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Contesting What Constitutes EdTech Success

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ABSTRACT With the rise of technology integration in education, much of its success is measured based on improving students' learning outcomes and experiences in Education Technology (EdTech)-supported classrooms and entirely online-based education settings, where access (for example, to a reliable network connection and laptop computers or smartphones) is implicitly assumed. Similarly, a large majority of the conversation about EdTech is dominated by notions of potential for high education quality, efficiency for teachers and administrators, and detailed learner data to inform quick decision-making. On the other hand, existing research is silent on including equitable access, replicability, institutional factors, and conditions as critical variables for evaluating EdTech success. In light of this, this paper contests what constitute EdTech success. It contends that to meaningfully reinterpret what success could (and should) mean for EdTech, it is necessary to first reframe one's understanding of Tech from focusing on the latest high-tech towards a holistic concept of Tech. Based on this shift, the paper further asserts that success for such a reframed understanding of EdTech can (and should) include aspects of widening access and inclusion of previously excluded learners, rather than improvements for those already privileged with access to education. In the spirit of the International Society of Comparative Education Science and Technology's (ISCEST) VIII Conference theme, *'Reinterpreting Success*,' the paper aims 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.

Keywords: EdTech, education technology, evaluation, success, context, access, inclusion.

Introduction

In recent years, and especially since the onset of the COVID-19 pandemic, most conversations about education sooner or later become about, or at least touch on technology, in one way or another. It seems that education and technology are in a marriage, or at least in a very solid relationship; and Education Technology (EdTech) appears to be a trend not only here to stay, but on track to becoming a new normal. EdTech is a hot topic among practitioners and a development that enjoys increasing attention among academics. Commonly defined 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 (Veletsianos and Moe, 2017), EdTech is the focus on numerous studies and often praised as the solution to all problems education faces. This extraordinary interest and the many expectations put into EdTech translate into a quickly evolving demand and market for EdTech, making it a booming industry. Compared to 2020, Global EdTech funding in 2021 (up to

the third quarter) has tripled in Europe, doubled in the United States (US), and is booming in India and several other regions, totalling almost 15 billion USD globally (HolonIQ, 2021). The business paradigm influencing much of what is happening in EdTech informs the premise that education may be packaged, processed, and supplied as a product. In this paper, we argue that the evaluation of EdTech and the notion of what constitutes EdTech success is flawed, in that, it is built on an understanding of EdTech, which overemphasizes the Tech in EdTech, and neglects some of the most pressing challenges Ed in EdTech has been, and still is facing. To address this imbalance, we propose a reframing of EdTech based on a less fancy, but more inclusive understanding of Tech, which we believe could better support Ed in addressing some of its significant challenges.

Conceptualising EdTech

In order to approach EdTech success, an understanding of EdTech itself is necessary. Early conceptualisations of EdTech, such as by Lumsdaine (1964), Silverman (1968), Nickson (1971), or Mitchell (1973), proposed three fundamental approaches of educational technology with corresponding major notions of the term's two-component relationship. These three approaches include, (1) Technology in education, (2) Technology of education, and (3) the Systems approach to educational technology. Technology in education (also: hardware approach, relative technology, or first educational technology) is concerned with using tools such as projectors, film, computers, or the internet in education and the mechanization of education. Technology of education (also: software approach, constructive educational technology, or second educational technology) is concerned with applying multiple fields of sciences to the study of educational problems and the educational needs of individuals and society. The systems approach to educational technology (also known as management technology) links hardware and software techniques based on system analysis and system development and is used chiefly to influence educational administration and organization. As these early conceptualizations demonstrate, there has always been a divide between using technology to improve teaching and using technology to solve educational problems.

When it comes to how EdTech definitions have developed over time, these ideas have stayed consistent, with different definitions leaning more towards one concept (using technology to improve teaching and learning) or the other (solving educational problems). For example, in 1972, the Association for Educational Communications and Technology defined educational technology as a field involved in the facilitation of human learning through systematic identification, development, organization and utilization of a full range of learning resources, and the management of these processes (Reiser and Ely, 1997). In 1977, the Association for Educational Communications and Technology then proposed EdTech to be a complex, integrated process involving people, procedures, ideas, devices; and organization for analysing problems, devising, implementing, evaluating, and managing solutions to those problems involved in all aspects of human learning (ibid). The definition was further updated to the theory and practice of design, development, utilization, management, and evaluation of processes and resources for learning in 1994 (ibid).

These two concepts are still present in many recent academic definitions. For example, EdTech is defined in the University of San Diego's Master of Education degree program as "technological tools and media that assist in the communication of knowledge, its development, and exchange," as well as "the theory and practice of utilizing new technology to develop and implement innovative educational

approaches to learning and student achievement" (Lathan, 2018). Recent practitioner -centred definitions seem to have become increasingly instrumental and focus on three major aspects of EdTech. These practitioner-centred definitions focus on EdTech as:

1) a systematic, iterative process for designing instruction or training used to improve performance (Encyclopaedia of Educational Technology, 2018);
2) technology that usually helps facilitate collaboration in an active learning environment; and
3) a wide array of teaching-and-learning–related software and hardware that's increasingly being used in college and university classrooms (Top Hat, 2019), or the adoption of hardware and software solutions which have the goal of improving teacher pedagogy and student learning (Global EdTech, 2020).

We argue that such increasingly instrumental definitions of EdTech also reflect an overall development in EdTech of a focus on technology (that is, apps, gadgets, platforms, and tools) over education (that is, education's most pressing and persistent challenges such as access and equity). The following sections look at how this exaggerated focus on Tech over Ed in EdTech affects how we approach EdTech evaluations and EdTech success.

EdTech Evaluation Research: Emphasis on Tech

With technological developments evolving quicker than ever and with technology finding its way into most, if not all aspects of our daily lives, many look to technology as the next major driving force to future-proof education. According to McMillan et al. (2005) and Rodriguez-Segura (2021), technology investment serves at least three essential purposes: (1) as a tool for solving issues in teaching and learning; (2) as a change agent; and (3) as an impetus for economic competitiveness. As we all go through education as part of our growing up, and as governments strive to provide quality education aimed toward employability, productivity, and competitiveness, the world has a shared interest in education, which is expected to reach a value of $10 trillion by 2030 (HolonIQ, 2020). EdTech has become a hot topic, with many seeing it as a panacea-like solution to all of education's current and future challenges. This is due to the enormous importance of education as a key to a successful future, as well as the huge promises and potentials that technology may bring to education, as well as the education industry's relatively low - but rapidly expanding - degree of digitization. This has also resulted in a booming industry with immense competition for a piece of the ever-growing amounts government, institutions, and individuals spend on EdTech. With more and more players competing for investment, the EdTech landscape of tools, gadgets, apps and solutions has grown equally fast. In their 2021 Global Learning Landscape report, HolonIQ mapped over 60,000 organizations and 500,000 applications in 55 clusters across ten learning and talent innovation segments to depict the current EdTech landscape (HolonIQ, 2020). As is undoubtedly in the interest of all these many providers of EdTech tools, EdTech has been depicted in the best possible light with narratives of great promise, excitement, high expectation, with one learning tool after another promising to do everything more effectively and more efficiently than all others.

In such a money-driven high-pace industry, it is only understandable that competing learning solutions providers distinguish themselves through constantly

updated and improved features, be it hardware or software. All these shiny bells and whistles have quickly become what the majority of EdTech conversations are about, and we argue that all this might well be distracting us from some of the more critical aspects of this very conversation. Research on EdTech appears to be subject to the same issue. According to Light (2008, p. 4), many of the studies on EdTech,

> ...looked so specifically at particular technologies and their impact, they contributed little to the larger, more challenging project of learning about the generalizable roles that technologies can play in addressing the key challenges of teaching and learning, as well as learning about optimal designs for such technologies.

Furthermore, recent review studies show an increase in interest in using Web 2.0 tools, mobile devices, and games for educational purposes, for example Cheng et al. (2015), Lai and Bower (2019; 2020), Mandinach (2012), Petri and Gresse von Wangenheim (2017), Vlachogianni and Tselios (2021) and Wu et al. (2012). Digital instruction, online learning management systems, animations and simulations, feedback systems, Massive Open Online Courses (MOOCs), student response systems, programming technologies, augmented reality, robotics, and e-books were among the other technologies mentioned (ibid). The literature's bias toward these products highlights the dominant mainstream characterization of EdTech. Given the broad meaning of EdTech, this characterization is problematic, exclusive, reductionist, serves as a breeding ground for inequality, fails to capture the breadth and depth of the current landscape of EdTech in developing countries, and narrows the scope of what constitutes success in EdTech in different contexts.

EdTech Evaluation Research: Limited Replicability

Improved student learning outcomes, more access to learning, and increased learner motivation are just a few of the reasons for the growing demand for EdTech (Bower, 2017). However, many of these stated effects of technology integration are associated with unique circumstances (e.g., classrooms, sample size, methodology) that may or may not result in a beneficial effect in other settings if the necessary variables are not there (Gresse von Wangenheim and Shull, 2007; Myers and Wilson, 2021; Nicolai, 2021; Shank, 2019). Most technologies are only evaluated in single research or a single specific/similar environment, with relatively small homogeneous sample sizes, frequently by the creators themselves, with just a few longitudinal studies and studies that analyse data from replicated trials separately in order to compare the results (Jenson, 2009; Petri and Gresse von Wangenheim, 2017; Shank, 2019). Also, replications do not appear to be used for comparisons between different contexts, which may be a first step toward developing guidelines on which EdTech is useful in which environment (Escuenta et al., 2017; Mandinach, 2012; Shank, 2019). Given the fact that there are several enabling factors or conditions (e.g., teacher preparedness, access to appropriate infrastructure) for the success of EdTech, it is critical to reproduce the proposed outcomes under various settings to assess the success or effectiveness of EdTech (Crawfurd, 2020; Rafalow, 2021; Rodriguez-Segura, 2021). Successful replication of EdTech studies demonstrates the generalizability of outcomes across situations that invariably differ from the original study, and poor replication demonstrates that the finding's reliability may be more limited or isolated than previously acknowledged (Mandinach, 2012; Nosek and Errington, 2020). According to Mandinach (2012), many publications, papers, and policy pieces examine

technology in specific countries but fail to address issues comparatively; as such, they run the risk of providing decontextualized data without sufficient knowledge of the social, political, and economic context within which the countries' educational systems function.

While we understand that due to evident variations, no single EdTech effort will achieve the same results everywhere (Ganimian et al., 2020), we also propose that the effectiveness of such efforts should be evaluated on their ability to work in a variety of settings and their ability to work effectively when being tested by people other than those who created them (Crompton and Burke, 2020, Ely, 1999; Lai and Bower, 2020).

EdTech Evaluation Research: Limited Emphasis on Conditions

Teaching and learning processes are embedded within complex systems (Ely, 1999; Heinecke et al., 2001). The challenge is to develop EdTech implementation and evaluation models that reflect this complexity. Just as technology has caused us to re -evaluate the nature of knowledge and instruction, it prompts us to re-evaluate the forms of evaluation that are brought to bear when examining educational technology (Jenkinson, 2009; Lai and Bower, 2019). Bodilly and Mitchell (1997) and Heinecke et al. (2001) indicate that performance outcomes result from complex causes - technology could be only one of many input variables influencing or causing changes. An EdTech project's implementation and outcomes are heavily influenced by its context. While the goals of various educational technology projects are part of that context, the conditions of each project are specific to its situation and may not be captured by a uniform evaluation design (Compton and Burke, 2020).

Education researchers, policymakers, and practitioners are interested in understanding more about how and why technology affects teaching and learning processes and the cognitive, pedagogical, and organizational consequences that result (Heinecke et al., 2001; Lai and Bower, 2021; Vlachogianni and Tselios, 2021). For some studies, the most crucial question is whether it works. Which, in simple terms, means whether or if technology promotes student learning in general and standardized exam scores in particular. We believe this is a naive question because education aims to develop students' learning abilities and help them become lifelong learners. Furthermore, we must understand and operationalize the term work to respond to the question and satisfy policymakers, lawmakers, and other stakeholders (Heinecke et al., 2001; Lai and Bower, 2021; Vlachogianni and Tselios, 2021). Is it only the technology – the hardware, software, and specialized application – or is it also the educational philosophy contained in the technology and then embedded in a subject area? Because constructivism is often inextricably linked to technology as the pervasive pedagogical philosophy, it is the assumption that teachers and students can use technology effectively to enhance teaching and learning activities through the construction of knowledge, rather than that technology will improve teaching and learning (Heinecke et al., 2001; Jami Pour, 2017; Mandinach, 2012; Rafalow, 2021). One might question whether the pedagogical perspective should be included as part of the technological it. We maintain that it is an integral part because, without pedagogy, there is no EdTech. If we claim the mainstream understanding of what it means to work is simplistic, we must then consider how learning occurs, why it occurs, and when it occurs, under what conditions. Increasing achievement test scores perhaps can be seen as a distal goal for technology infusion or any educational intervention (Heinecke et al., 2001; Jami Pour, 2017)

The Integrated Technology Adoption Diffusion Model, for example, can help guide tech evaluations based on a larger system perspective. According to this model, evaluations should include the contexts of technological innovations (Lai and Bower, 2020; Rodriguez-Segura, 2021). This encompasses an examination of technological, individual, organizational, and teaching and learning issues (Jami Pour, 2017; Rafalow, 2021). Flexible evaluation designs are required to account for the varying levels of adaptation that occur with different content areas (Heinecke et al., 2001; Petri and Gresse von Wangenheim, 2017; Rodriguez-Segura, 2021). The question really should not be, does educational technology work?; instead, when does it work, under what conditions, and for whom? (Heinecke et al., 2001; Mandinach, 2012).

This is very important because stating the particular condition under which a particular tech works will help evaluate its success. It may improve this and improve that, but in the absence of the particular condition/context under which it performs optimally, we cannot simply make a blanket statement of a particular type of technology being successful (Crompton & Burke, 2020; Ely, 1999; Shank, 2019). Educators and researchers also balance the promises and realities of educational technology in real classroom settings. Declaring such technologies effective in performing a specific task without much mention or emphasis on its restrictions or the conditions under which they work is a recipe for education stakeholders to make rash investments that will yield less fruitful results. Based on such an understanding of EdTech, we propose a critical re-evaluation of what EdTech success currently is and what it should be.

EdTech Evaluation Models: Confinement to School and Classroom Settings

Success as the core theme of this year's ISCEST conference means many things to many people in many contexts. The Cambridge Dictionary (2021) defines success broadly as "the achieving of the result wanted or hoped for". What is wanted and hoped for depends very much on the specific context and circumstances. In the case of EdTech, there are evaluation and implementation frameworks to aid this evaluation. Common models used in the evaluation of EdTech include:

(1) The Technology Acceptance Model (TAM) by Davis (1989) that measures the perceived ease of use and perceived usefulness of technologies;
(2) the Measurement of Diffusion of Innovation Theory by Rogers (1995), which suggests five characteristics impacting on the rate of adoption of innovation;
(3) the Unified Theory of Acceptance and Use of Technology (UTAUT) by Venkatesh et al. (2003), which measures the effort expectancy, performance expectancy, social influence and facilitating conditions;
(4) the Bhattacherjee's (2001) Expectation–Confirmation Model, relating to user's intention to continue using an information system;
(5) the System Usability Scale (SUS) developed by Brooke (1996) to measure the subjective usability of a technology (Jami Pour et al., 2017; Myers & Wilson, 2021).

Another particularly popular and often cited framework for planning and evaluating technology integration into learning is Puentedura's (2006) substitution, augmentation, modification, and redefinition (SAMR) framework (see Figure 1).

SAMR, which presents a four-level approach for selecting, implementing, and evaluating technology in education, encourages teachers to advance from lower to higher levels of technology use in education to achieve more enhanced and advanced levels of teaching and learning (Hamilton et al., 2016).

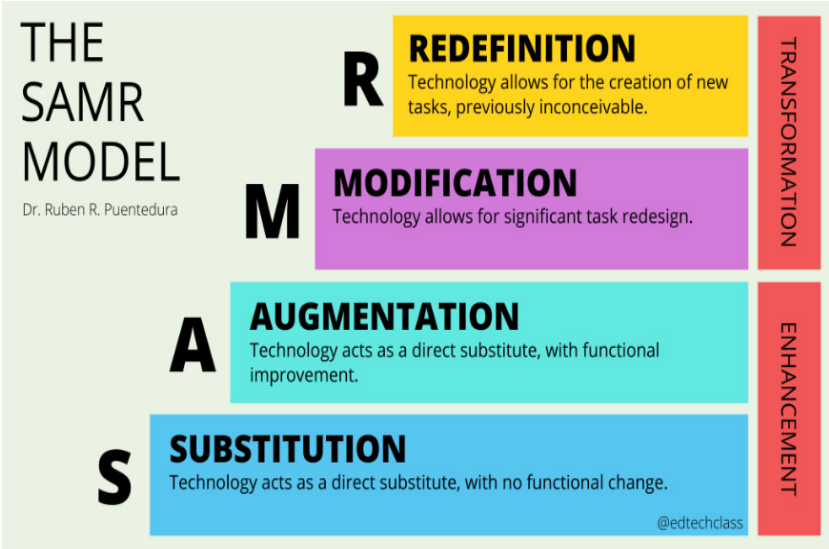

Figure 1: SAMR Visualization (EdTech Classroom, 2021)

This framework and similar other frameworks for implementing and evaluating EdTech programs and initiatives have quickly become popular – especially among EdTech partitioners and EdTech providers, who are under constant pressure to showcase how their products and services are newer, better, and more advanced than all the others. However, we believe that these frameworks share a major flaw rooted in an implicitly taken-for-granted assumption that guides most of the conversation about EdTech: The school or classroom as the context and setting for EdTech to be implemented. This assumption also manifests in many scholarly conversations about EdTech, which frequently, as we would like to put it, confine EdTech to the classroom and school settings, as this example from Light (2008, p. 2) illustrates:

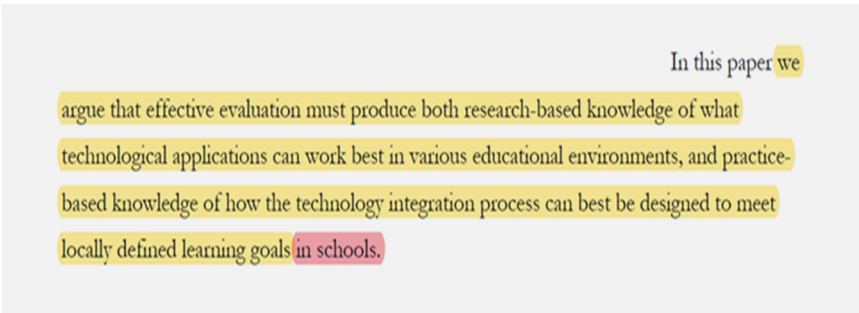
In this paper we argue that effective evaluation must produce both research-based knowledge of what technological applications can work best in various educational environments, and practice-based knowledge of how the technology integration process can best be designed to meet locally defined learning goals in schools.

Figure 2: Example of confinement of EdTech to school and classroom settings (Light 2008, p. 2).

The highlighted words 'in *schools*' in Figure 2 may only be its final two words; however, reading the same statement with and without these two words creates a substantially different notion of the relevant scope and potentials.

If the pandemic has taught us anything, it is to rethink learning outside the traditional school or classroom setting. Learning outcomes, affective aspects, behaviours, design, technology elements, pedagogy, presence, and institutional environment were identified as the primary EdTech evaluation themes in most systematic reviews (Calderón and Ruiz, 2015; Heckel and Ringeisen, 2019; Lai and Bower, 2020; Porter and Graham, 2016). This shows that the primary focus of these EdTech evaluation studies is on the learning outcomes or learning that occurs due to using technology to learn. If learning is the most critical aspect of evaluating EdTech success, then, it is essential to note that learning does not occur in a vacuum and is influenced by contexts other than the classroom. Evaluation and implementation frameworks should therefore create room for learning in and out of the traditional school setting.

What EdTech tends to neglect: Conversations beyond traditional Education Settings

Neglected Conversation on Access and Inclusion

As this paper looks at success as a result desired or hoped for, through a different lens, the authors would like to believe that what has been said and promised informs what is hoped for or even expected as the baseline against which to compare outcomes in order to evaluate and determine success. Here, internet search engines can provide us with a quick grasp of what the current buzz (that is, the conversation about EdTech) is all about. In late November 2021, a Google search of the term EdTech returned 128 million results, which shows that EdTech is indeed a hot topic. Further narrowing our search to additional terms paired with EdTech gives us an idea of which concepts are more or less prevalent within the EdTech conversation overall. As one might assume, combining the terms '*EdTech*' and '*online*' yields 65.2 million results, demonstrating the centrality of the internet in the EdTech context. Combinations with the terms school, classroom and performance return 44.9m, 37.7m, and 30.7m results, respectively, confirming the focus of EdTech on school and classroom settings to improve learning and teaching performance.

What such a simple analysis and comparison of search results also tells us, however, is which notions are being relatively neglected within the overall EdTech conversation. A pairing with the term inclusion, for example, returns 13.3m results (roughly 10% of overall results), which shows that only a tiny part of the EdTech conversation is concerned with using technology to make education more inclusive. Another pairing with the term offline only returns 2.8m results, representing 0.022% of overall results, indicating that the concept of EdTech is very much married to the concept of being online and that EdTech applications for offline learning might be close to none. Furthermore, a pairing of EdTech with access to education only returns 122k results, representing less than 0.001% of the overall EdTech conversation, which we consider highly problematic. Such an analysis is, of course, highly simplistic and by far not exhaustive, yet we believe it is a reasonable indication of how aspects of inclusion and access are very much neglected within the hype of EdTech. The following section focuses on what this means for many regions of the world with learners who do not have the luxury of the taken-for-granted prerequisite of reliable internet or even a school or classroom.

Neglected conversation on value for money

Although numerous studies have emphasized the positive impact of technology on student learning, few have been undertaken to establish whether the money spent on specific technologies is worthwhile (Adedokun-Shittu, & Shittu, 2011; Heinecke et al., 2001; Jami Pour et al., 2017; Lai & Bower, 2020). Furthermore, prior to introducing such technologies, needs assessments for instructors and students' technology demands are frequently overlooked. Before investing large sums of money in technology, educators and policymakers must address several evaluation challenges. To avoid resource waste, it is critical to ask before investing in EdTech what technology can do, that cannot be done without it (Compton & Burke, 2020; Rosell-Aguilar, 2017), how much should be invested in technology, how technology should be integrated into the curriculum to achieve educational goals and many other questions (Bull et al., 2016; Compton & Burke, 2020; Rosell-Aguilar, 2017).

This raises the essential question of whether educators are examining technology's usage in education holistically. It is possible that to narrow their research focus, researchers emphasize specific parts of education that they believe are relevant to their research goals. On the other hand, concentrating on evaluating only a few areas of education is likely a result of analytical narrowness (Bull et al., 2016; Jenkenson, 2009; Lai and Bower, 2019). Nonetheless, educational technology is a complex phenomenon that requires a focus on much more than learning outcomes and school-level settings to fully understand (Shank, 2019; Rafalow, 2021). As such, current practices for evaluating the impact of technology in education need to be broadened and rigorous since standardized test scores offer limited formative information with which to drive the development of any EdTech initiative (Adedokun-Shittu and Shittu, 2011; Jenkenson, 2009; Vlachogianni and Tselios, 2021).

Neglected Conversation on Enabling Factors

Mandinach (2012) and Ely (1999) contend that an extensive understanding of the variables that drive educational technology and the systemic nature of educational technology is crucial, not just within, but also between countries. Rather than making competitive and evaluative judgments about which countries are better or worse, Mandinach (2012) proposes that research in this field should concentrate on the dynamic interrelationships among the components that contribute to education technology infusion and use. In the same line, educational technology research should focus on the similarities and contrasts across settings from which useful lessons can be gained, because knowledge is a situated activity best understood within specific contexts and cultures, according to Brown (1989).

Against this backdrop, the EdTech conversation should begin with what happens with education and technology before reaching the classroom or teacher's office. However, this aspect is most often ignored. It should consider the needs assessments of the environment, the implementers (teachers), and the students before it reaches the classroom. Therefore, conversations around: (1) teacher skills, beliefs, attitudes, competence; (2) School facilities; (3) Students' preparedness (this is tied to teachers' skills and abilities since they will be responsible for preparing students to use these technologies); and (4) the government's role in preparing teachers are all important because the Tech will lie wasting if the Ed (implementers, environment, and students) are completely isolated from the discussion about what contributes to success, which in turn informs what evaluation should look like (Adedokun-Shittu,

& Shittu, 2011; Bull et al., 2016; Heinecke et al., 2001; Jami Pour et al., 2017; Rodriguez-Segura, 2021).

EdTech's forgotten Promise: Access, Inclusion, and the Case of SmartBox

As we presented, 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 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 (Crawfurd 2020; Nicolai, 2021), 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 (Escuenta et al., 2017; Rodriguez-Segura, 2021).

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 who actually live up to their promises, the case of SmartBox (2020) illustrates that EdTech can well be employed to address access and inclusion challenges (See Figure 3). SmartBox, which is basically a highly mobile box comprised of 20 laptop computers, a router which creates an instant network through which educational resources can be streamed to the laptops, and a power-bank to supply the router and to charge the laptops, promises – and achieves – to overcome some of the key challenges to education in displaced settings and situations without the usually taken-for-granted infrastructure of constant availability of electricity and the internet. Frames captured from the SmartBox's highly emotional product presentation video show the potentials and scenarios for the use of this powerful EdTech:

Figure 3: EdTech Product Presentation of Promises (SmartBox 2020).

The authors recognize and hail such a refreshingly low-tech approach to EdTech with relative independence from infrastructure and with numerous meaningful usage scenarios across those regions most in need. However, even this case of EdTech, with its promise to remove some of the key barriers to education, including first and foremost the lack of access, falls back onto the mainstream pattern of evaluating its success. In the case of the SmartBox, success is evaluated against the established school and classroom-bound measures such as student performance and test scores, rather than measures such as the number of students given access to education or communities included into education programming through the use of SmartBox (See Figure 4).

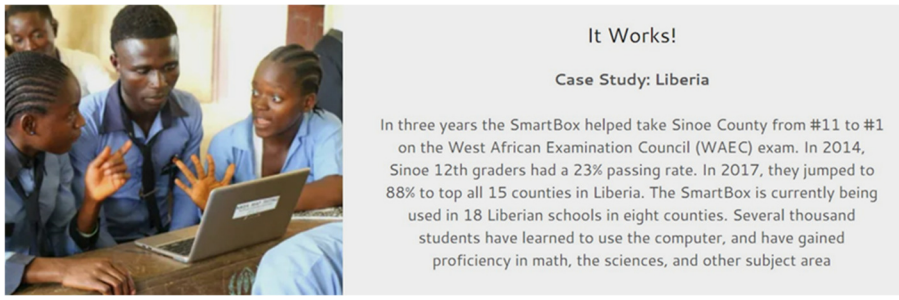

Figure 4: EdTech Product Presentation of Successes (SmartBox 2020).

This goes to show that among those few who join the EdTech conversation and make promises of access and inclusion, and of those the even fewer who actually deliver on these promises, still struggle to evaluate and showcase their successes in other (and as we would like to think more meaningful) measures than those established ones like performance within the confinements of traditional learning settings such as schools and classrooms.

Conclusion

Progress in EdTech is driven by the possibility for profit, hence there is an overemphasis on advanced digital tools. The majority of favourable EdTech results come from small studies with a small sample size, an emphasis on achievement scores, and are done by the tech designers themselves. There are few comparisons between settings to draw forth guidelines for evaluation and implementation. The classroom/school is implicitly assumed to be the context for implementation in evaluation systems. As a result, it appears that interactions outside of the usual educational context are being overlooked. Access and inclusion, as well as the use of technologies that are not reliant on the internet or picture-book infrastructure, are frequently overlooked. Nonetheless, there are attempts underway to address these underserved parts of EdTech. While many EdTech product and service presentations claim to be about access and inclusion, the vast majority refer to access to technology (as a supplement to learning for those who already have access to education), rather than technology-enabled access to education for those who were previously excluded. This demonstrates that those few who join the EdTech conversation and promise access and inclusion, and even fewer who actually deliver on these promises, still struggle to evaluate and showcase their successes in other (and, we hope, more meaningful) measures than currently fashionable ones like school and classroom performance.

The authors acknowledge the complexity of educational technology and characterize it as an innovative process that links teaching and learning outcomes rather than a product that increases standardized test scores generated by a black box. To redefine what EdTech success involves, we propose that 1) focus should be placed on the conditions under which they work, 2) they should be analysed alongside contextual and pedagogical concerns, and 3) implementation assessments should come before efficacy or effectiveness assessments, 4) utilize a variety of non-biased research and evaluation approaches, including comparative case studies, and 5) minimize our reliance on broad result evaluation metrics like test scores which hinder us from examining the intricacy of technology-based teaching and learning improvements from a variety of perspectives. All of this will aid in the identification of EdTech initiatives' strengths and limits, as well as guide education stakeholders in the selection of appropriate advancement strategies in EdTech.

Overall, the paper 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 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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