KNOWLEDGE PACK

Remote phone-based formative assessment

WORLD BANK GROUP
Education

LeAP
Learning Assessment Platform

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REMOTE PHONE-BASED FORMATIVE ASSESSMENT

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INDEX

Introduction

What is a KP?

Knowledge Packages (KPs) are short, pragmatic guides on individual topics within EdTech, meant to provide sufficient knowledge and understanding so that non-technical stakeholders can make key planning, design, and procurement decisions for education.

They can be used as a starting point for the planning of technology deployment to improve education, especially with education ministries.

About this KP

The use of technology has substantially increased in all stages of the learning assessment process, from the planning and design of learning assessments to the assessment scoring and assessment results dissemination.

This KP is developed by the World Bank's Learning Assessment Platform (LeAP) team and coordinated by the EdTech team.

Its purpose is to provide information on how basic phones, specifically through Short Message Service (SMS), Interactive Voice Response (IVR), and direct phone calls, can support formative assessment activities and continuation of learning outside the classroom even in low-resource contexts.

WHO are the main stakeholders ?

KPs are designed with a **human-centered vision**.

This knowledge pack is meant to provide sufficient knowledge and understanding to help decisionmakers make key planning, design, and procurement decisions of technologies for assessment.

Ministry of Education officials

Task Team Leaders (TTL's) & Bank Project Managers

Governmental agencies working on learning assessment activities

Researchers and technical experts in learning assessment

Other governmental or regional institutions specialized in curriculum and learning assessment

NGOs and private organizations working in the field of education

PROBLEM STATEMENT

WHAT ARE PHONE-BASED FORMATIVE ASSESSMENTS? WHY SHOULD WE FOCUS ON THEM?

What are phone-based formative assessments?

Formative assessment consists of activities commonly implemented by teachers to monitor students' progress towards curriculum learning goals. It aims to generate timely information that teachers can use to shape instruction, help students understand concepts and reinforce learning content, and inform subsequent coursework. Moreover, formative assessment is a low-stakes, adaptive process centered on individualized support and constructive feedback.

Phone-Based Formative Assessment refers to the use of mobile phone technologies to engage students outside the classroom, assess their learning in real time, and provide timely, constructive feedback to promote learning continuity.

Why should we focus on phone-based formative assessments?

Before the COVID-19 pandemic, students typically learned in classrooms and interacted with teachers who assessed their learning and provided real-time feedback to support their learning progress.

But this connection broke during the COVID-19 pandemic and it has had a significant impact on education systems worldwide, affecting whether and how students learn remotely.

Since the beginning of 2020, the COVID-19 pandemic forced countries around the world to close schools. This impacted the ability of teachers to provide real-time feedback to students.

As a response, expanding remote learning and assessment became common. While many countries were able to quickly roll out remote learning initiatives using various web-based applications, not all children were able to access such resources, particularly when they required having internet connectivity and digital devices (such as computers, tablets, and smartphones) at home. This situation reflects some of the challenges faced in low-resource contexts due to limited infrastructure.
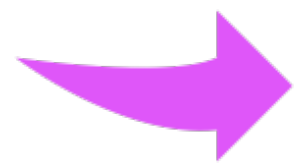
PROBLEM STATEMENT

PART OF THE SOLUTION FOR LEARNING CONTINUITY DURING FUTURE SHOCKS

How do we ensure that students continue to learn during school closures and our education systems are resistant to similar shocks and disruptions in the future?

With a global penetration rate of 104 percent, the access to basic phones for learning assessment delivery can be part of the answer.

Worldwide, mobile phone subscription rates per 100 people[1] have increased from 12 in 2000 to 109 in 2019. When looked at unique mobile subscribers[2], the penetration rate remains small in low- and lower- middle-income countries. For example, in Sub-Saharan Africa (SSA), unique mobile subscribers stand at 46% of the population, and only 28% of the population in SSA have access to internet on their mobile phone.
Thus, more low-tech and readily available modalities, such as basic phones[3], can facilitate learning continuity when students and teachers cannot be physically together.

The purpose of this KP is to provide information on how basic phones, specifically through Short Message Service (SMS), Interactive Voice Response (IVR), and direct phone calls, can support formative assessment activities and continuation of learning outside the classroom even in low-resource contexts. The three technology solutions are selected because they rely on texts and calls which are the most basic features available and are compatible with all kinds of mobile phones (including basic phones).

1. Mobile cellular telephone subscriptions are subscriptions to a public mobile telephone service that provide access to the PSTN using cellular technology. The indicator includes (and is split into) the number of postpaid subscriptions, and the number of active prepaid accounts (i.e. that have been used during the last three months). The indicator applies to all mobile cellular subscriptions that offer voice communications. It excludes subscriptions via data cards or USB modems, subscriptions to public mobile data services, private trunked mobile radio, telepoint, radio paging and telemetry services.
2. A 'unique mobile subscriber' is defined as an individual person who can own multiple mobile connections (i.e., SIM cards).
3. Basic phones are the most basic forms of mobile phones that use second generation (2G) network and can be identified with their small screen, a standard numeric keypad, long battery life and no high-end features such as access to internet. Basic phones primarily perform two main functions: voice calls and sending/ receiving text messages. These phones rely on mobile networks such as Vodafone for communication. One common example is Nokia 1100. When compared with 'feature phones' and 'feature smart phones,' basic phones are largely similar in their external appearance but feature phones also come with minimum multimedia and internet capabilities. These were among the first phones to use third generation (3G) networks.

WHY **is this KP designed ?**

USE CASES

RECOMMENDED USES OF PHONE-BASED ASSESSMENTS

Phone-based assessment solutions can be used for at least two purposes:

1 To conduct formative assessment to, for example, gauge the extent of 'students' absorption of content, identify any misconceptions in understanding, provide constructive feedback to students or caregivers, and offer additional learning resources and activities to support learning. Remote phone-based formative assessments can be used when in-person teaching and learning are not possible. Such as during school closures as a result of:
- pandemics,
- social unrest,

- natural disasters,
- conflicts, and
- other emergencies

2 To conduct impact evaluations on, for example, analyzing the effect of interventions introduced in response to the pandemic on student learning outcomes.

General Guidance: For the purposes of making high-stakes decisions or monitoring learning at the system level, phone-based assessments **are generally not a suitable option** due to several constraints (e.g. limitations to

student sampling, standardization of the assessment administration, test security and potential malpractice such as item leaking, test-taker identity corroboration, or cheating).

WHAT DOES PHONE-BASED FORMATIVE ASSESSMENT COVER?

The table below describes the three phone-based technologies and their use for the delivery of formative assessments including their advantages and disadvantages.

SMS	IVR	DIRECT PHONE CALLS
Text messaging is a basic feature included across all mobile phones. Formative assessment through text messaging is an asynchronous process, during which students respond to the questions sent to them based on a previously delivered content.	IVR works by inviting users to call a number (usually toll-free). An automated system delivers pre-recorded audio messages that may contain on-demand educational content or voice-based quizzes.	Direct phone calls allow teachers to assess students' engagement with remote learning resources, understand their absorption of learning content, and respond to students' questions.
The learning content delivery and assessment can occur either at different moments of time or presented together to acquire immediate information about students' learning. The delivery of assessment content through SMS typically requires the development of a tailored software application that sends out SMS messages and receives responses, which can be done through a variety of mobile aggregator platforms, such as Twilio and Tatango.	While using IVR, the users (child/caregiver) respond by pressing the number key or saying the number that corresponds to their answer choice (i.e., "say yes or press 1, say no or press 2"). IVR also allows users to leave a recorded voice message with a detailed response or query.	Direct phone calls serve as an opportunity to provide emotional support and encouragement, which are particularly important when students and teachers cannot be together physically in the classroom (Lainchaur, 2020, p. 16)

are the potential solutions?

STRUCTURE OF SOLUTIONS

The following table summarizes the key features of each technology solution and their use for the delivery of formative assessments.

	SMS	IVR	DIRECT PHONE CALLS
Assessment procedure	**Short text-based quizzes are sent to students.** With two-way SMS, students can respond via SMS (like the learning assessment, learning content can also be delivered through SMS either before or after the assessment).	**Users call a phone number to listen to learning content and respond to a series of voice-based multiple-choice questions.** Answers are selected either by pressing corresponding keys or saying the correct answer. The IVR system processes responses and may provide voice-based feedback based on the result.	**Teachers or instructors contact students by phone** to go over learning content, assess students' knowledge, guide students to appropriate learning content, and encourage their use of the learning content. Feedback can be provided during the phone call.
Assessment frequency	Received regularly— i.e., once a week to several messages per day.	Accessed at students' convenience.	Made sporadically or regularly —can also be requested by parents if needed.

are the potential solutions?

STRUCTURE OF SOLUTIONS

	SMS	IVR	DIRECT PHONE CALLS
Solution advantages	**Cost:** The most cost-effective of the three tools. **Time flexibility:** Users can respond at their convenience, given the asynchronous nature. **Reminders:** Additional messages can be delivered to remind students to take the assessment.	**Accessibility:** Supports students with visual disabilities as well as students/parents with limited literacy. **Higher Respnose Rate:** As a result of more inclusive sample, IVR leads to higher response rate compared to SMS. **Language flexibility:** Content can be delivered in multiple languages, including those with no written form.	**Accessibility:** Supports students with visual disabilities as well as students/parents with limited literacy. **Synchronicity:** Synchronous interaction with students allows for a more personalized approach, promotes active engagement of students in assessment and learning process, builds rapport with the assessor.
Infrastructure requirements	**Access:** working basic mobile phone Free SMS: need to SMS credits or a free of charge alternative. **Mobile aggregators:** needed to link different carrier networks with SMS software / platform providers. **Software:** needed to administer content and record students' answers.	**Access:** any type of phone. **Free calls:** need to offer phone call credits or a toll-free number. **Voice actors:** needed to record the content (in different languages). **Software:** needed to administer content and record students' answers.	**Access:** any type of phone. **Free calls:** need to offer phone credits to teachers for making calls. **Digital infrastructure:** needed to manage students' data and feedback. **Switchboard system:** needed if hotlines are used.

are the potential solutions?

CHALLENGES AND TRADE-OFFS

	SMS	IVR	DIRECT PHONE CALLS
Community considerations	**Parent authorization:** needed to send them SMS and reception of SMS outside of school hours.	**User familiarity:** necessary for receiving and engaging with IVR.	**Parent availability:** may be needed for monitoring the call between the child and the enumerator.
Solution limitations	160-character restriction. Non-Latin characters might not display properly. Phones with small screens may create usability issues. Hard to track possible parental interference (e.g. parents telling children the correct answers). Cannot be used with landline phones.	Possible difficulties due lack of access to a personal phone and longer duration of engagement. Students must be attentive and complete assessments in one sitting— saving isn't an option.	Possible additional burden on teachers to make the calls (sometimes even outside the school hours). Calls need to be scheduled and rescheduled to ensure children's availability and access to phone at the time of call.

WHAT HAS BEEN DONE IN OTHER COUNTRIES

USE OF SMS: MOBILE-BASED POST LITERACY PROGRAMME, PAKISTAN

ABOUT THE PROGRAM

Implemented in Punjab province of Pakistan.The program aimed at providing literacy teaching in Urdu to young and adult women aged 15-30 with limited or no literacy skills. Over three years, the program provided free mobile phones, SIM cards and SMS services for four months to over 2,500 participants.

CONTENT DELIVERY

The program spanned over six months and was divided into two stages: first stage comprised of in-person teaching that lasted two months and second stage focused on mobile based literacy that lasted four months. During first two months, the participants met six times a week for two to three hours to learn and write alphabet and read with emphasis on phonics. During the second stage, participants received SMS on their phones 6-8 times a day. After receiving the SMS, the participants were required to read the texts, write them in their notebooks and answer the questions asked.

ASSESSMENT PROCEDURE

To monitor the progress and participation, a web-based system was used to send SMS to the participants. Assessments involved responding to questions/multiple-choice-questions or tests sent to them.

RESULTS/OUTCOMES

During the pilot phase with 250 learners, test results showed that after 4 months of mobile based literacy instruction, only 14% of the participants fell into 0-50% score range compared to 90% during the first month.

WHAT are the potential solutions?

WHAT HAS BEEN DONE IN OTHER COUNTRIES

USE OF IVR: ALLO ALPHABET, CÔTE D'IVOIRE

ABOUT THE PROGRAM

The study was first piloted in a rural village in Adzopé (Côte d'Ivoire). The study included 38 students from grade 5 and spanned five weeks from October-December 2018. Later from 2019-2020, the program was scaled up to reach 1200 children (800 in treatment and 400 in control) in remote rural communities. Literacy curriculum in Attié and French were designed and implemented on an interactive voice response (IVR) system named Allo Alphabet.

ASSESSMENT PROCEDURE

To assess the learners, the system played a pre-recorded audio message containing a question. After selecting a response, the learner received feedback from the system. For correct answers, the system would prompt the next question. For incorrect answers, the system first provides a hint and gives another opportunity to answer.

CONTENT DELIVERY

The content delivered focused on overall literacy skills such as phonological awareness and print-sound mapping. Overtime, the difficulty of the content was increased from simple phoneme and syllable awareness to mapping between letters, words, and sounds.
The learner was required to call a specified number. Once the call was placed, it was automatically disconnected and the system was programmed to call back the learner. At start of each call, the system played a welcome message, that updated the learner of their progress .

RESULTS/OUTCOMES

The analysis showed that, on average, learners called the system 14.2 days out of 32 days and initiated 81.4 calls over five weeks spending 6.2 minutes on calls.

Source: Madaio, M.A., Kamath, V., Yarzebinski, E., Zasacky, S., Tanoh, F., Hannon-Cropp, J., Cassell, J., Jasińska, K. and Ogan, A. (2019). "You Give a Little of Yourself": Family Support for Children's Use of an IVR Literacy System. In ACM SIGCAS Conference on Computing and Sustainable Societies (COMPASS) (COMPASS '19), July 3–5, 2019, Accra, Ghana. ACM, New York, NY, USA, 13 pages. https://doi.org/10.1145/3314344.3332504

WHAT HAS BEEN DONE IN OTHER COUNTRIES

USE OF PHONE CALLS: YOUNG LOVE, BOTSWANA

ABOUT THE PROGRAM

Between February and March 2020, before many countries closed schools due to the pandemic, a phone-based assessment of basic numeracy skills was administered to over 4,500 students in grades 3 to 5. Over 70 assessors (former teacher aides) were trained remotely using voice notes and sharing resources via WhatsApp.

CONTENT DELIVERY

The sample of 4,500 students was randomly divided into three sub-groups: first group that received weekly text message followed by phone call, second group that received weekly text message only, and control group. The students in treatment groups received targeted instruction in the form of tailored messages based on their learning level.

ASSESSMENT PROCEDURE

The Annual Status of Education Report (ASER) survey instrument was adapted for phone-based administration. The assessment entailed the following tasks: a) Number operations; b) Timed word problem; c) Explanation of the solution. On average, the phone calls with students lasted between 15 and 20 minutes. Facilitators presented to the students a the learning activities sent via SMS and check their understanding.

RESULTS/OUTCOMES

The study suggested that SMS combined with phone calls can result in substantial learning gains and revealed that 'text message followed by phone call' led to 31% score increase in numeracy. 'Text message followed by phone call' had larger and more cost-effective effects on engagement in learning when compared to 'text message only'.

Source: Angrist, N., Bergman, P., & Matsheng, M. (2021). School's Out: Experimental Evidence on Limiting Learning Loss Using "Low-Tech" in a Pandemic. Working paper 28205. National Bureau of Economic Research

to implement next steps ?

ENABLING CONDITIONS

CONSIDERATIONS FOR IMPLEMENTING PHONE-BASED FRMATIVE ASSESSMENTS

The LeAP team elaborated a full list of pre-conditions to assess the prerequisites and enabling conditions for successful implementation of each of the solutions (e.g. mobile penetration rates, existence of mobile aggregator in the country, average cost per SMS/1MB mobile data/call rates, access to smartphones and internet by teachers, MOE's engagement, and local implementor's capacity among others)

EDUCATION SYSTEM CAPACITY CONSIDERATIONS

#1 Learning content and its alignment with assessment: Existing distance learning initiatives available and the type of technology used in distance learning are critical to define the feasibility and success of phone-based assessment.

#2 Human resources: Engage teachers either in direct implementation of phone-based assessments or in using the data obtained from these assessments.

to implement next steps ?

ENABLING CONDITIONS

CONSIDERATIONS FOR IMPLEMENTING PHONE-BASED FRMATIVE ASSESSMENTS

TECHNOLOGICAL AND LOGISTICAL CONSIDEREATIONS

#1 Demographics: Consider the skills and competencies required to use these devices . **Adult literacy rates, urban population share or language diversity** in the country/region can help select the modality (SMS, IVR or phone calls) for delivery of assessments.

#2 Technology: Mobile phone penetration and network coverage are key to evaluate a country's technological capacity. Phone-based assessments requires students to have a mobile phone at home. Consider the availability of connectivity, mobile cellular subscriptions, mobile accounts for financial transactions, access to electricity, etc.

#3 Service providers: Service providers and software platforms are key component to successful delivery of educational applications (assess the context of usability, accessibility and affordability). Aim for **at least one operational mobile aggregator capable of implementing SMS/IVR/phone call solution**. Availability of or ease of setting-up **toll-free numbers, short codes , two-way SMS, and frequency of internet outages/shutdowns in the country** also needs to be considered.

#4 Financial: Consider the costs of different phone-based technologies (e.g. **average cost per SMS, average per-minute cost of different types of mobile phone calls, average cost of mobile data for 1GB**).

#5 Time: Considering the time frame for implementation (e.g. **access to a database of caregivers' or students' phone numbers**). **Duration of school closures**, and **implementation timeline** are also important.

#6 Local implementor capacity: A key factor will be selecting the right implementing partner. It is critical to consider whether the candidates have **previous experience with implementing phone-based interventions or assessments, experience delivering distance learning interventions and working with mobile network operators and mobile service providers.**

Conclusion

WHO

The range of stakeholhers is wide: **World Bank staff** (TTLs), **Ministry of Education officials**, **governmental agencies** working on learning assessment activities, other governmental or **regional institutions** specialized in curriculum and learning assessment, **NGOs and private organizations** working in the field of education, **researchers and technical experts** in learning assessment.

WHY

SMS, IVR and direct phone calls are three technology solutions that can be used on all kinds of phones **to conduct remote formative assessments** during the time of school closures **and impact evaluations**. But for the purposes of **making high-stakes decisions or monitoring learning at the system level, phone-based assessments are generally not a suitable option.**

WHAT

Each technology solution has advantages and limitations. For instance SMS are cost effective but have 160 character-limit and does not always support all language scripts hence it may pose additional challenges when assessing literacy. Such **limitations should be carefully considered before finalizing a technology solution for assessment.**

HOW

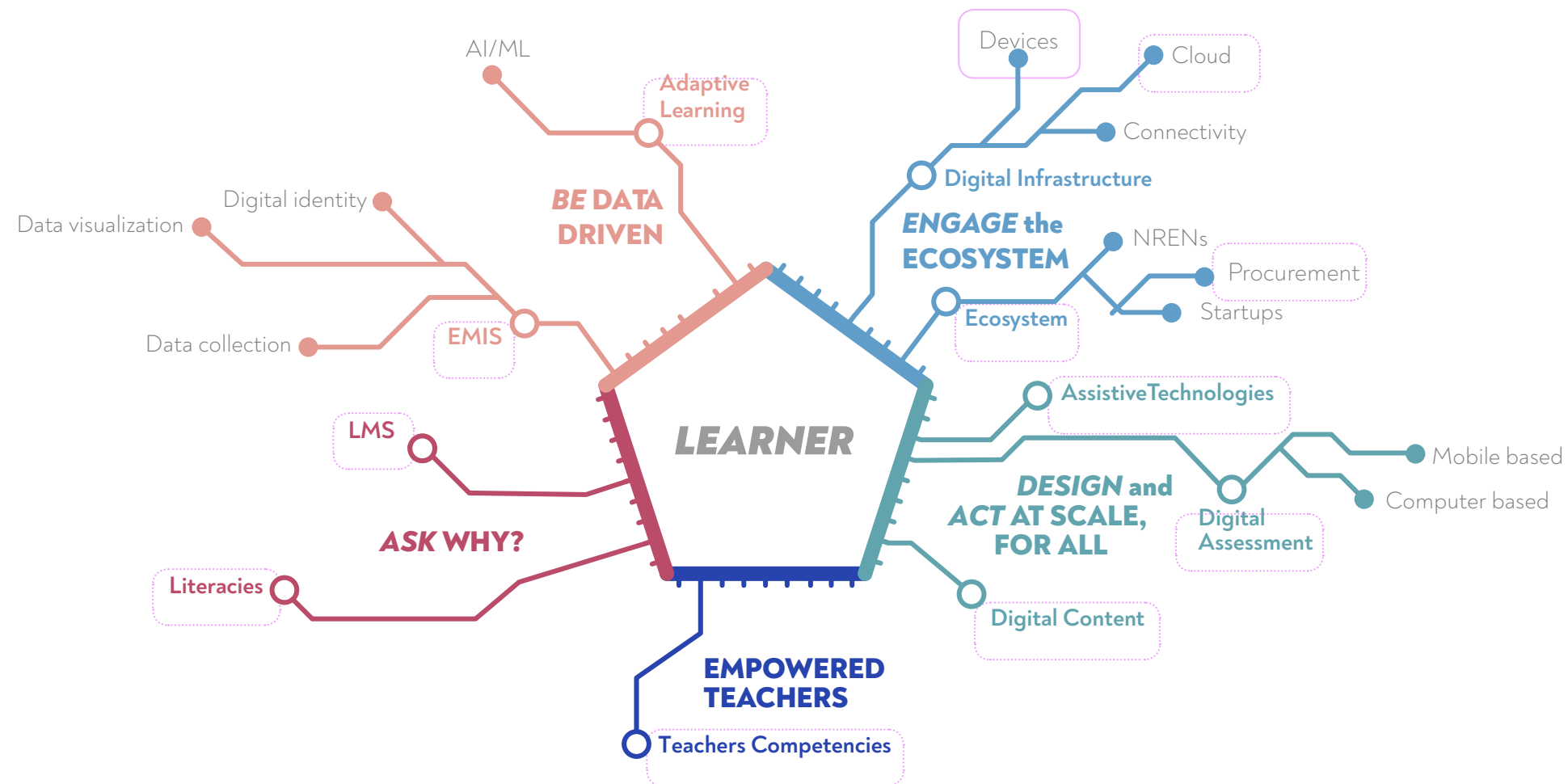Before implementing remote phone-based formative assessments, the following eight elements should be considered:
On education system capacity:
(a) Alignment with existing learning content, **(b)** Human resources;
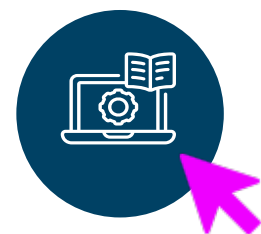**On technological and logistical considerations**
(c) Demographics, **(d)** Technology, **(e)** Service providers, **(f)** Financial, **(g)** Time, **(h)** Local implementor's capacity.

To go further

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OTHER EXISTING RELATED KPs

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Annexes

REFERENCES AND LINKS OF INTEREST

BLOGS

- Are students still learning during COVID-19? Formative assessment can provide the answer
- Assessing outside of the "classroom box" while schools are closed: The potential of phone-based formative assessments to support learning continuity
- Is It Possible to Measure Learning by Phone?

DOCUMENTS

- How to Create Learning Content in 160 Characters (SMS)
- Practical Lessons for Phone-Based Assessments of Learning
- Remote Learning: Evidence from Nepal during COVID-19

EVENTS

- Innovations in phone-based assessments to support learning
- Building and assessing youth skills remotely during COVID-19: The experience of Educate! in East Africa

PODCAST

- Adapting Assessments to the Remote Education Setting

TOOLS

- Viamo: Share valuable information with anyone who owns a phone in their language of choice. Use a combination of channels (voice, SMS, USSD, web app, IM bot, etc).
- Questbase: QuestBase is the tool to better and faster test and certify the knowledge of students.