PILOTING QATAR’S FIRST EDTECH TESTBED:
THE JOURNEY TOWARDS BEST PRACTICE, SUSTAINABLE PARTNERSHIPS AND INNOVATION

RR.7.2021

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EXECUTIVE SUMMARY

Edtech testbeds can help address challenges and barriers for effective implementation of technology in educational settings, as edtech testbeds seek to provide "an environment to test and experiment with edtech solutions in a real-world setting" (Batty et al. 2019, p. 5).

In 2020, WISE launched its first edtech testbed pilot in Education City, Doha in an effort to accelerate the introduction of new innovation within this learning ecosystem. In doing so, we hoped to increase local practitioners' understanding of edtech use and how it could be leveraged to overcome persistent problems of practice in the classroom. Developing a community of edtech specialists within Qatar and Qatar Foundation schools also presented a new opportunity to create a sustainable community of practice that could support innovative approaches to learning and capture improved practice.

The idea of establishing this type of network locally was also a key component of our overall ambition: developing a toolkit so that global partners could replicate similar initiatives in their own contexts.

With that said, testbeds are notoriously difficult to manage. Juggling the expectations of multi-level stakeholders, along with the task of delivering research is no easy feat to undertake, but we believed that with the right partnerships and always a bottom-up approach to implementation, we could begin to create a learning ecosystem capable of truly realizing the potential of technology.

Of course, for the 2021-2020 pilot, our testbed was forced to face an additional unique challenge – the onset of a global health pandemic. Schools and their teachers had to adapt to shifting sands of the crisis as it evolved; remote learning turned to hybrid and then back again without much notice, and at times the disruption to mainstream classrooms became insurmountable. In the midst of this, we remained focused on implementing new technology within selected schools and although there were significant challenges in doing so, these same hurdles proved to work to our advantage as we continued to adapt to the realities of learning online.

Key lessons that emerged from implementing an edtech testbed during the pilot phase included; (i) the importance of building relationships with school leaders early, and continuously revisiting expectations towards alignment, (ii) pre-testing the product prior to implementation to minimize technical difficulties and delays, (iii) identifying a champion or advocate within the school to motivate teachers to engage with a new product, and (iv) involving the edtech venture in the ongoing professional development of teachers.

At the close of this pilot phase, it became clear that there were more barriers in our existing systems than initially anticipated, decelerating the use of innovation in day to day learning. However, these barriers do not mean that edtech cannot have the impact that many, including the participating schools and teachers, had hoped for in the Qatari context. Learnings from this pilot will allow us to adapt and iterate our approach to testing and better anticipate future potential challenges. Ultimately, we expect this testbed to experience various iterations as we move closer to delivering our global toolkit. Each iteration will aim to address practitioner needs as they evolve and in turn, help create an environment where innovation, testing and experimentation are supported.

INTRODUCTION

CHAPTER ONE

When you think about technology in the classroom, what comes to mind? It is not uncommon in our digitalized context to associate a modern classroom with laptops, tablets and certainly interactive digital content of some kind. Indeed, as the COVID-19 pandemic grew, this concept of twenty-first century learning didn't change, but it did certainly evolve into what we see today –virtual calls, online collaboration and the more frequent utilization of edtech platforms like Google Classroom.

Educational technology (edtech) has certainly steadily evolved over the last few decades and is gaining greater acceptance in the modern classroom (Bush & Mott 2009). From computer-aided testing platforms, adaptive learning applications, gamification, and to AI-enabled personalized learning, edtech has been able to offer new student centered approaches to learning than ever before. This proliferation of technology has also presented new depths of student data, allowing teachers to adapt and evolve their practice in order to meet the reported needs of each individual in the class (Ostrow, Hefferman, & Williams 2017). Leveraging of data in this way may not always be the case in every classroom, but technology certainly offers us the opportunity to address problems of practice, innovate pedagogy, further engage students in the learning process and, most importantly, help reduce administrative work so that teachers can focus on what matters most: student learning.

Yet despite the potential, edtech has often fallen short of its expectations. Whilst AI, gamification, VR and AR have certainly begun to alter the way we design learning experiences, studies have shown that the impact of technology on student learning remains mixed at best (OECD 2015). Admittedly this is not always down to the platform itself. Teachers obviously have a huge impact on whether edtech is effectively used, but that does not totally account for why the edtech sector continues to undergo such extreme cycles of hype and disappointment (Scanlon et al. 2013). One reason for these mixed results may be due to the impossible expectation that technology alone will transform education. In fact, what has often been proven to have the most impact is the interaction between appropriate technology and meaningful pedagogy. For example, one study on use of smartboards in the United Kingdom revealed that the effective use of the technology improved student learning when used by teachers interested in developing creative and critical thinking skills in their students (Higgins et al. 2005). In other words, technology is at its best when it is used as a medium for intentional learning design and curated classroom experiences.

Given this understanding, there has been a recent shift toward defining how technology can be best applied in classrooms so that teachers can meet specific overarching standards and objectives. The frameworks outlined around this subject range from internal strategies, to specific curricular and technology standards such as those stipulated by the International Society for Technology in Education (ISTE) standards and the IB curriculum.

However, whilst there is a wealth of information on what teachers should be achieving, there is little information on how they can create those pathways to success. More specifically, there are few examples of how student data collated by edtech solutions can be leveraged in order to inform the development of interventions and lesson plans, creating in turn student specific learning strategies and individual definitions of student success. As a result, despite its potential to transform education, edtech remains limited by the conventional pedagogies still delivered in most classrooms. Moreover, the lack of reliable, relevant evidence on effective selection of edtech, make it even more difficult for teachers and school leaders to make informed decisions about the what and the how of integrating and implementing edtech solutions in their respective classroom and school contexts.

Effective application of edtech in classrooms can be bolstered, however, through close collaboration with practitioners. Whilst some professional development programs that explore the use of technology can fall into the trap of delivering generic strategies, the most effective approaches to building teacher capacity have relied on creating tailored roadmaps based on specific tools, subjects, teacher specialties, and grade level (Batty et al. 2019).

From the outset of our work in this pilot, it became clear that one of the major challenges we would need to help local stakeholders overcome would be their inability to assess and evaluate the effectiveness of education technology in their own terms, especially in a remote / hybrid learning context. Many of the schools we interacted with did not yet have a clear understanding of how blended learning systems could properly integrate technology across home and classroom contexts, and many more lacked clearly defined strategies that allowed teachers to adapt their roles and methods of teaching in order to meet the needs of students in an online space. For example, a number of schools grappled with the idea of whether teachers should remain strictly as facilitators online, especially when this space was able to provide students with far more agency during a lesson than a traditional classroom. Student assessment was also another clear issue during this pilot cycle; how could both summative and formative assessments be made more meaningful through the use of edtech and its backend data? Challenges like these were further exacerbated by the longstanding problem of startups having few opportunities to conduct pilot tests and research with school partners in order to generate evidence on their effectiveness and build schools' confidence in their capacity to help them answer some of these pressing questions (Cukurova et al. 2019).

With that in mind, edtech testbeds are inherently built to address some of the challenges discussed above since they aim to provide "an environment to test and experiment with edtech solutions in a real-world setting" (Batty et al. 2019, p. 5). The idea behind an edtech testbed therefore is relatively simple: provide a school with a selected platform or solution, and through teacher feedback, observations, and data analysis by the research partner, further develop this tool so that it can meet the needs of this classroom and others like it. In essence, testbeds aim to provide schools with a controlled, safe space where pedagogy and learning can be developed in tandem to the platform itself. Indeed, an iterative and experimental approach to testing edtech provides an opportunity to make innovation safer while maximizing real-world impact, as it offers ways to learn how new ideas, technologies, and solutions can be applied to address challenges in learning environments (Rae et al. 2019).

Globally, there are many examples of testbeds that have successfully managed to broker relationships between edtech ventures and schools. For example, iZone in the USA, EDUlabs in Europe, Testbed Helsinki in Finland, and MindCET in Israel, have all developed collaborative partnerships between schools and edtech providers that allowed for edtech companies to improve their products in ways that supported student and teacher needs (Batty et al. 2019). Moreover, NESTA in the UK, has been able to leverage its testbed to create a continual cycle of feedback among schools and entrepreneurs, improving the solution to meet both stakeholders' needs.

CHAPTER TWO

Learning from these experiences, WISE chose to pilot an edtech testbed for the first time in Qatar, Doha in 2020. This edtech testbed comes as an extension of WISE's Edtech Accelerator program that has for the last six years, supported edtech innovation building at a local and global level. As a result, the team have been able to organically mature an extensive network of entrepreneurs and start-ups focused on creating better access to quality education.

With that said, creating a pipeline between the WISE accelerator and the testbed made the most sense when developing this project. These ventures were trusted, established partners, and with the information gathered through a thorough needs assessment of Qatar Foundation schools, we were confident that we would be able to match teachers with edtech partners that best met their needs.

At its core, our testbed aims to first and foremost provide practitioners with access to technologies that address problems of practice and meet relevant student and teacher needs. In connecting participating schools with these ventures, we hoped to provide schools with opportunities to enrich their learning environments. Additionally, teachers would also have access to data and analytics that could track student interaction with online content. Such data included the amount of time spent on a specific topic or how long students took to progress across different levels. This information related to students' "learning journeys" online, would help to examine how data from edtech solutions/tools could inform learning design and whether it helped to accelerate student learning.

Secondly, the testbed seeks to provide professional development (PD) opportunities for participating teachers. The testbed includes a PD component because it aims to do more than simply provide schools and teachers with an opportunity to test various edtech solutions. Rather, the testbed also purposes to enable teachers to make use of edtech in ways that most benefit their objectives and goals. In fact, studies from other contexts have suggested that trainings are limited because they often focus on training for a particular product instead of the more complex task of learning how to connect the technology with pedagogy (Batty et al. 2019). In fact, studies found that teachers' lack of professional knowledge related to digital technology, design thinking, and how they relate to everyday pedagogy is a significant challenge for introducing technology as a design material in schools (Smith et al. 2016, Eriksson et al. 2018). This finding was further confirmed by our focus group interviews and initial survey results that showed how most of the teachers' utilization of edtech were largely limited to learning management systems (LMS), google classrooms, and some online learning platforms such as Kahoot!. Tablets and smartboards are also available and used in the classroom, but school administrators and teachers shared how they are being underutilized.

The PD offered as a part of the testbed, therefore, intends to enable teachers to have agency in exploring and applying how the edtech product can be utilized and integrated into the classroom and pedagogy to address problems of practice, facilitate, and bolster student learning through ongoing reflection as an iterative process. As a part of this process, a particular emphasis was placed on effective use and application of data provided by the EdTech product to inform instructional strategy, design, and practice.

BUILDING FROM THE BOTTOM UP: BUILDING RELATIONSHIPS WITH SCHOOLS

CHAPTER THREE

Although the planning process for the WISE Edtech Testbed began much before the global Covid-19 pandemic struck in early 2020, its launch certainly came at a challenging and uncertain time. The 2020-21 academic year has proved to be an especially difficult one for school leaders and teachers to navigate, with students moving in and out of hybrid classrooms, sudden school closures and re-openings, as well as the ever-present workloads and classroom dynamics to manage. To say that this was an especially busy period for schools would be a massive understatement.

Whilst the global pandemic presented numerous challenges and stressors, the fact that schools shifted largely to remote instruction because of the crisis provided an opportunity for the testbed to rapidly test an edtech solution that could be a valuable supplement to the teaching and learning process. In fact, there remained distinct desire by schools involved in this testbed pilot project to continue working together even as they were navigating the changes and uncertainties of the pandemic. This led us to continue building new relationships with participating schools and adapting to our ever changing circumstances. This consisted of (i) understanding the needs of the participating schools, (ii) designing an adaptive program that would incentivize participation and (iii) creating a collaborative environment that would incentivize active feedback and participation by all stakeholders involved.

1. Relationship building and incentivizing schools to participate

One of the ways that the edtech testbed supports schools is to provides a way for schools to integrate and demonstrate learning design through technology.

Many schools, including those within the Qatar Foundation system, are expected to demonstrate learning design and teaching through technology, and the ISTE standards are largely used as a benchmark for this type of practice. What we came to understand in the early stages of this project was that whilst these standards help to clearly delineate the types of skills that need to be developed, they do not necessarily define the pathways that teachers can use to get there. We therefore used our early discussions with schools to first understand how they were interacting with technology on a day-to-day basis and what their ultimate goals were when it came to embedding technology within their classrooms.

To do this, we coordinated with senior leadership teams to gain a macro-view of their school ecosystems and the challenges within them before speaking with the teachers themselves. The teachers were able to provide a more intimate understanding not only of the school's experience with edtech, but also their goals and targets around edtech, as schools, especially Qatar Foundation schools, are being increasingly expected to incorporate standards and pedagogies around technology and innovation. Through survey questions and small focus group discussions, we slowly gained a picture of what the reality of how edtech use looked in these spaces.

Surveys and focus groups with teachers revealed that teachers do employ and utilize technology and edtech platforms in the classroom but in a limited capacity, with majority of the teachers' use of edtech being limited to learning management systems and Google Classroom. Some had experience using online platforms and resources that provide online enrichment activities and demonstrations for the students, but this was not the case for the average teacher. The majority of the teachers expressed that they felt they had a good grasp of educational technology, and that their use of edtech was sufficient as classroom pedagogy was usually able to fill in the remaining gaps. And for these teachers, they did not necessarily see the need to engage in new and other forms of edtech even if they were curious and expressed interest in professional development around the topic of edtech integration and use in the classroom. This lack of desire to explore new technologies provided challenges for garnering interest and buy-in to participate in the testbed.

Although there was interest from school leadership to test out various edtech products to innovate pedagogy and practice, the lack of expressed need to explore and integrate new edtech products and platforms posed a challenge in generating interest and buy-in.

Moreover, there was the very real issue that much edtech simply did not work in the schools. There are, of course, cases in which an adopted or implemented EdTech tool does not yield expected outcomes. There are also cases in which the applied technology is not the most relevant to student or teacher needs. However, we found that reasons why edtech was "not working" were not exclusively because the tool itself was irrelevant or ineffective. Other barriers to effective edtech use were present which needed to be addressed in launching and piloting the testbed. First, procurement processes for these schools were incredibly lengthy. This meant that the time spent from initially identifying a technology for meeting a current need, to seeing it effectively rolled out in classrooms, could stretch to a year or more; and at such a point school funding, staffing or the challenges themselves may have altered. Second, digital literacy levels widely vary --among both students and teachers. Leading a horse to water won't make it drink; the same can be said for edtech in the classroom. Without a confident teacher who can leverage and purposefully engage with the technology in front of them in their own pedagogy, technology's potential can never be properly realized.

Surveys and focus groups showed that there were two areas that the WISE Edtech Testbed needed to address in introducing edtech products to schools to test and pilot: (i) reduce barriers that arise from long procurement processes and red tape by pre-identifying edtech products based on existing needs and ensure that they are approved and cleared for use in the classroom or schools, and (ii) model ways of utilizing edtech platforms and products in ways that enhance teaching and learning in the classroom through ongoing professional development.

These two aspects were integrated into the core design of the testbed and became launching pads for discussion with participating schools towards an agreement, which included selection of the edtech venture partner.

2. Iterative process that led to agreement and MOU

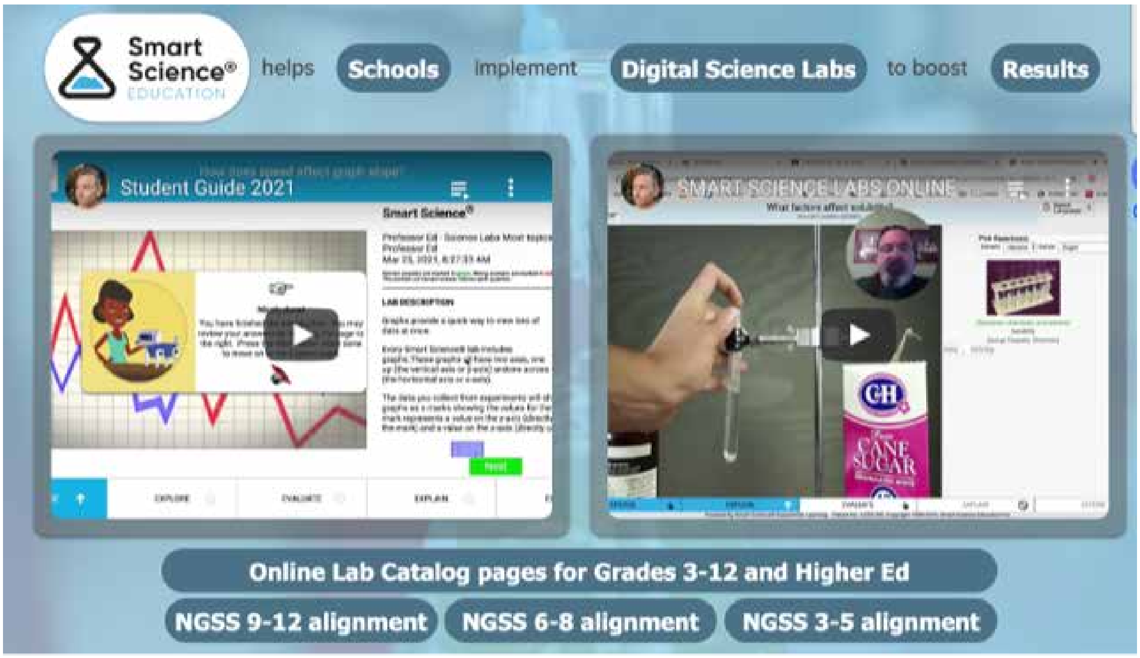
As mentioned above, we used the surveys and focus groups as a way to assess needs of select local schools to derive insights like these and gain a better sense of teachers' experiences with technology, the dynamics within their classrooms and what they hoped to achieve by embedding technology more concretely into their day-to-day practice. Our needs assessment therefore became more than just a tool to determine how best to match venture with school, it also became an opportunity to understand the teachers themselves and their experience of practice with and without edtech.

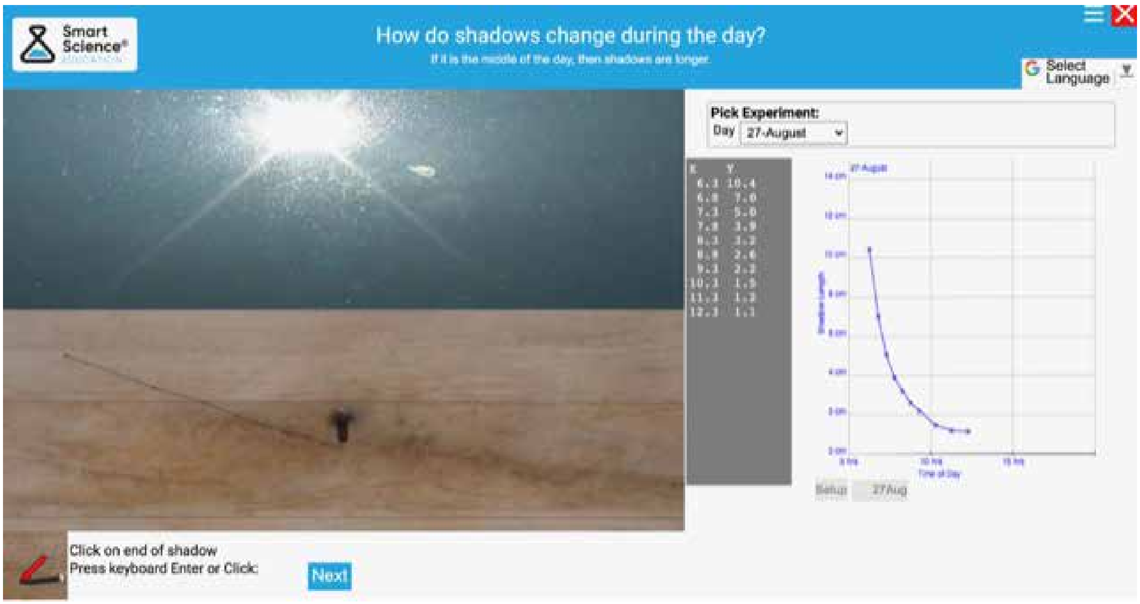
Naturally, results and insights from the needs assessment became the starting point of discussion between the testbed and the schools —from selecting the edtech product to be tested, setting expectations in terms of the scope of support provided and time needed to invest in the testbed, the data that would be collected for the testbed, to how the professional development component of the testbed would look. These discussions led to the beginning of expectations being set by the testbed, school leaders, and the teachers. Senior leadership teams had specific outcomes that they were hoping to meet through this project; teachers were keen to gain further support in technology use and training; and the testbed managers in turn asked for consistent feedback from our new school partners to understand and observe how and in what ways our selected edtech tool was being used and having an effect in the classroom.

As with any multi-level stakeholder project, accounting for each of the needs of these actors and delivering them collaboratively is a difficult task to undertake. Each additional component presents a higher risk of failure. We chose therefore to establish an MOU between us and the participating schools, mainly as a way to concretely define what the schools could expect from us and in turn, what we needed from them. This resulted in MOU agreements being signed with two private schools in Qatar.

3. Selecting an edtech partner for the testbed

After identifying the participating schools and discussing with them about the needs and areas where a new edtech solution could help address a problem of practice, WISE selected and matched one of our Accelerator partners with two participating schools in piloting the testbed.





An identified need in the participating schools was the challenge of having to deliver and demonstrate models, simulations, and labs remotely as instruction shifted online with the global pandemic. One of the WISE Edtech Accelerator ventures (SmartScience) provides a cloud-based learning platform delivering online science labs to students without the need for physical access to science lab equipment. Since it could address this challenge exacerbated by Covid-19, SmartScience, led by CEO Edward Keller, was selected to be a part of the testbed pilot.

After conversations with the schools and with Keller, it was determined that the product would be tested in Grade 8 and 9 science classes in the two participating schools. Given that the participating schools were small, four science teachers participated in the testbed pilot project across both schools.

3.3.1. Why would an edtech venture want to participate in the testbed?

One of the benefits and opportunities for the edtech ventures who are selected to participate in the edtech testbed is that the venture is able to connect with teachers more personally and receive feedback from them about what works well and what does not, which could help the iterative process of developing their edtech product. Moreover, by participating in the testbed, the edtech venture can test its product in more school, regional, and country contexts. This provides the benefit of observing the level of relevance and appropriateness of the product across various locations; it also allows the venture access to a potential new client base that could help expand and accelerate its business.

CHAPTER FOUR

It is not enough to build relationships with schools and come to an agreement about what and how the edtech product will be introduced and tested in the schools. More important is introducing the tool to the teachers; they play a key role in any edtech testbed. As the primary users and implementers of the tool, teachers are best-equipped to see what is possible with new technology and influence how various edtech tools and solutions can be developed (Pihlajamaa & Rantapero-Laine, 2020). Therefore, gaining support and buy-in from the teachers to use and test the edtech product, reflect on their experiences with the product, and having them understand their role as important contributors to the testbed are critical to the successful launch of the testbed.

In garnering buy-in from the teachers to participate in the testbed and test a new edtech product, it is important to recognize that participation in the testbed requires additional time and effort by the teachers. They have to spend time learning about and becoming familiar with the product, implementing it in their respective classrooms, and reflecting on their practice to see how it facilitated teaching and learning. Even with the potential and excitement around utilizing and trying a new edtech solution (e.g. tool or product), the work that the teachers need to put in as participants in the testbed may appear overwhelming and thus a barrier to active participation in the testbed.

One way to overcome this barrier is to use orientation discussions as an opportunity to establish expectations from the outset and share ways participation in the testbed could be beneficial to the teacher, both in terms of their own practice and professional development. During this pilot phase, we made sure to introduce the testbed, its objectives and purpose as well as the edtech partner and the reasoning behind its selection.

Two benefits of participation in the testbed were also highlighted during orientation: (i) the opportunity to try out a new, innovative edtech product in the classroom at no additional cost, and (ii) the ongoing professional development and support provided by the WISE team so that teachers could effectively implement and make use of the platform. We also hoped to demonstrate that participation in this testbed meant more than the superficial introduction of edtech into the classroom, but rather, was a unique opportunity for teachers to collaborate closely with the CEO and staff of an edtech startup.

The orientation session with participating school leaders and teachers garnered a great deal of energy. There was initial excitement to test the SmartScience platform during the academic year, as it seemed to deliver an alternative way to experience lab experiments -something of particular interest to schools who did not otherwise have the resources to meet this type of practice, especially in the COVID context.

4.1. Covid-19, technical difficulties, and challenges to continued implementation

Despite this initial enthusiasm however, actual usage, testing, and implementation of SmartScience was extremely low and well below expectations. Some of the reasons we identified for this were as follows:

Challenge 1: Increased workload, stress, and pressures due to Covid-19

Covid-19 presented unanticipated challenges and additional stress for teachers who were suddenly asked to navigate constant changes in the mode of instruction. With teachers facing the disruptions of school closings, re-openings and having to shift much of their instruction online, there remained little capacity for experimentation. Moreover, the new hybrid model of instruction that schools were expected to deliver meant that the staff could have upwards of 30 percent more teaching time. Not only were teachers now expected to run online sessions, they also had to plan for in-person classes for students who were still able to attend school. The increased workload limited any planning time teachers had remaining, and therefore understandably, they did not have the bandwidth to invest in, or explore, the newly introduced technology. The PD workshops we intended to curate for school partners were designed to help teachers reflect on their lessons, the evolving needs of their students and of course, further explore SmartScience as a resource to deliver appropriate labs. However, given increasing time limitations of workshops, teachers were asked to take on some short, independent tasks ahead of our meetings.

At the beginning of this endeavor, teachers had been excited about the prospect of engaging with technology in a new way through our testbed. But with immediate needs growing more urgent, and the challenges of adjusting to constant changes in modes of instruction more demanding, teachers moved away from testing new technology and instead, were pulled further toward familiar, existing tools. In addition, given the increased pressure on teachers to cover as much content as possible, school leaders chose not insist teachers use the edetch product and fully follow through with the testbed. School leaders remained our greatest champions during this pilot cycle, but there was diminishing impetus as the year went on to encourage staff to test the platform as we had originally intended. Experimentation takes a great deal of patience; as any good scientist knows, things often don't work immediately as you would want, and the effects of new strategies can be incremental. Patience in the middle of a pandemic therefore became less virtuous, and more of a heavy burden,

In response to teachers' lack of use and engagement with the platform, Keller noted that under-utilization of SmartScience and other similar platforms was not unique to Qatar, nor could it be simply attributed to the stress of Covid-19. Indeed, Keller detailed many cases where teachers simply became overwhelmed with the task of implementation because there was such a breadth of content available which would take time to explore and curate. Keller added, however, that he observed consistent evidence of positive learning outcomes once practitioners had become familiar with the content and began applying it to suit their own classrooms.

These anecdotes certainly pointed to the need for intensive scaffolding of any platform outside of the PD sessions. Whilst the PD intended to support application of the platform, this appeared to surpass an integral part of the onboarding process that we had overlooked – simply learning how to navigate the basic mechanics of the technology. We had made mistaken assumptions of teachers' digital literacy skills; this ultimately served to undermine our later attempts to see SmartScience used consistently.

Teachers' reluctance to engage with the platform stemmed most often from a lack of capacity to leverage SmartScience. We often take for granted just how steep the learning curve can be for teachers to use edtech but assume that students will not have much difficulty adopting new technological platforms. However, we found that a significant number of students struggled with utilizing a new platform on their own, indicating that digital literacy may be low.. A clear learning here for us and for Keller therefore, was that accessibility for students and teachers alike meant more than engaging design and relevant content. It was also important to deliver an experience that reduced effort for both levels of stakeholders. Teachers needed a something that was simple and clear to navigate from the outset, and students required a platform that could account for their unique context.

Let's go into this a little more deeply. From the outset, participating teachers reported their initial difficulty in navigating between the student and teacher platforms. Once they logged in, teachers found that they needed to toggle between student view of the platform and the instructor platform in order to see student interactions with their chosen virtual lab. The repeated log-ins, switching between the instructor and student view, became a burden for the teachers, contributing to a diminished interest in further exploring the platform.

Moreover, though an extensive library of content is provided by Smart Science, and Keller demonstrated how teachers could utilize the plethora of resources on the online platform, there was limited interaction between teachers and the platform. In theory, this extensive categorization of content should have created a better way for teachers to identify which labs would be most appropriate for their classes. However, the lack of time we were afforded to explore this platform extensively with the teachers, compounded by how the platform was not tightly customized to each school's curriculum, lesson objectives and plans, served as barriers to application of the edtech content in the classroom.

SmartScience's virtual labs meet various subject-specific standards, as well as technology integration/usage standards that more and more schools and districts require. However, whilst SmartScience may target a global audience, it is difficult to account for all of those contexts within a single platform. In doing so, it became even more difficult to ensure that this wealth of information would be accessible to all users at any given time.

As part of the testbed, establishing a feedback loop of this kind between the venture and our school partners, was of course one of our main objectives there was value in receiving such frank commentary from participating teachers. However, whilst commentary from the teachers was generally informative to the overall development of the platform, there were other points of feedback that were sometimes too vague to translate into concrete adaptations. Nonetheless, the SmartScience team decided to take specific feedback on the design of the platform and conducted a UI/UX audit of the new interface before their last platform iteration and relaunch. Since the testbed pilot, the team have continued to focus on ways to make navigation better and more intuitive.

Despite platform use, in the end, being far more limited than expected, participation in the testbed did provide opportunity for Keller and his team to receive clear direction on areas of improvement across content and design so that the overall user experience could be improved.

Challenge 2: Delayed implementation due to bureaucracy and infrastructure issues

One unfortunate circumstance that contributed to the dwindling interest of teachers in the testbed over time was that we were unable to launch the testbed in the beginning of the academic year as hoped.

Because of general unpredictability during the Covid-19 pandemic, it took longer than expected for the participating schools and the WISE Edtech Testbed to set expectations, come to an agreement in form of an MOU, and gain the necessary approvals to conduct human-subject research approval exemptions for the testbed pilot phase. The need to navigate IT security policies and protocols so that the platform could be accessed securely from Qatar contributed to further delay in launching the testbed and engagement with the SmartScience platform. This required

SmartScience to migrate its content to a server that was approved by the IT department for security levels. SmartScience did navigate the IT security protocols and were able to migrate its server in a relatively timely fashion. However, the need to ensure all security requirements were met, alongside other changes that were occurring among the school partners around expectations and requirements, resulted in the decision to delay the start of the edtech testbed pilot from the beginning of the academic year to the start of the second term.

This delay negatively impacted the teachers' ability to utilize and engage with the platform. Firstly, there was a time gap between initial introduction of the testbed and SmartScience, and the actual start of the testbed. This was because one school had gone through orientation at the beginning of the year, and then had to wait an entire semester until the next interaction with WISE and the edtech venture, which is when the testbed pilot officially began. Moreover, because lesson plans for the second term were mostly complete by the time the edtech solution was introduced, it was difficult for teachers to find time and space to integrate content from the edtech platform into existing, already planned lessons. The outcomes may have been different if we had launched the edtech product in schools prior to the school year by at least demonstrating how content offered by edtech products could be advertised and discussed with the students.

Furthermore, once the testbed was launched and teachers had access to SmartScience, an new unanticipated challenge arose: the inability to load content within the SmartScience lab in the schools due to slow internet connectivity and/or security restrictions (eg. firewall) in the schools. This was a surprise because SmartScience went through the process to meet all security requirements to be used within the participating schools' network. The slow internet connections also made it difficult for teachers to load the virtual labs in the schools in teaching remotely and in hybrid models. This created and added to teacher frustration, weakening their desire and will to engage with and test SmartScience with the students.

Challenge 3: Difficulties for students to access virtual lab content

Of the four teachers that participated in the pilot, two assigned virtual labs to all students in their classrooms. In both classrooms, students completed the introduction and the first quiz of the lab. None of the students went beyond the introductory portion of the lab into completion. Because there was limited use of the platform, we cannot make inferences about the extent to which the platform enhanced and/or facilitated their learning. Nonetheless, interviews with teachers about student engagement and feedback on the platform revealed that many students struggled in accessing the content. In fact, teachers expressed the difficulty for students in first navigating the platform and following instructions on logging on to the platform and progressing through the labs independently.

Additionally, teachers expressed that there was "too much reading" required for the students to engage with the virtual labs and that the literacy level was often above the students' average reading level. This was a surprising finding, as there are SmartScience labs specifically targeted for students in Grades 8 and 9, and that certain labs were differentiated for students across various academic abilities. Also, Google Translate was integrated with the virtual labs if students needed to access the content in a language other than English for additional language support.

That students could not adequately access the virtual science labs for reasons discussed above suggests that there is a need to first address students' digital literacy levels and also further integrate literacy across other subjects so that students can access and learn content knowledge in ways that are not hindered by below-grade level reading competence. This suggests that future PD sessions with teachers in how to integrate edtech solutions/platforms into lesson plans and student assignments need to also cover how to help students grow in digital literacy and literacy skills to be able to access and take advantage of digital and virtual content to the fullest.

4.2. On engagement, access, and support

Despite the challenges and very limited use of SmartScience, participating teachers noted that an important and helpful aspect of their testbed experience was the ability to engage with and access support from the CEO of SmartScience. The support provided by SmartScience was not limited to sharing of resources and videos that illustrated how to utilize the platform. The teachers were able to meet with the CEO of SmartScience virtually to ask questions about the platform and get a customized and tailored "demo day" that provided step-by-step guidance for using the platform effectively in addition to suggestions/recommendations from the CEO about which lab content the teachers may want to start with based on the subject and the grade level they were teaching as part of their professional development (PD) workshops.

In fact, the extent to which "in-person" connection and support from the CEO facilitated teacher use of SmartScience was reflected in the teachers' choices of lesson (lab) assigned to the students. After hearing the needs and level of the students from the teachers, the CEO recommended they begin with the "measurement and precision" unit, as that unit provides the fundamentals to engage with science labs. All the teachers who used the solution, regardless of the grade or specific subject area they were teaching, assigned this recommended lab first.

Of course, given that the teachers only made efforts to assign one virtual lab to the students and did not make further efforts to identify virtual labs that could be appropriate and relevant for their students and the key content knowledge being covered within a lesson/unit, it is difficult to make any assessments or draw substantive conclusions. However, what this suggests is that involvement of the edtech venture in the professional development process and having the edtech venture facilitate teachers' thought and planning process to brainstorm and ideate how the platform/tool can be utilized and integrated into their lessons could be helpful in facilitating teachers' use and implementation of the edtech product/solution.

LESSONS LEARNED AND RECOMMENDATIONS FOR FUTURE ITERATIONS OF THE TESTBED

CHAPTER FIVE

In reflecting upon the challenges and opportunities revealed by edtech testbed pilot, it appears that there are at least four main areas that need to be addressed for a more effective run of the testbed:

1. Recommendation: Start building relationships early, set clear expectations and norms, and continuously revisit them

Pilot phase of the testbed revealed that it is important to start building relationships with schools early and anticipate changes and adjustments along the way. This is important not only for identifying committed school partners for the testbed, but also for having enough time to consider benefits of participating in the testbed and setting clear expectations and norms, so that both the participating schools and the testbed are clear on what to expect from and of one another in this partnership. Moreover, early introduction of the edtech product to the schools and teachers would provide time for the teachers to plan with the edtech product/ solution in mind as they are lesson planning and preparing for the upcoming term. This would likely help increase use of the edtech solution/product throughout the course of the testbed cycle and have the school (teachers and administrators) follow through for better or worse for the duration of the testbed.

At the same time, however, it is important to note that there is high turnover rate for teachers in these schools in Qatar. This means it may be difficult for schools to know which teachers would be participating in the testbed for a given cycle based on the selected product. Though such planning would have to happen closer to the actual launch of a testbed cycle, building relationships early on, and sustaining those relationships throughout, would allow for the testbed to work with the schools to think through and plan for joining teachers and those who may have been briefed about the testbed.

2. Recommendation: Test the edtech product prior to actual implementation to avoid technical difficulties and delays

One of the ways that the WISE Edtech Testbed could facilitate the process of introducing new technologies into Qatar's schools would be by working closely with the IT department to clear security requirements in advance, and test the platforms/products in the schools to ensure that they work and are accessible. This would allow for smoother roll out of edtech platforms and products in schools so that teachers would not have to waste time and energy getting the platform to run in the classroom, but could instead focus on how to integrate educational technology in their lessons and pedagogy.

3. Recommendation: Identify an "digital innovation" or "edtech" champion to help drive and motivate teachers to try out the edtech product

One of the major challenges faced during the pilot phase was the lack of a teacher who understood and saw the potential of new technologies being introduced in the classroom, and was invested in testing out new edtech tools as part of the testbed. It is critical for school leaders to be invested in the testbed and to be champions who can encourage colleagues to try out new edtech, step out of one's comfort zone, and innovate practice. However, the school leader cannot be the sole champion, as teachers may feel pressured to comply and just use the edtech product once to "check the box" instead of actually considering how to make best use of the given product by connecting the technology with pedagogy.

Having a "champion teacher" to advocate for using the edtech product, and think/ideate with other teachers participating in the testbed to address challenges --especially those around student access and student digital literacy, is crucial. Such teacher leaders could help sustain energy and enthusiasm to continue testing the edtech product long enough to assess its effectiveness in enhancing student learning experience and outcomes, and/or addressing problems of practice or challenges faced by teachers in the teaching and learning process. This could help create a culture of reflection, iteration, and innovation within the school, encouraging collaboration and co-creation among teachers and partners within the testbed. Such a community of educators who share learning about edtech can become advocates in helping the venture strengthen their product, making it more relevant and useful for addressing real-world, real-time needs in the classroom and school context.

After all, the most important part of the testbed is the willingness of the teachers (and schools) to try something new and put in the time required to learn it and implement it well. Having a willing teacher become a "champion" to encourage and nudge other participating teachers to put in the required time to use it could help produce meaningful impact.

4. Recommendation: Involve the edtech venture in ongoing professional development of teachers

The testbed pilot revealed that opportunity for the teachers to access staff from the edtech venture to provide support and co-create and co-ideate with the teachers to make use of edtech platform/solution was helpful. Involving edtech venture in ongoing professional development of teachers as a part of the testbed would allow opportunities for teachers to receive training in how to use the particular product while being encouraged and challenged to think and reflect on how to connect the technology with pedagogy and needs in their respective classrooms. This would allow teachers to develop professional knowledge related to both educational technology and design thinking that would allow for more innovative pedagogical practice.

CONCLUSION

CHAPTER SIX

At the conclusion of the testbed's pilot phase, it became clear that there were more barriers within Qatar's current education system than initially anticipated. From IT and data protocols, to the incentivization behind professional learning, all the way to system level policies, developing an edtech testbed cannot be approached through a single lens. It should be considered a lateral initiative that involves the entire learning ecosystem. To unpack some of the challenges we saw during this last phase will therefore require a wholesale effort to create an edtech hub capable of supporting the development of research projects such as ours. This will undoubtedly take an extended period of time to realize, but it does not necessarily mean that the challenges we will face in our next cycle will remain impossible barriers to achieving the innovation and development we originally sought.

The learnings we've gained have allowed us to prepare for this next cycle and adjust our implementation strategy in anticipation of challenges related to school buy-in, platform use and structural policies. As most educators will agree, change within the sector is often incremental; we hope that by the time we come to the final cycle of this testbed, we'll be able to look back at this first iteration as a starting point for the significant change we've set in motion within our local learning landscapes. We hope to empower the global community to do the same through our shared knowledge and ever improved practice.

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ACKNOWLEDGEMENTS

Acknowledgements

The authors would like to thank **Her Highness Sheikha Moza bint Nasser**, Chairperson of Qatar Foundation, and **Her Excellency Sheikha Hind bint Hamad Al-Thani,** Vice Chairperson and Chief Executive Officer of Qatar Foundation, whose vision and guidance have supported WISE. They continue to believe in the power of education to create better lives for people around the world.

The authors would also like to thank teachers and school leaders across Qatar Foundation schools who participated in focus groups and interviews. We also extend our special thanks to those who participated in the testbed pilot. We also thank Edward Keller, the CEO of Smart Science, and his team for being a part of the WISE Edtech Testbed and the pilot study.

Additionally, the authors would like to acknowledge members of the WISE team for their invaluable assistance in the various stages of producing this report. Thanks to the Frazil House Advertising team in Qatar for the design and layout formatting of the report.

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REFERENCES

Batty, R., Wong, A., Florescu, A., & Sharples, M. (2019). Edtech testbeds: Models for improving evidence. *NESTA Report*.

Bush, M. D., & Mott, J. D. (2009). The transformation of learning with technology: Learner centricity, content and tool malleability, and network effects. *Educational Technology,* 49(2), 3–20

Cukurova, M., Luckin, R., & Clark-Wilson, A. (2019). Creating the golden triangle of evidence-informed education technology with EDUCATE. *British Journal of Educational Technology.*

Eriksson, E., Heath, C., Ljungstrand, P., & Parnes, P. (2018). Makerspace in school—Considerations from a large-scale national testbed. *International Journal of Child-Computer Interaction.* 16: 9-15.

Higgins, S., Falzon, C., Hall, I., Moseley, D., Smith, F., Smith, H., & Wall, K. (2005). Embedding ICT in the literacy and numeracy strategies: final report. *University of Newcastle.*

OECD (2015). Students, computers, and learning: Making the connection.

Ostrow, K., Hefferman, N., & Williams, J. (2017) Tomorrow's EdTech Today: Establishing a Learning Platform as a Collaborative Research Tool for Sound Science. *Teachers College Record,* 119(3), 1-36.

Pihlajamaa, J. & Rantapero-Laine, A. (2020). School as an innovation platform - a unique model for co-creation: the Finnish Smart Learning Environments for the Future project. In European EdTech Network. May 25, 2020.)

Rae, J., Arntzen, S., Wilcox, Z., Lee, N., & Hodfield, C. (2019). Testing innovation in the real world. *NESTA report*.

Scanlon, E., Sharples, M., Fenton-O'Creevy, M., Fleck, J., Cooban, C., Ferguson, R., Cross, S., & Waterhouse, P. (2013). *Beyond prototypes: Enabling innovation in technology-enhanced learning*. Open University, Milton Keynes.

Smith, R., Iverson, O.S., Veersawmy, R. (2016). Impediments to digital fabrication in education: A study of teachers' role in digital fabrication. *Journal of Digital Literacy and Digital Competence.* 7(1): 33-49.

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