Messaging apps, SMS & social media: Rapid Evidence Review

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RAPID EVIDENCE REVIEW

Messaging apps, SMS & social media

Date September 2020

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Version

1

This publication is one part of a series of rapid evidence reviews that has been produced by the EdTech Hub. The purpose of the rapid evidence reviews is to provide education decision-makers with accessible evidence-based summaries of good practice in specific areas of EdTech. They are focused on topics which are particularly relevant in the context of widespread global challenges to formal schooling as a result of Covid-19. All the rapid evidence reviews are available at edtechhub.org.

Abbreviations and acronyms

ASER	Annual Status of Education Report
AT	Assistive Technology
EdTech	Educational Technology
EGMA	Early Grade Mathematics Assessment
ERIC	Education Resources Information Center
HICs	High Income Countries
ICT	Information and Communications Technology
LMICs	Low- and Middle-Income Countries
RCT	Randomised Controlled Trial
RER	Rapid Evidence Review
SEND	Special Educational Needs and Disabilities
SMS	Short Message Service
TVET	Technical and Vocational Education and Training

Summary

This Rapid Evidence Review (RER) provides an overview of existing research on the use of mobile phone-based messaging (including SMS, and messaging through apps such as WhatsApp) to support education in low- and middle-income countries (LMICs). This topic was chosen as the focus for a RER in response to the Covid-19 pandemic and school closures, as this form of technology has been adopted as part of some countries' methods of providing continuing education during closures and disruption. As such, the overall purpose of this document is to summarise the existing research literature around messaging, so that the existing evidence can be used to inform ongoing responses to the pandemic. The findings are intended to be of use to educational decision makers, including donors and those in government and NGOs, to inform responses to the current pandemic.

Furthermore, the review findings suggest that this is a growing research topic in LMICs, which has received increasing attention in recent years. Given the practical examples which the RER draws upon, the findings and recommendations are also anticipated to be of interest to other education stakeholders (e.g. researchers and school leaders). This review will also be useful for advancing the field more generally, beyond the immediate response to the pandemic and building resilience for the future.

The RER was undertaken using a transparent, systematic approach to conducting a literature review, and guided by the following research question:

> **What is known about how social media and messaging apps can be used to effectively support education in LMICs?**

Although the topic at hand has not been extensively explored in the academic literature at present, there is some evidence to suggest that messaging can be a cost-effective mechanism to enhance learning outcomes. Structured according to three themes, the findings of the analysis reveal the following insights:

- **Supporting student learning** How messaging can be used to directly support students' learning. Particular clusters emerged around two sub-themes: interacting with peers and other students, peer tutoring and collaborative learning; and interacting with teachers, through content delivery, teaching and assessment.
- **Teacher professional development** How messaging can be used to support teachers' professional development, both pre-service and in-service. The studies discussed in this section include structured support and prompts, and informal communities of practice.
- **Supporting refugees' education** Messaging has been particularly useful in this context, both in terms of providing continuity of educational experience, and building new educational networks.

The key findings and recommendations from this review are:

- **Messaging can be used in a range of learning activities, through a combination of sharing educational materials, with interaction between pupils, peers, caregivers and teachers.** Use is more often focused on making use of the potential for the technology to foster interactions, rather than just as a way to deliver content alone. Interventions often combine multiple elements; likewise, messaging could be used as an interactive complement to broadcast media. To allow for flexibility and greater reach, materials should be designed in ways which are not platform-specific and can be adapted for different tools. Assessments and strategies can be adapted from face-to-face and telephone-based instruction. There is a trade-off in efficacy and cost here; for example, telephone-based interactions can be more effective but are more expensive, while messaging is lower cost and more readily scalable.
- **Messaging can be an effective way of supporting teachers, both in terms of providing activities such as lesson plans, and motivation.** Initiatives which deliver lesson plans and guidance have been shown to foster a wider range of classroom practices, and show good

potential to be applied at scale. Messaging is relatively low cost and teaching materials could be tailored to the local context. In terms of supporting teachers' professional development, messaging has been shown to be an effective way of maintaining contact and support in addition to in-person training. Materials adapted for messaging can also have a wider reach through being readily circulated among colleagues, and sharing of knowledge through informal communities of practice.

- **Caregivers are key gatekeepers to mobile phone access.** The role of parents and caregivers is particularly important in relation to supporting younger learners. Messaging is not only a way to send materials - using messages to send reminders and suggested activities can help to get parents and caregivers actively involved in using materials with children. Culturally-relevant design of materials and local languages can help promote this.

- **The use of messaging to support refugees highlights its flexibility and resilience - which may be useful for ongoing disruption and uncertainty in the pandemic and beyond.** Refugees' education faces multiple disruptions; the flexibility of messaging has contributed to its use in these complex circumstances. As such, this flexibility could also be used to build resilience in terms of being able to switch between modes of teaching - from face-to-face to distance education - if incorporated into a plan for ongoing or emergency school closures. Planning ahead would be required, such as ensuring that schools hold up-to-date mobile numbers, and have educational materials in forms which would be readily deployed this way.

- **There is some evidence to suggest that messaging may promote equity.** For example, the studies include examples which have been successful in remote and rural areas, supporting SEND students, refugees, and promoting girls' education. However, the equity gains may not be universal - contextual factors will need to be considered carefully. Inequalities could be exacerbated if the technology is not accessible to all, either through general availability of the technology, or different ways in which access is mediated (for example, gatekeepers may hold stereotypical views in terms of gender and technology use). The success of many of the interventions is due in part to the familiarity of the technology, but the design of interventions should not assume that everyone has access and instead consider how to reach those who would be excluded.

1. Introduction

As a result of the Covid-19 pandemic, school closures have affected learners across the globe at an unprecedented scale. The need for social distancing, to disrupt the spread of the virus, led to approximately 90% of school-aged learners being affected by school closures ↑(David, et al., 2020).

Background

In the immediate responses to Covid-19 school closures in low- and middle-income countries (LMICs), broadcast media has been a major focus. Adopting a combined approach of making educational content available through radio, television and online platforms, has frequently been used, in order to maximise the number of learners which can be reached during school closures, across a range of levels of technology access and online connectivity ↑(Vegas, 2020).

A number of evidence-based guidelines have been published to provide guidance in effective practices around the use of educational radio or television broadcasts (↑Damani, & Mitchell, 2020; ↑International Rescue Committee, 2020; ↑Richmond, 2020; ↑Watson, & McIntyre, 2020; ↑World Bank, 2020a). However, in the responses to Covid-19 school closures, examples have emerged of using messaging apps (such as WhatsApp, Facebook Messenger, or simply SMS) as a low-connectivity mechanism for educational content delivery, and to support peer interactions, as part of countries' crisis responses alongside broadcast instruction (see examples of country responses which have included use of WhatsApp in Annex C).

While the examples shown in Annex C indicate that messaging is being used as part of Covid-19 emergency responses, they are likely to represent only a small fraction of how the technology is currently being used in practice. Messaging is likely being used in a great deal of initiatives at more localised levels - from individual teachers, to schools and districts - as individuals adapt to the current situation. Two examples of programmes where WhatsApp is currently being used to facilitate delivery of resources to teachers and support communication between teachers are the IGATE-T project in Zimbabwe, and the ZEST teacher development programme in Zambia ↑(Buckler, et al., 2020; ↑Power, 2020). In Sierra Leone and Liberia, the Rising Academy Network responded quickly to the crisis, repurposing existing content for use through radio, television and SMS in the 'Rising on Air' programme ↑(Lamba, & Reimers, 2020). The RER focuses on completed, published research, although it is important to note that examples of how messaging has been used in the current crisis are likely to be published in the future.

Purpose

To date, we are not aware of any recent reviews or briefings which have focused on this medium. This may be particularly valuable as the examples encountered so far suggest that this technology offers particular advantages in terms of facilitating pedagogical approaches which make use of the interactivity - potentially between learners, teachers and caregivers - and may also address equity concerns. However, as the use of messaging is already being adopted in Covid-19 responses, there is a risk that its use will be led by the technology and not informed by previous research or effective practice. This RER is intended to fill this gap by examining the existing research literature on this topic. Note that the focus here is specifically upon how messaging may be used directly in relation to school-aged learners, and indirectly through teachers' development; Higher Education and other forms of adult education are outside the scope of this review.

Application

This RER provides an overview of the existing research literature about how messaging can be used to support school-aged learners and their teachers in LMICs. Furthermore, practical insights from the existing literature will be discussed. The document will inform educational decision makers, including donors and those in government and NGOs, about the potential to use messaging in responses to the

current pandemic, and beyond. Findings and recommendations are also anticipated to be of interest to other education stakeholders, such as researchers and school leaders.

Research question

The following research question guided the study:

> What is known about how social media and messaging apps can be used to effectively support education in LMICs?

Structure of the RER

The RER is structured around three main sections, following this introduction. In Section 2, the methodological approach is discussed, including the search strategy, inclusion and exclusion criteria and study limitations. In Section 3, detailed findings from the included studies are discussed, according to three main themes which emerged from the identified literature. This report concludes by providing a summary of findings and recommendations in Section 4.

2. Methodology

The methodological approach is informed by the Cochrane Collaboration Rapid Reviews Methods Group interim guidance on producing rapid reviews ↑(Garritty, et al., 2020). Rapid evidence reviews are intended to be undertaken quickly, to provide an overview of the research landscape around a particular topic of current interest. As such, the approach is akin to a scoping review, which in turn shares some characteristics with systematic reviews; both involve taking a logical, rigorous approach to searching and synthesis across the research literature (↑Colquhoun, et al., 2014; ↑Pham, et al., 2014). However, scoping reviews differ in that the goal is typically to profile the current status of a field, and identify gaps, rather than evaluate the evidence in relation to a specific, bounded question ↑(Arksey, & O'Malley, 2005).

Scoping reviews follow a similar protocol and are explicit in documenting the process of literature searching, screening, and the reasons why studies have been selected for inclusion. This section sets out how this process was undertaken for this rapid evidence review.

Literature search and inclusion criteria

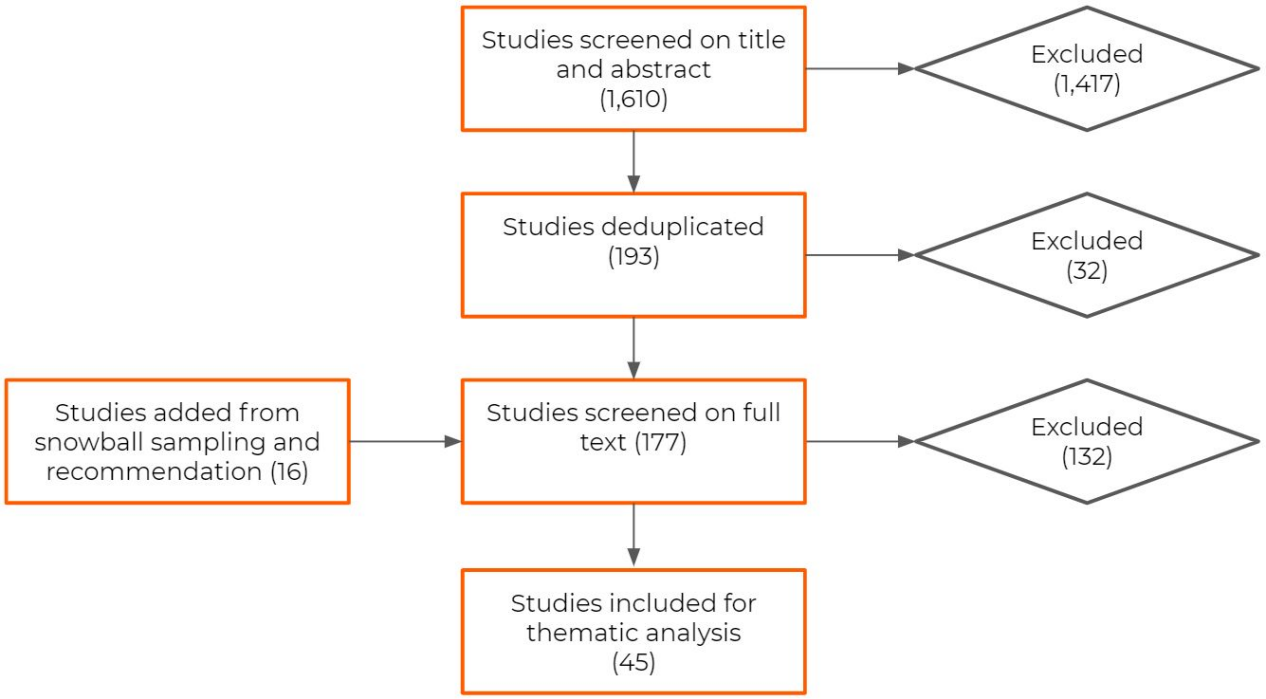
Literature searches were carried out in August 2020, using four of the main scholarly databases (ERIC, Google Scholar, Scopus and Web of Knowledge). The search string which was used, and the number of records returned per database, are shown in Annex B. The criteria for inclusion and exclusion of studies is shown in Table 1. The steps in the process from initial searches to final selection of studies for inclusion are summarised in Figure 1.

In the first round of screening, the criteria were applied at the level of title and abstract. If in doubt, any borderline cases were carried over to the next round of screening, which considered the full text. The most frequent reasons for exclusion were being focused on health rather than education, or focused on higher education rather than school-aged learners or teachers. Additionally, some further studies were identified when reading full texts through snowball sampling, and recommendations from others. This yielded further relevant studies, particularly reports, which would not have been found via academic databases, and very recently published works.

Table 1: Eligibility criteria for literature searches

	Inclusion criteria	Exclusion criteria
Population	Involving elementary and/or secondary school students (ranging from five to 19 years old) based in LMICs. This can include out-of-school children (e.g. refugees), and perspectives of those involved in supporting school-aged pupils (e.g. teachers, parents, caregivers)	Exclude any studies focused on HICs Exclude studies where the focus is on tertiary education, higher education, TVET, or other forms of adult education (exception: teacher training and professional development)
Intervention	Must be focused upon the use of WhatsApp, social media, SMS, or other forms of mobile-based messaging apps for educational purposes	Exclude studies which make only passing reference to this (e.g. levels of phone use/ownership by students), or do not have an explicit link to education (e.g. health interventions)
Study design	Studies must be empirically-based, presenting research findings and	Exclude theoretical papers, position papers, review papers or opinion pieces

	evidence	
Date	Published between 2010 and the present day (mid 2020)	Published before 2010



01. Literature search and screening process.

Limitations

There are two main limitations to this review. First, the searching and screening processes were undertaken rapidly. While the process has been documented and recorded in a manner akin to a systematic review protocol, which gives a level of rigour above a simple ad hoc literature review, a full systematic review would entail a more thorough and critical assessment of the evidence presented in the studies. Furthermore, as part of this compromise, the searches do not claim to be exhaustive. Given that major advances in consumer mobile telephone technology have been made in the last decade, studies published prior to 2010 were excluded. Searches were only undertaken in English, across a selection of major academic databases, primarily because these are indexed only in English - however the results themselves included articles written in other languages. On one hand, a focus on academic databases will mean that the results are likely to have been peer reviewed; however, on the other hand, a focus on this literature isn't going to pick up on interventions which took place but were not evaluated, or results went unpublished. Grey literature was not sought, although some major works were found by snowball sampling.

Second, at present, there is not a large body of rigorous empirical research literature associated with this topic. As a result, this review is quite descriptive in nature, with a greater focus on the ways in which this type of technology is being used to support education, rather than being able to draw comparisons about learning gains, for example. Quality of the studies - neither in terms of the quality of the intervention, or of the published articles - was not assessed as part of the screening criteria. Nonetheless,

the trends in publication dates and use of messaging in Covid-19 responses would suggest that this is a topic around which there is growing interest, and as such, this review should be useful to help move the field forwards.

It is also important to note that while the reason for undertaking the review is to be able to inform responses to the Covid-19 pandemic, findings will not necessarily transfer easily to the current crisis.

Theme identification

As a result of the screening process, 45 studies were identified for inclusion. Bearing in mind the overall research question of 'What is known about how social media and messaging apps can be used to effectively support education in LMICs?', and the distribution of topics addressed by the studies in the sample, the following themes and sub-themes were identified:

- Supporting student learning
  - Peer tutoring and collaborative learning
  - Content delivery, teaching and assessment
- Teacher professional development
  - Structured prompts and coaching
  - Communities of practice
- Supporting education in refugee contexts
  - Continuity of educational experience
  - New educational networks

The studies will be reviewed in the next section, with the discussion structured around the themes.

3. Findings

Supporting student learning

Within the theme of pedagogy, there are two sub-themes, according to the types of interaction underpinning the educational activities in each. Student to student interactions are first discussed in 'peer tutoring and collaborative learning', and student and teacher interactions are discussed in 'content delivery, teaching and assessment'.

Peer tutoring and collaborative learning

Peer tutoring draws upon examples in which messaging has been used as a communication medium to facilitate tutoring of school-aged learners by undergraduate student 'tutors'. 'Peer tutoring' as a term lacks clarity to an extent, as the models here typically connect high school students not with each other, but to university undergraduates in relevant subjects. It is distinct from other sections of this theme in that activities which facilitate interaction between learners are discussed in terms of 'collaborative learning', while interactions between learners and teachers are discussed under 'content delivery, teaching and assessment'.

One of the earliest interventions included in this review is an example of peer tutoring. The 'Dr Math' initiative started in South Africa in 2007, with a focus on fostering mathematics skills in school children, running through the mobile phone-based MXit messaging platform. In addition to connecting school children to peer tutors (undergraduates from the University of Pretoria), the system also provided "single-user text adventure games, multi-user arithmetic competitions, multi-user algebra skills competitions, multiple choice quiz competitions, and static lookups for information such as definitions and formulae" ↑(Butgereit, et al., 2010, p.1).

MXit was also used as a platform to support wider Science, Technology, Engineering and Mathematics (STEM) education ↑(Beyers & Blignaut, 2015), however, the platform declined in popularity and the Dr Math initiative ceased activities in 2013. Despite this, a recent survey suggested that there is still a potential role for peer tutoring for high school students' education in South Africa. Reflecting on the demise of Dr Math, ↑Budree and Hendriks (2019) note that WhatsApp is now the most popular platform and would be suitable for this purpose. However, they recommend making any initiatives as "platform agnostic" ↑(Budree, & Hendriks, 2019, p.619) as possible - that is, designing initiatives and materials in a way such that they could be easily repurposed to be run through different platforms or communication channels - in order to avoid similar problems.

↑Campbell (2019) documents a recent project inspired by Dr Math, and carried out using WhatsApp. The aim of the initiative was to improve South African high school students' understanding of mathematics. Groups of five high school students in Cape Town townships were connected to undergraduate student tutors from the University of Cape Town via WhatsApp groups, using the following model:

> *Tutees asked tutors mathematics questions when they were stuck on homework problems. Tutors responded with explanations and leading questions. To encourage communication in the group, weekly messages were sent by a project manager to tutors to share with tutees. The messages included a challenging mathematics question, study tips and encouragement of aspirations to attend university.* ↑(Campbell, 2019, p.1025)

The paper reports on three years' experience of the programme, which has used a design-based approach initially based on peer-tutoring principles ↑(Topping, & Ehly, 2001) and refined iteratively as a result of research activities. Although the study does not investigate the impact of the activities upon learning outcomes, it provides practical design principles for facilitating peer tutoring via WhatsApp, in relation to communication and organization; scaffolding, error management and cognitive conflict; and emotional factors that influence learning (see ↑Campbell (2019) for further details and principles within these categories).

A smaller group of studies addresses interactions between classmates, in collaborative learning activities, although large scale or robust evidence is lacking. ↑Çetinkaya (2019) reports on a small-scale experimental design to test the efficacy of a problem-based learning activity undertaken by Grade 9 mathematics students in Turkey, using a WhatsApp group and a virtual stock exchange app. The group who received the intervention performed better in the post-test than the learners in the control group. Feedback from participants was also sought, and the students who received the intervention showed high levels of agreement that it had been a positive experience and that they would be willing to use WhatsApp for educational purposes again. Advantages of using WhatsApp included "Learning anytime anywhere, resource and material sharing, organizing activities for academic purposes" ↑(Çetinkaya, 2019, p.73). Also focusing on teaching mathematics, ↑Jere et al. (2019) consider the use of WhatsApp to support a small group of South African Grade 12 students (the study focused upon a single group, comprising 10 students and one teacher). Findings suggest positive experiences of collaborative learning, sharing resources and extending educational time beyond the classroom, although the analysis is limited.

Focusing on the use of social media (including WhatsApp) to support learning English as a second language in a South African school, ↑(Rwodzi, et al., 2020) investigated the experiences of six teachers and 12 learners. Similar to other studies, the sample is small and analysis is limited, but building group communication and being able to use multiple modalities to communicate and share information are identified as benefits. ↑Suhaimi et al. (2019) also examine the use of WhatsApp in language learning, in the context of eight Grade 6 primary school pupils in Malaysia. It provides an interesting example of how an existing teaching activity - the 'Curriculum Cycle', which comprises four stages for writing lessons - was adapted for use through WhatsApp. Although the students showed an increase in scores in the post-test, the sample was too small to be conclusive.

↑Della Líbera and Jurberg (2020) present a case study of using WhatsApp to facilitate discussions within a group of 13 visually-impaired students and three teachers in Brazil, using mobile devices equipped with assistive technology (AT). Students reported a preference for mobile devices with AT, being easier to use than computers. Over the course of 11 weeks, the group was used successfully to facilitate discussions around a range of health-related topics, and with varying levels of individual engagement. While the study is small-scale and not rigorously evaluated, it is interesting to note the example of using WhatsApp to support visually-impaired learners.

These studies suggest that there are potential benefits for collaborative learning through apps such as WhatsApp, although the scope and rigour of the studies included here is limited. While there is likely to be a greater body of knowledge associated with understanding collaborative learning through messaging in higher education settings, there is a need for further research in relation to school-aged learners (notwithstanding the relevant legislation and age restrictions, and potential safeguarding concerns).

Content delivery, teaching and assessment

This theme explores two ways in which more formalised support and educational provision can be facilitated through messaging. First, messaging as a medium to distribute educational materials; and second, activities which allow students to interact with teachers. It is notable that there is a greater focus in the research literature on the latter. Models which allow learners to communicate with teachers are technically similar to peer tutoring, although less informal and more frequently linked to formative assessment.

The MobiLiteracy Uganda Program is a robust example of delivering content through messaging ↑(Pouezevara, & King, 2014). The program was designed with the goal of enhancing literacy in primary school pupils (Grades 1 and 2), by delivering audio content and SMS support. It was deployed and evaluated during 2013. Although the program did not involve interaction with teachers through messaging, it was highly reliant on active support to learners from parents, which is particularly important to note for reaching younger learners. 168 parents, across eight schools in a district of Kampala, participated in the study. Parents were assigned to one of three experimental groups:

- *Group A – Mobile phone content: Provided with a mobile phone and the MLIT 91-day SMS+audio product delivered to the phone daily.*
- *Group B – Paper-based content: Provided with a paper-based version of MLIT, which is a printout of all of the audio and text messages delivered to Group A.*

- *Group C – Control group receiving one-time verbal literacy message: Not provided with any literacy materials or support. At the time of assignment into the different groups, provided with a brief, one-time verbal message to support children's literacy* ↑(Pouezevara, & King, 2014, p.vi)

The groups receiving the intervention - whether by mobile (A) or paper (B) - showed increased learning gains in comparison with the control group (C). A key finding from the program was that while the medium of instruction did not lead to significant differences in learning outcomes, the material did empower parents to actively support their childrens' education ↑(Pouezevara, & King, 2014).

The role of parents and caregivers is a key part of any intervention supporting education in the context of home rather than school, as adults are gatekeepers to mobile phone access in many contexts. In the Covid-19 pandemic, where schools have been completely shut, the role for parents and caregivers in facilitating their children's education - and how to support them in this role - has been brought to the fore. Simple text-message-based reminders have demonstrated improvements in promoting reading with young children ↑(Mayer, et al., 2019; ↑York, et al., 2018), although these studies were carried out in a high-income context. This 'nudging' in education has been shown to be most effective when interventions are aligned with participants' beliefs and behaviours ↑(Damgaard, & Nielsen, 2018), which calls for a greater focus on how it can be used in a wider range of contexts. ↑Madaio et al. (2019) consider how such interventions could be adapted for low-literacy caregivers, through interviews with parents in Côte d'Ivoire. The interviews revealed that parents are keen to be involved and already play a role in supporting their childrens' literacy development, although levels of literacy vary, and they expressed a preference for French. Although the study is based on a small sample, the authors make practical suggestions for designing potential interventions, including drawing on culturally-relevant examples when designing activities, and designing for interaction and support with a wider group than parents alone, such as siblings and other peers ↑(Madaio, et al., 2019).

While ↑Pouezevara and King (2014) did not find significant differences between paper and mobile-based delivery, it is difficult to judge whether this finding would apply in other contexts, as further studies which directly compare the learning impact of delivering content through messaging alone are rare. One example is ↑(Dehghan et al. (2017), who conducted a small-scale intervention which compared delivery of content through textbooks and WhatsApp, and found no significant difference in test scores between both groups.

Other uses of messaging can be more interactive, such as using messaging for simple formative assessments. Note that although the studies included in this section of the review fall outside of the time period for inclusion in the analysis here, ↑Valk et al. (2010) review several early mobile learning-based pilot studies in LMICs in Asia. SMS is used for assessment in several of the case studies in the review ↑(Valk, et al., 2010).

In the context of the Covid-19 pandemic, ↑Angrist et al. (2020a) present the results of a randomised control trial of an intervention using phone calls and SMS messages to support education during school closures in Botswana. This builds on previous work using phone call-based assessments; while SMS may not be suitable for all types of assessment, elements of oral assessments (such as the Early Grade Mathematics Assessment, EGMA) could be adapted for text messages and potentially be more cost effective ↑(Angrist, et al., 2020b). The study was conducted with a sample of 4,500 families with children in Grades 3 to 5, conducted over a period of 4 weeks. Alongside a control group, families were assigned to one of two intervention groups: "we provided "two low-tech interventions: (a) one-way bulk SMS texts with multiple numeracy "problems of the week" and (2) SMS bulk texts with live phone call walkthroughs of the problems on a 15-20-minute phone call" ↑(Angrist, et al., 2020, p.5). Both interventions resulted in significant learning gains compared to the control group. Learning gains were measured by performance on an ASER (Annual Status of Education Report) test; both interventions showed marked improvements, while those who received SMS and a phone call showed a greater improvement than SMS alone. Similar to MobiLiteracy, the intervention also increased parental engagement.

In addition to providing robust evidence of efficacy, the study is also notable in that it considers cost effectiveness of the intervention, relative to other potential measures:

> *For the SMS-only treatment arm, the total cost by the four-week juncture was about $3,200 USD. For phone calls, the marginal cost above the bulk text message was $17,800. This equates to $2.13 per child reached in the SMS group and $14 dollars per child reached in the phone and SMS group. Given average treatment effects of 0.16 and 0.29 standard deviations, this translates*

> *to $13.3 USD per standard deviation gain in learning for the SMS-only group and $48.28 USD per standard deviation gain in learning for the SMS and phone group.*
>
> *These estimates are cost-effective relative to the literature. We make comparisons using a $50 benchmark which yields a 1 standard deviation gain for our phone and SMS treatment. As a comparison, conditional cash transfers in Malawi yielded an extra 0.01 standard deviation per $50; an extra contract teacher and streaming by ability yielded 0.47 standard deviation gain per $50 in Kenya; and remedial tutoring in India yielded an effect of 0.65 standard deviation gain per $50. These comparisons suggest both low-tech interventions tested are cost-effective relative to other popular and effective interventions in the education literature.* ↑(Angrist, et al., 2020, p.25)

Also related to assessment, ↑Zualkernan et al. (2014) present findings from an EdTech intervention undertaken with 24 schools in Pakistan. While the main form of technology used was satellite-linked tablet computers, SMS were used to communicate the results of learners' assessments to parents, community workers, and educational administrators ↑(Zualkernan, et al., 2014).

For activities such as multiple choice practice questions, responses can potentially be automated. ↑Poon et al. (2019) deployed and evaluated an intervention providing practice exam questions through WhatsApp and SMS to students at three Francophone high schools in Cameroon. Students responded to practice questions posed via SMS or WhatsApp, and received correct answers, feedback and further questions in response from the quiz manager. Engagement with quizzes was higher through SMS in comparison to WhatsApp; for the latter, students were more reliant on parents as gatekeepers to smartphones. Although learning outcomes were not measured, benefits to students included being prompted to study, including discussing the quizzes with their peers as a result. Limitations included the extent to which content matched their schools' requirements, unfamiliarity with interacting with automated messaging, and the need to design systems which users (and gatekeepers) will trust ↑(Poon, et al., 2019).

Although the discussion in this section has considered content delivery and teacher support separately, both can be combined through SMS. An example of this model is Eneza Education, which operates in Kenya, Ghana and Cote D'Ivoire. Its 'Shupavu291' product is a mobile phone-based educational platform, which provides learners with curriculum-linked educational materials, quizzes, and allows users to submit questions to teachers, via SMS ↑(Kizilcec, & Goldfarb, 2019). Being SMS-based, the platform is intended to serve rural and marginalised communities, and currently serves approximately five million users (ibid.). Research by the company suggests that it is successfully reaching lower-income households, and that users perceive the platform to be beneficial ↑(Eneza Education, 2018).

Although comparisons are not made with alternative or pre-existing models of provision, ↑Kizilcec and Goldfarb (2019) analysed a large dataset of Kenyan Shupavu291 users (n=942) in order to identify predictors of student success when using the platform. Factors associated with higher quiz scores included: possessing a stronger growth mindset; gender (higher quiz scores associated with female students); higher school grades; and greater satisfaction with the learning environment. The impact of receiving help depends on the source; those who "receive study help from parents or a tuition teacher have lower quiz scores than those who receive help from friends or classmates" ↑(Kizilcec, & Goldfarb, 2019, p.5), which may support the value of student-student communication through messaging. The authors conclude that the efficacy of products such as Shupavu291 could be enhanced by designing interventions and nudges to also promote a growth mindset in learners ↑(e.g. O'Rourke, et al., 2014).

Also using Kenyan Shupavu291 data, the authors examine patterns of disengagement and re-engagement with the platform. Similar to engagement with Massive Open Online Courses (MOOCs), a large proportion of learners do not use features of the platform after initial enthusiasm; in contrast with MOOCs, however, Shupavu291 users are more likely to resume use at a later date ↑(Chen, & Kizilcec, 2020). This may be because use is linked to school-based studies and the academic calendar, as the authors also reported increased use within school holidays and examination preparation in a third study ↑(Kizilcec, & Chen, 2020).

Examining patterns in use of the Shupavu291 platform in further detail, ↑Kizilcec and Chen (2020) present a thorough statistical analysis of a large-scale dataset (93,819 Kenyan students in Grades 6, 9 and 12) to identify patterns and clusters in how students interact with the platform. Research questions addressed engagement over time, whether this differs according to grade, and looking for differences between the

ways in which more and less active students use the platform. As Shupavu291 content is aligned to the curriculum, use varies according to the school year; higher levels of activity are associated with self-directed study in school holidays and in preparation for examinations. Some students demonstrate greater engagement and use throughout the year. Only minor differences in engagement were observed according to grade level.

> *We find that Kenyan students use mobile learning to complement formal schooling, bridge gaps in instruction, and prepare for standardized exams. The majority of students use it as a short-term study resource for a day. A smaller subset of students use it over extended periods like a low-cost tutor, and they exhibit promising learning behaviors and performance, even though we do not find formal evidence of learning gains in this study.* ↑(Kizilcec, & Chen, 2020, p.162)

While the study provides insights into how the platform is used to complement formal schooling, the authors did not find evidence to suggest that use of the platform is associated with enhanced learning outcomes.

Teacher professional development

The use of messaging to support teachers - either in pre-service training, or continued professional development - emerged as one of the main themes in the literature. Articles within this theme will be discussed according to two sub-themes. The first sub-theme includes instances where the technology was used to provide more structured support to individuals through text prompts, while the second sub-theme includes instances where the technology was used more informally to promote interaction within groups and build communities of practice.

In several of the initiatives reviewed in this section, the role of messaging serves to support teachers in their classroom practices. In the context of the current pandemic, where in-person teaching has been suspended, such models would not be directly transferable. However, there is still some scope to apply elements in the current context. Although teachers are less likely now to be in the classroom, messaging could be used to connect teachers - however their roles have been adapted in the current crisis - to provide a supportive network in uncertain times, distribute repurposed educational materials, and share emergent practices. Professional development activities, and prompts for reflection, could be used to keep teachers engaged while not actively in schools. This could be particularly important to distribute information in preparation for schools reopening, for example.

Structured prompts and coaching

This sub-theme comprises a small number of studies, which are notably rigorous and provide evidence that this type of intervention can have positive impacts for teachers and learners. Simple but effective strategies to enhance teachers' practices and motivation have been demonstrated using SMS ↑(McAleavy, et al., 2018).

In the SMS Story initiative, SMS was used to deliver daily content, including stories and lesson plans, to English teachers. The project was initially evaluated in Papua New Guinea ↑(Kaleebu, et al., 2013), and subsequently replicated in India ↑(Pratham Education Foundation & Voluntary Service Overseas, 2015). In Papua New Guinea, the initiative was trialled with 42 Grade 1 and 2 teachers across 20 schools in remote areas. Data collected mid intervention showed an increase in a range of classroom practices. Practical reflections include discussion of how to reduce the costs of mass SMS; timing of sending messages earlier, so teachers have more time to prepare; and ways to incorporate a wider range of media ↑(Kaleebu, et al., 2013). The impact on learners was assessed in the intervention in India, which included over 2,400 students, from Grades 4 to 8, across 50 schools, including an intervention and a control group for comparison ↑(Pratham Education Foundation & Voluntary Service Overseas, 2015). At the end of the study, pupils in the intervention group were found to have increased gains on a range of reading measures, compared to the control group. Given the effects and low cost, the authors of that study conclude that the intervention could be rapidly adopted at scale. Their recommendations for future development include: Developing stories and lesson plans tailored to different local settings; incorporating more text book materials into the stories; and considering a wider range of technology

(WhatsApp is given as an example - but with a caveat to also ensure means of distribution to teachers without smartphones) ↑(Pratham Education Foundation & Voluntary Service Overseas, 2015).

'English in Action' was a professional development program to support English teachers in Bangladesh ↑(Power, et al., 2012). Mobile devices were used to distribute materials to teachers, initially piloted with files loaded on to MP3 players, and later distributed through pre-loaded SD cards. Part of the initiative involved piloting the use of SMS messaging in addition to the materials, "to encourage teachers to try out activities in their classrooms and reflect upon successes and challenges" ↑(Power, et al., 2012, p.511). However, the lack of support from mobile phone providers for Bangla language SMS, and the character limits at the time, limited the efficacy of the messaging component.

Another initiative, the 'Leadership for Learning' (LFL) program, was undertaken in Ghana, with a focus upon the professional development of school leaders (↑Swaffield et al., 2013). As part of the program, SMS messages were sent via Skype as a way to communicate with the cohort of 175 participants. Messages were sent on Mondays during term time, from an LFL program Skype account, to participants. The messages sent from LFL comprises five types: "announcements; prompt to thought or action; request for feedback – open; request for feedback – 'yes'; and sharing participant response" ↑(Swaffield, et al., 2013, p.1298). Nearly all of the messages prompted responses from participants, to varying degrees. Although as a pilot, the study did not evaluate the impact of the activity on participants' learning or practice, the engagement and discussion was promising. The authors note that this approach has the potential to easily scale to support much larger training programs.

↑Brion (2019) also presents a study focused on educational leadership training in Ghana, instead using WhatsApp as a communication channel. Following short face-to-face training sessions, 23 participants joined a WhatsApp group. Conversation triggers were sent to the participants as a group, in order to sustain discussion about the training after the sessions. Interviews were held with participants to determine whether they felt that this had been successful. Reported benefits included being reminded about the training contents, networking, enhanced motivation and peer learning. Note that this study is included in the current sub-theme because of the use of discussion prompts; however, it is also related to the next section as the interaction initiated was a group, and the author notes that it could be considered a community of practice ↑(Brion, 2019).

Two projects provide rigorous evidence of the benefits of using messaging as part of a blended approach to teachers' professional development activities. ↑Jukes, et al. (2017) evaluated part of the Health and Literacy Intervention (HALI) project, focusing on the activities undertaken with teachers, which had an overall goal of improving literacy in Grades 1 and 2 at government schools in Kenya. The literacy intervention involved supporting teachers through three activity types: provision of sequential semi-scripted lesson plans; a three day training workshop for teachers; and continued support for teachers for two years, by text messaging.

> *Ongoing support for teachers for two years through weekly text messages providing brief instructional tips and motivation to implement lesson plans. Teachers also received credit of $0.50—around 50 Kenyan shillings—each week for their mobile phones. A total of 200 Kenyan shillings over the course of a month represents about 1% of the 16,662 Kenyan shillings starting salary for primary school teachers.* ↑(Jukes, et al., 2017, p.451)

The efficacy of the intervention was measured using a cluster randomized controlled trial research design, across a substantial sample (101 schools, half assigned to control and half to the intervention, equating to approximately 2,500 children in total). A range of educational assessments were used to measure students' progress toward a range of literacy-related outcomes. Classroom observations and interviews with teachers were also conducted. The analysis showed that the intervention led to a change in classroom practices, and sustained positive impacts in terms of most of the measures of childrens' literacy after two years. Furthermore, the beneficial impacts were greater for girls ↑(Jukes, et al., 2017).

SMS was used in a similar way as part of the Malawi Early Grade Reading Activity project ↑(Kipp, 2017; ↑Nyirongo, et al., 2018), to support continued development after training sessions. SMS was used as a potential way to extend and complement the beneficial effects of coaching, with SMS being a cost-effective, scalable way to maintain contact between sessions. Over a period of 6 weeks following training, at least three messages were sent to teachers per week, covering topics including "encouraging specific practices, reminders about student behavior, and encouragement and motivation" ↑(Nyirongo, et al., 2018, p.136). The study also presents a discussion about the relative cost effectiveness of SMS.

Although early results suggested that the SMS campaign had a positive impact (Kipp, 2017), the efficacy of the SMS intervention was, however, inconclusive, due in part to the fact that a number of the teachers receiving the messages then shared them with others (Jukes, et al., 2017).

Mtebe et al. (2015) present a study in which SMS-based quizzes were used to assess teachers' subject knowledge, following a training programme, in Tanzania. 486 teachers took part, over a period of eight weeks. Few teachers scored highly, and most of the participants disagreed that the initiative had improved their knowledge and skills, was convenient, or enjoyable. This is attributed in part to technical issues around reliability of receiving SMS on time, and limitations of the format (Mtebe, et al., 2015). Assessment alone, without feedback and support, may not be an effective use of the technology.

Communities of practice

This sub-theme is distinct from the previous section as the emphasis is on communication within groups of teachers, in order to share experiences and build communities of practice. The earliest paper within this sub-theme describes an intervention at Stellenbosch University, South Africa. Part of the teacher training programme involved telematic sessions; WhatsApp was used in order to compensate for the lack of interaction within the sessions (Ndlovu, & Hanekom, 2014). A qualitative analysis of conversations and feedback from 73 trainee teachers in mathematics and science suggests that this is an effective way of building teachers' subject and pedagogical knowledge, and networking between teachers (Ndlovu, & Hanekom, 2014). Also focused on trainee teachers in South Africa, Mabaso and Meda (2019) present a small-scale qualitative analysis of how two lecturers and 16 students use WhatsApp to support their training and teaching. In addition to being useful in order to relay practical and logistical course-related information from lecturers to student teachers, it was also perceived to be useful in collaborative learning, and providing students with a further way to discuss their course with the lecturers (Mabaso, & Meda, 2019). Similarly, the perceived value of contact and interaction with lecturers is highlighted by Habibi et al. (2018), in their study of 42 student teachers' use of social networking tools (including WhatsApp and Telegram, as messaging services) in Indonesia, while undertaking teaching practice.

Moodley (2019) offers a further example of how WhatsApp can be used to build communities alongside formal TPD. The sample comprised 18 teachers in a rural part of South Africa. The group actively discussed curriculum and assessment issues, and demonstrates the potential of WhatsApp for continued monitoring of in-service teachers, particularly in rural areas. Issues of TPD may be particularly important in rural areas, where teacher shortages may be more acute than in urban areas, and there may be fewer opportunities for TPD. The use of WhatsApp as part of a wider professional development and monitoring programme is also the focus of Nedungadi et al. (2018), in a rural setting in India. The 'AmritaRITE' programme "uses a model of remote teacher monitoring and support using a combination of two specially-designed apps for attendance and student assessments, along with WhatsApp to send photos and text regarding daily attendance, assessment records, activities like yoga, community services etc." [sic] (Nedungadi, et al., 2018, p.120). Focusing on the WhatsApp component, the analysis drew upon a large sample of messages (8,968) from 26 participants. Topics discussed aligned with the project's goals of enhancing attendance, teacher empowerment and community engagement (Nedungadi, et al., 2018).

Different communication tools can have different affordances for teacher training. Sun et al. (2018) report on an intervention to promote communication and interaction between pre-service teachers in China. 78 students were asked to use one of two communication tools (discussion posts via Moodle, or messaging via WeChat) as part of a learning activity, and then used the other tool for a second activity. Students were asked to choose their preferred tool for a third activity. While Moodle use was found to be associated with a greater degree of collaborative learning and knowledge exchange, greater social interaction occurred via WeChat (Sun, et al., 2018).

Further examples reinforce the potential benefits for messaging apps and social media to foster informal professional networks, in Pakistan, Bhutan (Impedovo, et al., 2019) and India (Wolfenden, et al., 2017). Both also highlight the link between networks and sharing of Open Educational Resources (OER). Much larger informal communities can be better supported by other forms of social media, as messaging groups are not open to organic internet traffic in the way that Facebook groups are, for example. See Bett and Makewa (2020) for an example of how Facebook groups can be used for similar purposes - to build support, and enhance subject and pedagogical knowledge - at a much larger scale. It is also worth

noting that online community groups can also benefit caregivers of children with special educational needs; for example, ↑Cole et al. (2017) examine the use of a WhatsApp group to support caregivers of children with autism in South Africa.

Supporting refugees' education

The third cluster of studies which emerged from the literature search includes instances where messaging has been used to support refugees' education in LMICs. Research on use of EdTech among refugees relevant to the context of the Covid-19 education crisis has been addressed by the ↑United Nations High Commissioner for Refugees (2020), the Education Development Trust (↑Hallgarten, et al., 2020) and others, including within the EdTech Hub's series of RERs ↑(Ashlee, et al., 2020). The reality of compounded crises in the lives and education of refugees is widely recognised within the sector. Disruption to refugee education by Covid-19 represents just such a challenge, albeit significantly different from double displacement, refugees returning to conflict zones or crises faced within camps. Across these contexts, refugees have employed technology to access information about continued educational opportunities as well as to open doors to new opportunities where the displacement or crisis they have faced has closed a preferred education pathway.

This section focuses particularly on the ways that messaging and social media have enabled those choices for refugees. The resilience demonstrated by refugees and the communities supporting them in the face of ongoing fragility and instability indicates a range of possible responses for other stakeholders in the current crisis of Covid-19-related education interruption. This theme explores the lessons that can be applied to Covid-19 education response from this literature on the experiences of refugees with social media and messaging related to EdTech, building on the findings from the previous rapid evidence review on refugees ↑(Ashlee, et al., 2020).

The following sections draw upon the studies identified through the literature search to build on the findings of ↑Ashlee, et al., (2020) with specific reference to messaging applications and social media, in highlighting the particular importance of these tools in two primary areas. The first sub-theme focuses upon communicating with learners, parents and teachers about opportunities which maintain continuity of education. The second addresses the potential for this form of technology to be used to open up broader horizons of educational opportunities, where previous education pathways are closed.

Continuity of educational experience

This sub-theme reflects the importance of communication in maintaining continuity and stability in the midst of displacement and crisis. Social media and personal messaging, which are often accessed on personal devices, provide crucial information to groups who are otherwise marginalised, and not given up-to-date information ↑(Dahya, et al., 2019), ↑(Bellino, & the Kakuma Youth Research Group, 2018). Addressing these gaps in access to information for young people (and girls particularly) reduces uncertainty and anxiety, allowing learners and their families to focus on their education. In refugee contexts where security is a major concern, the use of messaging to keep learners and their families aware of incidents is another example of messaging being used to develop a sense of stability, which is key for creating an enabling environment and mindset for learning ↑(Sork, & Boskic, 2017).

In addition to supporting learners and their families, messaging also supports teachers. As noted in ↑Ashlee, Clericetti and Mitchell (2020), in refugee contexts many educators are not formally qualified teachers. Peer support has therefore been one approach to addressing this. In the Kenyan "Teachers for Teachers" programme reviewed by both ↑McAleavy, et al. (2018) and ↑Mendenhall, (2017). The purpose of the programme was to "provide teachers with support and expertise that geographical limitations would otherwise prevent" ↑(McAleavy, et al., 2018, p. 40). The role of mentor teachers in this process allowed the programme to break down not only the physical isolation of teachers, but also reinforced their teacher identity by connecting teachers socially with other teachers.

> *The mentors' role was to connect teachers in groups of four to five through WhatsApp and Facebook, which they then used to facilitate discussions on good practice and provide advice on issues participants were facing in the classroom* ↥(McAleavy, et al., 2018, p. 40-41).

The importance of these programmes in supporting teachers is not only evident in their own well-being and improved practice, but in improved relationships and communication with students ↥(Mendenhall, 2017, p. 9). In an in-depth look at a specific group of refugee teachers using messaging to enhance their teaching practices, ↥Motteram, et al. (2020) analyse the WhatsApp messaging history of 18 teachers in Za'atari camp in Jordan. Their findings were that 45% of messages sent over a 7-month period engaged with the teachers' professional development, while 30% related to organisation and 25% on personal messages ↥(Motteram, et al., 2020). This demonstrates that a balance of needs are addressed through social messaging platforms, and that the personal nature (given they are accessed on personal mobile devices) allows a fluidity between seeking professional and personal support.

The parallels between the physical and social isolation by refugee teachers, and current challenges of Covid-19-related social distancing are clear, and the need to maintain continuity of identity for teachers is an important area for building up resilience.

Social media and education system renewal

While it is ideal to maintain continuity both for refugee learners and teachers, as part of ensuring greater stability for communities facing displacement and crisis, this is not always possible. This sub-theme addresses literature looking at system-wide recovery in the face of educational disruption, and the new educational pathways that may open when continuity of education provision is broken.

↥Shekaliu, et al., (2018) focused on the mobilisation of host communities to support refugees in education through Facebook in Malaysia. The Facebook messenger platform allowed the refugees to interact with the local community and receive tutoring support in a way that broke down barriers and tensions that often arise between refugee communities and host communities. The expansion of social networks across these two communities, and the improved communication also provided opportunities for integration and a broadening of educational horizons for the refugees.

A broader approach including both Facebook and WhatsApp is examined in ↥Alfarah, & Bosco (2018) regarding recovery efforts in Syria. The research methodology included qualitative case studies as well as social media discourse analysis of three programs: Nafham, Jusoor and UNICEF in Arabic. One function that distinguished the use of social media in these programmes from that of others was the collection, management and sharing of data to provide regular feedback. For example Nafham ran a poll asking:

> حسب معرفتك بنفهم في الوقت الحالي.. تفتكر ايه اكثر حاجة محتاجين تشتغل عليها مع بعض في نفهم علشان تحسّن من إفادتها للمجتمع؟ [1]
>
> *According to your knowledge of Nafham in the current time.. Which do you think is most needed that we work on together in Nafham so that we can improve its benefits for society.* [Author's translation] ↥(Alfarah & Bosco, 2018, p. 57)

This poll on their closed Facebook group "Crowd Teaching" allowed Nafham to discover that the teachers in their project need professional development opportunities - which was otherwise difficult for them to find out due to embargoes on tech companies in Syria limiting their access to survey applications ↥(Alfarah & Bosco, 2018, p. 57). Social messaging applications can circumvent such regulations due to their vast transnational influence which allows them to work outside of prevailing legal jurisdictions. However, their primary social function also means they are not seen as 'threatening' software by those who might limit their reach.

[1] Within the text of ↥Alfarah & Bosco (2018), (which is in Spanish) the translation provided is "Según tu opinión... ¿Cuál de las siguientes opciones sería prioridad y necesaria para que podamos junto ayudar a la sociedad?" this translation of the Arabic is not entirely accurate, and should be in English " According to your knowledge of Nafham in the current time.. Which do you think is most needed that we work on together in Nafham so that we can improve its benefits for society." The option "Professional [development] workshops" was the most widely chosen response.

In addition to collecting data, social media was used to share results, as in the case of Jusoor's whatsApp group in which the head teacher encouraged his colleagues with their positive results:

"لازم تكونو فخورين بالانجاز...مثال من صف من الصفوف ،،، فيكن تشوفو التقدم وانو ما في حدا اقل من 50%"[2]

> *You must be proud of the results... an example from one of the classes .... and you can see the progress and it is that no one is less than 50%* [Author's translation](↑Alfarah & Bosco, 2018, p. 56)

These examples of ad hoc, spontaneous data management through social media indicate an innovative appropriation of social platforms in challenging circumstances to re-establish educational systems which have faced complete disruption. Alongside the other examples of social media and messaging use in refugee education, these examples commend the innovative use of existing tools to enable both learners and teachers to continue in their roles.

[2] Within the text of ↑Alfarah & Bosco (2018), (which is in Spanish) the translation provided is "Tenéis que estar orgullosos de vuestro trabajo. Un ejemplo de uno de los clases y podéis ver la evolución de los resultados. Todos más del 50%."

4. Summary and recommendations

This rapid evidence review shows that there is a growing body of academic literature around the use of mobile phone-based messaging - including basic SMS, and messaging through social media and apps - to support education in LMICs. 45 studies were identified through a systematic search and screening of the academic literature. Many of the studies included in the sample were published within the past three years. However, since the use of messaging to support the education of school-aged children is not well established, there is not yet a substantial body of rigorous research to build upon. The majority of papers included in the thematic analysis were small-scale interventions, and their impact on education not fully evaluated. A full quality assessment of papers was not applied, in order to allow as wide a range of relevant research-informed examples to be included as possible, given that a relatively small number of studies were uncovered by the literature search. As a topic which is becoming a more frequent part of educational interventions, and indeed part of national responses to Covid-19-related school closures, this review will be a useful reference tool for advancing the field.

Notwithstanding the limitations of the RER approach and variation in rigour in the included studies, the articles reviewed suggest that the use of messaging can have positive effects for education in LMICs.

- **Messaging can be used in a range of learning activities, through a combination of sharing educational materials, with interaction between pupils, peers, caregivers and teachers.** Use is more often focused on making use of the potential for the technology to foster interactions, rather than just as a way to deliver content alone. Interventions often combine multiple elements; likewise, messaging could be used as an interactive complement to broadcast media. To allow for flexibility and greater reach, materials should be designed in ways which are not platform-specific and can be adapted for different tools. Assessments and strategies can be adapted from face-to-face and telephone-based instruction. There is a trade-off in efficacy and cost here; for example, telephone-based interactions can be more effective but are more expensive, while messaging is lower cost and more readily scalable.

- **Messaging can be an effective way of supporting teachers, both in terms of providing activities such as lesson plans, and motivation.** Initiatives which deliver lesson plans and guidance have been shown to foster a wider range of classroom practices, and show good potential to be applied at scale. Messaging is relatively low cost and teaching materials could be tailored to the local context. In terms of supporting teachers' professional development, messaging has been shown to be an effective way of maintaining contact and support in addition to in-person training. Materials adapted for messaging can also have a wider reach through being readily circulated among colleagues, and sharing of knowledge through informal communities of practice.

- **Caregivers are key gatekeepers to mobile phone access.** The role of parents and caregivers is particularly important in relation to supporting younger learners. Messaging is not only a way to send materials - using messages to send reminders and suggested activities can help to get parents and caregivers actively involved in using materials with children. Culturally-relevant design of materials and local languages can help promote this.

- **The use of messaging to support refugees highlights its flexibility and resilience - which may be useful for ongoing disruption and uncertainty in the pandemic and beyond.** Refugees' education faces multiple disruptions; the flexibility of messaging has contributed to its use in these complex circumstances. As such, this flexibility could also be used to build resilience in terms of being able to switch between modes of teaching - from face-to-face to distance education - if incorporated into a plan for ongoing or emergency school closures. Planning ahead would be required, such as ensuring that schools hold up-to-date mobile numbers, and have educational materials in forms which would be readily deployed this way.

- **There is some evidence to suggest that messaging may promote equity.** For example, the studies include examples which have been successful in remote and rural areas, supporting

SEND students, refugees, and promoting girls' education. However, the equity gains may not be universal - contextual factors will need to be considered carefully. Inequalities could be exacerbated if the technology is not accessible to all, either through general availability of the technology, or different ways in which access is mediated (for example, gatekeepers may hold stereotypical views in terms of gender and technology use). The success of many of the interventions is due in part to the familiarity of the technology, but the design of interventions shouldn't assume that everyone has access and consider how to reach those who would be excluded.

An area which was notably lacking in the sample of studies and would benefit from further discussion is the issue of safeguarding. In some of the studies, parents raised concerns about childrens' use of mobile phones. In the context of the Covid-19 pandemic, childrens' online safety is a concern given the speed at which various activities have moved online ↑(UNICEF et al., 2020). This is not a reason to discount this medium entirely, but does call for a more detailed discussion of how risks can be mitigated and the role that parents, caregivers and teachers can play in doing so.

The review also highlights the need for further research. By focusing on published academic research, the RER does not draw upon projects which are currently in progress and have not had findings published yet. Given the shift to remote and distance education necessitated by the pandemic, there is likely to be further research on this topic published in the future. For example, The EdTech Hub is currently supporting work with The Open University (UK) to conduct novel research building on a recent project to use mobile phones to share children's learning activities and activate local support, to understand how this has provided an equitable alternative in light of Covid-19 while schools in Zimbabwe are closed ↑(Power, et al., forthcoming). While the studies here all suggest that the use of messaging has good potential for promoting a range of positive outcomes for education in LMICs and times of crisis, both for learners and teachers, further robust evidence is required to take the principles demonstrated in small-scale studies to larger programs at scale.

Annex A: Bibliography

Note: Items denoted by an asterisk are included in the final set of 45 studies.

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Annex B: Search terms

Search string

The following search string was used for initial literature searches:

> ("skype" OR "telegram" OR "whatsapp" OR "social media" or "sms" or "text messag*" or "facebook") AND ("education" OR "school") AND ("africa" OR "LMIC" OR "developing world" OR "developing countr*" OR "ICT4D" OR "global south" OR "refugees")

Number of records returned from database, and number included after first round screening

	Total results	Included after title and abstract screening
ERIC	279	22
Google Scholar	2390*	25
Scopus	662	98
Web of Knowledge	369	48

*The first 30 pages - 300 items - of results were screened. Not all of the results were screened because (a) Google Scholar includes a high proportion of non-peer reviewed and grey literature, and (b) records are returned in order of 'relevance'.

Note that additional sources were found via snowball sampling from included studies, and recommendations.

Annex C: Examples of countries using WhatsApp in Covid-19 responses

Examples of countries which have used WhatsApp in Covid-19 responses and policies.

Bhutan	Teachers are using WhatsApp and social media to "assign students with specific chapters to read and a set of questions to respond to. Students are required to answer the questions and send an image of their answers back to teachers to assess." (World Bank, 2020b).
Cayman Islands	WhatsApp for teachers to communicate directly with parents and students, alongside a range of online platforms, broadcast and paper materials. (Center for Global Development, 2020; Cayman Islands Government, 2020).
Dominican Republic	"WhatsApp groups are giving specific support to teachers and parents and provide helpful content." (Center for Global Development, 2020; Cobo, Hawkins & Rovner, 2020; World Bank, 2020b).
El Salvador	"A national call center (accessible via email and WhatsApp) was set up to provide support to parents and students in delivery of educational activities." (Center for Global Development, 2020; Cobo, Hawkins & Rovner, 2020; World Bank, 2020b).
India	Teachers to provide academic support via Whatsapp and over the telephone. (Center for Global Development, 2020; Nath, 2020).
Jamaica	"School-based initiatives using Google Suite, Schoology, Edmodo, Zoom, Skype, WhatsApp, etc. are in place and supported by the Education Officers" (World Bank, 2020b).
Kyrgyz Republic	"Students and teachers will be provided by SIM-cards for free access to the education app, education web pages and to use WhatsApp for free communication." (Center for Global Development, 2020; EdTech Hub, 2020; World Bank, 2020b).
Malawi	The Ministry of Education, Science and Technology will continue to co-ordinate staff using WhatsApp (EdTech Hub, 2020; Republic of Malawi, 2020).
Nicaragua	In addition to a multi-platform response, "WhatsApp and social media are key coordination and communication channels" (Cobo, Hawkins & Rovner, 2020).
Peru	A WhatsApp number has been created to answer questions related to the wider provision of content, through the Internet, television, and radio, via the Aprendo en Casa initiative (Perú Ministerio de Educación, 2020; World Bank, 2020b).
West Bank and Gaza	The Ministry of Education is encouraging teachers to use Facebook, WhatsApp to communicate with students. (EdTech Hub, 2020; World Bank, 2020b).