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United Nations
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Sustainable
Development
Goals

Supporting teachers with

mobile technology

Lessons drawn from UNESCO projects
in Mexico, Nigeria, Pakistan and Senegal

Education
2030

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UNESCO Education Sector

Education is UNESCO's top priority because it is a basic human right and the foundation on which to build peace and drive sustainable development. UNESCO is the United Nations' specialized agency for education and the Education Sector provides global and regional leadership in education, strengthens national education systems and responds to contemporary global challenges through education with a special focus on gender equality and Africa.

The Global Education 2030 Agenda

UNESCO, as the United Nations' specialized agency for education, is entrusted to lead and coordinate the Education 2030 Agenda, which is part of a global movement to eradicate poverty through 17 Sustainable Development Goals by 2030. Education, essential to achieve all of these goals, has its own dedicated Goal 4, which aims to *'ensure inclusive and equitable quality education and promote lifelong learning opportunities for all'.* The Education 2030 Framework for Action provides guidance for the implementation of this ambitious goal and commitments.

Education Sector

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Education 2030

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Acknowledgements

Contents

Introduction

Research over several decades has established a strong link between teacher quality and student achievement. Experts agree that teachers influence student achievement more than any other school-related factors, including class size, services, facilities or leadership, and this holds true across education systems that vary enormously from country to country, state to state and district to district. Many studies indicate that the impact of teachers on student learning outcomes is 2-3 times that of other school-related factors.[1]

The international consensus is that teachers matter.[2] If the world is to improve the quality of education and make it more equitable and inclusive, countries will need to accelerate efforts to ensure effective and well-qualified teachers for learners. The fastest track to better education is better teachers.

This understanding has been codified in the United Nation's new Sustainable Development Agenda, a blueprint intended to steer the world toward peace and prosperity through to 2030. The 17 Sustainable Development Goals (SDGs) adopted by UN Member States in 2015 seek to end poverty, fight inequalities and mitigate climate change, while ensuring that no one is left behind. SDG 4 calls on countries to 'ensure inclusive and equitable quality education and promote lifelong learning opportunities for all'.[3] This goal is underpinned by specific targets and means of implementation, which include increasing the supply of highly qualified teachers, especially in less developed countries where teacher shortages are common. Overall, SDG 4 and the corresponding Education 2030 Framework for Action reflect an awareness that student learning is determined first and foremost by the quality of classroom instruction and, by extension, the readiness of teachers to provide relevant and effective lessons.

Unfortunately, there are not enough teachers to achieve international targets for education. New data from the UNESCO Institute for Statistics shows that the world would need to recruit 24.4 million school teachers to provide every child with a primary education by 2030. This total includes the creation of 3.4 million new posts and the replacement of 21 million teachers expected to leave the profession.[4] Tens of millions of additional teachers would be required to ensure universal education beyond primary school, as is called for by the Sustainable Development Agenda.

Presently, the most acute teacher shortages are geographically concentrated: 2.4 million additional teachers are needed immediately in sub-Saharan Africa to guarantee all children access to primary education.[5] Although the challenge of supply is most severe in poor countries, teacher shortages are also a problem in rich countries where hard-to-fill vacancies in specific subjects, such as the sciences, often result in educators teaching subjects for which they are not qualified.

1   RAND Education. 2012. *Teachers matter: Understanding teachers' impact on student achievement.*
2   OECD. 2016. *Supporting teacher professionalism: Insights from TALIS 2013.*
3   United Nations. ND. *Sustainable Development Goals: 17 goals to transform our world.*
4   UNESCO Institute for Statistics. 2016. *Fact Sheet: The world needs almost 69 million new teachers to reach the 2030 education goals.*
5   Ibid.

Schooling is valuable when there are professional teachers to help learners. A central lesson drawn from the 2000-2015 Education for All movement, a global effort that strongly encouraged countries to get more students to attend schools, is that *education access* cannot be decoupled from *education quality*. As countries hastened to put children into classrooms, less attention was paid to preparing the adults tasked with making these classrooms productive. Since 2000, school enrolments have indeed surged, but often at a cost of lowering standards for teachers and expanding class sizes, a situation which makes teaching—a demanding profession in any setting—even more challenging. The results have been dire: millions of young people are not reaching minimum learning standards despite being enrolled in formal education. UNESCO estimates that 1 in 5 of the world's approximately 650 million primary school students cannot read basic sentences or solve simple arithmetic problems after 4 years of classes.[6] Education without skilled teachers is, as the world has learned, a largely futile endeavour. Learning in schools must be guided by trained and knowledgeable educators capable of furthering student understanding in particular domains.

This means that countries must consider how they can improve both the quantity and quality of their teacher workforce, including in contexts where infrastructure is limited, poverty is widespread and crisis and conflict are realities.

Solving the twin challenges of teacher supply and teacher quality will require time and investment. It will also require innovation and a willingness to experiment and confront problems with new tools and approaches.

When considering different 'outside the box' strategies to bring teacher development to scale at minimal cost, especially in poor countries, UNESCO kept returning to a simple but increasingly prevalent technology: mobile phones.

Why mobile phones?

1 **Many teachers in developing countries already have them**. Cisco estimates that nearly 5 billion people (67% of the global population) currently use a mobile device[7] and that smartphones already account for close to half of these devices, a share that is expected to increase dramatically over the next five years.[8] The growing ubiquity of mobile phones means that this technology could potentially be leveraged to support and build the capacities of millions of educators, far more than are currently reached by traditional forms of face-to-face development.

2 **A mobile device offers an interface and functionality that is understandable to most teachers and other non-technical users**. Touch-screen phones have made operating systems and applications more intuitive, user-friendly and easier to learn than earlier digital technologies. While teachers may still need assistance to utilize mobile technology for educational purposes, the challenge is often one of repurposing a familiar device, rather than starting from scratch with a new technology.

3 **Mobile networks now cover large areas of the world**, providing connectivity to communities that were never served—and, in many instances, are still not served— by fixed-line internet connections. These

6   UNESCO. 2014. *EFA global monitoring report 2013/14.*

7   CISCO. 2017. *Visual networking index infographic.*
8   CISCO. 2017. *Global mobile data traffic forecast update.*

networks provide a financially feasible vehicle for reaching educators spread across wide geographic areas. By 2020, it is estimated that more people will have an internet-connected mobile phone than will have electricity.[9] While gaps still exist, mobile networks continue to expand and are now treated by many countries as a basic utility.

4 **Mobile phones are dynamic communication devices**. They allow teachers to connect with other educators, elicit feedback, access services, and forge and join online communities. Professional development delivered through a mobile phone, while constrained in many respects, empowers teachers by enabling them to respond and react to content in ways that other, earlier technologies did not allow.

5 **Mobile phones can facilitate 'anytime and anywhere' learning**. Teachers have busy schedules and, in many developing countries, more than one job. Mobile devices provide a portal to training and other services at times and places that are convenient.

UNESCO felt that mobile technology might offer a means to support teachers working or preparing to work in challenging environments. It further believed that services developed specifically for mobile devices could be brought to scale quickly and at reasonable cost, as exemplified by the broad uptake of existing mobile banking and mobile health services. Yet despite this considerable potential, there was very little evidence that teacher development via mobile phones was possible, desirable or effective.

This publication concerns UNESCO's attempt to fill this gap and pilot projects to help in-service teachers who are not often reached by standard capacity development initiatives. While the UNESCO projects did not target pre-service teachers, they shine light on practices that would benefit teachers preparing to enter classrooms as well as those who are already working. The projects were coordinated by UNESCO from 2012 to 2014 and then handed off to local partners after approximately two years.

The chapters to come detail what was attempted where, why and to what result. UNESCO's aim was to both test an overarching concept—can mobile technolgy support professional development?—and understand, at a local level, what elements contribute to the success and failure of individual projects implemented in unique contexts. To do this, pilot projects were carried out in four different countries, using four different designs and targeting four different beneficiary groups. This diverse project portfolio helped UNESCO probe the strengths and limitations of different solutions deployed in real-world settings. What follows is an account of lessons learned and a description of how UNESCO's approaches might be employed elsewhere.

The challenges encountered over the course of the projects were considerable. Even some of the perceived advantages of mobile phones proved to be frustratingly elusive in practice: not all teachers knew how to use mobile technology; mobile networks were less reliable than initially assumed; getting teachers to actively engage with new services was often a struggle; paying for teachers to access specific mobile content was logistically and technically complex; operating systems and other technical specifications varied enormously; and mobile technology changed so quickly that educational services developed for hardware that was relevant when a project began were not as

9   CISCO. 2016. *Mobile forecast projects 70 percent of global population will be mobile users.*

relevant when the project ended. But these setbacks, although serious, did not cause the projects to fail, nor did they fully overshadow the remarkable potential of mobile phones to reach and support large numbers of teachers.

Taken holistically, this publication is important because teacher development is important. Examining data from the United States of America, Linda Darling-Hammond, a leading educational scholar, found that teacher preparation is 'by far the strongest correlate of student achievement in reading and mathematics, both before and after controlling for student poverty and language status'.[10] Good teachers can, in effect, reconcile social inequities outside the immediate control of the education sector; they can make education a springboard for opportunity.[11] Research in other countries has drawn similar conclusions. This report examines how mobile technology can help train new teachers and improve the practice of existing teachers to ensure education opens doors of opportunity for all students.

10   Darling-Hammond, L. 2000. *Teacher quality and student achieve-ment: A review of state policy evidence.*
11   Burns, D. and Darling-Hammond, L. 2017. *Empowering educators: How high-performing systems shape teaching quality around the world.*

Mexico

Situating

the UNESCO projects

Senegal

Nigeria

Pakistan

Situating the UNESCO projects

1. A diverse portfolio

In order to advance international understanding about how mobile technology might be leveraged to build teacher capacity, UNESCO designed unique projects in four countries: Mexico, Nigeria, Pakistan and Senegal. Each project employed a different approach to support the work of classroom teachers and expand their capacities. UNESCO intentionally adopted cost-effective models that could be replicated in other developing and middle-income countries.

All four pilot projects aimed to facilitate teacher learning and knowledge exchange through mobile networks and hardware. The solutions were designed to be accessible to teachers with limited technical knowledge and easily scalable within a given country.

2. Context of the four participating countries

The four countries that hosted the UNESCO projects were selected because of their educational needs and geographic diversity, with Mexico in Latin America, Pakistan in South Asia, and Nigeria and Senegal in Africa. Nigeria, Pakistan and Senegal are home to many of the world's poorest people and have urgent educational needs. Mexico is more developed, but progress has been uneven and the provision of good-quality, universal education remains a challenge.

Table 1 on the opposite page gives an overview of the countries' educational indicators in 2011,

the year in which the projects were conceived and planned. The indicators are organized according to the six Education for All (EFA) goals, priorities which guided UNESCO's education work from 2000 to 2015.

All countries participating in the UNESCO projects have yet to achieve universal basic education, and Nigeria, Pakistan and Senegal face the most severe deficits. According to data from the UNESCO Institute for Statistics (UIS), approximately 25% of school-aged children in these countries are not in primary school. Across the three countries, nearly 15 million children are out of school: 8.7 million in Nigeria,[12] 5.6 million in Pakistan,[13] and 0.65 million in Senegal.[14]

Of the four project countries, Nigeria faces the most acute teacher shortages. In this country, the most populous in Africa, UNESCO estimates that 400,000 primary school teachers are needed to achieve universal primary education through to 2030 and the skills of existing teachers need to be improved.[15] Pakistan also needs large numbers of new teachers, due, as in Nigeria, to a booming youth population. Upgrading the training of working teachers is also a high priority, especially for female teachers who are well placed to help promote gender equality in schools.[16] In some Nigerian schools, there are more than 200 students per trained teacher.[17] Senegal's teacher recruitment

12   UNESCO Institute for Statistics. 2017. *Nigeria country data.*
13   UNESCO Institute for Statistics. 2017. *Pakistan country data.*
14   UNESCO Institute for Statistics. 2017. *Senegal country data.*
15   UNESCO. 2015. *The challenge of teacher shortage and quality.*
16   Pakistan Ministry of Education. 2015. *Education for All: National review report.*
17   UNESCO. 2014. *EFA global monitoring report 2013/14.*

rate is largely on track, but many untrained teachers are placed in classrooms resulting in the need for sustained in-service development.

Across the four countries, teachers' self-efficacy is quite low. In Senegal for example, only 8% of trainee teachers expressed any confidence about teaching reading in local languages.[18]

The challenges encountered in the four countries reflect, in many ways, the educational challenges facing other developing and middle-income countries.

Table 1: Overview of country performance according to EFA goals at the outset of the UNESCO projects in 2011

Attributes	Mexico	Nigeria	Pakistan	Senegal
Total public expenditure on education as % of GDP	5.15	No data	2.22	6.04
EFA Goal 1: Expand and improve early childhood care and education				
Gross enrolment ratio in pre-primary education (total %)	98.97	20.87	83.55	13.04
EFA Goal 2: All children to have access to free and compulsory primary education				
Primary education enrolment (total %)	95.44	63.84	71.74	70.03
EFA Goal 3: Meet the learning needs of all youth and adults				
Youth literacy rate (total %) F = Female, M = Male	98.46 (F/M: 1.00)	66.38 (F/M: 0.77)	70.77 (F/M: 0.80)	66.03 (F/M: 0.79)
EFA Goal 4: Improve adult literacy				
Adult literacy rate (total %)	93.52 (F/M: 0.97)	51.08 (F/M: 0.68)	54.74 (F/M: 0.63)	52.05 (F/M: 0.61)
EFA Goal 5: Gender parity in education				
Gender parity index (GPI) for primary education GPI is expressed as a ratio of females to males in school	F/M: 0.99	F/M: 0.94	F/M: 0.86	F/M: 1.06
GPI for secondary education	F/M: 1.08	F/M: 0.87	F/M: 0.75	F/M: 0.91
EFA Goal 6: Improve all aspects of the quality of education				
Trained teacher %	95.6	66	83	48
Pupil to teacher ratio at primary school	28.11	28.38	39.83	32.94
Pupil to trained teacher ratio	29	57	48	70

Source: UNESCO Institute for Statistics

3. Overarching aims of the intervention

The four-country UNESCO intervention was created through a partnership between UNESCO and Nokia (now part of Microsoft) and aimed to advance EFA goals by harnessing mobile learning technologies for teacher development.

In particular, the project targeted EFA Goal 6 which called on UNESCO and its Member States to 'improve all aspects of the quality of education, and ensure excellence of all so that recognized and measurable learning outcomes are achieved by all, especially in literacy, numeracy and essential life skills'.[19] At the most basic level, the UNESCO project sought to improve teacher

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18 UNESCO. 2014. *Children need to be taught in a language they understand.*
19 UNESCO. 2015. *EFA global monitoring report 2015.*

quality by integrating mobile technologies in national teacher professional development systems in ways that supported teachers' pedagogical practices.

Prior to this endeavour, very few projects had been conducted to build teacher capacity in developing countries by leveraging mobile technologies. Previous attempts included a text messaging service for teachers in Kenya which showed reasonable success in improving teachers' classroom management skills and facilitating student learning. However, the Kenya project and others like it did not mature beyond a test phase. A specific goal of the UNESCO intervention was to demonstrate that mobile services for teachers are scalable and, with country ownership, sustainable.

The UNESCO project sought to create mobile phone 'ecosystems' to support teacher professional development in each of the four host countries. The country projects, while unique in many regards, shared important underlying characteristics: each employed mobile devices and mobile content to support teacher professional development.

The project outputs were also broadly similar and included:

- Mobile phone utilities;

- Short training courses designed to help teachers to use mobile phones for capacity-building;

- Digital platforms to facilitate teacher collaboration and peer learning.

Figure 1 below illustrates processes and steps that guided the overarching intervention and helped shape the individual country projects.

Figure 1: The enabling ecosystem of mobile learning for teachers
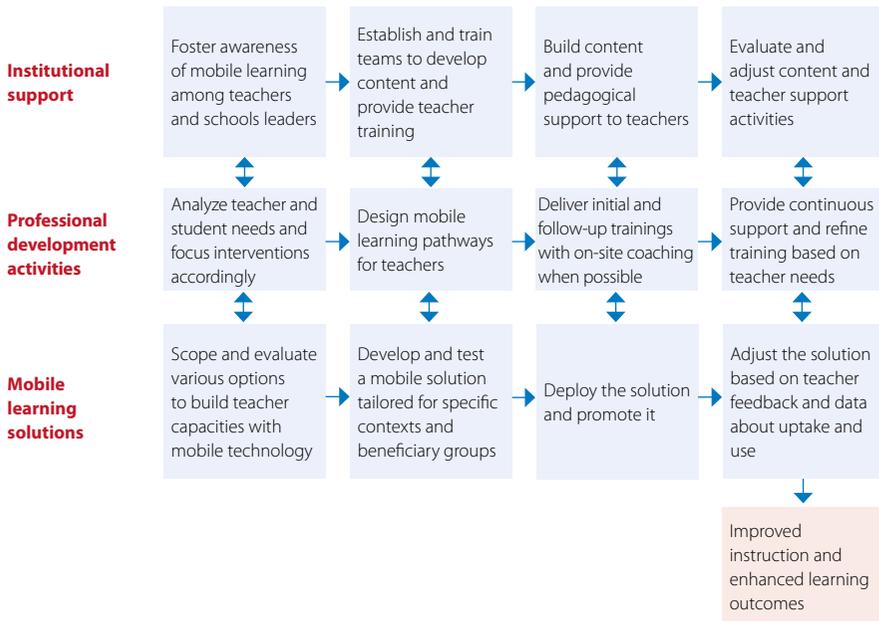
4. Overview of the four projects

The four UNESCO country projects aimed to advance new and cost-effective models of teacher development that could be emulated elsewhere, especially in developing countries where access to fixed-line ICT is non-existent or scarce. Each country project included:

- Ministries of education, particularly the divisions responsible for teacher education and ICT for education;
- Teacher development institutions;
- Developers and programmers, drawing particularly on the technical expertise of specialists at Nokia;
- Teacher development and educational content specialists.

The main beneficiaries were teachers, and secondary beneficiaries were teacher training institutions and ministries of education. The aim was to assist teachers working in schools and to provide models that might be of use to larger institutions looking for strategies to support teacher development.

Specific features of each country project are outlined in Table 2 and Table 3. What all projects shared was mobile learning content developed to assist primary school teachers. UNESCO and its partners also worked to ensure teachers understood how to access the content. External evaluators sought to measure the uptake and use of the content as well as its impact as reported by the teacher beneficiaries.

Table 2: Overview of the four projects

Country	Objective	Features
Mexico	Improve the teaching practice of Spanish language instructors working with indigenous children who speak minority languages	The project in Mexico sought to help develop the Spanish language skills and pedagogical practice of multi-grade primary school teachers working in areas where indigenous languages are dominant. The pilot project involved 59 teachers in schools located in the state of Puebla, academically the lowest-performing state in the country.
Nigeria	Build the pedagogical capacities of primary school English language teachers	The project in Nigeria utilized mobile phones to help teachers improve the English language and literacy skills of primary school students. The project targeted 50 teachers working in 50 different primary schools in the Federal Capital Territory of Nigeria.
Pakistan	Strengthen the knowledge and pedagogical practices of early childhood care and education teachers working in rural areas	The project in Pakistan sought to improve the content and pedagogical knowledge of female teachers working in the field of early childhood care and education. The project reached 150 female teachers working in 75 different schools in 4 areas of Pakistan.
Senegal	Enhance the teaching practice of mathematics instructors and provide students with additional educational resources	The project in Senegal supported early grade mathematics instruction. The intervention was unique because it provisioned mobile technology for student use as well as teacher use. The project involved 100 primary school teachers, reaching 40 schools in Diourbel, a city in the centre of the country, and 10 in Pikine, a city near Dakar.

Table 3: Underlying attributes and mobile learning solutions in the four projects

Attributes		Mexico	Nigeria	Pakistan	Senegal
Target teachers		Multi-grade primary school teachers	Primary school teachers	Early childhood care and education teachers	Primary school teachers
Teacher professional development	Subject focus	Language	Language	Child development	Mathematics
	Format	Centralized	Centralized and self-directed	Centralized and self-directed	Centralized
	Purpose	Upgrade teachers' technological and pedagogical content knowledge	Upgrade teachers' pedagogical content knowledge	Upgrade teachers' pedagogical content knowledge	Upgrade teachers' technological and pedagogical content knowledge
	Offline	Workshops and school visits	Workshops and follow-up meetings	Workshops	Workshops and follow-up meetings
	Online	Knowledge sharing	-	Knowledge sharing	-
Technical platform	Content delivery	Nokia Education Delivery	Nokia Life+	Nokia Education Delivery	Nokia Mobile Mathematics (MoMath)
	Interaction	Blog	-	Facebook	-
Mobile learning	Content	Spanish language lessons	Pedagogical tips for English language instructors	Video clips about ECCE based on national curriculum	Mathematics lessons, including lessons designed by teachers
	Learning activities	Viewing lesson plans; video recording student conversations; sharing and applying own videos	Reading tips about English language teaching methodologies; taking multiple choice questions	Viewing of video clips; taking multiple choice questions	Using and creating MoMath lessons; encouraging students to use the mobile learning utility and monitoring and guiding its use

5. Evaluation

The project evaluation involved a collaboration between three parties: independent evaluators, UNESCO and NOKIA.

Research questions and proposed data-gathering activities were outlined by the independent evaluators, reviewed by UNESCO managers, circulated to project implementing agencies and then agreed. Country-level partners were responsible for securing local support for the evaluation process and ensuring that any ethical permissions specific to the subprojects were secured.

The projects were monitored and evaluated using a mix of quantitative and qualitative methods. Data collection mechanisms for all four countries included:

- Surveys with Lickert-scale and open-ended questions to gather both quantitative and qualitative data;
- Statistics regarding the duration, frequency and nature of technology use by programme participants.

The instruments for data collection comprised:

- Participant questionnaire given near the outset of the intervention (baseline);
- Participant questionnaire given near the end of the intervention (endline).

The evaluation tools sought to measure teacher perceptions related to:

- Changed ICT skills;
- Changed frequency of ICT use;
- Changed attitudes regarding using ICT for teaching and learning purposes;
- Changed subject matter and pedagogical knowledge;
- Changed teaching and communication practices;
- Perceived impact of the intervention.

The survey tools and questionnaires were designed in English by the evaluation team and translated into local languages by UNESCO. All qualitative feedback from participating teachers in non-English languages was translated into English for use by the evaluation team. It was noted from the outset that the responses in the surveys represented the *opinions* of the participating teachers, therefore the impacts detected were self-reported.

To gather statistics about technology use, each subproject employed mobile technology platforms which anonymously tracked and stored usage data. The evaluation team reviewed this data and collated uptake and use statistics. The usage data was collected for a minimum of seven weeks.

For data analysis, only surveys completed by teachers who had done a baseline and endline survey were used. The survey was designed to group data into coherent sections to show overall trends and shifts. Paired T-tests were used to measure the statistically significant shifts in pre- to post-data.

The uptake and usage data analysis compared the initial profile of beneficiaries to the actual uptake by beneficiaries. It examined usage patterns in relation to project phases and, where possible, examined types of use by beneficiaries.

6. Report structure

The body of this report has four chapters. Each chapter describes work undertaken in a specific project country and is organized around the following headings:

- Educational context;
- Project focus;
- Objectives;
- Mobile learning ecosystem;
- Teacher training;
- Key results;
- Lessons learned and recommendations.

A concluding chapter shares findings running across the four country projects. It also includes recommendations intended to benefit future efforts to support teachers with mobile technology.

Mexico
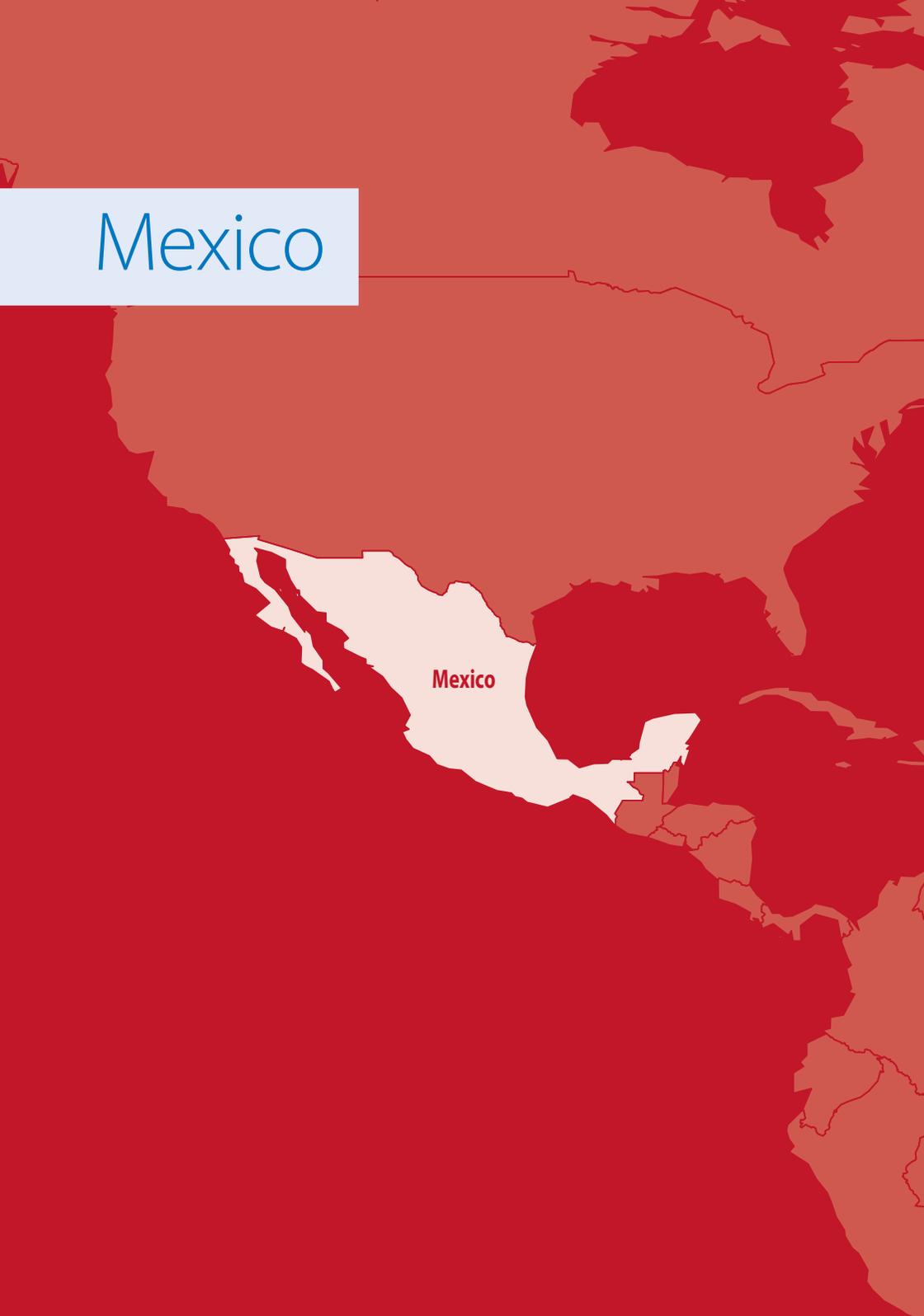
Mexico

Mexico

1. Educational context

Mexico has made substantial progress in improving literacy rates for children and adults. Targeted policies such as the introduction of distance education programmes and initiatives to expand early childhood education have helped to ensure that over 98% of the population can read and write, while also making learning opportunities more accessible to people from disadvantaged communities.[20] Participation in education has also improved at the primary school level.

Despite this progress, deficits remain. Of particular concern with regard to literacy are persistent performance gaps in reading between speakers of indigenous languages and native Spanish speakers. Mexico is home to the largest indigenous population in Latin America and has 6.7 million inhabitants who speak an indigenous language. Roughly one million of these people do not speak Spanish, the dominate language of the country.[21] Improving Spanish language literacy for these learners, especially children and adolescents enrolled in formal education, ranks among the country's most urgent educational challenges. The geographic isolation of indigenous groups has complicated efforts to provide expanded education services. The implementation of high-quality bilingual education programmes that can reach remote indigenous communities is thus a strategic priority to improve education equity and enhance the integration of Mexico's ethnically diverse population.

20   UNESCO Institute for Statistics. 2017. *Mexico country data.*
21   OECD. 2013. *Education policy outlook for Mexico.*

2. Project focus

UNESCO and the Mexico country project team planned the mobile learning intervention to enhance the pedagogical practice of Spanish language teachers working with indigenous students who did not speak Spanish as a native language. The project aimed to help make language instruction more authentic and to take advantage of mobile phones features with educational relevance, notably voice and video recording capabilities. Care was taken to ensure that the pedagogical approaches promoted in the mobile resources were aligned with the national curriculum.

3. Objectives

The project had the following objectives:

- Create lesson plans that are easily disseminated via mobile phones and support the social practice of language aligned with formal curricula;

- Encourage communication among teachers and build communities of practice to enhance knowledge sharing;

- Develop a new, cost-effective model for teacher development that can be replicated in other areas of Mexico.

The project design allowed for two phases in the teacher development process:

- The **first phase** aimed to familiarize teachers with the Nokia Education Delivery (NED) platform, the technical utility used to access educational content from a basic mobile

phone. Ten lesson plans were uploaded on the platform, based on the existing national curriculum developed by the Federal Ministry of Education. Each of the lesson plans introduced teaching strategies to practice language for a specific communication purpose, for example understanding and talking about recipes for cooking. Teachers were also shown how to create a blog to encourage knowledge sharing and communication among peers.

- The **second phase** allowed the teachers to deliver eight out of the ten lesson plans in a classroom setting.

4. Mobile learning ecosystem

Beneficiaries

At the start of the project, the beneficiaries were:

- 59 bilingual teachers, trained and equipped with mobile devices, teaching in rural multi-grade elementary schools;

- 770 students from 9 schools in the State of Puebla (6 in Tlacotepec de Benito Juárez and 3 in Tehuacán).

Partners

While UNESCO was responsible for overall project monitoring and evaluation, the organization worked with several key partners in the field:

- The **State of Puebla** hosted the project under the auspices of the Secretary of Public Education (Secretaría de Educación Pública, SEP) and funded part of the project.

- The **National Pedagogical University** in Mexico City, a public research university

that focuses on the use of technology in education, was responsible for the local management of the project and the coordination of implementation.

- **Nokia** provided technical assistance for project and ongoing support related to the NED platform.

Mobile learning solution

The mobile learning solution included mobile applications, mobile learning content and a mobile learning pathway.

The project employed two mobile tools:

- The NED platform was used for delivering lesson plans containing specific objectives and educational activities.

- A blog was used for feedback, comments and knowledge sharing.

The **first phase** of the project introduced the NED mobile platform and the ten lessons it contained. Each lesson included specific objectives and activities for selected teachers. The lessons were based on the existing national curriculum developed by the Federal Ministry of Education and emphasis was placed on the social practices of language, in particular on the usage of spoken and written language in social contexts. Thus, each lesson was a teaching sequence that focused on a communicative purpose of language as identified in the curriculum. Overall, the teaching strategies of this project aimed to develop social practices of the language in various contexts, with different communicative purposes by using authentic texts.

In the **second phase** of the project, eight of these lessons were adapted by the teachers for

use with their students in a classroom setting (see Annex I for lesson outlines).

Activities designed for the lessons involved:

- Teacher viewing of lesson plans;
- Recording videos;
- Students recording videos of conversations among students;
- Sharing and applying the videos made by the students themselves.

5. Teacher training

At the outset of the project, a two-day training workshop was organized for the teacher trainers tasked with overseeing the projects and the implementation with classroom teachers. The workshop helped trainers learn to use mobile phones and project applications including NED and the project blog. It also taught the trainers how to develop and monitor the classroom teachers under their supervision. The training was provided by the project content developers as well as by a technical team specializing in mobile technology.

The 59 local participant teachers were then invited to a separate two-day session to initiate them into the project. The trainers helped the teachers practice using mobile devices for learning and worked with them to improve their technical understanding of how to use mobile devices and applications.

Two site visits were made by the local implementation team in the San Marcos Tlacoyalo and Tehuacán Puebla regions in order to monitor the progress of teachers and support project implementation.

6. Key results

An independent evaluation of the holistic project found mixed results. Teacher engagement flagged over the course of the project mainly because of inconsistent mobile network connectivity. Also, because very few participating teachers completed surveys at the conclusion of the project, it was difficult to generalize findings. While the responses received were valuable, they came from only about 15% of the participating teachers.

From the data that was collected, teachers reported that the project enabled them to 'be more professional', especially in terms of lesson planning and assessing the prior knowledge of students. One respondent noted that the intervention helped him see education as a 'task of constant evolution, especially with respect to the use of technology as a learning tool'. The teachers also appreciated the integration of authentic learning activities, such as the creation of recipes and poetry books, which they felt were exciting and positive learning experiences for students.

Another important point raised by respondents was the alignment of the interventions with the national curriculum. Such coherence between micro implementations of lessons and macro formulation of national policies created a clear direction for teachers.

Teachers also reported a higher level of comfort using ICT and greater interest in using it to support teaching and learning. Most respondents remarked that the project carried a lasting impact; they said they had learned new ways to investigate and search for information on the internet, and that they would continue to incorporate these skills in their teaching. Overall, a considerable increase in digital skills was reported for every area. The evaluation

report showed that the greatest increases were in accessing the internet for teaching and using social networking sites.

After the intervention, most teachers were strongly in favour of using the device in classroom settings. While many teachers also supported using the device for out of school teaching and learning, there was a notable increase in the small number of teachers who were 'strongly opposed' to the idea, perhaps reflecting an objection to blurring lines between work and home. The World Bank and other organizations have reported that powerful teachers unions in Mexico often oppose measures that do not clearly delineate professional and personal time.[22] Overall though, the attitude of the project teachers towards using ICT for teaching both in and out of the classroom improved significantly over the course of the intervention, in line with project goals.

Another aim of the project was to 'promote dialogue between experts and participating teachers to improve Spanish language pedagogy' and to 'encourage exchanges between teachers and build communities of practice'. Given the low response rates to the endline survey, it is not possible to comment on the extent to which these aims were achieved for the target group. However, based on the limited responses, there was a reported increase in the frequency of the use of mobile phones for calls and e-messages to various groups (managers, peers, parents and students), which indicated greater use of mobile devices for communication and networking.

An evaluation of the uptake and use of educational resources showed low to moderate use of the NED platform and moderate use of the project blog. It is estimated that the lesson plans hosted on the NED platform were accessed less than once a week, a frequency that was lower than anticipated. On the blog there were consistently more views than posts and the blog activities were skewed towards viewing both lessons and the profiles of other participants. The group communication tools, functions that allowed teachers to communicate with all project participants, were used consistently throughout the project, but the frequency of use fell off considerably after five weeks reflecting most likely declining interest.

Evaluation data gathered about the second phase of the project, the period in which teachers implemented the lessons plans hosted on the NED platform in classrooms, indicated that teachers found the lessons beneficial and felt that they benefited learners. Teacher attitudes about using ICT in classrooms also went up significantly for instructors who completed phase two and completed a survey, a sign of enthusiasm about the implementation of the lessons plans accessible from mobile phones. These encouraging findings should be treated with caution though in light of the relatively small sample size.

Overall, the intervention resulted in improvement in the following areas:

- Support for using mobile phones in classroom settings for teaching and learning;

- Moderate support for using mobile phones out of school for teaching and learning;

- Frequency of general ICT use;

- Reported mobile phone skills.

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22 Bruns, B. and Luque, J. 2015. *Great teachers: How to raise student learning in Latin America and the Caribbean.*

7. Lessons learned and recommendations

The pilot project in Mexico encountered challenges related to context, infrastructure, time duration, connectivity and teacher support and coordination.

Contextual constraints

Mexico was the only country where two stages of activities were planned and tested, and one of the greatest challenges confronting this project was the high attrition rate of participants from the first stage to the second. Of the 59 teachers, only 40 continued into the second stage, and blog use declined sharply from 39 users to just 8. Based on interviews with local project managers and tutors who conducted the teacher training and school guidance visits, this was due to: excessive daily academic workloads in schools; other planned priorities during the period, especially assignments for degree programmes; teacher frustration and demotivation due to poor internet connectivity; intermittent mobile phone signals in certain communities; problems reading small fonts on the phone screen; and personal issues, including family obligations.

Recommendation: These results suggest that complex contextual constraints need to be addressed beforehand if a new mobile learning solution is to be created for teachers who have heavy daily workloads and live in poorly resourced communities. Attention must also be paid to teachers who drop out of a mobile learning project. Mechanisms should be in place to identify the specific reasons for steep drop-out.

Infrastructural constraints

According to the project close surveys, the quantity of mobile phones was insufficient and there were persistent difficulties with internet connectivity. Several teachers commented that devices with larger screens would have benefited them; some also suggested that the phones were not easily connected with other devices, such as a projector, which limited the utility of devices in classroom settings.

Recommendation: Improve the quantity and quality of mobile phones, and include projectors to enable classroom viewing. Gather inputs from teachers and technicians at the conceptualization stage in order to ensure more engagement and to obtain a more detailed understanding of classroom operating conditions, appropriateness of technology and connectivity issues.

Time constraints

Most of the teachers in the survey reported that time pressures restricted their engagement in the project, showing that initiatives which ask teachers to do 'one more thing' are not always enthusiastically received. The first phase of the project aimed to have teachers study one lesson per week but this was expanded to one lesson every three weeks, due largely to heavy teacher workloads and other competing time commitments.

Recommendation: Help teachers understand how mobile learning interventions can, in the long run, save and decrease workloads. Alternatively, provide teachers with adequate time to experiment with new technology and practice implementing mobile learning solutions.

Poor connectivity

Many teachers reported that WiFi and mobile networks did not work consistently. Several teachers lived in areas that were not served by any mobile signal. Because aspects of the mobile learning solution were dependent on connectivity, this led to frustration on the part of teachers and likely contributed to the lower than expected teacher retention over the course of the project.

Recommendation: Establish locations where mobile services are guaranteed to work and regularly monitor and maintain connectivity at these location. Train teachers how to download content from internet or mobile network 'hot-spots' and then use this content offline.

Lack of coordination and teacher support

The lack of teacher coordination was cited as one of the intervention's weaknesses. Respondents expressed the desire to work more closely with other teachers and to have a mentor who could answer questions and facilitate faster progression through the mobile learning content.

Recommendation: Increase social learning and guided participation in order to enhance project outcomes. A pre-implementation study of the schools would be advisable, in order to gauge the commitment level of school leaders and participating teachers, and also to determine the kind of support needed for a successful intervention. If the project is to be replicated, project managers should carry out regular teacher visits to schools, in order to provide input to participating teachers and facilitate their learning.

Nigeria
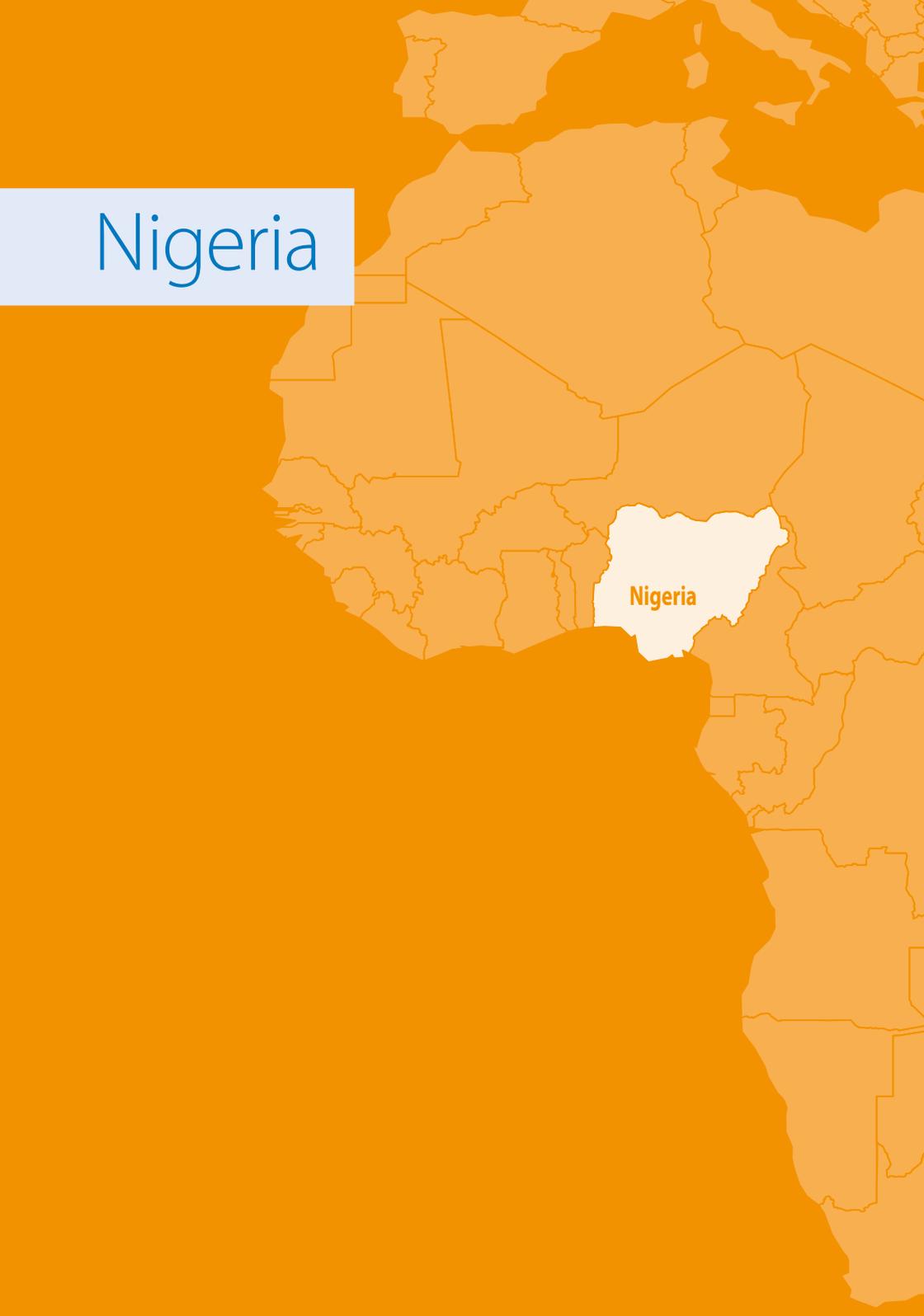
Nigeria

1. Educational context

Nigeria faces serious challenges in the education sector. Currently, 8.7 million children are out of primary school and many more are not attending secondary school.[23] In addition, many of the children and adolescents who are in school often fail to achieve basic literacy and numerary skills.[24]

Gender disparities in education are another concern. Currently, only 65% of girls acquire basic reading skills whereas the literacy rate for boys is approaching 80%.[25]

The twin problems of educational access and quality have resulted in some of the highest illiteracy rates in the world. Nearly 40% of the adult population in Nigeria cannot read or write. For the youth population, illiteracy is slightly lower but is still very high by global standards: 27% of youths between 15 and 24 years of age are illiterate.[26] Data from the UNESCO Institute for Statistics shows that progress toward improved literacy has largely stalled over the past two decades.

2. Project focus

UNESCO tailored its mobile learning intervention to support and build the capacity of 50 English language primary school teachers in the Federal Capital Territory of Nigeria.

English is the primary language of instruction in Nigeria and foundational to students' educational

success. The importance of early English language instruction is heightened by the fact that many children—whose first language is regional or tribal—have had very little exposure to English when they start primary school. Students in Nigeria often leave school at an early age because they fail to develop strong English language proficiency and cannot follow curricular instruction.

Several studies have shown that the quality of English language instruction in Nigeria is very low. Teachers are frequently underprepared to manage the large classes typical of Nigerian schools, and unfamiliar with contemporary pedagogical strategies.[27]

For these reasons, improving teacher capacity in the field of English language instruction is critical.

3. Objectives

The project had the following interrelated objectives:

- Improve the quality of English language instruction delivered to primary school students;

- Help build the ICT capacities of teachers so they can use mobile technologies for professional development and other educational purposes;

- Build a sense of community among English language teachers within and across schools.

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23 UNESCO Institute for Statistics. 2015. *Leaving no one behind: How far on the way to universal primary and secondary education?*
24 UNESCO. 2014. *EFA global monitoring report 2013/14.*
25 UNESCO Institute for Statistics. 2017. *Nigeria country data.*
26 Ibid.

27 UNESCO Institute for Statistics. 2014. *Wanted: Trained teachers to ensure every child's right to primary education.*

4. Mobile learning ecosystem

Beneficiaries

The project targeted 50 teachers working in 50 different primary schools in the Federal Capital Territory of Nigeria, a state that encompasses the nation's capital Abuja. The teachers, predominately women aged 30-40, were overseen by five teacher trainers. Indirect beneficiaries of the project included anyone who accessed the mobile learning service.

Partners

The project in Nigeria involved four core partners: UNESCO, Nokia, the British Council and the Nigeria Teachers' Institute (NTI). These partners worked cooperatively to create, launch and sustain a mobile learning service to support English language teachers:

- **UNESCO** designed the project and provided overall coordination, working closely with the other partners to ensure that the mobile service for teachers was of high quality and easily accessible from basic mobile phones provisioned as part of the project. UNESCO also organized an initial training seminar and four subsequent support meetings for the 50 pilot group teachers. UNESCO elicited and consolidated feedback from participating teachers on a regular basis in order to improve the mobile service and to ensure that it responded to the needs of project beneficiaries.

- **Nokia** hosted the educational content on its Nokia Life Plus platform from May to December 2013. The Nokia Life Plus system ensured that the content was easy to find and use on a wide variety of Nokia mobile phones. Nokia also handled various technical demands related to the project.

- Drawing on its global expertise in English language teacher-training, the **British Council** provided the educational content, which was a consolidation of its Certificate in Primary English Language (CIPELT) course. Following the closure of Nokia Life Plus in December 2013, the British Council moved the mobile learning content to a mobile-friendly website in January 2014.

- **NTI** promoted and supported the project in Nigeria. Working with UNESCO, the organization identified teachers and teacher trainers for each pilot group, and arranged initial service registration and training. NTI also helped to establish the monitoring and feedback structure that allowed teachers to communicate feedback to UNESCO and other project partners.

Mobile learning solution

The content developed by the British Council in cooperation with UNESCO formed the core of the mobile learning service in Nigeria. The content took the form of short daily messages delivered over a 52-week period. Holistically, it aimed to convey the same learning as the British Council's 30-hour CIPELT course.

The mobile content targeted in-service primary school teachers working in low-resource contexts with large mixed-level classes. It covered the basics of child language acquisition; how instructors can produce and use resources for primary-age students; and how to plan, manage and assess the progress of classes.

The content was broken into daily messages of 50-100 words, accompanied by one image or graphic. On the Nokia Life Plus platform,

individual messages carried a label such as 'information', 'resources', 'hands-on activities', 'review', 'summary', 'quote', or 'reflection' to signal the type of content messages contained.

The messages were sequenced to gradually build more complex pedagogical understandings. Messages regularly referenced or elaborated content covered in previous messages and followed an order established by the British Council and UNESCO. While the sequencing was intentional and important, missing one or two messages from time to time was not disruptive to the learning process.

Overall, the messages sought to help teachers encourage learner independence, cultivate different learning aptitudes and reflect on their teaching practice. They also included resources, information and quotes relevant to teachers. (See Annex II for sample messages and screenshots.)

The service application on the Nokia Life Plus system was called 'English Teacher' and could be activated using a simple interface. Once activated, the service sent a daily message behind an icon labelled 'English Teacher' (see Figure 2).

The Nokia Life Plus system could only be used on Nokia brand phones. However, because Nokia Life Plus was pre-installed on most Nokia headsets sold in Africa, teachers only needed to activate the English Teacher service to use it; installation of third party application was not needed. The end user incurred only minimal data fees to download the message. These fees did not exceed more than a dollar per month and, depending on the data plan of the user, could be as low as a few cents per month.

At the end of the pilot project, the service was moved to a mobile-friendly (HTML 5) website

and the content was reorganized. The new website could be accessed by any mobile device equipped with an internet browser.

Figure 2: Nokia Life Plus home page

5. Teacher training

At the outset of the project UNESCO and Nokia, in collaboration with NTI and the British Council, organized an initial training seminar for all teachers participating in the pilot project. The teachers were given Nokia headsets with pre-paid SIM cards and received training on how to access and navigate the mobile learning service.

The teachers were organized into five groups, each overseen by a teacher trainer who provided ongoing interaction and support—both technical and pedagogical. Teachers in each group also provided support to other group members and met regularly to discuss

the application of the pedagogical concepts learned. The teachers gave feedback about the service to their respective teacher trainers who, in turn, reported this information to UNESCO. UNESCO consolidated the feedback and, when appropriate, made changes to the service, ensuring it met teacher needs and remained useful and engaging for end users.

In addition to the initial training, three meetings were held with teachers in the pilot group. These meetings allowed teachers to voice questions, troubleshoot technical issues, discuss the mobile service and share examples of how they translated pedagogical tips into classroom practice.

Following the conclusion of the pilot project, the service was migrated to an HTML website hosted by the British Council. Additional training was organized to explain the new platform, and ensure participants were able to access and use it on their mobile phones. Teachers continued to receive support from NTI and teacher trainers following UNESCO's handover of the project.

6. Key results

Feedback from participating teachers was positive, with significant shifts in teachers' views regarding the value and utility of mobile learning. There was also an impressive uptake of the service beyond the targeted beneficiaries during the pilot period which extended over one academic year. Teachers reported that the project exceeded their expectations by helping them accomplish more than they had initially anticipated.

Teachers said that the mobile learning intervention improved their English language teaching skills, in line with the project's

objectives. The evaluation also showed that the reported frequency of ICT use for both general and teaching-specific purposes had increased considerably over the course of the project.

Another finding was that the project had helped to create communities of practice among teachers. At the project conclusion, teachers stated that the frequency with which they used mobile phones for making and receiving calls, sending messages and communicating via websites and social media with other teachers had increased significantly.

Based on the analysis of baseline and endline surveys, the project intervention reduced the feeling of isolation in schools and instilled a sense of collegial community. In interviews and testimonials, teachers routinely made statements such as: 'The project helped me meet teachers who face similar challenges' and 'The service provided a platform for talking about teaching and debating effective practices for language learning'.

The evaluation further found that teacher attitudes towards using ICT *out* of the classroom for teaching and learning became more positive over the course of the project, but less positive about using ICT *in* the classroom. The precise reason for this divergence is unknown, but it seems to highlight the difficulty of leveraging mobile phones for education in classroom settings.

A peripheral benefit of the project was that it improved teachers' views of their profession generally. It also seemed to have helped demonstrate that pedagogy is a complex act. In completion surveys, teachers often agreed with statements such as 'I have a lot to learn about teaching English', indicating that engagement with the project helped them recognize how

much knowledge and skill is required to teach a particular discipline.

In terms of quantitative data, teachers in the pilot group regularly accessed the daily content messages, even when it required overcoming connectivity problems. A surprising finding was the large numbers of people who used the service outside the pilot group. At the end of the project, the UNESCO-Nokia mobile learning service was reaching approximately 70,000 users, far more than anticipated. Furthermore, there was a positive correlation between the increased user numbers and daily page views. The high uptake strongly indicates that the mobile service had relevance far beyond the pilot group of 50 teachers. The numbers further indicate how quickly mobile learning projects for teacher development can upscale to reach more users. While the growth in user numbers reflects a general interest in mobile learning services, the UNESCO offering had two advantages that likely accelerated uptake: the service was available on the widely used Nokia Life Plus platform and NTI promoted the service extensively throughout Nigeria.

Overall, the project demonstrated that the capacity of English language primary school teachers could be improved through a relatively simple mobile service. It also helped show that a mobile learning service could be scaled-up quickly without major financial investments. The challenges confronted and lessons learned over the course of the project should inform the development of future projects. Similarly, recommendations derived from the project have wide applicability both within and beyond Nigeria.

7. Lessons learned and recommendations

The pilot project encountered challenges related to content, technical problems, training, mobile phone credit, connectivity and hardware.

Content sequencing and delivery

Teachers generally reported that they preferred messages that gave them concrete ideas for lessons, rather than more abstract pedagogical advice. They also preferred messages that were open-ended rather than merely information. Messages that posed questions or sparked reflection were also generally well-received. UNESCO and its partners worked to incorporate these preferences into the service.

Educators involved in the project designed the Nokia Life Plus service so that all users received messages in a strict sequential order, beginning the day they activated the service. This meant that a teacher who initiated the service on, say, 28 May would always be 'one message ahead' of a teacher who initiated the service on 29 May.

While some teachers seemed to have no problems checking messages on a daily basis, others indicated that they preferred to read multiple messages on the same day. Ultimately, this seemed to be a matter of taste. When the service was migrated to the mobile-friendly website, it was built in such a way that teachers could easily peruse the full library of messages, reading as many as they wanted in a single sitting.

Recommendation: Content should be practical, open-ended and constructive, rather than merely informational. Ideally, content sent to

groups of cooperating teachers should be the same and sent at the same time to facilitate discussion about it. While content can be ordered and delivered in a sequential fashion to build on previous learning, platforms that host this content should also be searchable and flexible; the full library of content should be accessible.

Site-based support and coaching

The structure of the pilot project—teacher trainers overseeing small groups of classroom teachers—worked well. The teacher trainers greatly facilitated communication with classroom teachers and helped UNESCO and its partners tailor the service to the needs of end users.

While UNESCO and its partners invested significant resources in training teachers how to use the mobile phones, teachers with limited ICT experience still had trouble accessing English Teacher messages and using other options such as text messaging. Informal training sessions were arranged where teachers taught one another how to take photographs, use email, store contact information and use third-party applications such as WhatsApp, a free messaging service.

Recommendation: Enhance communication networks by using teacher trainers to oversee small groups of classroom teachers and give feedback to project partners. Informal support training should be given alongside more formal technical training in the early stages of any future interventions, in order to ensure that all participating teachers are able to utilize educational and capacity-building services available on their mobile devices.

Credit to access the internet

Initially, UNESCO and Nokia provided teachers with SIM cards containing a modest data plan. The plan provided sufficient credit to access the educational service for months, but it was impossible to track the kind of data that was actually downloaded. Many teachers exhausted their data plans quickly, probably because they used data to retrieve content that was not purely educational.

UNESCO and Nokia stopped providing free data credit towards the end of the pilot study for this reason. However, because costs to access messages on the Nokia Life Plus system were minimal (fractions of a USD cent), the effect on participation was minimal.

Recommendation: Future projects should consider involving mobile network operators as partners. Zero-rated access to educational content would ensure that teachers have the data privileges needed to access mobile learning services, and would prevent the issues encountered above with regard to data plans and private usage. There is a growing precedent for this. For instance, in South Africa leading network operators provide free access to Nokia Mobile Mathematics. Separately, the Wikimedia Foundation has lobbied numerous operators in developing countries to allow people to view mobile versions of Wikipedia articles free of charge.[28]

Connectivity

One of the most serious project challenges was poor connectivity. Some teachers in the pilot group reported a loss of connectivity to mobile phone networks, making it impossible for them to access English Teacher content.

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28   Wikimedia Foundation. 2016. *Wikipedia Zero*.

Feedback reports indicate that teachers gradually identified coping strategies—for example, by identifying the places and times where their phones could get reception—but these were fraught with difficulty: teachers had to know the precise locations (and, in some instances, specific times during the day) where they were likely to find a mobile signal. While limited connectivity did not compromise the overall viability of the project, it represented a significant barrier for teachers living in more remote areas of the Federal Capital Territory.

Recommendation: Although expanding connectivity is normally beyond the scope of small projects similar to the one UNESCO undertook, future interventions should acknowledge the challenge of limited connectivity upfront and give participants concrete coping strategies, such as identifying different locations with connectivity and restarting a device to force it to search for a mobile signal. A platform offering flexible access to a complete repository of educational messages would also enable those with limited connectivity to view and download numerous messages when connectivity is available.

Ideas for ICT use in classroom settings

A significant finding of the project evaluation was that participating teachers were less in favour of using ICT inside classrooms for teaching and learning than they had been at the outset of the intervention. This finding highlights difficulties associated with integrating mobile devices in classroom settings. While the current project did not explicitly seek to promote technology use in classrooms, more could have been done

to support teachers who attempted to use technology in this way.

Recommendation: Organizers of future projects may wish to develop mechanisms and processes to support mobile learning inside classrooms as well as outside them.

Data disruption due to phone sharing and multiple SIM card use

In developing countries, mobile phone owners commonly use multiple SIM cards. This caused the sequencing of messages to be disrupted during the project because the sequence was determined by the SIM card. At the outset of the project, UNESCO felt that using SIM cards as identifiers was advantageous because it eliminated the need for user names and passwords to track the progress of participants. However, the use of multiple SIM cards by individual users complicated efforts to track user progress and led to frustration for end users when the sequencing of messages was disrupted.

Recommendation: Future projects should provide a unique user login for mobile services employing sequenced messages if participants are expected to use multiple SIM cards to access mobile services. Organizers might also like to try and develop content that is not sequence dependent.

Pakistan

Pakistan

Pakistan

1. Educational context

Pakistan has long been working to improve the provision of education. According to the latest figures from the UNESCO Institute for Statistics, the national literacy rate stands at 56.44%, well below regional benchmarks and international targets. Access to basic education remains a challenge; Pakistan is home to 5.6 million out-of-school children, approximately 10% of the global total. Gender equity is another area of concern: for every 100 boys in school in Pakistan, there are only 83 girls.[29]

To confront these challenges, Pakistan has begun to emphasize early childhood education (ECE). In 2002 a national ECE curriculum was developed and policy attention continues to be directed toward building learning foundations for young children before they enter primary school.[30] These efforts are constrained however by persistent teacher shortages at the pre-primary level and underqualified ECE instructors. The vast majority of ECE teachers in Pakistan are women and they tend to receive low salaries for their work. Opportunities for them to receive professional development are rare and many ECE instructors enter the profession with limited grounding in childhood development and education.

Harnessing widely owned mobile technologies to build the capacities and knowledge of ECE teachers has the potential to better prepare children to excel in primary education and acquire basic skills that empower individuals and communities, and spur development.

2. Project focus

UNESCO and the Pakistan country project team designed mobile learning solutions to build the capacity of female ECE teachers working in mostly rural areas, with a specific focus on applying teaching methodologies introduced by the Federal Government. The project was aligned with Goal 1 of the Education for All (EFA) initiative: 'Expanding and improving comprehensive early childhood care and education, especially for the most vulnerable and disadvantaged children'.[31] Since the launch of the Dakar Framework of Action in 2000, Pakistan has included ECE in key areas of its education sector reforms.

3. Objectives

The project had the following objectives:

- Improve the subject matter knowledge of female ECE teachers working primarily in rural areas;

- Provide pedagogical training and guidance to ECE teachers;

- Improve student skills in writing, speaking and listening;

- Introduce a new and affordable model of teacher development for replication in other regions of Pakistan.

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29   UNESCO Institute for Statistic. 2017. *Pakistan country data.*
30   Pakistan Ministry of Education. 2007. *National curriculum for early childhood education.*

31   UNESCO. 2015. *EFA global monitoring report 2015.*

4. Mobile learning ecosystem

Beneficiaries

Project beneficiaries included teachers and schools:

- 150 rural teachers working in pre-primary schools;

- 75 different schools in 5 areas (Bhara Kahu, Nilore, Sihala, Tarnol and urban areas of Islamabad Capital Territory).

Partners

While UNESCO was responsible for overall project execution, it was supported by different public and private sector organizations:

- UNESCO's primary partner, the **Ministry of Capital Administration and Development Islamabad**, ensured political commitment to the project and was responsible for local supervision and coordination.

- The **Federal Directorate of Education** (FDE) in Islamabad was responsible for providing training and support to teachers.

- **Nokia**, the main donor, provided technical assistance on the Nokia Educational Delivery platform, the main technical platform used to access content related to the project.

- **Midas Communications**, a media firm, was responsible for the digitalization of educational content.

- **Mobilink** provided data-enabled SIM cards which provided free internet connectivity and supported text messaging for the duration of the pilot project.

The partners collaborated to lay foundations for the project. Main activities included:

- The formation of a technical committee to facilitate implementation. The technical committee helped the FDE to select and train teachers, and to develop content which was uploaded to the NED platform along with other training materials. Members of the committee included representatives from the following organizations:

  - Ministry of Capital Administration and Development Islamabad;

  - FDE;

  - Federal College of Education;

  - Islamabad Model School for Girls;

  - UNESCO Islamabad Office.

- A 3-day workshop to select content for 20 teacher training videos on ECE themes. The objectives of this workshop were to:

  - share and discuss the content of the selected ECE themes;

  - receive feedback and advice regarding the content from a group of ECE experts and media script writers;

  - discuss video themes and content in order to ensure their relevance to teachers and learners;

  - reach consensus regarding the video content.

Mobile learning solution

A mobile learning solution encompassing video learning content and other resources was designed to respond to teachers' training needs.

To strengthen ECE teaching capacity, an early education training manual was developed for use on mobile devices. The manual digitized

existing learning materials drawn from the National Curriculum for ECE and included four major topical areas:

1 Introduction to ECE;

2 Effective implementation of ECE, including the role and responsibilities of teachers in ECE, instructional guidance for teachers, and the creation and management of effective learning environments;

3 Key areas of learning, including personal and social development, language and literacy, health and hygiene;

4 Effective assessment of ECE.

This content was optimized for use on small screen mobile devices.

The project team also developed 20 videos on ECE, 12 of which were class-based and included activities in creative arts and basic mathematics. The remaining 8 were lecture-based and aimed to improve teachers' understanding of ECE. (See Annex III for details about the content developed as part of the project.) The videos were recorded in Urdu, the first language for most teachers and learners. Furthermore, all the videos were open educational resources under a creative commons licence, which means that they could be freely shared, adapted and modified as long as attributions were respected.

Each participating teacher was given a free Nokia mobile handset by the UNESCO Islamabad Office, and Mobilink provided SIM cards with six months of free internet connectivity in addition to generous credits for text messaging and voice calls. The Mobilink text messaging service was the principal means by which the participant teachers interacted with each other and asked questions.

Video content was hosted in a cloud library and downloaded to teachers' phones via the NED platform. The videos were supported by multiple choice questions intended to motivate teachers, facilitate their engagement with the videos and evaluate their understanding of the content.

A Facebook page created for this project facilitated communication and collaboration between the teachers and other stakeholders. A broad-brush analysis of the posts indicated that the social media platform helped participants:

- Share pedagogical tips with members of the community, such as dealing with different types of learners, motivating students and creating a positive classroom environment;

- Improve the visibility of the project by showcasing educational content;

- Keep parents and community members informed about outputs created by students;

- Disseminate administrative information such as the project evaluation surveys.

5. Teacher training

Participating teachers were organized into 5 groups of 30. Each of these groups received a 3-day training workshop on the operation of mobile learning tools and the pedagogical use of the 20 ECE videos.

The workshops:

- Reaffirmed the importance of ECE and sensitized teachers about the national ECE policy plans;

- Familiarized participants with the operation of project provisioned mobile phones and how to access educational resources using the phones;

- Linked the mobile learning content to the national ECE curriculum.

6. Key results

The teachers reported that the intervention improved their teaching and technical skills and, more importantly, changed their approach to teaching. Teachers said the project helped them practice innovative teaching methods, including activity-based learning, in addition to more conventional written activities. Participating teachers also reported improved relationships with children, teachers and parents. Reasons given include a broader understanding of ECE and related pedagogical strategies. Additionally, the project prompted lively exchanges between teachers and parents about class improvement. The teachers were positive about the impact of the project on their teaching practice. They reported that the intervention helped them expand their knowledge of ECE, facilitate learning with students and find new materials to make their teaching more versatile.

The participating teachers were also surveyed on their use of mobile phone functions. This included downloading educational videos, and accessing the internet for other resources, such as games, music or general information. In all but one case, the shift from pre- to post-survey was positive. The most dramatic improvement recorded related to accessing social networking sites and downloading videos which was expected, as these were the two tasks teachers completed most often as a result of their inclusion in the project.

Although the intervention resulted in personal impact, there was little change in anticipated impacts in the teachers' schools. The teachers also reported that the impact on learners was lower than anticipated. However, most participating teachers noted improved student motivation.

Overall, the majority of participant teachers supported the use of ICT for education but, interestingly, not in classroom settings. Teachers were less enthusiastic about using technology in the classroom after the intervention than before it. However, teacher attitudes towards using mobile phones out of school for teaching and learning were more positive.

The analysis of the pre- and post-intervention surveys indicated that the project achieved many of the desired outcomes. The most notable change was the increase in usage and skills associated with mobile devices. Reported increases in knowledge-sharing among colleagues and learners as well as the use of internet-based ECE support programmes for teaching were encouraging.

An evaluation conducted regarding the uptake of the mobile learning tools used in this project indicated a high overall participation rate from the teachers consistent with the project design and objectives. Consistent participation by the majority of targeted teachers was evident in their regular responses to SMS questions, where participation rates were recorded for each week of the project. It is useful to note that although teacher engagement fluctuated somewhat over time, there were not strong differences in activity levels among individual teachers. The participating teachers remained with the project for its duration; no notable drop off was detected.

There was regular, albeit moderate, use of NED and Facebook by the participating teachers. There was slightly more activity on NED in the early phases of the project than its concluding

phases, probably reflecting enthusiasm at the outset of the intervention. However, the reverse was the case for Facebook, where activity increased in the latter part of the project, revealing that social media platforms appeal to users, even when engagement is educational in nature. In interpreting the decline in NED data, it is important to realize that NED logged usage data only when an 'online' activity was performed, and so would not have recorded repeat classroom viewings of a previously downloaded video.

The Mobilink text messaging platform was used as a tool to reinforce communication among teachers and to build communities of practice. The participating teachers interacted with the service by answering questions posed via the platform. A total of 714 closed questions were posed to teachers, eliciting an average of 22 replies per question, of which 78% were correct. There was consistent engagement with the questions from teachers in all project regions and the backend data from Mobilink showed high levels of participation.

The main aim of the project was to leverage mobile technologies to improve the professional capacities of ECE teachers and, overall, data collected from the project suggest that this objective was achieved. Given that the project did not set out to provide or improve classroom access to ICT, it is not surprising to see how little increase there was in the use of ICT for classroom teaching purposes. ICT is not yet fully integrated into the teaching and learning processes in Pakistan and its impact on the academic outcomes of the learners is not yet known.

7. Lessons learned and recommendations

There were several areas identified for improvement which could inform the development and implementation of similar projects in the future.

Connectivity

The main concerns raised by teachers included the poor internet connection and difficulties with mobile connectivity. This led to delays in downloading videos, despite the NED's 'queuing' feature that allowed users to download files overnight.

Recommendation: Project managers need to develop contingency plans to help beneficiaries in areas with intermittent or slow connectivity. While videos can transmit compelling educational content, they generally require high bandwidth connections. Allowing participants high and low bandwidth options to access content can help ensure project goals are achieved even in areas with slow data networks.

Time constraints

Some teachers expressed concern that the project started late into the school year and was interrupted by the summer vacation. Some teachers reported that they did not have enough time to work through all the capacity-building materials.

Recommendation: Organizers should establish flexible project durations to account for scheduling uncertainties and hard-to-predict training needs. They should also find ways to

support and reduce teachers' existing workloads to create space for the use of ICT.

Site-based support for teachers' continuous development

The project was favourably received by the participating teachers and seems to have generated significant enthusiasm for ICT. However, teachers noted a lack of monitoring visits and ongoing evaluation in their feedback. Lack of time for feedback and engagement was also highlighted.

Recommendation: Include training during teaching days and extend the feedback period. Ongoing monitoring and evaluation of project activities are likely to improve engagement and establish feedback mechanisms that allow project managers to tailor interventions to better meet the needs of intended beneficiaries. Also, more context-specific information about how teachers use mobile learning resources is likely to help reveal strategies to refine and improve these resources.

Hardware limitations

Several teachers raised concerns about the sound quality of videos, and the lack of projectors or large screens for classroom viewing of video materials.

Recommendation: If groups of people need to watch videos, access to a projector or TV screen equipped with speakers is essential. Videos should not be used in a classroom setting when such ICT is unavailable or outside the scope of a project budget.

Provision of free handsets and data

The active engagement of participants throughout this project, despite limited access to ICT, poor connectivity and low ICT skills, was probably due in part to the provision of free handsets and free data for six months.

Recommendation: In order to ensure that future projects receive similarly positive engagement, the provision of free handsets and data should be continued. While this clearly presents challenges related to sustainablity, it is unrealistic to expect teachers in developing countries to shoulder substantial costs to access mobile learning services.

Senegal

Senegal
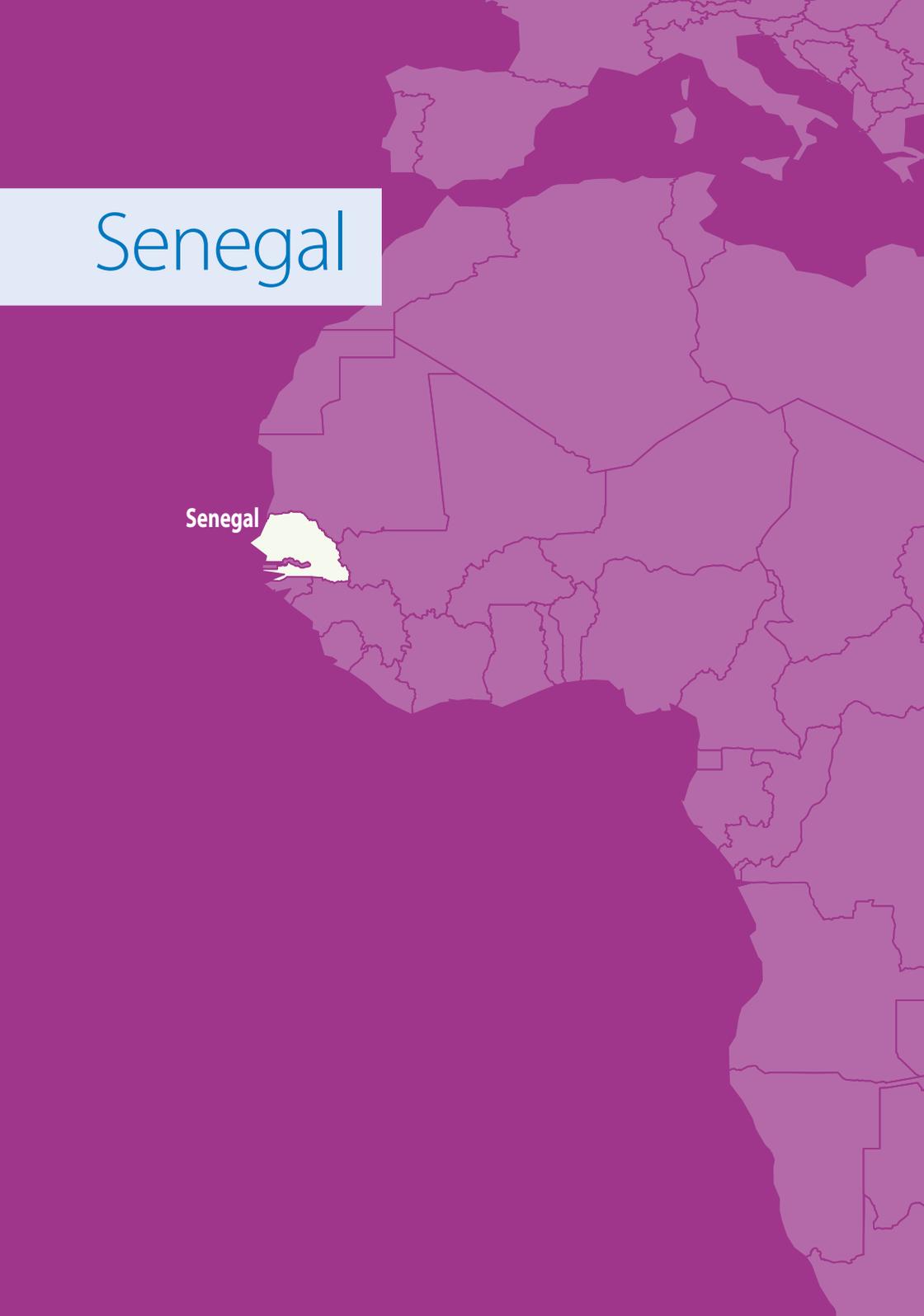
Senegal

1. Educational context

While Senegal has made considerable progress toward achieving international goals for education over the past decade, the country still faces major challenges relating to literacy, numeracy, resources and teacher training.

The literacy rate for adults only recently surpassed 50% and currently stands at about 56%.[32] However, this figure obscures large gaps in literacy between males and females. Across the country, male literacy is approximately 66% for the adult population while the rate for females is only 44%.[33] This gap has narrowed because of efforts to make education more inclusive for girls, but the divisions remain: for young people (aged 15 to 24 years), the literacy rate for males is 76% and 64% for females.[34] These rates, low by global standards, reflect continuing problems guaranteeing universal access to basic education. Despite improvements since 2000, Senegal has one of the lowest primary gross enrolment ratios in the world.[35]

In mathematics, the area of focus for the UNESCO mobile learning project in Senegal, fewer than 60% of learners reached or exceeded the 'sufficient' level established by the Programme for the Analysis of Education Systems (PASEC), a programme that helps francophone countries conduct and analyse educational assessments. Gender differences in performance were also detected, with boys significantly outperforming girls in both early and late primary school.[36] Educational equality is also problematic with regard to performance: PASEC data showed that Senegal had the greatest inequality between lower primary school students of all the 10 African countries included in the study.

Learning resources in Senegal are scarce. The PASEC data found that a majority of learners have to share a textbook with one or more student in both primary and lower-secondary school. This is particularly true in mathematics classes, where there tend to be fewer textbooks available than in other subject areas.[37]

In an attempt to accommodate a growing demand for teachers, many countries in West Africa have 'accelerated' teacher training programmes, condensing training that used to extend over years into months. A 2016 World Bank report estimates that primary school mathematics teachers receive only six months of training in Senegal, among the shortest preparation periods in the region.[38] Many teachers receive even less training. Senegal makes wide use of contract teaching to accommodate more students in primary schools, and by 2004 over 50% of teachers were on temporary contracts and earning only one-third of the salary of teachers on regular contracts.[39]

32 UNESCO Institute for Statistics. 2017. *Senegal country data.*
33 Ibid.
34 Ibid.
35 UNESCO. 2014. *EFA global monitoring report 2013/14.*

36 PASEC. 2014. *Education system performance in francophone sub-Saharan Africa: Competencies and learning factors in primary education.*
37 Ibid.
38 World Bank. 2016. *Mathematics education in sub-Saharan Africa: Status, challenges, and opportunities.*
39 UNESCO Dakar. 2014. *World Teachers' Day: Teacher challenges in the Sahel countries.*

Recent UNESCO data indicates that only one half of teachers are trained to national standards.[40]

While educational technologies are regularly identified as a tool to improve the quality of mathematics education, teacher training institutes in Senegal and the wider region rarely prepare teachers to use technology for teaching and learning. A recent study of formal teacher education programmes in sub-Saharan Africa found that none provided access to video material to support the teaching and learning of mathematics and none had computer software specifically related to mathematics instruction.[41]

2. Project focus

The UNESCO project in Senegal sought to enhance teaching and learning in mathematics at the primary school level through the use of services accessible from mobile phones.

Teachers working in basic education in Senegal often face very large classes of students and have limited resources at their disposal. This can be particularly problematic in mathematics where students often require individual attention and need workbooks and other resources to apply concepts and practice operations learned in school. A shortage of teachers and well-qualified teachers, combined with a dearth of learning resources, contributes to Senegal's low completion rate for primary school and persistent problems with learning outcomes in mathematics. In Senegal only 50% of students can count to 100 by the end of Grade 2, and a similar percentage of students cannot solve basic subtraction problems.[42]

Surveys conducted in Senegal prior to the start of the UNESCO project indicated that large numbers of Senegalese owned personal mobile phones. Subsequent surveys have suggested that people in Senegal and other developing countries are receptive to using internet connected technologies as portals to learning and education.[43] The UNESCO project sought to leverage mobile devices and connectivity to help teachers improve mathematics instruction.

The overall goals of the project were:

- Contribute to teachers' overall professional development;

- Use mobile technologies to support teaching and learning in mathematics.

3. Objectives

The project had the following objectives:

- Reinforce teachers' skills in mathematics and increase their knowledge of the curriculum;

- Improve student learning outcomes in mathematics and increase their engagement in the subject;

- Improve communication within the school community;

- Promote a new model of teacher development to other teacher training institutions in Senegal and influence national and state policy-making in this area.

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40   UNESCO Dakar. 2014. *Paradigm shift for teacher training in the making in Senegal.*
41   World Bank. 2016. *Mathematics education in sub-Saharan Africa: Status, challenges, and opportunities.*
42   Ibid.

43   PEW Research Center. 2015. *Internet seen as positive influence on education but negative on morality in emerging and developing nations.*

4. Mobile learning ecosystem

Beneficiaries

The beneficiaries of this project were 100 primary school teachers with classes of 31-50 learners at CE1 (8-9 years) and CM2 (10-11 years) levels. The project covered 50 schools in total, 40 in Diourbel, located in central Senegal, and 10 in Pikine, located in the suburbs of Dakar. One male and one female teacher were selected from each school to pilot test the mobile learning platform with their students.

Around two-thirds of the participating teachers owned a basic mobile phone, with almost 20% owning a smartphone. About one in three owned a laptop and one in five had a personal computer. Almost half the teachers (44%) accessed the internet, usually from home.

While the project did not set out to improve the ICT infrastructure of the pilot schools, it did interject mobile technology into schools that either had no ICT or a very limited number of computers and other hardware which was typically outdated. Only a small number of schools had ICT planning and policies in place.

Partners

While UNESCO was responsible for overall project execution, it was supported by different organizations:

- The **African Distance Learning Network** (Réseau Africain de Formation à Distance or RESAFAD in French), a branch of the Senegalese Ministry of Education, was responsible for the local management and implementation of the project.

- The **Dakar Regional Teacher Training Centre** (Centre Régional de Formation des Personnels

de l'Éducation de Dakar or CRFPE in French), delivered the teacher training.

- The main project donor, **Nokia**, provided technical support for the mobile learning application chosen for this project, Nokia Mobile Mathematics, also known as MoMath.

- **Orange-Sonatel** provided free mobile connectivity to the MoMath application for teachers and students participating in the project.

Mobile learning solution

Nokia Mobile Mathematics (MoMath) was the main mobile learning solution selected to respond to the needs identified by the local partners. A free, browser-based mobile application, MoMath could be accessed from any mobile phone with a data connection or any computer with an internet connection. In addition to the application, the project used a Moodle-based online learning management system to support administration related to the project. Although this was the first project to use MoMath in Senegal, the platform was effectively deployed in South Africa in 2008 and reached 50,000 learners by 2014.[44]

The local implementation team, which included inspectors and members of educational institutions, was responsible for delivering teacher workshops and validating the digital content. Teachers and their students connected to the MoMath application through mobile phones. Teachers received a free mobile phone, and pilot schools were also provided with five additional phones to be used by students under the teachers' supervision.

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44 Finland Ministry of Foreign Affairs. 2014. *Nokia mobile learning app makes mathematics fun for everyone.*

Using a structured, game-style approach, MoMath allowed students to learn mathematical theories and concepts via a mobile phone. After reading about a mathematical concept, students could earn points through practice exercises and tests, compete with their classmates and send messages to other students or teachers. Information about student progress, for both groups and individuals, was stored on a remote server and made available to teachers. This enabled them to track usage statistics, provide help where needed, compare progress between learners and send homework reminders.

For the purpose of this project, MoMath had to be tailored to match the national curriculum. Teachers were then given opportunities to develop content for students, under the supervision of their respective school directors and inspectors, a process that helped further assure the alignment of MoMath to the formal curriculum. After validation of teacher-produced content by the local implementation team, the content was uploaded onto the MoMath platform. During the pilot phase of the project, approximately 20 lessons were developed by instructors.

5. Teacher training

All the teachers participating in the project were taught how to use the MoMath application to support their instruction and provide students with increased opportunities to practice problem sets. Participating teachers also received a free mobile phone and face-to-face training was provided to address basic ICT literacy skills for mobile devices.

The specific objectives of the trainings included:

- Help teachers and principals understand how to use basic mobile phones;

- Train teachers how to use the MoMath application and inform them about other educational uses of mobile technology;

- Increase student interest in mathematics and improve student performance;

- Support teachers in their work with students;

- Explain the process of content creation and validation.

6. Key results

The Senegalese teachers were surveyed twice during the project: a baseline survey was administered at the outset of the project and a second endline survey was given at the completion of the pilot project. The full project duration in Senegal was approximately seven months. Overall, the evaluation data indicated that teacher skill levels in using ICT and mobile phones increased significantly as a result of this project. Not surprisingly, the biggest increase was accessing the internet from mobile phones. Because the MoMath application was web based, teachers had to use a mobile browser to access project-specified learning content.

The uptake and usage data for the MoMath service was somewhat disappointing. UNESCO and its partners studied backend data collected from the MoMath application for seven weeks and found that 853 user accounts were established, of which 407 were new. Many of these users were not active in the application however, and may have discovered it through avenues unrelated to the project. Because students as well as teachers were supposed to use the application, these overall numbers were quite low and likely reflect difficulties teachers had

getting acquainted with the service in a relatively short time period and perhaps a hesitation to encourage students to use the service.

Despite these setbacks, the reported frequency of ICT and mobile phone use increased substantially over the course of the project. The greatest increases were detected in project focus areas, such as accessing the internet from mobile phones and accessing online programmes to support teaching and learning in mathematics. Prior to the project the teachers used PCs more often than mobile phones to access the internet. This practice reversed over the course of the intervention, although the frequency of internet use for both PCs and mobile phones remained relatively low. The increase in usage frequency was larger in some non-project-related areas, for example playing and downloading songs and videos. However, increased usage of ICT, even when not strictly education-related, is usually positive, as teachers who become more comfortable using technology are better able to use it for educational purposes.

Another positive finding was that users tended to create content rather than view it passively. Authorship of content peaked early in the project and then declined steadily. The downward trajectory likely reflected a number of factors: a honeymoon phase at the outset of the project weeks when enthusiasm was unusually high and competing time pressures and declining interest after this initial period.

Most of the mobile learning content viewed in the MoMath application consisted of either problem sets or explanations of mathematical concepts. With regard to exercises and tests, there was a marked shift away from easy level problem sets and concepts in the initial phase to a more balanced pattern across different difficulty levels in later phases.

Disappointingly, the participating teachers felt less positive about the project at its conclusion than they did at its start. This likely indicates that the project did not meet teachers' initial expectations. In the project close survey, participating teachers were asked to comment on their experiences, consider the project strengths and weaknesses, and propose recommendations for future projects.

Reported strengths included:

- Motivation of learners and teachers;
- Improved teacher understanding of ICT and the internet;
- Improved teaching quality.

Reported weaknesses included:

- Heavy reliance on mobile phones and a shortage of devices;
- A need for larger screens.

Suggested changes included:

- More teacher training, particularly on the creation of learning resources for MoMath;
- Replace emphasis on individual content creation with a more collaborative approach, allowing groups of teachers to develop educational resources;
- Improve communication on project progress.

7. Lessons learned and recommendations

On the whole, the evaluation data indicate that the participating teachers felt that the project had a strong potential, but due to practical difficulties encountered during the implementation, this potential was only partially realised due to a number of constraints.

Internal and external disruptions

Activity levels in the MoMath application provided an indicator of user participation in the project. The expected weekly participation from users was lower than expected, due in part to a number of disruptions, including a national teacher strike, a lengthy examination period and school holidays. The intervention was also delayed by the project management team who wanted to improve the quality of the learning content.

Recommendation: Contingency planning for future projects is essential. A longer period of time for implementation would provide greater flexibility to overcome disruptions and help teachers and students establish routines using mobile technology for learning.

Inadequate teacher training

Although teachers reported improvements in their teaching, they also said that they felt insufficiently trained to fully exploit the potential of mobile phone technologies in their classrooms.

Recommendation: Revisit, revise and perhaps lengthen teacher training workshops prior to the outset of projects involving unfamiliar technologies and learning resources.

Insufficient mobile devices

Given the large class sizes in Senegal, it is clear that the single mobile phone given to a project teacher and the five additional phones provisioned for students were not enough to engage classes in a meaningful mobile learning experience.

Recommendation: Increase the number of mobile phones provided. If one-to-one computing is not feasible, then mobile phones should be provided in sufficient numbers to facilitate work in groups of 3 or 4 students.

Registration and data tracking

One of the useful features of MoMath is that teachers can monitor each student's progress and provide relevant feedback and guidance. However, in Senegal the MoMath user accounts were created by the project administrators, and did not appropriately differentiate between teacher and student accounts, limiting the opportunity to collect meaningful data on user participation. Teachers could not easily see which students were completing MoMath activities.

Recommendation: Ensure differentiation between user accounts. Self-registration by users might be a useful way to track user data in order to provide relevant feedback to both teachers and learners.

Teacher participation in content development

This project employed a participatory approach where teachers acted as content developers. The content was validated and uploaded to the MoMath platform by the local implementation team. Teachers expressed frustration that they were expected to design high-quality online materials in addition to their normal teaching loads, which had a negative impact on their overall perception of the project.

Recommendation: Ensure that teachers are equipped with the necessary time, support and tools to benefit from such pedagogical design experiences. Teachers should be given opportunities to practice developing content in collaborative groups led by mentors, before being asked to produce content individually.

Conclusion

Conclusion

The work described in this publication sought to test whether mobile technology can support teachers and build their capacities in low-resource contexts. UNESCO piloted solutions in Mexico, Nigeria, Pakistan and Senegal to better understand the feasibility of implementing mobile learning interventions targeting teachers.

This chapter is broken across four short sections. The first section shares key findings from the projects as perceived by the teacher beneficiaries. The second section summarizes lessons learned from the overarching intervention. The third section proposes recommendations to guide the development of future mobile learning projects targeting teachers. The fourth and final section offers forward-looking reflections.

1. Findings about the perceived impact of the intervention

UNESCO contracted an independent organization to conduct evaluations of each of the four country projects, drawing on baseline and endline surveys—both quantitative and qualitative—given to participating teachers. This section presents findings from a meta-analysis of country-specific results.

Reception

Across the four project countries, teachers were largely enthusiastic about using mobile technologies to build their capacities, particularly at the beginning of the UNESCO intervention. Despite oft-repeated laments about educators being resistant to change, UNESCO's finding was that teachers were excited to use mobile technology to build their professional capacities.

Teachers reported strong interest in each country project at its outset and—with the exception of Senegal and, to a lesser extent, Mexico—interest remained high throughout the intervention. Instances where teacher interest flagged could be attributed to clearly defined-challenges: in Mexico limited mobile connectivity and in Senegal difficulties implementing a mobile learning solution with students. The broad takeaway was that teachers in the four countries were quite willing to experiment with 'outside the box' approaches to teacher professional development.

Challenges

Teachers called attention to a number of challenges that transcended individual country projects.

Notably, many teachers felt that the initial trainings were sometimes insufficient for their needs, despite UNESCO's attempt to frontload interventions with in-depth workshops, orientations and other face-to-face preparatory meetings and demonstrations. Teachers also indicated a desire for additional continuous support, following the early training period.

Teachers routinely had trouble with connectivity and, in some instances, connectivity problems prevented teachers from easily or seamlessly accessing mobile learning content. Unreliable connectivity tested the

patience of even highly motivated teacher beneficiaries, especially in Mexico.

Although the overarching UNESCO projects, with the exception of Senegal, did not normally ask teachers to use mobile technology directly with students, a number of teachers wanted to share materials with students in classroom settings and felt constrained by the lack of projectors, large-screen TVs and full classroom sets of mobile phones.

Several teachers said the project timelines should be extended in order to give them more time to become acquainted with mobile learning solutions. In some country projects, scheduling posed challenges. School breaks and unanticipated developments such as strikes complicated project implementation and disrupted sequenced activities and trainings.

ICT skills

Teachers reported dramatically improved ICT skills as a result of the intervention. The greatest gains were measured in Pakistan and Nigeria, with more modest but still statistically significant shifts in Senegal and Mexico. Improved ICT skills for teachers is probably the single greatest impact of projects, as measured by quantitative indicators. (See Table 4 for details.)

Table 4: Reported increase in ICT skills (expressed as change in the average value of responses to a Likert scale question)

	Mexico	Nigeria	Pakistan	Senegal
Improved mobile phone skills	31%	83%	133%	61%

Although the UNESCO evaluation did not specify the precise sub-domains where teachers' ICT skills had improved, qualitative feedback from

country project managers indicates that teachers strengthened their ability to find high quality learning information on the internet and inside mobile applications, some of which were not specified by project managers. This is a promising development. Academic studies of teacher use of ICT in and out of schools have underscored that in addition to needing general ICT skills, teachers are particularly well served by an ability to judiciously search for and select good quality educational resources from the internet and other repositories of digital content.[45]

Frequency of ICT use

Unsurprisingly, teacher use of ICT increased substantially as a result of the intervention. In all project countries, a statistically significant increase in teacher frequency of ICT use was detected, both in general and specifically with regard to the use of mobile technology. This was a consistent trend across the different projects. (See Table 5 for details.)

Table 5: Reported increase in frequency of ICT use (expressed as change in the average value of responses to Likert scale questions)

	Mexico	Nigeria	Pakistan	Senegal
Increase in frequency of general use of ICT	33%	43%	46%	41%
Increase in frequency of mobile use	20%	19%	54%	25%
Increase in frequency of use of ICT for teaching	no significant change	76%	46%	41%

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45   Hinostroza, J. E., Ibieta, A., Claro, M., and Labbé, C. 2016. *Characterisation of teachers' use of computers and internet inside and outside the classroom.*

Content knowledge

Changes in content knowledge were not tested empirically in isolation by the evaluations, so statistical measures of shifts are unavailable. However, participating teachers who completed open-ended questions on project endline surveys often noted that content knowledge of their subject areas had improved as a result of the intervention. This was particularly true for the projects in Nigeria and Mexico.

Pedagogy

Although teacher pedagogy was not directly observed or formally measured by the project evaluations, qualitative data derived from teacher surveys point to possible changes in teaching practices. In all countries, teachers reported increased learner participation in the classroom, especially in Pakistan and Nigeria. The data also showed an increase in the use of technology to support the teaching of educational content in formal school settings. These findings are encouraging because they suggest that the projects may have prompted altered classroom practices. Improved pedagogy—while difficult and expensive to measure scientifically—was a central aim of the intervention.

Communication

Clear trends with respect to teacher changes in communication with colleagues were difficult to detect. In some countries and for some types of communication, there was a small and statistically significant increase in reported communication with school managers and other teachers. In other countries, there was little to no change. This result is somewhat disappointing because a peripheral benefit of the projects was expected to be increased interaction between teachers and their peers and mentors. More

attention could have been paid to encouraging this type of communication, although it is possible that teachers were already participating in established professional networks at the outset of the projects and the intervention did not change overall communication practices.

School-level changes

Teachers indicated that the intervention had a beneficial impact on their schools in three of the four project countries (Mexico, Pakistan and Nigeria). In these countries, the reported school-level impact was encouraging, with all or almost all responses to various statements about positive impact averaging between 'agree' and 'strongly agree' on Likert scale questions. The exception was again Senegal where teachers were neutral about the impact of the project on their schools.

Student learning

The reported impact on learners as reported by the teachers was largely positive but not particularly strong. In the cases of Pakistan and Senegal, almost all responses to various positive statements about impact on learners fluctuated between 'neutral' and 'agree' on Likert scale questions. Responses in Mexico were slightly more positive, and responses in Nigeria were very positive. This result is understandable because the country interventions sought to improve the pedagogical knowledge and capacity of teachers. Improving student learning outcomes in a short period of time (or the perception of these outcomes) was not a core objective of the project. Over a longer time horizon, it would be important to see evidence of this, but learning outcomes were not measured empirically in the current study.

2. Lessons learned

Mobile phones appear to provide a viable means to expand access to professional development opportunities

Considered collectively, the UNESCO interventions established, beyond mere hypothesis, that teachers in developing and middle-income countries are able to access and productively use mobile learning solutions, embedded in carefully planned ecosystems, to facilitate their professional development. This is exciting because it means that an increasingly ubiquitous technology offers a vehicle to support teachers living in areas where traditional capacity building opportunities are scarce.

The interventions also appear to be scalable. In Nigeria, around 70,000 people regularly accessed a mobile service designed to improve the knowledge and pedagogical practice of primary school English language teachers. The projects in other countries did not have anywhere near this reach, but this was due to limited user uptake rather than technical barriers. From a technical perspective, any of the projects could have supported the scale achieved in Nigeria.

Access to mobile phones should not be conflated with a mobile learning solution

The UNESCO projects underscored that while working mobile phones provide a basis for mobile learning, they are one ingredient among many. Equally essential ingredients include compelling content, institutional partners, extensive teacher training, ongoing project support, communication campaigns and buy-in from education leaders. UNESCO built complex ecosystems in each project country to transform a generic communication technology into an integrated learning solution. The solutions implemented in each country went well beyond the provision of mobile phones. In Nigeria, Mexico and Pakistan, content had to be built from scratch to ensure its relevance for teachers. Even the content used in Senegal, repurposed from an earlier deployment in South Africa, had to be changed in fundamental ways to align it with the Senegalese national curriculum. Teachers also needed numerous face-to-face trainings to become familiar with the mobile phones used in the projects. While some teachers understood the basic functionalities of mobile phones prior to the intervention, nearly all of them required assistance learning how to leverage these devices to access lesson plans, pedagogical tips and other capacity building resources. Ultimately, the teacher training workshops proved to be the most expensive and logistically complex aspects of the four country projects. They were also the most important. The success or failure of the interventions hinged on teacher knowledge of how to use a mobile phone for educational purposes. This mattered at least as much as teacher access to a connected device.

Consistent and well-curated educational resources appear to be hallmarks of effective mobile learning content

Overall, the UNESCO projects seemed to work best when they provided teachers with discrete,

well-organized and sequenced packages of learning resources that established clear learning pathways. This was evident in Nigeria where teachers received daily messages and in Pakistan where teachers accessed a carefully organized library of educational videos. Some of the content used in the UNESCO projects was interactive (teachers would occasionally take short quizzes to show comprehension) but most of it was static and didactic in nature. While there is understandable enthusiasm around mobile learning content that is highly interactive, this type of content was not always easy for teachers new to digital technology to use and added a layer of complexity to projects with relatively short durations. As an example, in Senegal teachers were expected to use a dynamic mathematics application tailored for use on mobile devices with students. The application and a supporting web-portal provided rich feedback to teachers about student progress and offered various customizable features, but these resources were not used as often as less interactive content developed for projects in other countries. Across the four country projects, content that supported a direct learning pathway seemed to be more effective and easier to implement than content that supported multiple and less defined learning pathways. This almost certainly stemmed from teacher inexperience. As teachers build digital skills, they are likely to become more comfortable experimenting with complex mobile portals, applications and software. In the beginning though, simplicity is a defining attribute of successful content.

Mobile learning solutions carry significant costs

While mobile learning solutions can offer good value for money vis-à-vis comparable interventions seeking to achieve similar objectives, they generally require substantial up-front investments and incur regular, ongoing costs. For the projects reviewed in this publication, UNESCO had to provide mobile hardware and SIM cards to participating teachers, in addition to contracting content developers and paying for initial teacher training and follow-up support.

Mobile learning projects premised on assumptions that teachers in poor countries will appropriate phones they already own to access educational services and incur associated data fees rarely gain traction or achieve scale. Sometimes teachers in developing and middle-income countries do not own phones at all and those who do often have very basic handsets that cannot access project-recommended applications and services. Even teachers with powerful phones often have devices with operating systems that are incompatible with project content. Beyond this, teachers should not be expected to purchase a mobile phone for professional purposes. Although the price of mobile hardware is falling rapidly, it is still out of reach financially for many of the primary school teachers who participated in the UNESCO projects. Data plans can also be prohibitively costly. Across the four country projects, UNESCO paid for SIM cards with enough preloaded data credit for teachers to access target educational content for the duration of the intervention.

In summary, holistic mobile learning solutions incur major expenses, and some of these expenses, like connectivity and maintenance, are continuous. This is not to say that mobile learning solutions are expensive compared to other, comparable interventions, but project organizers should be realistic about the costs required to leverage mobile technology for teacher development. While mobile devices and data plans may eventually become so affordable

that institutions can reasonably expect teachers to use their own hardware and data plans to access learning services, this is not yet a reality, particularly in developing countries where teacher salaries are low and mobile hardware and connectivity tend to be more expensive than in developed countries.

Mobile learning solutions for teachers have numerous limitations and are not yet substitutes for traditional and evidence-based teacher training and development

While mobile phones offer a promising vehicle to assist underserved teachers, they are, in many respects, severely limiting: screen sizes are small; complex information is difficult to package for learning on mobile phones; and creating and producing new content is difficult on phones compared to PCs. While some of these disadvantages are being addressed by improved technology (for example, tablet computers have larger screens and better input options than mobile phones), mobile learning solutions should supplement rigorous teacher training programmes, not replace them. Complex pedagogical strategies are usually best demonstrated in-person, and classroom observations followed by discussion and feedback with expert teachers, remain among the most effective ways to mentor teachers and help them improve their practice. The solutions UNESCO piloted should not stand-alone; they offer pathways to expand capacity development that is already in place and deemed effective. In lieu of no other options or resources to assist teachers, mobile learning still has utility, but ideally it will supplement richer and deeper teacher training.

3. Recommendations

Ensure institutional-level support and investment

Institutions need to embrace holistic and integrated approaches to create mobile learning solutions for teachers. The mere presence of mobile technology does not provide adequate foundations for large-scale initiatives. Institutional-level support and investment are needed to guarantee the creation of strong content, ready necessary infrastructure, procure hardware and provide training to teachers, among other essential components. Mobile learning initiatives, especially those seeking to have national impact, require buy-in from the highest levels of ministries in light of their complexity.

Provide appropriate and agnostic mobile learning tools

Close attention should be paid to ensuring teachers have appropriate tools that can fulfil project objectives and meet teacher needs. Ideally, mobile learning technology selected for educational use will be agnostic and open. Teachers should be able to access mobile learning solutions from different devices with different operating systems and from different network operators on platforms that are free and open. Accomplishing this in practice is challenging and, in many instances, expensive. As one example, developing educational applications to work on different mobile operating system typically incurs significant costs, much more than developing for a single operating system. Nevertheless, decisions related to the selection and development of mobile learning tools should be guided by a

principle of expanding access and creating as many entry-points as possible.

Integrating new technology with existing investments is also important. Teachers in the Mexico project wanted inexpensive cables to connect their mobile phones to digital projectors and TV screens already installed in a handful of schools. Although UNESCO could not provide the cables due to compatibility issues, institutions should make efforts to ensure earlier technology investments complement newer investments when possible. Institutions should further strive to maximize opportunities for teachers to model mobile learning resources and practices to students. More and more young people in developing countries are getting access to mobile phones, but they do not know how to turn their devices into portals to education. A teacher who can connect a phone to a projector is able to demonstrate utilities that are increasingly accessible to students and others in the community.

Enhance access to mobile networks

Problems with poor network service was a recurring complaint across all four project countries. Although resolving the issue was beyond the scope of the UNESCO intervention, future interventions may wish to establish partnerships with outside organizations or telecommunication ministries to expand mobile networks and ensure end users are able to access learning content from school and community locations. Connectivity should not be limited to schools exclusively or the 'anytime and anywhere' potential of mobile learning will be lost. A practical idea to help teachers stay connected to mobile networks is to let them select their own mobile carrier because they

tend to know which networks provide the most reliable coverage in their areas. Vouchers have been used successfully for this purpose.

Support teacher training and continuous development for mobile learning

Teachers need initial and continuous support to use mobile technology for educational purposes. This was apparent in all the UNESCO projects. Ideally, teacher training for mobile learning will be integrated into mainstream teacher credentialing programmes and constitute a pillar of professional development efforts.[46] Policy makers and school leaders should also consider 'phasing' the use of technology. In the first phase, teachers can access mobile learning resources individually for professional development; in the second phase and after intensive training, teachers can begin using technology to facilitate the learning of students in school settings. Teachers should feel comfortable with mobile learning tools before they are deployed in classrooms. Teachers in the UNESCO projects reported that transitioning from using mobile technology for personal professional development to using technology with learners represented a major jump and required commensurate training, as was particularly evident in Senegal. Overall, teacher capacity building for mobile learning is likely to become increasingly essential as a growing number of educators and students, including those in poor countries, buy and use mobile phones.

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46   UNESCO. 2013. *Mobile learning policy guidelines.*

Build strong and sustainable partnerships

The UNESCO projects benefited from numerous partners invested in the success of the different country projects. In Nigeria for example, UNESCO collaborated with dedicated partners who supported content development, hosted technical platforms, provided teacher training, promoted mobile learning services, reported user feedback and evaluated the impact of the intervention. Other UNESCO projects involved partnerships with mobile network operators. Unifying all the projects was a desire to incorporate organizations— large and small—that could leverage specific competencies to support projects and establish buy-in at international, national and local levels. Educational institutions should work to build partnerships with organizations, including those not normally associated with the education sector, such as telecommunications companies, to support and sustain mobile learning projects.

Invest in high-quality mobile learning content

Major investments are needed to build high-quality mobile learning content. UNESCO allocated a substantial proportion of project funding to create content that was easily accessible from mobile phones. Tellingly, content that was built from scratch for the projects in Mexico, Nigeria and Pakistan was better received than the content deployed in Senegal which had been repurposed from a separate initiative in South Africa. Feedback from participants showed that content designed to address specific teacher needs, unique to particular contexts, was most effective. While many mobile learning projects rely on content that is freely available online, these resources are not always relevant

to end users. Other projects ask teachers to develop original mobile learning content, but in the UNESCO experience this entailed a steep learning curve. This was seen most clearly in Senegal where teachers were supposed to build content in addition to using content that had been created professionally. Asking teachers to create mobile-friendly content requires extensive training and appropriate incentive structures. Quality controls are needed to assure the value and appropriateness of content regardless of its source.

4. The way forward

Viewed holistically, the UNESCO projects examined in this publication shine light on the considerable potential of mobile technologies to benefit working teachers. They also revealed that these gains are unlikely to come quickly or easily. Mobile learning interventions need to be embedded in carefully planned projects that extend well beyond technology and emcompass training, partnerships, content development and financing. Even then there are likely to be hitches: the technology does not always work as it should, teachers need different levels of training to begin using mobile devices for professional purposes, infrastructure is limiting, and support networks are challenging to build and sustain. But overall, the UNESCO projects point in a promising direction. With the correct preparation, learning pathways and infrastructure, teachers can use widely owned mobile technology to improve their professional capacities.

Mobile technology is exciting because it seems to provide a cost-effective vehicle to reach underserved educators and advance progress towards the Education 2030 Agenda. Institutions should continue to experiment with efforts to leverage, adapt, shape and deploy mobile

technology to respond to specific educational challenges and enlarge the evidence base about what works, where and why. More work is needed to clarify mobile learning models that can support teacher development, but some guiding principles—including those proposed in this publication—are emerging from pilot projects. Observation-based evaluations of how particular mobile learning solutions influence teachers' pedagogical practices would be especially valuable. The goal is to understand how mobile-based professional development interventions can facilitate improved teaching and, ultimately, better learning outcomes for students.

It is UNESCO's hope that other organizations can use the lessons learned in Mexico, Nigeria, Pakistan and Senegal to continue leveraging mobile devices to assist teachers and, by extension, improve learning opportunities for students around world.

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Note: All URLs listed in the references above were checked and verified on 15 June 2017.

Annexes

Annex I

Mexico

1. Screenshots of the project blog

2. Outline lesson plans from the second phase of the project

Lesson 1

We speak and write about ourselves

Aim: To provide opportunities for students to use spoken Spanish to introduce themselves and to adapt the verbal introduction into written text.

Activities: Record a verbal introduction using a mobile phone and upload video to the blog site. Write up the introduction on the blog and describe the attributes of classmates. Reflection on the relative challenges of speaking vs writing Spanish.

Teacher provides comments based on students' responses via blog.

Lesson 2

Write to offer products or services

Aim: To enhance student understanding about advertisements as a form of social practice, and to create advertisements that are relevant to daily life.

Activities: Scan newspapers to identify different types of advertisements, design an advertisement to market a relevant service or product. Using students' mobile phones, upload photos of advertisements onto blog.

Lesson 3

The words can be flowers

Aim: To enhance student understanding about features of poems.

Activities: Creation of poems, paying particular attention to the meaning of words used and the rhythm of verses. Digital resources provided as a source of reference to scaffold students.

Teacher records and downloads the videos of children reciting their poem and invites students to perform self-evaluation when viewing the video clips.

Lesson 4

Reflect on the use of language

Aim: To enhance students' conceptual understanding of the social practices of language in their daily life and its relationship with school practices.

Activities: List how language is used in students' daily life, take photos of activities and upload them onto the blog. Teachers facilitate the discussion and draw linkages between the social practices of language and the activities in the classroom. Students reflect critically on whether what has been done in school would be useful for their development in society. Teachers take a photo of the points written alongside the discussion and post it onto the blog.

Teachers write a brief reflection on the uses of language that children need outside of school and critique whether the school is promoting the use of this language in the classroom.

Lesson 5

Collect stories of the community: listening, transcribing, editing, publishing and reading

Aim: To enable students to transcribe and write a story and to identify the characteristics of different genre of texts. To facilitate a richer understanding of the students' community through the compilation and reading of relevant stories.

Activities: Students identify a suitable person from their community and invite them into class to narrate stories related to the history and traditions of their locale. Record the narration using a mobile phone and download the video clips onto a computer. Students hear the audio again and re-write the story based on their interpretation. Teachers provide scaffolds such as asking students to write the name and description of characters, places and the major events recounted. Students share their output and peers provide comments about the story. Students are then grouped into pairs to go through the written text again and amend factual errors or grammatical mistakes. Students revise the story taking into account their peers' feedback and inputs. Partner will review the final product. Students upload their artefacts onto the blog and the teacher reviews the recording as well as the first iteration and revised version of text.

Lesson 6

Recipes for learning and cooking

Aim: To enhance student understanding about the purpose and essential elements of recipes, and the implications of reading and using a recipe to prepare a dish.

Activities: Distribute recipes to students; ask students to choose one of the recipes and identify its name, ingredients and steps involved in its preparation. Students agree on the ingredients required and bring them to the classroom to prepare the dish. Teacher records the process on a mobile phone and posts the video onto the blog. Students can then create a recipe themselves and present their recipe to the class, reading out the text and performing the steps. Teacher records the process and uploads the video onto the blog. Students exchange recipes for review and further improvement, then integrate and compile all recipes into a cookbook, ensuring that the cover, title, index, introduction and necessary embellishments are included. Teacher takes photos of the recipes and shares them on the blog.

Lesson 7

Emotions in the voice

Aim: To enhance the oral skills of students through reading a story to children from another class or school. Students use the recording function on the mobile phone to self-correct and make improvements to their reading skills.

Activities: Select a story book from the library and prepare a draft of the story to be narrated, to include title, author and publisher of the book. Teacher invites volunteers to read the draft and records their narration with the mobile phones. Students listen to their audio clip and revise their story to make it more enticing to the audience, and re-present it. Teacher records their performance using a mobile phone and organizes a plenary for students to reflect on the experience.

Lesson 8

Teach what we learn

Aim: To enhance student skills in conducting a self-assessment on their participation in this project; to provide feedback and suggestions on content and project development.

Activities: Recapitulating what the students had practised and learned. Teacher creates a new group space on blog for students to report if and how they have improved their Spanish language proficiency; activities they liked best; activities they would like to include in future; and recommendations for enhancing content and project development.

Teachers are also invited to reflect on the project, especially on whether the activities could help students learn to speak, listen, read and write Spanish better. They are encouraged to write a conclusion about the participation of students in this project and upload the text onto the blog.

Annex II

Nigeria

1. Messages from the Nokia Life Plus platform sent in week 2 of the project

WEEK 2

Week 2/day 8 – HOW WE LEARN – Message 1 – INFORMATION

We are all unique

Each of us is unique and we all learn differently. The more we understand about how our students learn, the better we can help them.

We all teach in different ways with our own teaching style and what we believe about learning affects the way we teach.

We are going to look at two areas that affect learning: learning style and motivation. Learning style is the way that we take in, process, absorb and retain new information. Motivation is the desire or willingness to learn the language. Think of a time that you were motivated to learn as a child and as an adult. What motivated you?

Week 2/day 9 – HOW WE LEARN – Message 2 – INFORMATION

What is motivation?

Was what motivated you as an adult different to what motivated you as a child? We begin our lives doing things because we are intrinsically motivated, that is, because it makes us feel happy and fulfilled. Later, we become extrinsically motivated by rewards such as money or holidays etc. Intrinsic motivation provides the best long-term performance. We need to motivate our learners so that they enjoy learning English and build a lifelong enjoyment of the language. What do you do in class that motivates your learners?

Week 2/day 10 – HOW WE LEARN – Message 3 – RESOURCES

How can we motivate?

As individuals, our students are motivated in different ways. How can we motivate them?

RELATIONSHIPS - get to know your learners as individuals and help them to get to know you!

ENGAGE - make them curious, tap into their interests and be sure what you are doing is relevant.

CHOICE - let learners choose what to learn and lead the learning to enhance independence

CHALLENGE – set tasks which make them think

ENCOURAGE – make sure you look for small things to praise

ACTIVE – make your lessons interactive and move the learners around. Variety is the spice of life.

Be motivated yourself.

Week 2/day 11 – HOW WE LEARN – Message 4 – HANDS ON

Get Active, action it!

Do a mini action research project with your class. You can find information about action research at TINYURL2. Choose 21 new items of vocabulary linked to the topic you are studying. Each day, teach seven new items using a different five- to ten-minute activity. Each activity should address a different multisensory learning style: visual, auditory or kinaesthetic. Your action research question is – Do multisensory activities help a range of learners to remember vocabulary better? You will be finding out more about these learning styles over the next week.

Week 2/day 12 – HOW WE LEARN – Message 5 – REVIEW

What have we learned so far?

Our students are motivated in different ways and by different things. Motivation is more sustainable if it is intrinsic. We can help our learners develop motivation towards language learners through the way we teach and the enthusiasm we show for the language.

Week 2/day 13 – HOW WE LEARN – Message 6 – SUMMARY

In order to learn, your students need to be motivated. That motivation is best if it is intrinsic and comes from within. You cannot give or show them how to have intrinsic motivation but you can help them to get it through providing interesting, stimulating and challenging lessons which appeal to a range of learning styles. To do this, you need to get to know your learners as individuals, their needs and their interests. Have some fun learning English and the motivation will automatically develop.

Week 2/day 14 – HOW WE LEARN – Message 7 – QUOTE

Tell me and I will forget. **Show me** and I may remember. **Involve me** and I will understand. – Confucius, 450 BC

2. Screenshots of the 'English Teacher' application on Nokia Life Plus platform as seen on project-provisioned mobile phones
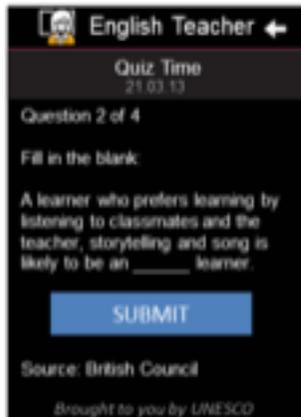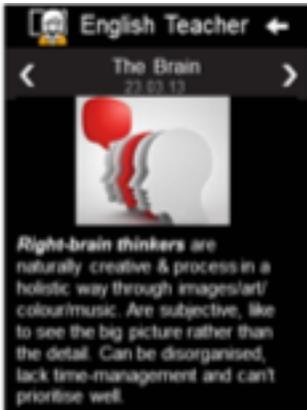
Annex III

Pakistan

1. Key themes of the 20 teacher-training videos

Theme number	Title	Content
1	**Importance of ECE**	• Definition of ECE • Research findings on the impact of ECD • How ECE/ECD enhances personal and professional development throughout life
2	**Child development**	• Stages of physical and mental development in children • Critical stages in development • Consequences of lack of cognitive stimulation and opportunities for intervention during early childhood
3	**Basic pedagogical principles of ECE, including ELD**	• Activity-based, child-centred learning replacing conventional teaching methods • Participatory approach and continuous motivation of children • Dos and don'ts of ECE
4	**'Katchi' (state) class in Pakistan and quality of ECE**	• Poor learning conditions in rural primary schools • Teacher attitudes (instructional or teacher-centred approach) • Desirable learning conditions for ECE
5	**Pakistan's national and international commitment to ECE**	• Education for All – Goal 1 • National Education Policy 2009 • Article 25-A and Senate Bill 2011
6	**National curriculum for ECE 2007**	• Understanding the curriculum and its implementation in classroom settings • Salient features and structure of 2007 curriculum (5 key learning areas and 32 competencies) • Other requirements for implementation of 2007 curriculum
7	**Personal and social development (part I)**	• Physical development • Sensory development • Social development • Personal development • Safety and security

8	**Personal and social development (part II)**	• Culture • Values
9	**Language and literacy (part I)** **English language**	• Oral skills (including national and provincial language, local dialect poems) • Poems and rhymes • Short stories, jokes and riddles • Naming of different objects, events and plants
10	**Language and literacy (part II)** **English language**	• Introduction of symbols and pictures with names of common items in the learning environment • Introducing and repeating central words and their constituent letters through activities
11	**Language and literacy** **Urdu reading skills**	• Speaking skills: poems and rhymes (including national and provincial language, local dialect poems) • Telling short stories, jokes and riddles • Naming of different objects, events and plants
12	**Language and literacy** **Urdu writing skills**	• Introduction of symbols and pictures with names of common items in the learning environment • Introducing and repeating central words and their constituent letters through activities
13	**Basic mathematical concepts** **(part I)**	• Introduction and recognition of different colours • Introduction to size and volume • Concept of numbers
14	**Basic mathematical concepts** **(part II)**	• Concept of geometrical shapes • Measurement
15	**The world around us**	• Introduction of family relations • Different occupations and their roles • Cultural sites in local area • Introduction of local animals and plants • Weather and the four seasons • Environmental issues
16	**Health and hygiene**	• Food and health benefits • Personal hygiene • Cleanliness of personal and local environment
17	**Creative arts**	• Colouring, drawing and painting • Clay moulding and creation of objects out of waste material

18	**Preparation of low-cost and no-cost teaching-learning aids for ECE class**	• Recycling waste materials (e.g. empty bottles, buttons, boxes, ropes, clay, plastic) to create low-cost and no-cost teaching aids
19	**Parent-community involvement for mobilization of resources and support for ECE**	• Active parent participation and community involvement at educational institutions • Improve parent, teacher and student collaboration • Avenues of parental involvement
20	**Assessment**	• Assessment techniques of ECE pilot project on mobile learning • Assessment for teachers • Assessment for classroom (teachers and students) • Assessment techniques for all ECE domains, based on the 20 themes

2. Screenshots of the ways in which the Facebook page was used during the project

Contents of teaching learning resource kit produced for the project

Students' artefacts on display during school monitoring visit

Broadcasting events such as the project close survey with teachers

Troubleshooting technological problems

Annex IV

Senegal

1. Screen shots of Nokia MoMath (now Microsoft Math)
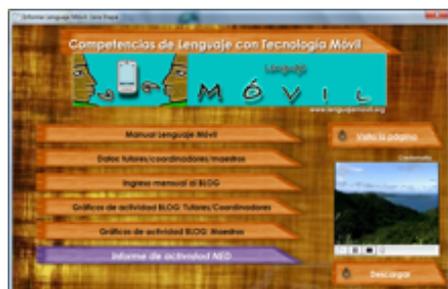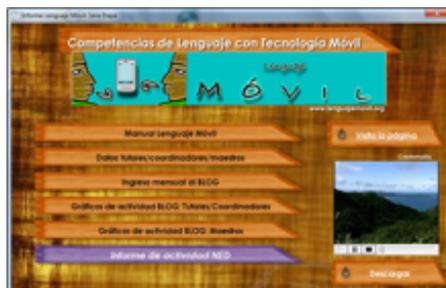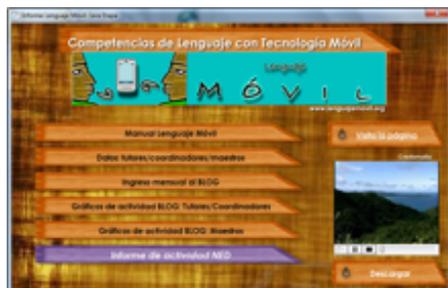
ANNEX V

Survey used to evaluate the project

SURVEY for UNESCO-Nokia project on using mobile technologies to support teachers' professional development

Please answer these questions in as much detail as possible. If you require more space, please add in lines, or write on the back of the page. Where options are provided in the blocks (e.g. question 12), please circle the one that is most appropriate for you.

Please be aware that:

- Although your name is asked for in this survey, it is only so that the researchers can identify you and link your baseline responses to those you will make later in the project close survey.

- The data collected will be for the group as a whole, so your individual responses will not be traceable.

- There is no right or wrong answer, so please answer as honestly and accurately as possible!

GENERAL INFORMATION (Please use capital letters)

1.	First name:	
2.	Last name	
3.	School name:	
4.	For how many years have you taught in this school?:	
5.	For how many years have you been a teacher?:	
6.	Position held:	
7.	E-mail:	
8.	Personal telephone	
9.	Highest qualification/ Diploma obtained	
10.	Region in which you teach	

11.	Your gender	Male		Female		
12.	Your age	20-29	30-39	40-49	50-59	60+
13.	What subjects do you teach?					
14.	For which grades do you teach…?:	English		Other subjects:		
15.	Number of learners in your class(es)	<21	21-30	31-40	41-50	51+
16.	Age range of learners in your class(es)					

ICT ACCESS

17.	Does your school have a policy about ICT (computers, mobile phones and the internet)	Yes	No
18.	Does your school ban the use of mobile phones at school?	Yes	No
19.	Does your school give learners guidance on appropriate ICT use?	Yes	No
20.	Does your school have a budget for buying and maintaining ICT equipment in the school?	Yes	No
21.	What types of ICT **do you own personally** for use at home or at school?		
21.1	PC	Yes	No
21.2	Laptop	Yes	No
21.3	Tablet (e.g. Apple iPad)	Yes	No
21.4	Mobile phone: basic features	Yes	No
21.5	Mobile phone: smart (WAP-enabled, etc.)	Yes	No
21.6	E-mail address	Yes	No
21.7	Internet access	Yes	No
21.8	If you do have internet access, please specify where:	at home	at school	at a community centre	Other:

22. What types of ICT **does the school provide for you to use at home or at school?**			
22.1	PC	Yes	No
22.2	Laptop	Yes	No
22.3	Tablet (e.g. Apple iPad)	Yes	No
22.4	Mobile phone: basic features	Yes	No
22.5	Mobile phone: smart (WAP-enabled, etc.)	Yes	No
22.6	E-mail address	Yes	No
22.7	Internet access	Yes	No

23. What types of ICT are available **in your school?**		Number available
23.1	Dedicated computer laboratory <u>without</u> internet access (minimum 20 computers)	
23.2	Interactive whiteboards	
23.3	Dedicated computer laboratory <u>with</u> internet access (minimum 20 computers)	
23.4	Mobile computer stand (minimum 8 computers)	
23.5	Computers for administrators (secretaries and/or clerks)	
23.6	Computers for school managers (principals, deputies, heads of department)	
23.7	Computers for teachers	

24. Do you have a mobile phone?		Yes (Answer the rest of this question please)		No (skip to Question 25)		
24.1	Can your mobile phone send and receive e-mail?	Yes		No		
24.2	Can your mobile phone access the internet (go to a website)?	Yes		No		
24.3	For how long have you had your current mobile phone? Or how old is your phone if you got it second hand?	Six months or less	One year	2-3 years	3+ years	5+ years
24.4	What is the model of your phone (e.g. Nokia E72)?					

YOUR CURRENT ICT SKILLS

25. Rate yourself from 1 to 5 where 1 = a complete beginner (no knowledge) and 5 = an expert (know all there is to know about this): **for your current level of skill in using the following:**	1 beginner				5 expert
25.1	**Using a computer**					
	25.1.1 general (emailing, internet usage, etc.)	1	2	3	4	5
	25.1.2 for word-processing packages (e.g. MS Word)	1	2	3	4	5
	25.1.3 for spreadsheets (e.g. MS Excel)	1	2	3	4	5
	25.1.4 for presentation software (e.g. MS PowerPoint)	1	2	3	4	5
	25.1.5 with a digital/data projector	1	2	3	4	5
25.2	**Using an interactive whiteboard / smart board**	1	2	3	4	5
25.3	**Using computer supported learning software**	1	2	3	4	5
25.4	**Using a mobile phone**					
	25.4.1 for voice calls	1	2	3	4	5
	25.4.2 to send a text	1	2	3	4	5
	25.4.3 to access the internet	1	2	3	4	5
	25.4.4 to find educational information	1	2	3	4	5
	25.4.5 to share educational information with colleagues	1	2	3	4	5
	25.4.6 to share education information with learners	1	2	3	4	5

CURRENT ICT FREQUENCY OF USAGE

26. **In general,** how frequently do you use the following ICT		Never	Once or twice a month	Weekly	Twice a week	Daily
26.1	Computer (PC or laptop)	1	2	3	4	5
26.2	Internet from a computer	1	2	3	4	5
26.3	Internet from a mobile phone	1	2	3	4	5
26.4	Digital projector/interactive white board/smartboard	1	2	3	4	5
26.5	Send/receive e-mail messages	1	2	3	4	5
26.6	Send/receive text messages	1	2	3	4	5
26.7	Use chat rooms or instant messaging	1	2	3	4	5

27. **For teaching or educational purposes, how frequently do you use ICT for each of the following:**		Never	Once or twice a month	Weekly	Twice a week	Daily
27.1	Internet browsing/searches (e.g. researching information on a teaching topic)	1	2	3	4	5
27.2	Internet chat forums (e.g. English teacher support groups)	1	2	3	4	5
27.3	Internet-based English language education interventions	1	2	3	4	5
27.4	Word-processing (e.g. worksheets, notes or tests)	1	2	3	4	5
27.5	Spreadsheets (e.g. class mark lists)	1	2	3	4	5
27.6	Presentations (e.g. MS PowerPoint presentations)	1	2	3	4	5
27.7	E-mails (school-related)	1	2	3	4	5
27.8	Texts (school-related)	1	2	3	4	5
27.9	Instant messaging chats (school-related)	1	2	3	4	5

28. How frequently do you use a MOBILE PHONE to …	Never	Once or twice a month	Weekly	Twice a week	Daily
28.1 …**make or receive calls …**					
28.1.1 …to/from colleagues in your school	1	2	3	4	5
28.1.2 …to/from colleagues at other schools	1	2	3	4	5
28.1.3 …to/from parents	1	2	3	4	5
28.1.4 … to/ from learners	1	2	3	4	5
28.2 …**send and receive electronic messages (e-mails, text or instant messages) …**					
28.2.1 …to/from colleagues in your school	1	2	3	4	5
28.2.2 …to/from colleagues at other schools	1	2	3	4	5
28.2.3 …to/from parents	1	2	3	4	5
28.2.4 …to/from learners	1	2	3	4	5
28.3					
28.3.1 …Transfer or 'download' files (music or video) to your phone (using Bluetooth or Infrared)	1	2	3	4	5
28.3.2 …Use the internet to get news or information about current events	1	2	3	4	5
28.3.3 …Use the internet to get news or information about school/teaching	1	2	3	4	5
28.3.4 …Use social networking sites (Facebook, MySpace, Hi5 or similar websites)	1	2	3	4	5
28.3.5 …Go to websites about movies, TV shows, music groups or sports stars	1	2	3	4	5
28.3.6 …Go online for no particular reason, to 'Google' or browse for fun	1	2	3	4	5
28.3.7 …Play games	1	2	3	4	5
28.3.8 …Play videos	1	2	3	4	5
28.3.9 …Play music	1	2	3	4	5

		One per term or semester	About monthly	Weekly	Twice a week	Daily
	28.3.10…Download songs, videos, games or ringtones	1	2	3	4	5
	28.3.11…Use the calculator	1	2	3	4	5
	28.3.12…Use the calendar, diary or set reminders	1	2	3	4	5

29. How frequently do you communicate with others, where 1 = Once per term (about 3 or 4 times per year) 5 = Daily	One per term or semester	About monthly	Weekly	Twice a week	Daily
29.1 Face-to-face meetings with…					
29.1.1…managers at your school (principal, heads of department)	1	2	3	4	5
29.1.2…colleagues at your school (other teachers)	1	2	3	4	5
29.1.3…parents of learners in your school	1	2	3	4	5
29.1.4…individual learners in your school	1	2	3	4	5
29.1.5…colleagues at other schools	1	2	3	4	5
29.2. Paper/mail communication with					
29.2.1…managers at your school (principal, heads of department)	1	2	3	4	5
29.2.2…colleagues at your school (other teachers)	1	2	3	4	5
29.2.3…parents of learners in your school	1	2	3	4	5
29.2.4…individual learners in your school	1	2	3	4	5
29.2.5…colleagues at other schools	1	2	3	4	5
29.3 Electronic communication (e-mail, text or instant messaging)					
29.3.1…managers at your school (principal, heads of department)	1	2	3	4	5
29.3.2…colleagues at your school (other teachers)	1	2	3	4	5
29.3.3…parents of learners in your school	1	2	3	4	5
29.3.4…individual learners in your school	1	2	3	4	5
29.3.5…colleagues at other schools	1	2	3	4	5

29.4 Websites/social media (for example, Facebook, school website, intranet site, other web platforms)					
29.4.1…managers at your school (principal, heads of department)	1	2	3	4	5
29.4.2…colleagues at your school (other teachers)	1	2	3	4	5
29.4.3…parents of learners in your school	1	2	3	4	5
29.4.4…individual learners in your school	1	2	3	4	5
29.4.5…colleagues at other schools	1	2	3	4	5

CURRENT ATTITUDES TO ICT / MOBILE LEARNING

30. Please rate what you think the current attitudes are, where 1 = Strongly opposed 3 = Neutral 5 = Strongly in favour	Strongly opposed	Opposed	Neutral	In favour	Strongly in favour
30.1 Attitudes towards using mobile phones out of schools for communication, teaching and learning…					
30.1.1…my attitude	1	2	3	4	5
30.1.2…my managers' (principals, heads of department) attitude	1	2	3	4	5
30.1.3…my colleagues' (other teachers) attitude	1	2	3	4	5
30.1.4…my learners' attitude	1	2	3	4	5
30.1.5…the parents' attitude	1	2	3	4	5
	Strongly opposed	Opposed	Neutral	In favour	Strongly in favour
30.2 Current attitude towards using mobile phones in schools for use in class time…					
30.2.1…my attitude	1	2	3	4	5
30.2.2…my managers' (principals, heads of department) attitude	1	2	3	4	5
30.2.3…my colleagues' (other teachers) attitude	1	2	3	4	5

30.2.4…my learners' attitude	1	2	3	4	5
30.2.5…the parents' attitude	1	2	3	4	5

ATTITUDES AND BELIEFS

31. Please rate your response to the following statements, where 1 = Strongly agree 3 = Neutral 5 = Strongly disagree **For how you feel NOW (before the project starts)…**	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
31.1 I am an excellent and professional teacher of the subject English	1	2	3	4	5
31.2 I regularly network with teachers teaching the same grade(s) in my region.	1	2	3	4	5
31.3 I regularly network with teachers teaching the same grade(s) in my country.	1	2	3	4	5
31.4 I know all about the subject (English) that I am expected to teach to my learners	1	2	3	4	5
31.5 I know exactly how to teach the subject (English) to my learners	1	2	3	4	5
31.6 I can easily find out how others are teaching English and find out about good practice	1	2	3	4	5
31.7 I can easily find resources and ideas about how to teach English	1	2	3	4	5
31.8 I regularly share my ideas on teaching English with others	1	2	3	4	5
31.9 I feel confident teaching English	1	2	3	4	5
31.10 I feel excited about teaching, and have many new ideas to try with my learners	1	2	3	4	5
31.11 I still have such a lot to learn about English	1	2	3	4	5
31.12 I still have such a lot to learn about how to teach English	1	2	3	4	5
31.13 I feel isolated in my school. I am on my own.	1	2	3	4	5
31.14 I feel part of a group of professional teachers for the subject (English) who support each other	1	2	3	4	5
31.15 I need more training to understand the subject (English)	1	2	3	4	5

31.16	I need more training to understand how to teach English	1	2	3	4	5
31.17	I get all the support that I need to be a good teacher	1	2	3	4	5
31.18	I am well connected with other teachers and know where to get help if I need it.	1	2	3	4	5
31.19	I am connected with my learners' parents and meet with them to discuss learners' behaviour towards education.	1	2	3	4	5
31.20	I think this project increases the equal opportunities between boys and girls.	1	2	3	4	5

ANTICIPATED IMPACT of THE 'UNESCO- Nokia Project on Mobile Technologies and Teacher Development' (The project)

32. Please rate how you THINK the project will help YOU (before the project starts), where 1 = Strongly agree 3 = Neutral 5 = Strongly disagree **I think this project will help ME …**	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
31.1	…to be a better teacher	1	2	3	4	5
32.2	…to be more professional	1	2	3	4	5
32.3	…to communicate more with parents	1	2	3	4	5
32.4	…to communicate more with colleagues at my school	1	2	3	4	5
32.5	…to communicate more with colleagues at other schools	1	2	3	4	5
32.6	…to communicate more with colleagues (educators and experts) about English.	1	2	3	4	5
32.7	…to communicate more with learners	1	2	3	4	5
32.8	…to better understand the content that I must teach for my subject (English)	1	2	3	4	5
32.9	…by reducing my workload	1	2	3	4	5
32.10	…by helping me use mobile phones appropriately for education	1	2	3	4	5
32.11	…to use a mobile phone	1	2	3	4	5
32.12	…to build better relationships with learners	1	2	3	4	5
32.13	…to build better relationships with parents	1	2	3	4	5

32.14	…to have more status as a teacher among learners	1	2	3	4	5
32.15	…to have more status as a teacher among parents	1	2	3	4	5

33. Please rate how you THINK the project will help YOUR LEARNERS (before the project starts), where 1 = Strongly agree 3 = No comment 5 = Strongly disagree **I think this project will help MY LEARNERS to…**		Strongly agree	Agree	No comment	Disagree	Strongly disagree
33.1	…master the subject (English) knowledge	1	2	3	4	5
33.2	…enjoy their subject (English) more	1	2	3	4	5
33.3	…improve their results for the subject (English)	1	2	3	4	5
33.4	… work harder at the subject (English)	1	2	3	4	5
33.5	…use technology to support their learning more often	1	2	3	4	5
33.6	…practise English more outside of school hours	1	2	3	4	5
33.7	…use technology to support peer-to-peer learning	1	2	3	4	5
33.8	…use technology to support collaborative learning outside of school hours	1	2	3	4	5
33.9	…use technology to ask advice or help to solve English problems from teachers	1	2	3	4	5
33.10	…think my role as a teacher has changed	1	2	3	4	5

34. Please rate how you THINK the project will help YOUR SCHOOL, where 1 = Strongly agree 3 = No comment 5 = Strongly disagree **I think this project will help MY SCHOOL to…**		Strongly agree	Agree	No comment	Disagree	Strongly disagree
34.1	…implement a project involving outside funders.	1	2	3	4	5
34.2	…be known as a school that is innovative in trying new ideas	1	2	3	4	5
34.3	…be known as a school that uses technologies to support learning	1	2	3	4	5
34.4	…collaborate with teachers and learners at other schools	1	2	3	4	5
34.5	…be known as a school that uses technologies to support equal learning	1	2	3	4	5

Thank you very much for taking the time to complete this survey.

Highly qualified teachers are essential to the realization of the Sustainable Development Agenda, but there are not enough of them, especially in developing countries. UNESCO estimates that 69 million teachers must be recruited and trained to achieve universal primary and secondary education for all by 2030. Additional interventions are needed to ensure teachers already working in classrooms have the subject and pedagogical knowledge required to help students achieve literacy and numeracy, develop skills for employment and promote a culture of peace.

This publication traces UNESCO's efforts to harness mobile technology to support teacher development. It describes and analyses projects conducted in Mexico, Nigeria, Pakistan and Senegal. While the projects differed in terms of scope and focus, collectively they reveal how governments and other organizations can use widely owned technology to help educators facilitate the learning of students in ways that are scalable, cost-effective and sustainable.

4 QUALITY EDUCATION

Sustainable
Development
Goals