team4tech

Solutions Roadmap

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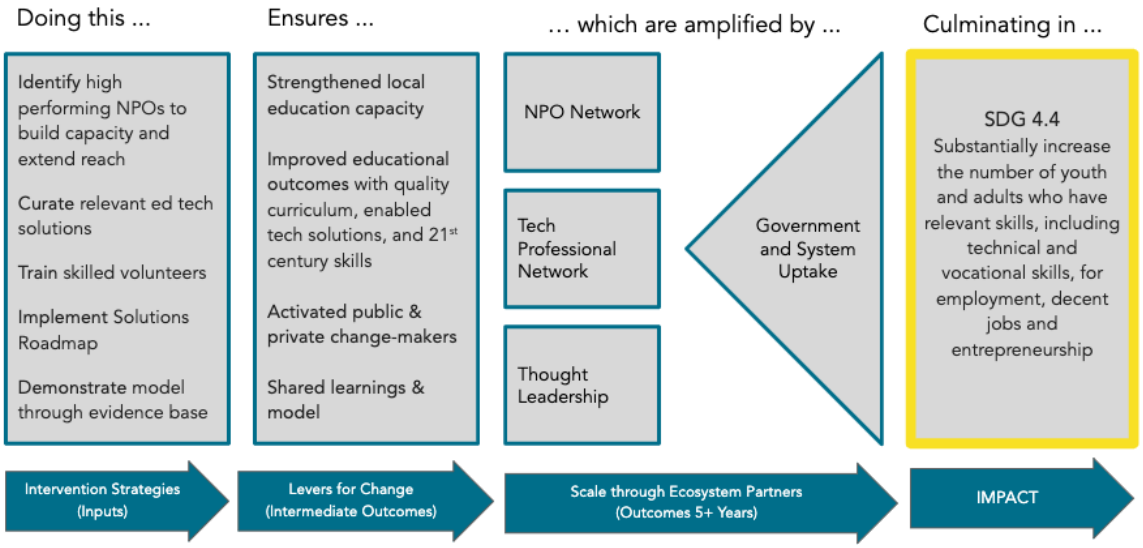
Introduction

Team4Tech works to advance the quality of education for underserved students around the world by engaging technology pro bono consultants and solutions to support accredited non-profit organizations (NPOs) who have a vision for how technology integration can help them amplify their impact on teaching and learning. The goal is to build capacity for NPO staff, teachers, and students to use technology to accelerate knowledge acquisition and build lifelong learning skills, with a view towards expanding economic opportunities for learners in the global knowledge economy.

Figure 1. Team4Tech's Theory of Change



This whitepaper summarizes Team4Tech's approach to partnering and building capacity for local NPOs. We outline the typical phases of a collaboration life cycle, designed to amplify the impact of our partner NPOs on teaching and learning. We have also provided short vignettes from three of our long-term partnerships, highlighting outcomes as well as sharing challenges we faced along the way.

Global Context

Since 2000, the international community has rallied together to end poverty by setting the Millennium Development Goals (MDGs) and Education for All (EFA) goals. At the World Education Forum 2015, a framework for action was created to ensure access to basic education. In the same year, the global community adopted Sustainable Development Goals (SDGs) with SDG4 that "ensures inclusive and equitable quality education and promotes lifelong learning opportunities for all" (United Nations, 2017). Globally, access to education is improving, but the quality of education is still poor. 250 million children cannot read or write a cohesive sentence even though 130 million are in school (UNESCO Education for All Global Monitoring Report, 2014) and there continues

to be an over-emphasis on rote-learning practices in developing countries even though more and more jobs require 21st Century skills (Brookings Institute, 2016).

Information and communications technology (ICT) plays a critical role in providing access to education and moreover, addressing issues of inclusion, equity, and quality. At the Incheon World Education Forum in 2015, the approved Qingdao Declaration continued to emphasize leveraging ICT to achieve SDG4 by 2030. The declaration states:

> *The remarkable advances in Information and Communication Technologies (ICT) and the rapid expansion of internet connectivity have made today's world increasingly interconnected and made the knowledge more accessible for every girl and boy, woman and man. To achieve the goal of Inclusive and Equitable Quality Education and Lifelong Learning by 2030, ICT must be harnessed to strengthen education systems, knowledge dissemination, information access, quality and effective learning, and more efficient service provision.*

Especially in underserved communities around the world, harnessing ICT to design and deliver education and training programs in innovative ways is imperative. Nearly 40% of schools across 65 developing countries lack access to computers and the Internet for training. In the *World Development Report 2018: Learning to Realize Education's Promise* (WDR 2018), the World Bank continues to document high inequality, poor learning outcomes, and slow progress in education across low- and middle-income countries. To address issues of inclusion, equity, and quality in education, the strategic integration of ICT can improve access, extend learning spaces, and provide multiple ways of delivering effective learning resources and opportunities.

Research Foundation

Team4Tech's approach to NPO capacity building is grounded in research around how technology usage can most effectively advance the quality of teaching and learning, ultimately resulting in improved educational outcomes and expanded economic opportunities for learners.

Technology Integration

Technology alone is not transformative and access to devices alone is not enough to shift learning outcomes. A 2015 report released by the Organisation for Economic Co-operation and Development (OECD) provided an international comparative analysis of countries that had invested in ICT for education and revealed sobering mixed results (at best) on student outcomes.

However, a consensus in technology-assisted learning literature shows that technology can help to build both foundational and lifelong skills. This is particularly true when technology is integrated with the core curriculum and linked to changes in approach to teaching and learning (Brookings Report 2019). Research shows that the combination of teacher training and educational technology used for interactive learning and authentic applications is the "ideal" and most impactful (Darling-Hammond et al. 2014)

For example, in systematic reviews of education interventions, technology-assisted learning, together with teacher training programs, has among the largest positive effects on learning outcomes (World Development Report 2016; Ortiz and Cristia 2014; McEwan 2015; Evans and Popova 2015). A meta-analysis of 77 randomized education experiments in developing countries (McEwan 2015) found that the largest mean effects of school-based interventions on learning were produced by treatments with a computer or instructional technology (0.15) and teacher training (0.12). In another World Bank study (Evans and Popova 2015), the intervention category which most commonly produces large improvements in student learning is pedagogical interventions that match teaching to students' learning - or adaptive instruction - including the use of computers and technology.

From 2014-2018, in the All Children Reading: A Grand Challenge for Development (USAID, 2019), improvements to children's foundational reading skills were observed across all 14 projects carried out in ten countries due to some type of technology-based educational innovation. From these pilots, five recommendations were made:

1. The importance and potential for technology-based projects to effectively disseminate material to underserved populations in their mother tongue.
2. Technology-based projects present the opportunity to differentiate instruction and provide beneficial individualized learning experiences to students.
3. Technology-based projects now facilitate digital tracking and assessments of students' learning experiences, although implementation can still be difficult in remote areas.
4. The quality of the hardware and software used for teaching and learning matters greatly.
5. The users' ICT comfort level should always be considered. Interestingly, across all projects, the children did not have significant problems using technology, even when exposed to technology for the first time.

Capacity Building for Teachers

Across high-performing education systems worldwide (and within-country disparities), what matters most is effective teaching. High-quality teachers are the key ingredient. Successful students have been exposed to good teaching more often (OECD 2016). In the most extensive meta-analysis to date, Hattie (2003, 2009, 2015) examined 65,000 research papers on the effects of hundreds of interventions and their effects on student learning and the result: the 20 most powerful ways to improve learning are all linked to the teacher. Teachers are crucial to students' knowledge acquisition and critical thinking (Coe et. al. 2014).

In the *World Development Report 2018 (22)*, one of the three "promising principles" to make teaching more effective is the delivery of professional development. Additionally, the *World Bank East Asia and Pacific Regional Report* (2018) highlights the key across high-performing education systems: their investment in and focus on teachers. Digital Promise shares how "ensuring that educators are effectively trained in research-based teaching methods may be one of the most powerful ways to reform education" (Darling-Hammond et. al. 2009). Quality teacher professional development leads to effective teaching and the research points to effective training as local, individualized,

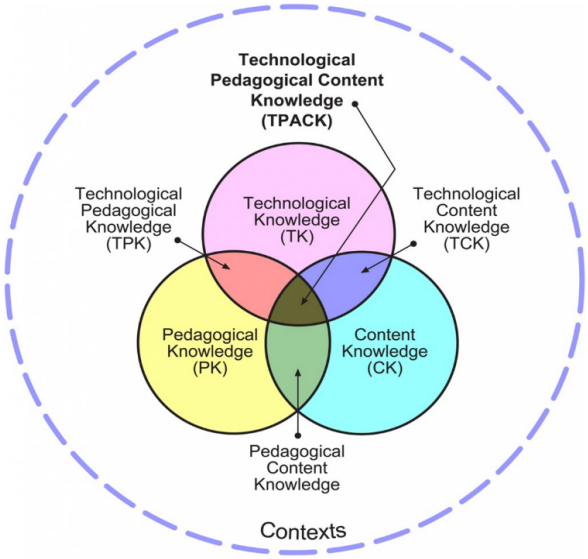
specific, practical, and continual development (Darling-Hammond et. al. 2017; Popova, Evans, and Arancibia 2016; Walter and Briggs 2012; Yoon et. al. 2007). Moreover, the Brookings Institution (2018) argues for education "leapfrogging" - transformative shifts in teaching and learning - and presented six innovative teaching pedagogies to effectively integrate technology: blended learning, computational thinking, experiential learning, embodied learning, multiliteracies, and gamification.

Team4Tech works to integrate technology by staying abreast of educational technology research, literature, and recommendations across all projects. Partnerships focus on capacity building for local staff members and educators as they are critical to the success of fully adopting new technologies into teaching and learning. Team4Tech's work is defined by our localized human-centered design process of infusing relevant technology into the education community.

Team4Tech's Model

Guided by the foundational research regarding the promise of technology integration and the importance of linking it to capacity building for teachers, Team4Tech projects focus on integrating relevant technology into local contexts to produce measurable improvements in teaching and learning. Specifically, the Team4Tech support model is based on the TPACK framework (Mishra and Koehler, 2006), which outlines teachers' essential steps for ICT integration to ensure that its classroom use is both meaningful and productive. TPACK reinforces the idea that technology should be used *only after* gaining clarity of content goals and using appropriate activities. TPACK can also guide teachers' self-reflection around their progress in meaningful ICT use along a continuum of improved pedagogical practices.

Figure 2. TPACK Model for Technology Integration



At the heart of good teaching with technology are three core components: content, pedagogy, and technology, plus the relationships among and between them, creating six areas of focus for the advancement of teaching and learning when incorporating technology.

Content Knowledge (CK) is teachers' knowledge about the subject matter.

Pedagogical Knowledge (PK) is teachers' deep knowledge about the processes, practices, and methods of teaching and learning.

Technical Knowledge (TK), otherwise known as Fluency in Information Technology, requires that users understand ICT broadly enough to apply it productively, recognize when ICT can assist or impede the achievement of a goal, and to continually adapt to changes in ICT. Effective teachers are empowered to choose appropriate technologies that might afford or constrain the types of content ideas that can be taught.

Partnership Highlight - Building Capacity for Teachers in South Africa

With about 22 million young people currently in its education system (UNESCO Stats 2020), South Africa continues to be one of the most unequal societies in the world, as a legacy of its apartheid system of government (1948-1991). As of 2011, the black population accounted for "more than 90% of the country's poverty share" (Leibbrandt, Wegner, and Finn, 2011). This inequality is further magnified in South Africa's education system. In 2016, the latest trends in International Mathematics and Science Study (TIMSS) revealed that "of 200 black pupils who start school just one can expect to do well enough to study engineering. Ten white kids can expect the same result." (The Economist, 2017) In fact, "the learning gap between the poorest 60% of students and the wealthiest 20% of students is approximately three Grade-levels in Grade 3, growing to four Grade-levels by Grade 9" (Spaull, 2015). And yet, as the government invests in its education system, the impact is evident: "Between 1994 and 2014 the number of black graduates with degrees … more than quadrupled. [From] 2004 and 2014, [the number of] black graduates increased by about 137 percent (compared to 9 percent for whites), while the black population grew by about 16 percent" (Spaull, 2016).

Over the last six years, Team4Tech has partnered with LEAP Science and Maths Schools to invest in their IT infrastructure at each of their six schools and provide ongoing teacher training to integrate technology into their instruction:

2014 focus	2015 focus	2016 focus
Priority: Infrastructure and building a digital foundation	Priority: Infrastructure and organizational capacity building	Priority: Infrastructure and increased digital literacy
- Deployed teacher laptops - Introduced teachers to productivity tools (MS Office)	- Deployed more teacher laptops and set up school server - Introduced teaching staff to integrating technology into core	- Deployed teacher laptops, student tablets, projectors, and printer - Advanced teacher confidence

	curriculum	and collaboration through digital literacy (Google Suite)
2017 focus	2018 focus	2019 focus
Priority: Advancing teacher capacity and introducing students to maker mindsets	Priority: Infrastructure upgrade and expanding maker education	Priority: Infrastructure updates and integrating technology into the core curriculum
- Advanced teacher productivity skills using technology - Introduced maker education through various introductory projects and beginner coding platforms	- Virtualized main server and updated school computer lab - Integrated more advanced coding kits into maker curriculum and project-based learning	- Upgraded school servers and improved network - Provided adaptive math software for all schools - Advanced students understanding of robotics

Ensuring strong teacher pedagogy was important to this partnership in working with six of LEAP's Science and Math schools. Each LEAP administrator and their staff were varied in their experience and pedagogical training.

Pivotal moments and learnings in the partnership:

- *Empowering the black South African community:* In 2019, Team4Tech reflected with LEAP's Founder and Executive Director, John Gilmour, on the partnership as it had evolved over the course of the last five years. He remarked on one major approach of Team4Tech: placing their local nonprofit partners in the driver seat by always asking "What do you want? What is your IT strategy?" rather than driving the conversation and telling partners what they needed. Mr. Gilmour remarked how LEAP didn't have an IT strategy but when confronted with the question from Team4Tech, it not only made them realize they should create one for LEAP but also, empowered them to take charge of their own vision and goals.
- *Teacher capacity building at the forefront:* Hungi et al.(2011) report that only 32% of South African Grade 6 mathematics teachers have desirable levels of mathematics content knowledge - again, a legacy of the apartheid system where black South Africans were banned from math and science education. "This is in stark contrast to many other poorer African countries with much higher proportions of maths teachers with desirable levels of mathematics content knowledge" (Spaull, 2015). As a result, many of LEAP's teachers are not native to South Africa and come with varied experiences and pedagogical background. And yet, Team4Tech's partnership built upon LEAP's commitment to the local black communities - not just for the youth and students - but also for the teachers in providing a dynamic and inspirational teacher training program. Therefore, Team4Tech's projects focused on teacher capacity building first and only as time allowed, students workshops second.

Collaboration Model

Team4Tech's core strategy is to strengthen relationships, build capacity, and empower local communities for sustained impact in developing high quality, 21st century education. To achieve this, Team4Tech identifies high performing NPOs supporting quality education for underserved learners and works with them to design collaborative capacity-building projects that can advance the quality of teaching and learning through the effective integration of technology. Throughout the engagement, Team4Tech provides coaching and project management to support the development of appropriate measurement and evaluation tools.

Team4Tech also recruits, trains, and manages teams of *pro bono* consultants (referred to as "Fellows") from global technology companies to provide in-person capacity building to NPOs and the educators they serve. During in-service projects, workshops are tailored to meet the needs of the NPO and site staff. Teacher training is often focused on developing confidence and proficiency in practical digital literacy skills as well as introducing relevant education software. Training for NPO and site leadership supports the development of a community of practice, establishing vision and mindsets for 21st century teaching and learning. Furthermore, Team4Tech engages with NPO partners across three- to five-year engagements to provide ongoing, scaffolded training.

Figure 3. Building Relationships for Scaled Impact

Team4Tech works closely with its NPO partners to identify goals and success metrics for each phase of the collaboration. Team4Tech conducts an IT health assessment (needs assessment) for the NPO to inform the Program Development Plan that will guide the long-term collaboration. Team4Tech then supports the NPO with capacity building around technology implementation and teacher training to ensure that solutions are addressing local needs in a practical, individualized, focused, and sustainable way.

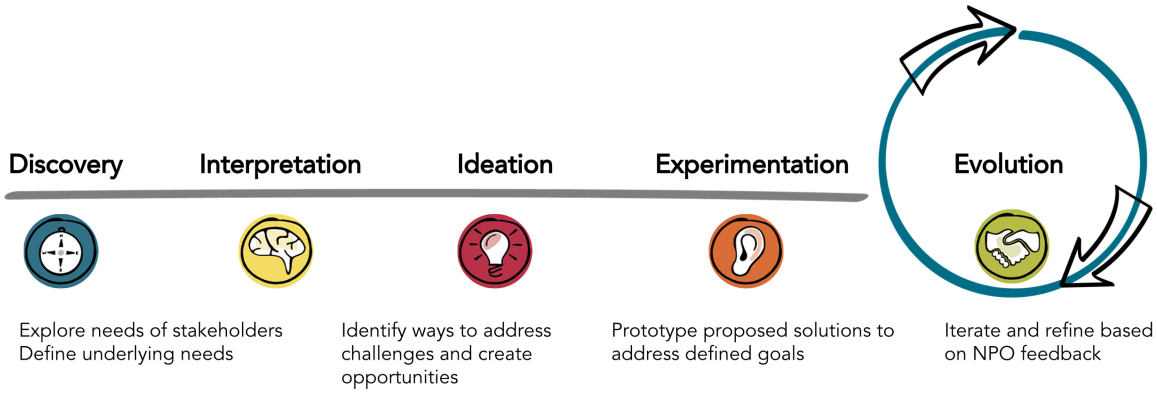
Partner Selection and Program Development

Team4Tech selects its partner NPOs based on three primary criteria:

- demonstrated, sustainable education impact;
- alignment of program goals with Team4Tech's mission and Fellows' skills;
- commitment to monitoring and evaluation around program impact.

Team4Tech uses a human-centered design model to shape and support each NPO partnership. Modeled from IDEO's Design Thinking for Educators, the process begins with *Discovery* at least six months prior to the engagement of a team of pro bono Fellows. Team4Tech works with the NPO partner exploring the needs of the different stakeholders involved, including the NPO as well as the needs of school leaders, teachers, students, and communities they serve to define the program goals and project scope of work. The focus then cycles from the *Interpretation* of the underlying needs through *Ideation*, identifying new and creative ways to address real and perceived barriers, to *Experimentation* and *Evolution*, ensuring that proposed solutions actually work to address the defined goals. Classrooms and schools across the world are facing design challenges every single day, from integrating new technology to equitably managing resources. The human-centered design model provides a collaborative, creative framework for Team4Tech and our NPO partners to explore and address issues with a new perspective to design innovative solutions that work in the local context.

Figure 4. Team4Tech's Human-Centered Design Process with NPO Partner



The objectives of a Team4Tech partnership with NPO staff and site leadership are to help:

- Explicitly define the needs of the learning environment;
- Craft a plan for developing site leadership capability, technical infrastructure and support, digital literacy for teachers and potentially, participating students;
- Secure resources to maintain infrastructure and provide technical support;
- Develop, revise, and monitor measurement and evaluation metrics to evaluate the effectiveness of implementation and report on progress toward established goals;
- Cultivate external relationships necessary toward scale and sustainability.

Partnership Highlight - Iterations from Vietnam

With more than 10 million students in Vietnam's education system (World Bank EdStats, various years), returns to schooling are rising and the labor markets for youth are rapidly changing. Vietnam's Fundamental School Quality Level (FSQL) standards designed in 2001 have shown that basic inputs enhance learning outcomes. Students' test scores in Mathematics and Vietnamese have gone from 10% to 40-60% of students scoring "excellent" (Attfield and Vu 2012). The population of 20-24 years old in Vietnam has 8.6 years (on average) of schooling compared with 7.5 years of schooling in the working-age population, and job prospects for graduates are high - with increasingly high returns to additional years of schooling (Barro and Lee 2013). According to the World Bank Development Report (2018), Vietnam is nearing 100% primary school enrollment. However, more than 50% of school children still do not have access to the Internet. As much as the returns for educational investment are clear, so are the continued needs.

Over the last six years, Team4Tech has partnered with Kidspire Vietnam to provide after-school educational technology classes to 500+ children growing up in Vietnamese orphanages. A major priority of this project was to expand university and life opportunities for these learners. Across nine orphanages, Team4Tech provided hardware, software, and training to support Kidspire Vietnam staff, volunteer teachers, and students to increase student self-confidence, develop critical thinking, and enhance communication and creativity:

2014 focus	2015 focus	2016 focus
Priority: Infrastructure and building a digital foundation	Priority: Infrastructure and organizational capacity building	Priority: Infrastructure and lifelong learning
- Deployed student laptops - Fostered 21st-century skills in students through the introduction of coding and robotics	- Deployed more student laptops, classroom projectors, and WIFI routers - Introduced teaching staff to human-centered design concepts	- Deployed more student laptops to additional orphanages - Developed LeadVN (Kidspire's career preparation program) with career planning tools
2017 focus	**2018 focus**	**2019 focus**
Priority: Foundations for Maker education	Priority: Expanding Maker education	Priority: Advancing Maker education and empowering learners
- Introduced maker education through various robotic and coding kits	- Integrated more advanced coding kits into maker curriculum	- Established student digital portfolios to showcase their work - Introduced positive storytelling into the curriculum for building students' socioemotional health

		- Embedded 3D designing and entrepreneurship into Maker curriculum

Using a human-centered design process was key to supporting this growing nonprofit organization to build up its staff and refine their vision. As Team4Tech utilized the human-centered design process in planning and supporting Kidspire staff, the leadership of Kidspire started implementing this same process into their own teacher and student program development.

Pivotal moments and learnings in the partnership:

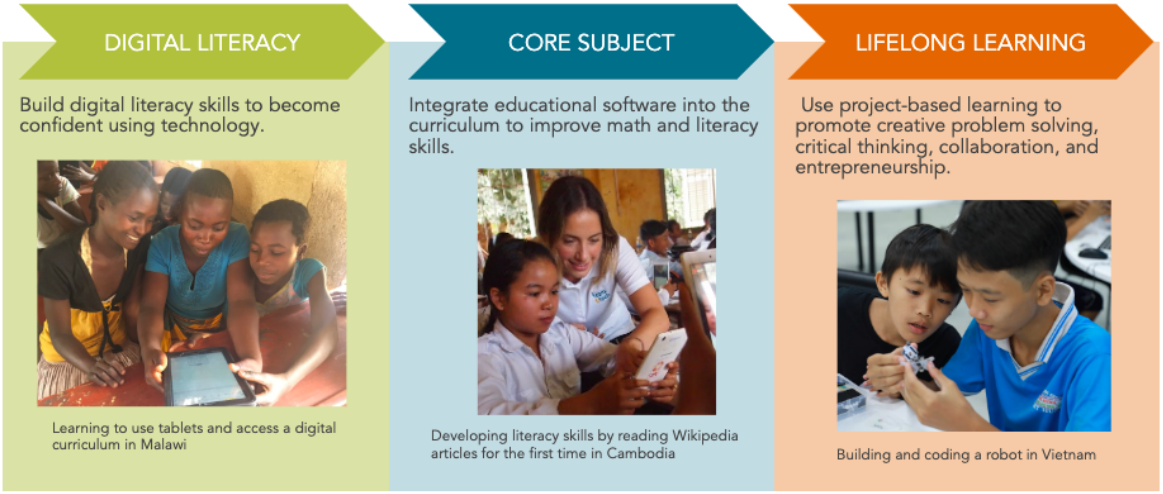
- *Unafraid to experiment and change course:* In 2014, when Team4Tech started partnering with Kidspire Vietnam, Kidspire was ambitious, hoping to reach and engage as many Vietnamese orphans in their after-school program as possible. In the Ideation phase, the challenge was access to educational technology classes, and in the Experimentation phase, the solution was Kidspire classes maintained across 20 orphanages. However, as the partnership continued, it became clearer to the leadership of Kidspire that the underlying need was not simply educational technology, but also personal mentorship and the socioemotional needs of these children. According to the *World Bank East Asia and Pacific Regional Report* (2018), "children who develop strong socioemotional skills are more likely to persist with effort in the face of hardship and achieve higher test scores." Therefore, the focus and scale of Kidspire needed to change, as well as the Team4Tech projects. By the end of 2017, Kidspire scaled down their work into just 9 orphanages but increased or maintained their teacher-to-student ratio as well as increased the number of class hours per student. And in addition to educational technologies, Team4Tech sought to support Kidspire through socioemotional curricula and technology scaffolds.
- *Interpretation and ideation every step of the way:* Although Team4Tech has partnered with Kidspire for many years, taking the time to listen, understand the underlying need, and then finding ways to create new opportunities is pivotal to each year's project. By the end of 2018, Kidspire had amassed a critical set of technology tools for their maker curriculum and yet, their lessons felt disjointed. The solution was no longer "more tools" but rather, sustainability, instilling a maker mindset, and connecting the technologies into a cohesive curriculum.

Long-term Partnership

According to the *Technology Acceptance Model* (TAM), there are two key factors that determine whether someone will adopt new technology: *perceived ease of use* and *perceived usefulness* to one's work (Davis 1989). Digital Promise further reports that "educator support of and comfort with technology is fundamental to technology adoption in the classroom" (Hew and Brush 2007). Therefore, while each Team4Tech collaboration with an NPO partner is unique, most engagements follow a long-term

three-phase model across a three- to five-year partnership. At the school level, this often begins by establishing a technology foundation and constructing teachers' digital literacy and technical capacity. Successive projects build from this foundation to integrate relevant educational software and digital content to meet defined learning objectives. The final phase emphasizes student-centered teaching and learning, with capacity building workshops for teachers around project-based learning and other activities to further strengthen lifelong learning skills. [See Appendix Table 1 for detailed objectives, focus areas, and success metrics for each phase of this programmatic model.]

Figure 5. Team4Tech's Long Term Three Phase Model



Phase One – Digital Literacy

The focus of Phase One is to support the NPO in empowering the school or learning environment to 1) build leadership capacity, 2) develop teacher digital literacy, and 3) lay foundational technology infrastructure with adequate maintenance and support. Team4Tech helps with the capacity building of a Site Leadership Team to guide and support the transformation of learning environments and teaching practices. The Leadership Team is responsible for identifying needs, developing plans for infrastructure and maintenance, building a shared vision amongst teachers and staff, running pilots, leading a Community of Practice, and planning and leading teacher development.

Phase One teacher training workshops are most often focused on developing teacher confidence and proficiency in their own digital literacy, as well as learning to use instructional technology to teach digital citizenship, basic web searches, and introduce productivity software. Training for NPO staff and Site Leadership supports the development of project-based learning, establishing the vision and mindsets for 21st Century teaching and learning, setting and tracking goals, designing instructional support plans and troubleshooting.

Objectives of a Phase One project may include:

- NPO and school leadership staff are able to demonstrate foundational digital literacy, including the operation of laptops, devices, and peripherals, navigation of the web, use of productivity software including email and document creation.

- Teachers are able to use technology to plan and deliver lessons, including presentation software and overhead projectors.
- Students acquire knowledge of digital citizenship, how to operate laptops, and conduct basic web research.

Phase Two – Accelerating Core Subject Learning Outcomes

The focus during Phase Two shifts from laying foundations and supporting basic digital literacy to the integration of technology into local core subject classroom instruction. Teacher workshops are typically focused on expanding teacher confidence and proficiency in utilizing technology for instructional practices as well as introducing differentiated instruction. Staff workshops are focused on augmenting site-based leadership to expand the availability of technology and instructional support.

For NPO and school leadership staff, the objectives of a Phase Two project may include:

- assess the needs of staff, teachers, and students with respect to integrating technology into the classroom
- expand foundations to provide a stable and secure infrastructure that supports increased teacher and student access
- expand collaboration and teacher instructional support
- select and evaluate appropriate educational software and tools
- troubleshoot and solve technical issues
- build awareness among the broader education ecosystem

For participating teachers, the objectives of a Phase Two project may include:

- integrate technology effectively into the teaching of their local core curriculum
- begin to target instruction and differentiate instruction based on student needs
- incorporate project-based learning opportunities to increase student engagement

Finally, for participating students, the objectives of a Phase Two project may include:

- demonstrate positive digital citizenship
- learn local core subject matter through educational software
- perform online research
- troubleshoot basic technical issues

Phase Three – Lifelong Learning Skills

The full combination of ICT and lifelong learning entails moving from learning opportunities that are enhanced through the use of technology to learning environments where teachers and learners collaborate to create new knowledge. Teacher workshops in this phase include empowering teachers to fully utilize project-based learning, human-centered design, and moving through the TPACK model of technology integration. Teachers may have the opportunity to practice STEAM activities, maker education, coding, and other collaborative tools.

For NPO and school leadership staff, the objectives of a Phase Three project may include:

- provide a strong infrastructure to support reliable access for all teachers and students during core learning time

- provide continued teacher development in project-based learning, opportunities for hands-on STEAM activities, and digital content creation
- involve the broader education ecosystem to begin sharing and scaling learnings

For participating teachers, the objective of a Phase Three project may include:

- provide opportunities for students to become productive digital citizens - to communicate, collaborate, solve problems, generate new ideas, work at their own pace, and drive their own learning

Finally, for participating students, the goals of a Phase Three project may include:

- collaborate, communicate their ideas, solve problems, and generate new ideas
- demonstrate their depth of knowledge
- make informed choices to drive their own learning

Partnership Highlight - Change Over Time in Rural Cambodia

With a population of 15.6 million, an adult literacy rate of 74%, and about 3.5 million students, Cambodia's educational system is now categorized as "emergent" where the alignment of policy with practice has been attempted (basic school conditions, teacher selectivity, and support) (*World Bank East Asia and Pacific Regional Report* 2018). Net primary enrollment rates have increased significantly and girls now have equal access. However, although primary school enrollment is nearing 100%, secondary school enrollment is still less than 40% and according to Barro and Lee (2013), the average years of educational attainment among the population of 25 and older was less than four. Moreover, less than 20% of school children have access to the internet (World Bank Development Report 2018).

Over the last four years, Team4Tech has partnered with CARE Cambodia in the rural region of Ratanak Kiri as a part of their Know & Grow project which targeted nearly 3000 youth, over half of whom are ethnic minorities. A major priority of this project was to empower these minority youth, especially girls, with expanded economic and life choices. Across five middle schools, Team4Tech provided hardware, software, training, and support to regional and school-level ICT Core Trainers, teachers, and students to promote equality, educational attainment, and quality teaching:

2016 focus	2017 focus	2018 focus	2019 focus
Priority: Infrastructure and building a digital foundation	Priority: Organizational capacity building and advancing teacher productivity	Priority: Organizational collaboration and integrating technology into classroom teaching	Priority: Increasing student engagement, creativity, and problem-solving skills
- Deployed computer labs, teacher laptops, and student tablets - Workshops focused on IT setup and use, word	- Established equipment tracking system and organizational upkeep - Workshops focused on	- Installed offline servers to mitigate connectivity issues - Workshops focused on STEM content creation	- Adding interactive Khmer STEM simulations and advancing content use of offline servers

processing, file management, etc. - Supported student engagement in STEM	advanced office skills and digital magazines for creating and sharing STEM content	using the servers, video production, and utilizing Khmer content (Wikipedia, etc.)	- Workshops focused on coding, robotics, and maker activities to augment learning and inspire

Using a long-term model was key to supporting these dynamic rural communities. The needs and opportunities of the learning environment varied across each school, and with each year the local infrastructure to support technology was rapidly changing. The first two years laid down digital foundations and organizational capacity building, the third year addressed offline capabilities, and by the fourth and final year, schools - especially the students - were prepared to take on coding, robotics, and maker activities. Each year was an iteration and refinement based on previous year learnings and, with each progressive year, Team4Tech's relationship with CARE Cambodia staff was further reinforced: each partner knew the role, responsibilities, and strengths of the other.

Pivotal moments and learnings in the four-year partnership:

- *Addressing challenges and creating opportunities through Phase 1 and 2:* Starting in 2016, the infrastructure for connectivity was a major issue in this rural part of Cambodia. The first two projects attempted to make use of limited access but connectivity continued to be a challenge. However, for the third project, Team4Tech chose a different route: employing offline servers that contained Khmer content and still allowed teachers to upload and download their own created content. These servers allowed teachers and students the opportunity to still "access the internet" through an offline solution. And by the end of 2019, some schools had LTE connectivity and the infrastructure could now support more advanced technological solutions.
- *Refinements and finishing strong in Phase 3:* Due to fluctuating school staff and a range of teacher motivation, Team4Tech training wasn't getting as much traction as anticipated. After the first two years, CARE Cambodia staff members recommended a strategic change in priorities: continue to train the ICT Core Trainers and teachers, but also train students to take ownership and empower them in their own learning. Since the adults seemed apprehensive and sometimes unwilling to integrate technology, the aim was to spawn demand from the students. By bringing along extremely motivated, curious, and invested students into Team4Tech workshops, the technology was placed directly into the hands of inspired users. Although this didn't completely mitigate the greater issue of teacher motivation, it did provide an alternate avenue toward increasing student engagement.

Outcomes

Team4Tech measures its impact through four outcome categories. These categories cover assessments and measurements for our multiple beneficiaries: learners (pre-primary to

secondary, vocational, entrepreneur), and teachers/school administrators/NPO staff/local community members.

Figure 6. Team4Tech's Outcome Categories

Each of our nonprofit partnerships is unique and together, we design solutions that address local challenges. Team4Tech also collaborates with each nonprofit to create a program development plan for the course of the 3-5 year partnership. In this plan, Team4Tech works with the nonprofit partner to identify partnership goals, short-term project outputs, and long-term outcomes. Our nonprofit partners commit to collecting, monitoring, evaluating, and reporting back on data twice a year. This allows Team4Tech and the nonprofit to learn, improve, and make a sustainable impact together.

Conclusion

Since 2013, Team4Tech has implemented this phased support model to help 25 partner NPOs integrate technology to advance teaching and learning for over 60,000 learners in 18 countries. Our work has catalyzed over $11M in pro bono consulting services and technology grants for these local NPO partners.

While each partnership has been tailored to local needs, the long-term journey has proven relevant across all contexts and partners. Team4Tech will continue to adapt the model to incorporate new learnings and best practices from future projects as they are implemented.

Appendix

Table 1. Team4Tech Solutions Roadmap

	Phase 1 Digital Literacy	Phase 2 Core Subject	Phase 3 Lifelong Learning
Phase Goals	Support NPO (in helping school or learning environment) develop teacher digital literacy and foundational technology infrastructure.	Support teachers in integrating relevant technologies into the local core curriculum.	Support teachers in integrating student-centered, project-based methods to build lifelong learning skills.
Client Prerequisites	NPO + Learning Site(s) will be able to demonstrate: ● Site leadership and vision ● Teacher interest in building ICT literacy ● Sufficient infrastructure* for the first cohort of teachers and students, including: ● Power, secure storage ● Devices and productivity software for teachers ● Access for students ● Software for students ● Plan for tech support ● Plan for instructional support ● NGO funding for Team4Tech matching grant (if a grant is required)	NPO + Learning Site(s) will be able to demonstrate: ● Site leadership and development plan for expanded integration ● Teacher readiness for ● Technology Integration (1st cohort) ● ICT literacy (2nd cohort) ● Sufficient infrastructure for expanded teacher and student access ● Plan for expanded tech support ● Plan for expanded instructional support	NPO + Learning Site(s) will be able to demonstrate: ● Site leadership and sustainability plan ● Teacher readiness for ● 21st Century learning, including PBL or other student-centered learning shifts (1st cohort) ● Technology Integration (2nd cohort) ● Site-wide ICT literacy ● Sufficient infrastructure to support reliable access for all teachers and students ● Plan for expanded tech support ● Plan for expanded instructional support
Phase Objectives	Participating teachers will be able to demonstrate use of: ● office productivity software ● operation of tech hardware (e.g. laptop, tablets, smartphone, printer, projector, flat panel) ● web search Teachers will be able to teach students: ● digital citizenship ● web search ● operation of tech hardware	Participating teachers will be able to use instructional technology to: ● enhance the teaching of curriculum: ○ Math, Literacy ○ English, Languages, Research, Sciences, Social Studies ● increase student engagement Students will be able to: ● demonstrate positive digital citizenship	All teachers will be able to provide opportunities for students to: ● communicate, collaborate, solve problems, create new ideas ● work at their own pace ● drive their own learning Students will be able to demonstrate an increase in: ● 21st century skills ○ communicate, collaborate, solve problems, create new ideas ● interest in learning

	The teacher support team will be able to:
	● plan for effective implementation
	● support effective use among participating teachers
	  ○ select and evaluate software
	  ○ troubleshoot and solve technical issues
	● evaluate effectiveness of implementation
		● use math, language, and other instructional software effectively
		● troubleshoot technical issues
		
		The teacher support team will be able to:
		● plan for effective expansion
		● support effective use among participating teachers and students
		  ○ integrate into teaching and learning
		● evaluate the effectiveness of implementation
			● depth of knowledge
			
			The teacher support team will be able to:
			● plan for effective expansion
			● support effective use among participating teachers and students for
			  ○ small group instruction
			  ○ personalization
			  ○ project-based learning
			  ○ STEM projects
			● evaluate the effectiveness of implementation

Technical Solution	● Basic infrastructure foundation including network, computers (i.e. desktops, laptops or tablets), printer, and projector or display. ● One computer for the first cohort of teachers, and shared access for participating students. ● Very basic device usage with projector/display, productivity software, search, etc. ● Teacher productivity software and pilot instructional software is on teacher devices. ● There is adequate electrical power to run or charge computers. ● Computers are kept in a dedicated room with safe storage. ● The student:device ratio is typically no more than 10:1 and low enough for students to use the devices once or twice a week. ● Tech and user support may be very basic but must be sufficient for computers to be usable by students and teachers on a daily basis with an SLA of 1 or 2 days.	● Infrastructure is expanded into the classroom environment so that teachers and students can use their Wi-Fi mobile devices (e.g. tablets and laptops) in the classroom. ● Laptops are used to support subject-matter curriculum delivery. ● Some hardware and software integration (e.g. makers, robotics and coding) for select grades and subjects. ● The student:device ratio is typically no more than 5:1 and low enough for students to use consistently for at least one subject or use the devices on a regular or daily basis. ● Tech and user support is sufficient to keep computers operational for the subjects in which they are being used with an SLA of hours.	● Infrastructure may be expanded across the entire learning space including classrooms, such that teachers and students can use their Wi-Fi mobile devices (e.g. tablets and laptops) across the entire learning space. ● STEM peripherals (e.g. robotics, maker, coding, etc.) used to support science and math subjects, as well as support project-based learning and extracurricular activities for middle and high school grades. ● The student:device ratio is typically no more than 2:1 and low enough for students to use consistently for multiple subjects. ● Tech and user support is sufficient to keep computers operational for the subjects in which they are being used with an SLA of minutes.

Training Focus	Developing teacher confidence and proficiency in their own: • Digital literacy (Basic device use, Projector/display, Productivity software, Search) Using instructional technology to teach: • Digital Citizenship • Search • Supplemental software (productivity, games, free programs) Developing capacity for site-based leadership & support (supported by NPO) • Developing a Community of Practice • Establishing vision & mindsets for 21st C Teaching and Learning • Setting goals and tracking progress • Troubleshooting & instructional support	Developing teacher confidence and proficiency in instructional practice: • Intro to targeted small group and self-paced learning • Methods for student engagement • Classroom management for small group instruction • TPACK model for integrating technology (intersection of tech and content) Using instructional technology to teach: • Content mastery (Literacy, Maths, Sciences, Social Sciences) • Search Developing site-based leadership & support	Developing teacher confidence and proficiency in instructional practice: • Project-based learning • Human-centered design • TPACK Model for integrating technology (intersection of tech and pedagogy) Using instructional technology to teach: • STEAM • Maker Ed • Coding Developing site-based leadership & support
Tools Delivered by Tech Volunteers	IT & Support • IT maintenance guide/BKMs • privacy/security controls • Managing User accounts & Passwords Site Leadership • change management tools • running community of practice • models for decision making • Setting up and managing device access Digital Literacy • Device Protocols, Tips & Tricks • Productivity software training guides (samples) Lesson Samples for • Introducing Digital Citizenship lessons • Classroom management	Site Leadership • Usage plans for new SW/tools • Tracking & evaluating usage • Resource management Instructional Practice • Edtech SW guides (e.g. how to interpret student dashboards), guided • Small group instruction • Exit ticket/check for understanding Lesson Samples for • Research • Math, Reading, Writing, Science	Site Leadership • Setting up and managing a Maker Space • 21st Century Teaching and Learning Environments • 21st Century Mindset Instructional Practice • Project-based learning resources/guides • Individually targeted instruction • Scaffolding teamwork • Open-ended questions • 21st century skills assessment rubrics Lesson Samples for • Collaborative assignments • Using tech tools to communicate • Project-based learning units • online content / curriculum / resources

	Protocols, Tips & Tricks using Tech • Supplemental software (games, tools, etc)		
NPO Capacity building	Design Vision and Implementation Plan • Vision for 21st Century Teaching and Learning • Define Metrics of Success and Tracking methods • IT and Infrastructure plan • Teacher development plan Develop Site-based Leadership • Site Leadership • Develop a Community of Practice • Tech Support • Build external relationships to support success and scale	Develop Site-based support systems • Site Leadership • A Community of Practice & instructional support • Tech support • Invite participation of broader ecosystem	Update Sustainability plan • Leadership • Funding • IT and Instructional support • Showcase emerging successes with the broader community
Success Metrics	Across all long-term partnerships, Team4Tech collaborates with each NPO to develop indicators of growth under four major outcome buckets: <u>Learner Engagement</u> • Access, uptime, participation, and usage • Portfolios and increased opportunities <u>Learner Growth</u> • Knowledge & skills gain • Local subject (STEM) pass rates • Learning outcomes <u>Teacher Productivity</u> • Confidence & efficiency gains • Motivation & creativity gains • Knowledge & skills gain <u>Sustainability & Scale</u> • Internal systems developed • External relationships formed • Opportunities for external participation, government uptake		
Ongoing NPO Efforts	• Regular leadership and PD sessions • Metrics and evaluation support • Build external support	• Regular leadership and PD sessions • Metrics and evaluation support • Invite broader (external) participation	• Regular leadership and PD Sessions • Metrics and evaluation support • Showcase emerging successes