. Now, these numbers are certainly not perfect, however we do believe that they confirm our general impression of what the conversation on EdTech tends to focus on celebrate, and which aspects tend to fall through the cracks.

The always lingering underlying assumption of schools and classrooms as contexts in EdTech conversations is also apparent in recommendations explicitly addressing offline learning. The majority of articles addressing this topic revolve around recommendations along the lines of teachers downloading online content for offline viewing, and providing students without internet access (e.g., at home, during the pandemic) with copies of such offline contents on USB flash drives[10], the encouragement of students to rely on community resources for gaining access to the web, or the 'spinning' of limited access to the web as normal[11].

(ATTEMPTS OF) TAKING EDTECH BEYOND ITS CONFINEMENTS

As we discussed, the conversation around EdTech overly focuses on notions of high-tech, sophisticated features for tech-enhanced traditional learning settings like schools and classrooms, and student or teaching performance as a key measure for success. Notions of access and inclusion or the use of technologies that do not rely on the internet and picture-book infrastructure are very much neglected. Despite the EdTech industry's expanding importance, this growth does not reflect other essential indicators

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[10] Micah Castelo, "Continuing Remote Learning for Students Without Internet", last modified April 9, 2020, https://edtechmagazine.com/k12/article/2020/04/continuing-remote-learning-students-without-internet.

[11] Maria Winters DiMarco, "6 Ways To Support Students Without Internet Access At Home", accessed June 16, 2022, https://www.teachthought.com/technology/6-ways-support-students-without-internet-access-home/.

such as a more equitable reach to all learners in underdeveloped nations or the adoption of adequately validated technologies. According to a recent review of the EdTech Hub database, which includes EdTech enterprises from all around the world [12] [13], less than 5% of Africa's roughly 450 million children were utilizing any type of EdTech prior to the pandemic. Furthermore, most of these users clustered around a few prominent enterprises in a few nations or around students viewing instructional programs on television. More than 50% EdTech enterprises serving developing countries are situated only in South Africa, Kenya, and Nigeria [14] [15]. This is not to say that no efforts are being made to address these underrepresented aspects of EdTech. While many EdTech product and service presentations claim to be geared at access and inclusion, the vast majority actually means access to the technology (as an enhancement to learning for those who already have access to education in the first place) rather than technology-enabled access to education for those who previously were omitted. Among the few applications and approaches which actually seem to prioritize true access and inclusion, the following present relevant examples in the right direction:

Offline Access Integration in Online Apps (e.g., Google Apps)

Many applications that were (originally) designed for us in online environments can be modified to enable offline access and use. Several applications provided by Google[16] serve as examples, such as Google Suite, which enables the offline use of its stand-alone office applications (such as Docs, Sheets, Drive, or Slides) or in the browser through the installation of an offline-use extension. Application of this approach also include Canary Learning (a grading tool which also works offline for later automatic synching) or KA Lite (Khan Academy's offline version which can be run on local servers)[17].

CaseStudy

CaseStudy is an EdTech product by the NGO Las Patatas described as a "digital school-in-a-box solution for remote communities"[18], featuring a water-proof and shock-resistant box containing a central Raspberry Pi device which stores learning contents, and a portable projector and charger, which can rely on local renewable energy sources for recharges. CaseStudy claims to a solution for potentially setting up classes anywhere.

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[12] Lee Crawfurd. "Why the COVID Crisis Is Not Edtech's Moment in Africa.", last updated May 18, 2020, https://www.cgdev.org/blog/why-covid-crisis-not-edtechs-moment-africa.

[13] Susan Nicolai. "EdTech to Reach the Most Marginalised: A Call to Action.", The World Bank Position Paper, (September 2021). https://doi.org/10.53832/edtechhub.0045.

[14] Maya Escuenta, et al. "Education Technology: An Evidence-Based Review." NBER Working Paper No. 23744. 1–102. August 2017.

[15] Daniel Rodriguez-Segura. EdTech in Developing Countries: A Review of the Evidence", The World Bank Research Observer, August 2021, https://doi.org/10.1093/wbro/lkab011.

[16] "Even without internet at home, students can keep learning", Google, last modified March 13, 2020, https://blog.google/outreach-initiatives/education/offline-access-covid19/.

[17] Priyanka Gupta. "5 Tools For Educators For When There's No Access To Internet", last modified July 13, 2017, https://edtechreview.in/trends-insights/insights/2856-offline-tools-for-educators.

[18] "Education Solution for Schools without Electricity", The Patatas, last modified May 26, 2020, https://www.thepatatas.com/education-solution-for-schools-without-electricity/.

Kolibri

Kolibri is described by its creators, the NGO Learning Equality, as “an adaptable set of open solutions specially developed to support learning for the half of the world without Internet access”[19] and follows an offline first philosophy of EdTech deployment. The Kolibri learning platform is centered around a seeding device, on which the Kolibri software is downloaded and installed. This seeding device then can share learning contents and updates with a broad range of learners’ devices by broadcasting an offline local network. The most remote communities can be served by carrying a device by foot to provide installers, updates, and contents through local networks.

SmartBox

The SmartBox[20] takes this idea a step further and combines the concept of a central seeding device which stores and broadcasts educational contents through an offline local network (like in the case of Kolibri) with end-devices for the students and with a central power supply for these devices. The SmartBox securely stores and charges 20 student laptops along with the seeding device and router, and basically represents an out-of-the-box classroom, which can be deployed in challenging settings beyond school buildings and classrooms, such as remote locations, islands and coastal regions, and war-torn nations. Similar products include BeeKee box[21].

Dell Learning Labs

The Dell Learning Lab is a portable, solar-powered computer lab equipped with 10 networked Dell Wyse zero computers, a Dell OptiPlex hub that manages the 10 computers, and a power storage battery, that makes it possible to also operate the lab at night[22].

CyberSmart Africa’s Interactive Whiteboard

CyberSmart Africa’s interactive whiteboard[23] is a low-tech whiteboard solution based on only three technological components: One laptop computer which stores learning contents, one low energy projector, and one battery, which can be solar charged. The board itself is basically a projection screen, and is thus sturdy and highly mobile, and interactivity is achieved through an infrared camera (e.g., the Nintento Wii remote), which recognized interactions on the board as clicks on the computer.

While we consider all of these development approaches and products or services real

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[19] “Kolibri. “An Adaptable Product Ecosystem for Offline-First Teaching and Learning”, Learning Equality, accessed June 6, 2022, https://learningequality.org/kolibri/.

[20] “SmartBox Instant Wireless Classroom. Changing Education Around the World”, SmartBox, accessed June 24, 2022, https://thesmartbox.net/.

[21] “BeeKee. Making Learning Possible”, BeeKee, accessed June 28, 2022, https://beekee.ch/.

[22] Jeff McIntire-Strasburg. “Dell’s Mobile Solar-Powered Classroom Brings Computers To Areas Without Electricity”, last modified July 23, 2014, https://cleantechnica.com/2014/07/23/dells-mobile-solar-powered-classroom-bring-computers-areas-without-electricity/.

[23] Jim Teicher. “Is High Impact Digital Learning Possible in Schools without Electricity?”, last modified March 5, 2014, https://www.ictworks.org/is-high-impact-digital-learning-possible-in-schools-without-electricity/.

stand-outs for their efforts towards making true on the often neglected EdTech promise of access and inclusion for challenging settings, most of them still suffer certain limitations, such as the remaining need for at least some access to electricity or internet (at least for initial configuration and setup). What we see as the most severe limitation, however, is the fact that all of these solutions still are built for use in traditional school or classroom settings, which they attempt to improve, enrich, or emulate, be it through the designated use in schools, or the need of a central person in charge of controlling the device(s) to provide learning (teachers), or the mere fact that use is restricted to a shared physical space, at which learners have to gather. This – yet again – means that these approaches can only benefit those who already have access to such traditional education settings in the first place, and – yet again – leaves out the many millions who don't.

CONCLUSION

We have discussed how EdTech is very much a phenomenon driven by money and a focus on sophisticated features and devices designed for use in well-developed and wealthy settings. Some of these developments are later 'tweaked' in attempts to also make them work for less ideal settings. This appears to be an approach which ever too often fails or only achieves limited results. It appears crucial to stress, as Trucano, in his 2011 post on the world bank's EduTech blog, points out, the importance of beginning EdTech projects for remote and developing settings "by working in the most challenging environments and not simply taking a model that worked successfully in Paris or Pretoria and assuming that, with some small modifications here and there, it will work everywhere[24]".

Along with such a bottom-up approach, we also propose, that EdTech be reframed from its current implicit notion of technology in education, which implies leaving education mostly as it is, and plugging technology into education as such, with the goal of (often minor) improvements – mostly in efficiency – here and there, towards the notion of technology for education, which we see as an understanding of technology as a way to not just enhance, but fundamentally change education towards a better version of itself. Based on a broader scope of technology in its widest sense (beyond just the latest and fanciest high-tech gadgets, including simple and even offline ones, such as T.V., radio, or print, to name just a few), we believe that technology for education could serve as a means to address some of education's most pressing issues in ways that go beyond improvements for those who already enjoy access to ever-improving education, and instead change education so that it can become more inclusive and provide access to those who were previously excluded.

Considering that globally 260 million children at primary and secondary school age are out of school, we also believe that as part of such a shift from technology in education to technology for education, the entire EdTech conversation would naturally have to move beyond school and classroom settings, so that it can evolve around and include the bigger picture of how to make fundamental changes which address more than improvements of existing education, and instead focus on how Tech can enable a new education paradigm. This new education paradigm should be built on the requirement for

[24] Michael Trucano. "Using ICTs in schools with no electricity", last modified October 19, 2011, https://blogs.worldbank.org/edutech/off-the-grid.

technology to enable education to do things that it could not do before, and thus potentially taking education a significant step closer towards the hoped-for education as defined in SDG 4.

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