DECONSTRUCTING DESIGN: TRANSFORMING READING ASSESSMENTS THROUGH TECHNOLOGY IN CAMBODIA

The Case Study of World Education's TEST App

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ACKNOWLEDGEMENTS

ACRONYMS

CamMob	Cambodia Mobile Developers
DAI	DAI Global, LLC
DI	Development Innovations
ICT	Information and Communication Technologies
KAPE	Kampuchean Action for Primary Education
MoEYS	Ministry of Education, Youth, and Sport
NGOs	Non-Governmental Organizations
TEST	Technology for Education Systems Transformation
TRAC	Total Reading Approach for Children
WEI	World Education Inc.
WV	World Vision
USAID	United States Agency for International Development

DEFINITION OF KEY TERMS

Human Centered Design (HCD): A multi-stage approach to the design of tools and services that focuses on developing empathy with users, understanding problems through their eyes and experiences, and making strategic decisions that are guided by that empathy and understanding. HCD was created to help design solutions that respond to users' needs and concerns, and in doing so solve complex problems in a sustainable way (IDEO.org, 2015).

Inspiration Phase: The first phase of HCD. During this phase the designer defines the communities of interest, studies the problems they are facing, and engages them in a creative process (IDEO.org, 2015).

Ideation Phase: The second phase of HCD, wherein the designer analyzes the data and findings obtained during the Inspiration Phase, brainstorms possible solutions with the design team, creates a prototype (or prototypes) and presents it to the target audience for feedback. During this phase, the designer will make changes and continue to iterate their prototype based on feedback from users (IDEO.org, 2015).

Implementation Phase: The third and final phase of HCD, where the designer launches and implements the solution. This includes piloting the tool, the human processes that make it work or that it feeds in to, listening sessions to collect feedback from the target audience, and continual iteration as time and resources permit. By this stage, the designer will have a strong sense that that the solution will solve the problem, given the high level of user engagement throughout the development of the project (IDEO.org, 2015).

Information and Communication Technologies (ICT): Technologies which enable access to information through telecommunications such as the internet, wireless networks, cell phones, and other communication channels (Christensson, 2010).

Iteration: The process of improving a solution by testing it with users, making improvements based on user feedback, then testing and iterating again until a working solution is created.

National Reading Standards/Reading Benchmarks: A benchmark system developed by World Education Inc., and the Cambodian Ministry of Education, Youth and Sports and Kampuchean Action for Primary Education (KAPE) in 2015 to complement the national curriculum of first, second and third graders. The reading benchmarks illustrate the explicit tasks and skills that each student should acquire at each particular interval. This benchmark helps teachers pinpoint slow learners and identify appropriate interventions to support them (World Education Inc., 2018).

Prototype: The first or original form of a solution, app, tool, or service. Generally a prototype is used for user testing; it exists to show the user where the developers are in their process, and solicit direct feedback on how well it works. Prototypes are generally used in the early stages of development, but can also be deployed at later stages to ensure a product's function and fit to its audience (Oxford Dictionaries, 2018).

EXECUTIVE SUMMARY

In 2014, World Education Inc., (WEI) developed a literacy assessment application for primary school teachers and students with the support of the United States Agency for International Development (USAID)'s Development Innovations (DI) project. The Technology Education Systems Transformation (TEST) tool was developed to help teachers and students conduct better, faster, more accurate, more standardized, and less biased examinations, using the National Reading Standards[1] approved and endorsed by the Ministry of Education, Youth, and Sport (MoEYS).

This case study, **Deconstructing Design: Transforming Reading Assessments Through Technology in Cambodia** describes the TEST project from inspiration to implementation to sustainability. The research for this case study was carried out through desk reviews, in-person interviews, and focus group discussions with the TEST project team, as well as key stakeholders and project beneficiaries who played an important role in making the TEST project possible.

The TEST app was inspired by the challenges that primary school teachers encountered when using paper versions of reading assessments for their students. Through their field research, the WEI team identified those challenges: long testing times, error-prone review methods, and scoring bias, and identified the opportunity to develop a mobile tool to address these problems. In addition, the WEI team conducted additional user research to validate assumptions and explored the various tech tools available to teachers and students. Following field feasibility testing, a prototype was developed and tested with targeted users to gather feedback for refinement and iteration. The TEST project has since undergone thorough user-testing and iterative design, after which the app was finalized and implemented.

Prior to roll out in schools, the TEST app encountered a number of challenges, including the lack of institutional buy-in and investment during the design phase, and lack of tangible benefits for users and stakeholders during early stages of the project. The WEI team needed to navigate and manage a wide spectrum of preferences presented by different types of users and their distinct technological capabilities. As the first app of its kind, that TEST app also needed to prove its usefulness to secure funding and generate partnerships to scale beyond the pilot. Based on the success and lessons learned from the TEST project, organizations and development practitioners who wish to implement a technology-enabled solution should first begin with the problem statement, learn from the target users, explore the existing and appropriate ICT tools and resources, engage users in the design process, test the proposed solutions, refine the solution until it meets the needs of the users and finally identify and build strategic partnerships to ensure the success and sustainability of the solution they create.

This paper is published with the purpose of sharing the successes, challenges and lessons learned through the design and development of the TEST app with DI's NGO partners who are currently implementing ICT projects; donors who are interested in investing in ICT for

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[1] In this study, the term "National Reading Standards" and "Reading Benchmarks" are used interchangeably.

development projects; and development practitioners who want to study the implementation of ICT for education projects in Cambodia.

INTRODUCTION

"It is difficult to identify the real ability of each student since they can easily cheat on the printed assessments. There is no standard time per each question. Thus, we need to examine ways to ensure that each student has standard time for their test. We need a tool that could evaluate student's reading skills in a systematic and transparent manner." Sokchanna Chhay, Former ICT Specialist, WEI.

Grade two students are using the TEST app at Toul Roveang Primary School in Takeo Province.
Photo Credit: Development Innovations/Sotheavy AT

Project Background

With support from the United States Agency for International Development (USAID) through the Development Innovations (DI) Project, World Education Inc., (WEI) implemented the Technology Education Systems Transformation (TEST) project, which digitizes the reading benchmarks designed by WEI's Total Reading Approach for Children (TRAC) project under the Continuous Assessment System (CAS) activity. The reading benchmarks align with the Cambodian national curriculum and demonstrate the explicit tasks and skills that each student should acquire at specific intervals. The benchmarks help teachers pinpoint slow learners and identify appropriate interventions to support them. The TEST app also facilitates teachers' and students' understanding of the utilization of technology in the classroom. The app is a free to use and was built on the learning and experience of the TRAC project[2].

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[2] World Education Inc. (2015). Quarterly Report 1: Technology for Education Systems Transformation (TEST).

Prior to the implementation of the TEST project, teachers used laminated paper copies of reading assessments to conduct each interval test for students. During the assessment, students listened to the teacher's instructions and marked down their answers on papers[3]. This approach caused teachers to spend a considerable amount of time correcting students' papers and caused difficulty for teachers in determining appropriate interventions to help students, based on their individual needs. The TEST app not only saves teachers the time necessary to conduct and evaluate students' assessments, but also resulted in greater transparency and consistency, and confidence in the assessments themselves. As such, it provides teachers and schools with consistent information that will enable them to offer better interventions, customized for individual students. It also provides the Ministry of Education, Youth and Sports at both the provincial and the national level with standardized information about the results and performance of schools and students[4].

Since 2014, the TEST app has been used by more than 12,000 students in grades one through three, 45 government officials and 620 teachers and educators. At the time of this report, TEST has more than 6,000 active users across Cambodia[5].

Methodology for Case Study

This study employs qualitative methods through a desk review of project documentations such as the original proposal, grantees' quarterly reports and field monitoring reports; and through interviews and focus group discussions with Development Innovations' team, Innovation Program Advisor, WEI's project team, mobile app developers (CamMob), MoEYS ICT Department and beneficiaries at the targeted school. The approach narrated in this case study and the visual mappings of TEST project were developed based on project documents and interviews with key stakeholders and beneficiaries. In addition, the authors conducted a field visit to Siem Reap province to meet with beneficiaries such as the Provincial Department of Education, a school director, teachers and students to learn about their insights and experience using the TEST app.

In the following pages, this case study will describe the project from inception through to implementation, following the Human Centered Design (HCD) process, followed by the success of the TEST app, challenges and lessons learned and conclusions and recommendations for practitioners.

INSPIRATION PHASE

"Sometimes you are focused on a specific problem, sometimes you are focused on a specific population. The only thing not to focus on is the solution. If someone has an idea for a tool, it is best to think of it in terms of the problem you are solving and the people you are solving it for." - Adam Fivenson, Senior ICT Specialist, DAI

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[3] Development Innovations (2014). Development Innovations Catalyst Fund Approval Memorandum: P001.
[4] Development Innovations (2014). Development Innovations Catalyst Fund Approval Memorandum: P001.
[5] Neff, V. (2018). Grantee Final Report. Phnom Penh: World Education Inc

Problem Identification

During field visits, the WEI team discovered that after each paper-based assessment, teachers spent a significant amount of time correcting students' papers and could not suggest interventions to address weaknesses in a timely manner. Additionally, the project team found that paper-based tools were not effective in measuring the ability of students because the lack of oversight of such an approach facilitates cheating. To evaluate students' abilities, each student should be given a standard time to answer each question during the reading assessment. Testing in such a way minimizes the opportunities to cheat during the test.

Between 2012 and 2014, WEI implemented the *Total Reading Approach for Children (TRAC) project* which improved reading outcomes for students in grades one and two through a series of continuous assessments based on the reading benchmarks[6]. Under the TRAC project, the WEI project team expanded their activities with the Ann Khmer (Read Khmer)[7] app, designed to help early grade students to pronounce and read Khmer language through sound, animation and games. Since its launch in 2013, the Ann Khmer app has received remarkable attention and support from teachers and students in Phnom Penh. To respond to the student interest in using technology for learning, WEI sought an opportunity to use a digital tool to standardize the assessment, reducing scoring errors and bias that ensured the quality of test results.

With the introduction of the Ann Khmer app, teachers and students have developed their interest and familiarity in using technology in the classroom setting. At the same time, WEI and CamMob conducted a rapid study on teachers and students' behavior in using technology, particularly tablets, and examined how tablets can substitute and digitize paper-based assessments. Given teachers' and students' previous experience and familiarity in using tablets, WEI and CamMob decided to develop a tablet-based app as opposed to web-based platform or other tech tools. Additionally, a tablet app is the most appropriate tech tool to replace to paper-based assessment since tablet is mobile, affordable and easy to use in the classroom.

During the same time period, the Good for Nothing[8] team, a tech group based in New Zealand and working to accelerate social innovators internationally, engaged with DI to release a call for NGOs' proposals in solving problems related to their work. The WEI team took the opportunity to discuss with Good for Nothing their ideas to address challenges teachers faced in administering paper-based assessments and think about the ways that a tech tool might be utilized to address this problem. The Good for Nothing team suggested multiple open source platforms which WEI could use to digitize the reading assessment;

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[6] World Education Inc. (2015). Quarterly Report 1: Technology for Education Systems Transformation (TEST)
[7] This app is not available for public download. It is installed by WEI in the target school's tablets.
[8] Find out more about Good for Nothing Challenge at http://www.goodfornothing.com

however, WEI's project team found that the platforms were complicated, difficult to localize and did not serve the purpose of assessing student's reading abilities.

Following discussions with the Good for Nothing team; WEI developed a simple, rapid prototype, accessible via the web, before seeking funding for further development. This prototype added great value to the project, saving time and resources before the actual development of the TEST app. The process of developing the rapid prototype also opened adequate time for WEI to conduct field immersion and user testing activities with target beneficiaries to verify their assumptions about challenges teachers and students face in relation to paper-based assessment. The prototype (accessible through a web link) was tested with teachers to see if it saved time in correcting students' papers and provided immediate, transparent results.

Engagement with Partners from an Early Stage

Engaging with project partners and stakeholders from an early stage plays a vital role in the success of this project, as indicated by WEI's team. In this regard, WEI has been working closely with Ministry of Education Youth and Sports (MoEYS) across their education programming. At the beginning of the TEST project, WEI organized a meeting with MoEYS's advisors to discuss the purpose of the project and the process of digitizing reading benchmarks. The team also sought technical support and collaboration from MoEYS as a part of this project.

WEI engaged MoEYS since project start up, while also partnering with mobile development firm – CamMob to develop the digital reading assessment and other NGOs including World Vision (WV) and Kampuchean Action for Primary Education (KAPE) to integrate the TEST app into their existing education and ICT projects.

The selection of the app developer is a complex process. WEI and the DI team first co-hosted an information session to discuss the opportunity with app developers. At this session, WEI presented the concept of the TEST project and showed their prototype to potential developers, so that they understood the concept precisely and had the opportunity to ask WEI for clarifications. WEI then asked the service providers to develop an example of second iteration of the TEST prototype and conduct a presentation. This exercise served to assess the extent to which the developers understood the nature of the project and could project a vision for its future. As a result, CamMob was selected to create the app, due to their previous experience developing educational apps and their exhibited understanding of the TEST objective. WEI also consulted both WV and KAPE as official partners in the initial stages of the TEST app due to their previous work on education projects.

Field Immersion

WEI's project team held a focus group discussion with school directors and teachers at Anutwat Primary School in Kampong Cham Province.
Photo Credit: World Education Cambodia

Developing a grounded understanding about the challenges that beneficiaries face is very important to making good decisions during the design process. After the selection of the app development firm, WEI and CamMob conducted a field visit to Kampong Cham and Siem Reap to gain a better understanding of the challenges associated with hard copy administration of reading assessments. The field visit also aimed to challenge their assumptions about the issues related to paper-based examinations and determine the feasibility of the proposed solution. As a result of the focus group discussions with school directors, teachers and librarians, the project team found that teachers spent significant time correcting students' papers and that the assessment result itself was neither transparent nor necessarily accurate. Furthermore, teachers did not have proper mechanisms to assist slow learners, based on the results of paper-based reading assessments.

Additionally, the team took the opportunity to learn about the issues that schools, teachers and students encounter in the classroom, and to study their experience using technology. Due to the field immersion experience, the team learned that senior teachers and students, as that they were not familiar with the potential uses of smartphones or tablets in a classroom or educational setting. However, teachers and students expressed their interest and willingness to learn and try a new tech tool. Furthermore, teachers perceived the technology as an opportunity to spend less time grading students' assessments.

IDEATION PHASE

After completing the field immersion phase, WEI and CamMob met to discuss and brainstorm the design of the TEST app, based on the reading benchmarks approved by MoEYS. Discussion with school directors, teachers and librarians provided the project team with useful insights to improve the design of the tool, responding to the needs and concerns surfaced through the process.

Prototype Development

Screen shots of prototype accessible through web link developed by the TEST project team.
Photo Credit: World Education Cambodia

CamMob started development of the TEST app and used the prototype accessible through web link and reading benchmarks as references. The developers were responsible for the design of the user interface of the TEST app and received support from WEI to guide the overall concept and design. During the app development stage, the prototype developed by CamMob was presented to WEI for comments and feedback. At first, the developers wanted to design animation and add features in the app; however, they determined animation would be a distraction for children. As for the new features, CamMob decided that a simple design for the formative assessment tool would be best, and did not implement them. WEI also held a prototype review session with MoEYS, the ICT Department, Department of Primary Education and Department of Curriculum Development for feedback and consolidation. Feedback was provided on the app's alignment with the reading benchmarks, accuracy of information provided and suitable time limits according to the level of difficulty per each question since these are the critical aspects of TEST app. After compiling the feedback from MoEYS and other relevant departments, WEI and CamMob used this prototype to test with school directors, teachers and students for another round of feedback before making a final consolidation.

User Testing

CamMob conducted the user testing with first and second graders at Anutwat Primary School in Kampong Cham Province.
Photo Credit: World Education Cambodia

"We went to Anuwat School in Kampong Cham to study about our users, how they adapt to technology and their knowledge in the uptake of tech tool." Keoaudom Puth, Product Owner/Project Manager, CamMob.

WEI and CamMob teams conducted user testing with targeted beneficiaries at schools in Tbong Khmum, Kampong Cham and Siem Reap Provinces. At this stage, the prototype incorporated a number of test intervals for grade one and two. The prototype was being tested and iterated several times to ensure that the tool incorporated appropriate reading benchmarks and adhered to standards. The technical teams also conducted another focus group discussion with school management, teachers and librarians to discuss about what to modify and improve. The TEST app was being tested with the students to see if they understood the app's function and whether time allocations were appropriate for students during the assessments. Even though the timing per each question posed a concern to students, WEI ensured that it was standardized in accordance to the level of difficulty of each question. The team also sought to understand whether the students understood the questions and whether they could actually use the app. This helped WEI and CamMob to modify the user experience and design of TEST app appropriately. The feedback from students was primarily related to the time per each question; they expressed concern about not being able to complete the test on time. To respond to the students' concerns, WEI discussed with MoEYS and teachers the time allocation of each question and modified the timer based on the feedback.

Additionally, internet and Wi-Fi is a considerable issue in the remote areas. In this regard, CamMob suggested WEI to use the master tablet to connect student's tablets with the same network wireless connection. This process does not require an internet connection, allowing the administration of the digital test even in rural areas.

Feedback and Refinement

WEI received feedback from MoEYS and beneficiaries related to the user interface, question design, and timing. For instance, one area of feedback explored how WEI might design a vocabulary and phonemic awareness assessment for the app. Beyond that, user feedback provided valuable insights for the developers to improve the tool and enhance user experience, particularly simple colors, bigger fonts and buttons. Through multiple field visits and rounds of user testing, WEI and CamMob worked together to consolidate the feedback about the app's alignment with national reading standards, the accuracy of information provided and suitable time limits according to the level of difficulty per each question and finalize the digitalization of reading assessments for a wide range of users.

Training Targeted Beneficiaries

Grade one and two teachers and librarians practiced using TEST during the training in Kampong Cham Province. Photo Credit: World Education Cambodia.

School directors, teachers and librarians received formal training and guidance on administering the TEST app in the classroom from the WEI and CamMob teams. The training was conducted at targeted schools in Tbong Khmum Kampong Cham and Siem Reap province, at a point when the TEST app was ready to be tested in the classroom. During the training, teachers and librarians received support on how to use tablets and administration of each assessment interval. Moreover, they were given a guide book which they could refer to after the training. Senior teachers were trained on how to use the app even if they were reluctant to use the technology at the beginning as many of them did not own smartphones and perceived technology as complicated to use. After receiving proper instructions from WEI and CamMob and have junior teachers were able to assist the senior teachers with the technology, and they began to feel more comfortable with using the tech tool. After the training, teachers commented that felt confident using the app and saw the benefits of using technology, especially as a time saving measure to correct papers and a method to more easily identify students' weaknesses, allowing them to formulate intervention plans for individual students.

IMPLEMENTATION PHASE

The Launch of TEST App

"After seeing the instant result from TEST app, we can quickly identify the slow learners, in which areas they are struggling, for instance pronunciation and reading for comprehension. We then printed the result out and handed it out to teachers […], so during the recess, teachers, librarians and senior students would help the slower learners to improve their reading abilities." Teacher at Raksmey Samakei School in Siem Reap Province.

A teacher administered the TEST app to the third graders at Reaksmey Samakei Primary School in Siem Reap Province.
Photo Credit: Development Innovations/Chav An Chin

In 2015, the TEST app was launched in seven target schools in Tbong Khmum, Kampong Cham and Siem Reap[9]. A refresher training was conducted with teachers at the target schools as an additional opportunity to provide critical feedback on administering TEST app. The project team monitored progress and solved any technical errors in the app after launch.

During the administration of the TEST app in the classroom, the project team observed that students at a bit nervous of using a tech tool at first, and were worried that they might damage the school's property. However, after multiple assessments, they were very receptive and excited to use the tablets. According to WEI's field monitoring visit report in

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[9] World Education Inc. (2015). Final Report: Technology for Education Systems Transformation (TEST).

2015, 100% of respondents[10] qualified the app as very useful, while 97% of respondents said the app interface is user friendly and 96% of the respondents mentioned that students' results were easier to analyze[11].

After each test interval, teachers are able to see the results immediately. During the focus group discussion with school directors and teachers at Raksmey Samakei School in Siem Reap, the teachers explained their method of printing the TEST app results and handing them over to the peer support groups, which consist of senior students and librarians who helped students one on one during recess or free time. Teachers play an important role in assisting slow learners on the skills they lack, with help from the peer support group to provide extra assistance with specific lessons, reviews assessment results and provide additional tutoring. The data behind TEST app also indicates which skills students are mastering and lacking. More importantly, WEI ensures that only authorized persons can get access to the app's data. The only authorized parties with access the app data include WEI and MoEYS's ICT department. All personal information is kept confidential and all data is encrypted and inhibits access by other users.

The team then made the final refinement of the app including data export, new school registration, and collaborated with MoEYS to add new tasks and activities in case the curriculum changes.

Screen shots of the TEST app.
Photo Credit: World Education Cambodia.

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[10] Respondents were teachers, librarians and students.
[11] This data obtained from 39 respondents participating in focus group discussion organized by WEI project staff in 2015.

Contributions of TEST App to Early Grade Education

"As I can see, the improvement is up to 70% in term of their reading and pronunciation abilities." Director of District Department of Education in Siem Reap.

Interviewed with the Director of District Department of Education in Siem Reap about the impact of TEST app at the target schools.
Photo Credit: Development Innovations/Chav An Chin

The TEST app has made a significant contribution to early grade education in the schools where it has been implemented, in terms of standardizing the test administration, minimizing the scoring errors and unfairness and helping teachers to propose appropriate interventions to assist slow learners to master the skills they are lacking. In addition, TEST app has contributed to the efficiency in test administration by saving on average one hour of teacher time per test; improving scoring accuracy; increasing teacher satisfactions and raising the bar for student achievement[12].

The TEST app has received recognition and support from the communities in which it has been launched. According to an interview with Department of Education in Siem Reap, the community understood the importance of the TEST app to evaluate students' reading abilities. Department of Education (DoE) has also acknowledged the benefits of using tablets for education: tablets can substitute as a library resource as students can use them to access e-books. This can address the problems of limited library in certain remote schools. Additionally, the DoE acknowledged that teachers can use ICT to improve their knowledge through research, building their confidence in the classroom.

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[12] Neff, V. (2018). Grantee Final Report. Phnom Penh: World Education Inc.

According to the focus group discussion with school directors and teachers at Raksmey Samakei School, the benefits of the TEST app were widespread. First of all, the TEST app promotes transparency, accuracy and standardization in primary education. After the introduction of the TEST app, the school found that students were more interested in library activities during their recess and free time. In addition, they continue to develop reading skills through guided activities and exercises in the educational toolkit provided by WEI. During the informal conversation with students, they mentioned that they spent more time in the library than they previously had. In addition to coming to the library to read and borrow story books, they now also come to play with the educational toolkits outside of the supervision of teachers.

Promotional Plan and Strategy

WEI has an established mechanism and prepared strategy to share information and project resources to all partners and relevant stakeholders. WEI maintains communications with their partners throughout all stages of the project, and actively shares information on ICT events and project achievements through social media channels. With respect to the promotional strategy for ICT tools, WEI and CamMob team have participated in a number of events opportunities in Phnom Penh to present and promote the TEST app.

First, the team joined Innovation in Action in Phnom Penh, which was organized by DI. Innovation in Action was a series of monthly events to present and showcase technology projects implemented by CSOs. At this event, WEI provided a demonstration of reading assessments to participants from CSOs and technical service providers. The WEI team also joined another local event, Mobile Camp, to showcase the TEST app and participate in a panel discussion on how mobile technology is impacting education in Cambodia. Additionally, during the Science Engineering Festival in 2015 organized by MoEYS, WEI presented the TEST app to a group of NGOs and provided the audience an opportunity to try the app[13].

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[13] World Education Inc. (2015). Quarterly Report 2: Technology for Education Systems Transformation (TEST)

Design for Scale Up

WEI's project team and education officials conducted training on the administration of TEST app for grade three students to school directors, teachers and librarians in Takeo Province.
Photo Credit: World Education Cambodia.

Seeing that the TEST app was successfully implemented in schools, the project was then scaled to include third graders and expanded to other schools and areas, particularly in Takeo Province. The purpose was to refine and integrate grade three assessments into the existing TEST app[14]. WEI's project team indicated that time and resources spent in the scale up phase was more efficient since the project team was able to leverage the lessons learned from the first phase of the project. Given that the TEST app was already implemented in grades one and two, as mentioned by teachers, grade three students were easily able to adapt and use the second version of TEST app since they had already used it in grades one and two. This emphasizes the importance of building digital tools which are scalable and ready for expansion.

As mentioned, WEI involved many of the relevant stakeholders in the education sectors such as the NGOs and planned to make TEST app publicly available for usage in other primary schools outside their target area through the handover plan with MoEYS.

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[14] World Education Inc. (2017). Grantee Quarterly Report: Technology for Education Systems Transformation Expansion (TESTx).

Partnership for Sustainability

The engagement of the ICT department under MoEYS and the Provincial Department of Education since the inception of the project played a significant role in strengthening the partnership and promoting its sustainability. To ensure the sustainability of the TEST app, WEI has prepared a handover plan to MoEYS to take over the app through a complete training of the key staff on how to maintain and manage the database, including how to make adjustments in case the curriculum changes. Currently, WEI, CamMob along with MoEYS are working together to migrate the current server managed by CamMob to MoEYS[15]. As a part of the sustainability plan, WEI will equip MoEYS with data literacy and data analysis through technical support and training. This will ensure that MoEYS is able to utilize the data from the TEST app, and monitor trends and progress among targeted schools.

Having realized the benefits of using technology in education, the ICT department under MoEYS asserted that the department is planning to develop an e-learning platform in which teachers and students could study short courses related to professional development. WEI is in discussions with the ICT department about including teachers in the e-learning platform and potential links to course curriculums. There is also an opportunity to have a course on or guidelines for of the TEST app integrated into the platform. Furthermore, the TEST app has the potential to be launched in the Google Play Store, so that the schools can download and use it themselves.

FACTORS FOR SUCCESS OF TEST APP

User Centered Design

Technology is not the primary focus of the TEST project. The WEI team started with the problem statement they wanted to address and identified the target users they wanted to design the solution for. In accordance with the focus group discussion with WEI team, we learned that they identified the issues while administering paper-based assessments through observations prior to the inception of TEST project. The team took the time to study the problems, challenge their assumptions by talking with their targeted beneficiaries and gathering feedback on prototypes and live versions. This included the opportunity to transform their idea into a rapid prototype accessible through web-link.

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[15] This was discussed during a meeting between WEI, CamMob and ICT department in February, 2018.

Committed Human Resources and Expertise

Human resources play a very important role in the success of the project. TEST project team consists of committed individuals and expertise in the education sector. Further, the team has extensive experience in implementing early grade reading projects which added a remarkable value to TEST project. The team not only has the right expertise, but also wants to create positive impact on Cambodian education, especially in rural and remote areas. This commitment to generate real change motivated them to work towards producing results.

Strong Partnership with the Government, Service Provider and NGOs

"It is a good initiative and I have been supporting it since the start. That is why I have involved my government officials and even myself with the project." Sok Tha, Director of ICT Department of MoEYS.

One of the success factors of TEST project is the extensive support from the Ministry of Education, Youth and Sports, ICT Department and Department of Primary Education. By design, the TEST app aligns with the national policy of education in order to support consistent initiatives. As stated by WEI, the results and data generated from TEST app serve as a platform for the Ministry to identify trends and progress among teachers and students in relation to reading. NGO partners whom with WEI has been working provide additional encouragement and advocacy of ICTs in schools as well as donate additional tablets as needed. For instance, KAPE and WV integrated their existing ICT projects with WEI, so that they could work together to achieve common goals rather than implementing standalone projects. WEI has acknowledged the value which their partners bring to the project and endeavors to maintain the relationship and keep the communication open for the future development of TEST.

Resources and Information Sharing

WEI has developed a strategy to share TEST app and relevant resources through public events and social media and has an interest in collaborating with other prospective partners. Beyond their NGO partners, WEI continued to showcase the TEST app project at various tech events in order to draw attention to the initiative from the general public. WEI has maintained a strong connection with the key stakeholders including MoEYS, DI, CamMob and NGO partners to provide updates and address challenges during the ongoing development of the app.

Iterative Process

The project followed an iterative process, as there were multiple rounds of user-testing and re-design based on the user feedback. This allows the project team to validate their assumptions and test the sample solution with target users before returning to

development. The app went through a number of rounds of feedback and modifications[16]. Comments from teachers, students, project staffs, and MoEYS were all taken into considerations in the time of prior, during, and post development of the app.

Peer Support System

A librarian assisted teacher to administer a reading test to grade two students at Kor Primary School in Kampong Cham Province.
Photo Credit: World Education Cambodia.

The success of an ICT project isn't based solely on the tool itself. In the case of the TEST app, one of the most important non-tech contributions came from librarians, who have become knowledgeable and skilled in using TEST app. They mentored and trained senior teachers to administer the reading assessment. The assistance from librarians helps build the confidence of senior teachers who are not familiar with technology. Through this peer support system, teachers are able to administer the reading assessment in an effective and efficient way. In addition to support from librarians, senior students also help the slow learners: students who are having more difficulty to improve their reading abilities. Teachers at Raksmey Samakei School in Siem Reap explained that the results generated from each assessment are given to the senior students so they are able to specifically target certain areas of deficiency or challenge in tutoring sessions with their junior peers during recess and the weekend. School directors, teachers and the community acknowledged their contributions and perceived the peer support session as an effective way to help the slow

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[16] This is based on the Quarterly Reports submitted by World Education Inc, and focus group discussion with the project team.

learners, while younger students reported feeling comfortable working with senior students in mentoring sessions.

The Selection of App Developer

"We are proud to develop this social App. There are more users with bigger impact; it took a lot of creativity to develop this tool." Keoaudom Puth, Product Owner/Project Manager, CamMob.

The process of selecting an app developer is one of the critical elements of the project. As a method of testing ability and TEST app comprehension, WEI asked potential app developers to present their prototypes prior to the selection. CamMob's presentation illustrated the most thorough understanding of WEI's concept and objective. To enhance the testing process, CamMob suggested to use one master tablet for the teacher and to operate the testing system via one wireless connection that does not require internet. WEI has established a good working relationship with CamMob through regular check-ins, as well as support and mentorship throughout the collaborative process of the app development. As a CamMob is a proactive software development company, WEI felt confident they had the right expertise and capacity and would fulfill the responsibility in terms of delivering a complete product. The WEI team said that working with CamMob has been a remarkable advantage, since CamMob has a very good understanding of the long-term goal of the TEST app and was cooperative and flexible throughout the process. According to the DI interview with the developers, CamMob reported having received sufficient and regular support from WEI in the design concept. CamMob also expressed the value of being involved in the user research and testing, which enhanced their understanding of social development projects.

As the CamMob team explained, they identified a unique commitment among developers because TEST is a social impact app that aims to contribute to improving education in Cambodia. CamMob previously worked on business apps which target users in foreign countries. Additionally, working with WEI on the TEST app enhanced their creative thinking in terms of user interface design through the design process.

CHALLENGES AND LESSONS LEARNED

Institutional Buy-In from Donors and Partners at the Idea Stage

It is a common challenge for development practitioners to market their ideas at the initial stages. Traditionally, donors require organizations to submit their ideas in the form of a proposal which illustrates detailed activities and tangible results, such as explaining exactly what type of tool the organization is going to develop. This typical process limits the space for creativity in project design and does not allow time for organizations to adapt to their project in case something does not work. This particularly applies to the case of the TEST project. It was a challenge for WEI's project team to obtain the institutional buy-in from donors and partners at the idea stage given that they were not certain what sort of tech tool they were going to develop initially. WEI was determined to study the context before determining what the appropriate solution should be. WEI continued to pitch their ideas to other key stakeholders to attract interest and buy-in for the project in the early stages, despite not having a solidified concept.

Investment in the Project Design Phase

Investment of human resources, budget, and sustained commitment in the project design phase were consistently challenging for WEI. Before bringing the tech solution to life, they needed to devote their own time and resources to study the problems they wanted to address, validate their assumption through field immersion with their targeted population, and determine the most capable developer for the solution. The data generated from this stage plays the very important role of informing the project design, particularly how to design a tech tool which responds to the needs and concerns of teachers and students. In addition, WEI used multiple rounds of user testing and feedback before deciding on the final development of the TEST app. The process took much longer than the traditional implementation approach. In order to overcome this challenge, WEI and CamMob had to be flexible in the design and development process of the TEST app. They did not rush into the tool development until they had studied the problems and verified with the users, which took a significant amount of time and resources. Often, we overlook the significance of the project design phase and rush into the implementation stage, which results in a weak final product. Therefore, it is imperative to invest time and resources in this design stage in order to learn from the users, get their insights and feedback to inform the design of TEST app. It is also best to avoid jumping to quick conclusions about the problem and solution without spending time to learn and verify with the targeted beneficiaries.

Lack of Tangible Results in Inspiration and Ideation Phase

The app was not fully developed until the implementation phase, as the team was testing their ideas, iterating and refining the prototype up until launch. Instead of focusing on creating an app, the team initially focused on the user research, design and iteration. This runs contrary to the traditional implementation approach where development practitioners define the problem for themselves and seek solutions. This took a considerable amount of time prior to producing a final TEST App. The project team had to remain patient and flexible since they could not guarantee the tangible tool at the beginning until they had studied with the users and tested it for feedback and refinement.

Teachers tested the TEST app during the training.
Photo Credit: World Education Cambodia.

Design a Tech Tool for a Wide Range of Users

Designing an app for wide range of users of different ages is a difficult task. Before taking on the TEST project, the majority of CamMob's projects focused on for-profit apps which had a clear and specific group of users who have high uptake of technology. However, in the case of the TEST project, CamMob needed to design an app which is user friendly and attractive for students, but also friendly and understandable to teachers who are older and often not receptive to new technologies, especially in remote and rural areas.

For senior teachers with less uptake of technology, WEI and CamMob needed to design an easy and simple app. However, students have a slightly different need from teachers. At first, CamMob wanted to design fun and animated features, specifically for students; however, such features could have been a distraction to them during the test in addition to being non-user-friendly for teachers. So as to address this challenge, WEI and CamMob came to the decision to design a very simple user interface with texts and relevant pictures from the national textbook. Additionally, they used bigger fonts and buttons with attractive colors that helped senior teachers with poor eyesight to see better.

User Testing and Consolidation of User Feedback

During the user testing phase of the TEST app project, WEI and CamMob presented the prototype to a wide range of stakeholders and beneficiaries including the Department of Education, Department of Curriculum Development, ICT department, school directors, teachers, librarians and students. The user testing sessions were conducted separately in Tbong Khmum, Kampong Cham and Siem Reap province. This consumed a vast amount of time, including the consolidation of feedback, which proved to be burdensome for both the teachers and students. Schools and teachers also spent a considerable amount of time to participating in user testing sessions, which is time they could have spent in class. The user testing sessions were conducted on weekdays and each session lasted for about two hours. Since the sessions were conducted during teaching hours, they needed to cancel their classes in order to participate. Through this experience, the team learned that in order to mitigate this challenge, they planned to conduct the user testing and feedback consolidation after teaching hours or on the weekends instead.

Some feedback was not easy to consolidate and needed time to debate before coming to a final conclusion, for instance, the time allocation of each question in the test administration. From MoEYS and the teachers' perspective, 10 seconds are appropriate for the pronunciation assessment. However, when the project team tested it with the students, there were a lot of complaints about short times and many students asked for additional time to complete their test. This is a particular challenge on an educational project, creating a challenging exercise while assessing students' ability.

User Uptake of New Technology

Given that the targeted users of the TEST app are situated in remote communities, it was a challenge to obtain the buy-in from people who are generally not receptive to new technologies, especially if the tool is complicated. As mentioned in the inspiration phase, senior teachers at first felt reluctant to use technology in their teaching and test administration as they were not familiar and comfortable with such tools. Likewise, the students were not accustomed with the tablets and were afraid to use them since they did not want to damage the school's property. During the inspiration phase, attaining the buy-in from schools, teachers and students took time on the part of WEI. Nevertheless, WEI's project team worked hard to ensure that the target beneficiaries would receive appropriate training and support to use the tech tool that WEI and CamMob developed. Throughout the implementation of the TEST project, WEI has conducted trainings on how to administer the TEST app to school directors, teachers and librarians before the launch. In addition, the junior teachers and librarians who are familiar with technology mentor and train the senior teachers on how to administer the digital assessment tool better.

Tech Tool Does Not Work in All Circumstances

WEI mentioned that a particular type of assessment does not fit with TEST app: the dictation of Khmer phrases and writing short essays. Writing Khmer language on a tablet consumed a lot of time comparing to writing on paper. Therefore, the project team decided to not develop such an assessment in the app. This indicates that tech tools, at least the present types, do not work in all circumstances, thus using the traditional way of doing reading assessments is still relevant in some contexts.

Investment in ICT

Technology needs investment; not only human and financial resources, but also long term commitment and maintenance. In the case of TEST project, WEI invested in extensive human resources with expertise in the education sector, experienced designers, strategists and tech developers. In relation to financial resources, WEI had a budget for app development costs, server maintenance, solving technical errors, and purchasing the tablets, WIFI modems, and printers for schools. WEI also developed materials for partner schools, including National Reading Standards and guide books for the TEST app. To get additional financing, WEI partnered with World Vision and other donors to receive further financial support in the procurement of tablets and the maintenance of the app.

Being one of the first in its kind was also a challenge for TEST app. Breaking through the tech barrier, especially in provincial schools, required significant effort and hard work to help teachers to operate the app without supervision. In this regard, capacity building to rural teachers on basic ICT skills is critical, specifically in the classroom/education setting. The basic ICT training includes online research, data literacy, and how to utilize smartphones and tablets for learning and teaching. In addition, peer support and mentoring groups at school also play an important role. The teachers and librarians who have sufficient understanding and knowledge of ICT can train or mentor senior teachers who are not familiar with technology.

Classroom Management during the Test Administration

Based on an interview with the Department of Education (DoE) in Siem Reap, the Director of DoE added that most of the teachers are short term and contractual. Therefore, sometimes the schools need to spend time and resources to train new teachers more frequently due to high turnover. The teacher to student ratio remains an obstacle to improved student learning. High student enrollment and a low number of tablets means teachers need to administer interval assessments on the TEST app two or more times. Additionally, there are about 40 to 50 students in some classrooms due to the lack of teachers. As of this pilot exercise, there were not enough tablets per each classroom.

Limited Libraries in the Remote Areas

Some schools in the remote areas do not have libraries, therefore students do not know what to do when they are waiting for the test interval sessions. Some of them would stand beside the window, while the others wait at the playground. The teachers at Reaksmey Samakei School added that having the library would help students use their spare time/waiting time to learn rather than playing around and create noises. In this case, tablets can add value to student's learning since they can use Ann Khmer app to learn during the waiting time. Teachers can instruct students to use education toolkits consisting of tools and exercises for them to practice during this period.

Electricity and Network Connection

The lack of reliable connection is one of the main challenges most of the teachers encounter while administering the tests. Sometimes, the electricity cuts off and network connection drops in the middle of the test. In this situation, the teachers cancel the test and wait to resume it again once the electricity comes back. The battery life of tablets is also one of the

weaknesses. There are cases when the battery does not last long and dies during the test administration, thus the teachers need to conduct the test again with just one or a few students which is very time consuming. With their target schools situated in areas with less cellphone service coverage, WEI had to ask the teachers to find suitable and fast internet connection to transfer the test data once they have finished conducting it. In order to overcome this challenge, WEI will work to ensure that the data is automatically saved when connected to the internet, so that they will not lose the data in case the battery dies during test administration.

RECOMMENDATIONS FOR PRACTITIONERS

Start with a Problem Statement: General objectives should be identified prior to project implementation. A problem statement should be informed by gathering insights from users' needs and concerns to properly inform project design. In addition, conducting desk research to learn about the problem your team wants to address is also important. This helps the design team take a step back to validate assumptions through comprehensive research and interviews with the target audience.

Exploring and Utilizing the Existing Tech Tools and Resources: An important action to take before really considering a new project is to look at the current ecosystem to check whether or not a similar idea has been implemented, what lessons were learned and what recommendations others would have. Take time to explore existing tech tools and open source platforms developed by other organizations to see if these solutions could be incorporated or further developed to reduce cost, improve the final product, or better engage users. This exercise saves time and resources, preventing the creation of a brand a new tool. Moreover, it is advisable to conduct a rapid search on the Google Play Store and the Apple App Store to review existing mobile applications in the sector.

Talk with Your Targeted Users: As mentioned in the case study, WEI put the target users at the center of the project, given that they wanted to design a tech solution that responded to teachers and students' needs rather than developing an elaborate technology that people might not find useful. Hence, during the project design phase, it is imperative to spend time in the field field to talk with the targeted users and gather grounded insights and feedback which is essential for tool design.

Develop Prototype for Testing: After the team conducted user research with the targeted users and made sense of the findings, it is recommended to develop a low cost or rapid prototype to present and test with the targeted users. Based on the case study, WEI developed a web link prototype of the TEST app prior to project implementation to exhibit with potential partners. They used the prototype to test with target users for feedback multiple times before proceeding with actual development. This allowed time for WEI to refine and iterate the tool until the teachers and students found it understandable and easy to use.

Think about the Timeframe: For education based solutions, school holidays should be taken in to account when it comes to the work plan. In addition, the number of meetings and trainings with schools and teachers should be considered. In the case of TEST project, the trainings took about half or full day, which is a considerable sacrifice in terms of class

time in order to participate. User testing, focus group discussions, and trainings should be flexible with their fixed schedules as they have classes to teach.

Partnership for Sustainability and Success: Partnership is one of the critical success factors of the project, therefore the organization should identify partners and relevant stakeholders to engage in the project, early on and throughout the process. The identification of partners helps the organization to learn what other areas their counterparts are working on and identify points of collaboration or inform specific activities. In addition, the organization can integrate their projects and work together to create a long lasting impact, rather than working on a standalone project.

ADDITIONAL RESOURCES

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Visual Mapping of TEST App Project

Problem Identification	WEI identified the challenges in paper assessments.	Digital tool needed for a standardized and quality of assessments.	Good for Nothing helped to find a tech tool for digitizing.
Web link prototype developed			

Engagement with Partners from an Early Stage	Discussed with MoEYS for collaboration.	Called for mobile app developer – CamMob is selected.	Worked with official partners: World Vision and KAPE
			Field Immersion

WEI and CamMob visited target users to gather insights.	Prototype Development	Digital prototype developed.	Prototype presented MoEYS and relevant departments.
			User Testing

User testing was conducted with teachers, librarians and students.	Feedback and Refinement	Feedback consolidated and digitization finalized	Training Target Beneficiaries
			Teachers and Librarians trained to administer TEST app.

The Launch of TEST App	Launched TEST app at target schools in Tboong Khmum, Kampong Cham and Siem Reap.	Refresher training conducted to seek feedback.	Promotional Plan and Strategy
			TEST app was promoted at ICT events

Design for Scale Up	Grade three assessments integrated into TEST app	Partnership for Sustainability	Partnered with MoEYS to take over TEST app for sustainability

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