MOBILE LEARNING STUDIES CONDUCTED IN CERTAIN SECONDARY SCHOOLS IN SOUTH AFRICA FROM 2005 TO 2015: A REVIEW STUDY

Chaka Chaka
University of South Africa

ABSTRACT

Mobile learning studies have been conducted at a secondary school level in South Africa. In particular, most of these studies have been carried out as one-off trials or experiments in one or more schools, on a short-term basis. However, there have not yet been studies that harness and review mobile learning projects undertaken at a secondary school level. To this end, the current study reviewed mobile learning projects conducted at secondary schools in South Africa between 2005 and 2015 which are published in DHET-accredited academic journals. It reviewed such projects by employing eligibility criteria meant to include qualifying journal articles and by synthesising key areas such as educational context, subject domain, research design, sample groups, data sources and summary of findings. The study reveals that three areas, English L1, English L2 and mathematics constituted the primary focal areas of the reviewed studies.

KEYWORDS

Mobile learning, mobile technologies, mobile devices, secondary schools, accredited academic journals

INTRODUCTION

The advent of mobile phones—and later of different mobile devices—was to have heralded an exponential growth in mobile learning not only in South Africa but also in various parts of Africa. With the increasing use of mobile phones, mobile learning is gaining traction and currency in South Africa to varying degrees. This trend is hardly surprising since the adoption and use of mobile phones is an almost universal norm. However, even though mobile phone diffusion is high, mobile learning as a pedagogical practice has not reached a critical point at which it can be deployed as a standalone form of learning. It is also not viewed as mainstream learning to be embedded into formal school curricula. Often, it is utilised informally as a supplemental or support form of learning (Deumert & Masinyana, 2008; Freudenberg, 2009; Guy, Chaka, Ngesi, Mehigan, Pitt, Simbulan … Williams, 2010; Kreutzer, 2009). Moreover, in most instances, mobile learning is deployed as part of short-term or one-off projects or initiatives. That is, it is rarely utilised on a long-term, sustainable basis. Furthermore, since the dawn of mobile learning in South Africa, there is a paucity of review studies on mobile learning projects, initiatives or experiments undertaken at the secondary school level in South Africa. There is also no evidence of studies focusing on

meta-analyses of mobile learning that have taken place at the secondary school level in South Africa.

The current review study is limited to the following aspects:

- Studies on mobile learning published in DHET-accredited journals between 2005 and 2015 in South Africa;
- studies focusing on mobile learning/teaching purposes at secondary school level;
- studies based on empirical evidence using quantitative and/or qualitative research methods;
- studies having learners as a primary target group and
- studies published in English.

The reason for selecting mobile learning journal articles published in the Department of Higher Education and Training (DHET)-accredited journals is that such articles are peer-reviewed and have, as a result, been quality-assured. Studies published in edited books were excluded as it is often difficult to ascertain their peer-review process. In this regard, the duration, 2005 and 2015 was considered to mark the first ten-year period during which studies on mobile learning at secondary school level in South Africa were published in DHET-accredited journals (see Deumert & Masinyana, 2008; Freudenberg, 2009; Geertsema, Hyman & Van Deventer, 2011; Winzker, Southwood & Huddlestone, 2009).

PURPOSE OF THE STUDY

The current review study had three purposes. These were to:

- Review mobile learning technologies that were used for teaching and learning purposes at secondary school level in South Africa between 2005 and 2015 as reported by selected reviewed studies;
- explore subject domains, research foci, research designs, sample groups, and data collection tools of these reviewed studies and
- compare and synthesise the main findings of these reviewed studies.

In this context, the paper uses synthesis to refer to aggregate and integrate key findings of the reviewed studies (see Schick-Makaroff, MacDonald, Plummer, Burgess & Neander, 2016; Wyborn, Louder, Harrison, Montambault, Montana, Ryan … Hutton., 2018). Given the aforementioned purposes, the present study seeks to contribute to the field of mobile learning as it relates to the secondary school sector in South Africa from a review perspective. As highlighted earlier, there is a dearth of review studies on mobile learning at a secondary school level in South Africa. Therefore, this study is intended as a contribution to this segment of mobile learning research at the secondary school level in South Africa. In a different but related scenario, there are review studies that have been conducted on mobile learning in Grades K–12 from 2007 to 2014 (Liu, Scordino, Geurtz, Navarrete, Ko & Lim, 2014) and on the synthesis of the use of mobile devices for K–12th grade English language learners in the United States (Ok & Ratliffe, 2018).

PROBLEM STATEMENT

There are mobile learning studies—including mobile learning projects—that have been conducted at secondary school level in South Africa after 2005. Some of these studies have been trials or experiments on an individual or group basis (Deumert & Masinyana, 2008; Geertsema et al., 2011; Vosloo, Walton & Deumert, 2009a; 2009b; also cf. Ok & Ratliffe, 2018). Moreover, some of these studies have been published as journal articles, books or book chapters, while others have been published as standalone projects on the websites of the respective projects (Ford & Batchelor, 2007; Ford & Botha, 2007). Still others remain as dissertations or theses published on the portals of given universities (Freudenberg, 2009; Le Roux, 2013; Mcetywa, 2014; Reynolds, 2010). Nevertheless, no sufficient body of research exists that has collated, compared and harnessed mobile learning studies conducted at secondary schools in South Africa into a meta-synthesis, meta-analysis or systematic review (Kaliisa & Picard, 2017). Therefore, the current study is an attempt to collate, compare and harness mobile learning studies conducted in secondary schools in South Africa between 2005 and 2015.

Research Questions

Given the problem framed above, the study set out to answer the following research questions:

- Which mobile learning technologies were used for teaching and learning purposes in certain secondary schools in South Africa between 2005 and 2015 according to the reviewed studies and were these technologies used as part of formal learning and teaching or not?
- At what level of education and under what educational context were these mobile learning technologies used in each school?
- What were the subject domains, the research foci, the research design, sample groups and data collection tools of these reviewed studies?
- What are the reported main findings of these studies?

RESEARCH METHODOLOGY

This study followed an integrative review method. The latter has the following features: critiquing or synthesising evidence (as its purpose), narrow or broad research questions and searching for research articles and other published texts (Chaka, 2019, 2020; Okoli & Schabram, 2010; Schick-Makaroff et al., 2018; Russell, 2005; Snyder, 2019; Whittemore & Knafl, 2005). In this case, Russell (2005) and Whittemore and Knafl (2005) argue that the integrative review method is open to diverse methodologies (e.g., experimental and non-experimental research). As mentioned earlier, the present study set out to compare, integrate and synthesise the findings of mobile learning studies conducted in certain secondary schools in South Africa and had been published in DHET-accredited journals between 2005 and 2015. Its four research questions are narrow, as framed in the preceding section. Moreover, its search, screening and selection procedures are outlined below (see Tables 1 and 2).

Three stages were followed in the review process: searching for the relevant studies online, applying the inclusion/exclusion criteria to the studies located through the online search and

assessing the studies that met the inclusion criteria. These are the steps that are recommended in the literature (Schick-Makaroff et al., 2018; Van den Berg, Heymans, Leone, Vergouw, Hayden, Verhagen & de Vet, 2013; Wu, Hou, Hwang, Lee, Lai, Chiou … Tsai, 2013).

Literature Search Strategy

The search procedure followed some of the aspects of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Hutton, Salanti, Caldwell, Chaimani, Schmid, Cameron … Moher, 2015) and those spelt out by Atkinson, Koenka, Sanchez, Moshontz and Cooper (2015) and Lorenc, Felix, Petticrew, Melendez-Torres, Thomas, Thomas … and Richardson (2016). Through a desktop retrieval mechanism, studies conducted on mobile learning in secondary schools in South Africa between 2005 and 2015 as reported in peer-reviewed, DHET-accredited academic journals were searched from 01 September 2017 to 31 December 2017. The search was conducted on *Google* and *Bing* as internet search engines. It was also conducted on the following online databases: *Google Scholar*, *Web of Science*, *Education Resources Information Center* (*ERIC*), *ScienceDirect*, *Taylor & Francis Online* and *Sage Journals Online*. The search was conducted using the following key phrases: *mobile learning in South African secondary schools*, *mobile learning studies in South African secondary schools*, *mobile learning—South African secondary school examples* and *mobile learning studies—South African secondary school examples*.

In addition, an online search of back issues of the following academic journals was carried out: *Educational Technology & Society*, *Journal for Language Teaching*, *Communitas*, *Per Linguam*, *Distance Education*, *South African Journal of Education* and *Southern African Journal of Linguistics and Applied Language Studies*.

To locate data sources, four phases were followed during the search process: search and retrieval, inclusion and exclusion, individual study review, and cross-study comparison and analysis. During the search and retrieval phase, four search strategies were used to retrieve and locate data sources: online search engines, online database searches, journal and bibliography searches, and ancestry and descendant searches (Atkinson et al. 2015); Russell, 2005; Whittemore & Knafl, 2005). To perform the first three search types, the key phrases (descriptors) mentioned earlier were used to search for and retrieve the available mobile learning studies from the two internet search engines and the six online databases listed above. Boolean connectors like "AND" and "OR" were used to try to include qualifying entries, while a Boolean operator such as "NOT" was not employed as part of the descriptors to avoid excluding qualifying entries from the search. (Chaka, 2019, 2020; Chaka, Lephalala & Ngesi, 2017). Subsequently, both ancestry and descendant searches were conducted on the bibliographies of the documents yielded by the first three search types.

After searching the two internet search engines, six online databases and seven academic journals, the relevant studies conducted on the use of mobile learning in secondary schools in South Africa, within the specified period, were screened and selected. Three stages were followed in doing this: searching for the relevant studies, applying the inclusion/exclusion criteria to the studies located through online searches and determining the relevance and suitability of such studies (Schick-Makaroff et al., 2018; Whittemore & Knafl, 2005; Wu et al., 2013).

Sampling Techniques and Data Sources

The data sources for this review study were sampled using judgmental and snowball sampling. Judgmental sampling involves using one's judgment in selecting data and units of analysis (Sharma, 2017), while snowball sampling entails utilising identified data as the basis to get more related data (Dusek, Yurova & Ruppel, 2015). In the current study, the researcher and two raters used their judgement to select the datasets (see Table 3) to be extracted and analysed from the retrieved journal articles. Additionally, the researcher and two raters utilised the identified data sets to locate more relevant data from related articles in other journals, an aspect that entailed a snowball effect.

Inclusion and Exclusion Criteria

After conducting an online search and screening of mobile learning studies through the search engines and the online databases mentioned earlier, relevant studies were selected accordingly. To qualify for selection, studies were screened using the inclusion and exclusion criteria depicted in Table 1.

Table 1. Inclusion and exclusion criteria

Inclusion Criteria	Exclusion Criteria
Studies on mobile learning in secondary schools published between 2005 and 2015 in South Africa	Studies on mobile learning in secondary schools not published between 2005 and 2015 in South Africa
Studies focusing on mobile learning/teaching purposes at a secondary school level	Studies not focusing on mobile learning/teaching purposes at a secondary school level
Studies that were purely mobile in nature and did not have a blended mode	Studies that were not purely mobile in nature and had a blended mode
Studies that were based on empirical evidence using quantitative and/or qualitative methods	Studies not based on any form of empirical evidence
Studies that involved at least twenty or more participants sampled accordingly	Studies with fewer than twenty participants
Primary research and not a review of past studies	Reviews of past studies
Studies focusing on how mobile technologies mediate learning	Studies focusing solely on student perceptions of / attitudes towards mobile learning technologies
Learners as a primary target group	Learners not as a primary target group
Studies published in English	Studies not published in English
	Conference proceedings, technical reports, dissertations/theses, non-peer-reviewed journals and internet/online articles/papers

As highlighted in the preceding sections, the reviewed journal articles comprised only studies on mobile learning conducted in South African secondary schools, which were published in peer-reviewed, DHET-accredited academic journals between 2005 and 2015. Studies that were in non-peer-reviewed academic journal articles and dissertations/theses and online articles were not considered as they are regarded as "grey literature" (non-peer-reviewed

publications) according to Schlosser (2007) and Wright, Golder and Lewis-Light (2015). These types of source material are generally not included in most review and meta-synthesis studies because of their grey literature nature (Conn, Valentine, Cooper & Rantz, 2003; Majora & Savin-Baden, 2010). However, sometimes their exclusion may lead to publication bias—also referred to as the file-drawer problem or funnel-plot asymmetry by Vevea and Woods (2005)—and other related bias permutations such as availability bias, familiarity bias (Egger & Smith, 1998; Rothstein, Sutton & Borenstein, 2005), source selection bias and scope bias (Schlosser, 2007).

The relevance of the studies was assessed based on the same inclusion criteria. Full-text copies of the relevant studies were retrieved and vetted in keeping with these inclusion criteria (Van der Kleij, Feskens & Eggen, 2015). Before studies were selected for inclusion or exclusion, an initial screening for their relevance was conducted as a prerequisite for the final inclusion and exclusion process. This was done by reading the titles and abstracts of the retrieved studies.

Searches of the two internet search engines and the six online databases yielded several returns. Studies retrieved and screened from these two sets of online search platforms were categorised into three groups: eligible, partially eligible and not eligible (Korpershoek, Harms, De Boer, Van Kuijk & Doolaard, 2016). Off-topic and duplicate studies were eliminated through a repeated screening process and by applying the inclusion and exclusion criteria spelt out in Table 1. Eventually, only seven studies (see Table 2) were considered to be relevant as they satisfied the required inclusion criteria.

Results of the Vetting and Selection Process

During the searching, screening and selection processes which spanned three months (from 01 September 2017 to 31 December 2017) and entailed five stages, a total of 2,255 articles were generated before the selection phase was carried out on the two sets of online search platforms (see Table 2). Of these articles, 314 were retained, while 1,951 were excluded after the selection process as they were off-topic returns. After this selection stage, 56 articles comprising mainly duplicates generated from the two aforesaid search engine platforms, were isolated. In the end, seven articles were retained and these served as the basis of the data analysis for this study.

Table 2. Results of included, excluded and accepted articles on mobile learning studies

Search engines and databases	Total before selection phase	Total included after selection	Total excluded after selection	Total accepted with duplicates	Total accepted without duplicates
Google	450	100	350	18	2
Google Scholar	315	85	230	12	1
Bing	440	95	345	8	0
Web of Science	110	0	110	0	0
ERIC	270	10	270	6	1
ScienceDirect	130	2	128	2	1
Taylor & Francis Online	360	20	340	8	2
Sage Journals Online	180	2	178	2	0
Totals	2,255	314	1,951	56	7

Data Extraction and Data Analysis

The datasets that had been extracted from the seven peer-reviewed academic journals were coded in terms of the following categories: author and publication date, year and duration, mobile devices, study type, educational level, educational context, subject domain, conceptual/theoretical framework, focus, research design, sample groups, data sources and summary of findings. In the context of this study, these variables constitute second-order constructs (a researcher's interpretation of first-order constructs). These data were analysed through narrative analysis. The narrative analysis involved thematic synthesis (Ring, Ritchie, Mandava & Jepson, 2011), narrative synthesis (Popay, Roberts, Sowden, Petticrew, Arai, Rodgers & Duffy, 2006) and cross-study comparison (Majora & Savin-Baden, 2010). Thematic synthesis is used for synthesising findings from multiple studies by focusing on iterative themes or issues contained in the primary studies to make inferences and conclusions. It entails structuring textual findings from primary studies into free codes, organising free codes into descriptive themes and generating analytical themes from descriptive themes (Barnett-Page & Thomas, 2009; Ringet al., 2011). The aforesaid variables also constituted units of analysis for the current study (Burston, 2015; Crompton, Burke & Gregory, Gräbe, 2016).

FINDINGS AND DISCUSSION

Author and Publication Date, and Year and Duration

Of the seven studies under review, one study was published in 2009 (Winzker, Southwood & Huddlestone, 2009) in the journal, *Per Linguam*; another study was published in 2011 (Roberts & Vänskä, 2011) in the journal, *Distance Education* and one more study was published in 2012 (Chaka, 2012) in the journal, *Communitas*. Four studies were published in 2015. Two of these, Chaka (2015) and Jantjies and Joy (2015), were published in the journals, *Per Linguam* and *Educational Technology & Society*, respectively. The other two— Roberts, Spence-Smith, Vänskä and Eskelinen (2015) and Steyn and Evans (2015)—were published in the journals, *South African Journal of Education* and *Journal for Language Teaching*, correspondingly. All of these journals, except one, are South African-based journals (see Table 3).

Only three studies state the years in which they were conducted and the duration it took to conduct them. All three of them were conducted in 2010. The first of these was conducted for six months (January–June); the second was undertaken for two weeks (one week in August and one week in September) and the third took place for two days (31st August–1 September).

Table 3. An analysis of studies on mobile learning in certain secondary schools in South Africa from 2005 to 2015 (n = 7)

	Winzker, Southwood and Huddlestone (2009) (PL*)	Roberts and Vänskä (2011) (*Distance Ed.*)	Chaka (2012) *Communitas*	Chaka (2015) *Per Linguam*	Jantjies and Joy (2015) (*ET&S*)
Year & Duration	Date not mentioned; (1 day)	(January–June 2010);	2010 (2 weeks: 1 week in August and 1 week in September)	31st August–1 September 2010	Not mentioned
Mobile devices	Mobile phones & *MXit*	Nokia mobiles, *MXit*, direct learning application (DLA) & *Moodle*	Mobile phones (SMSs) & *MXit* (IM)	Mobile phones (SMSs) & *MXit* (IM)	Mobile phones & *M-Thuto* software
Study type	Implementation	Implementation & evaluation	Implementation)	Project (implementation)	Implementation)
Educational level	Secondary school (Grades 8 & 11)	Secondary school (Grades 9 & 10)	Junior Secondary School (8th Grade)	Junior Secondary School (8th Grade)	Secondary school (11th & 12th Grades)
Educational context	Informal	Informal	Informal	Informal	Formal
Subject domain	English L1 & English L2	Mathematics	English first additional	English first additional	Mathematics
Conceptual/ Theoretical framework	N/A	N/A	conversation theory, presence learning, relationality, new media writing and mobiles for sustainable learning environments (M4SLEs)	Conversation theory and new media literacy	N/A
Focus	Writing	Implementation evaluation	SMS paragraph writing	Paragraph writing	Learning (code-switching Setswana Eng concepts)
Research design	N/A	Case study	Case study	Case study	Case study
Sample groups	88 learners (43 Grade 8's & 45 Grade 11's)	25 schools (512 learners, 72 focus group)	20 eighth-Grade learners	29 eighth-Grade learners	4 schools (90 learners)
Data collection tools	Questionnaires & essay samples	Usage data, learner results, questionnaires & interviews (focus group)	SMSs & IMs (instant messages)	SMSs & IMs (instant messages)	Questionnaires, interviews, exercises & tests
Main findings	Many reported using SMS language in their written schoolwork; participants' written work samples did not contain many SMS language features.	Substantial variation in uptake, use and attainment by schools, with very high uptake and use in some schools, but very low uptake and use in others; on average, the mathematics results of learners who used the mobile service less or did not use it declined more than those of the learners who used it more or frequently.	SMSs and MIMs served as enablers of mobiles for sustainable learning environments in varying degrees; SMSs served as a space for a sustainable asynchronous learning environment, while MIMs served as an instance of a sustainable synchronous learning environment.	SMS paragraphs had more contextual textisms than IM paragraphs, while the latter had more linguistic textisms than the former; IM paragraphs had more compound and complex sentences than SMS paragraphs	Mobile learning could be used to support learners to code-switch mathematical concepts in Setswana and English.

Study												
Roberts, Spence-Smith, Vänskä and Eskelinen (2015) (SAJE*)	Not mentioned	Nokia mobiles	Implementation)	Secondary school (10th Grade)	Informal	Mathematics	Variations on mobile learning configurations	Implementation & evaluation	Quasi-experimental design	30 schools (1,950 learners)	Data sourced from Moodle, & Grade 9 & 10 school maths results	There was a mean decline in mathematics attainment from Grade 9 to Grade 10 of 15 percentage points; there was a significant difference in the percentage point shifts of non-users (a 19-percentage point mean decline) compared to regular/extensive users. (An 11.5 percentage point mean decline).
Steyn and Evans (2015) *Journal for Language Teaching*	Not mentioned	Proofreading protocol	Implementation)	Two public sec. schools & one private sec. school (eighth to eleventh Grades)	Informal	English first language	N/A	English writing and spelling	Quantitative research	288 learners	Proofreading protocol	Findings showed that the 288 respondents managed to identify textisms, meaning that they had an adequate grasp of register to refute media claims that textese leads to language decay.

Mobile Devices and Study Types

All of the seven studies under review refer to the mobile devices that they employed in the periods during which they were conducted. Three of these studies utilised mobile phones and *MXit*. Two studies used a combination of mobile phones and *M-Thuto* software, and a mixture of Nokia mobiles, *MXit*, direct learning application (DLA) and *Moodle*, respectively. The last two studies employed Nokia mobiles and a proofreading protocol. Several mobile learning review studies have reported mobile phones and other mobile devices such as personal digital assistants (PDAs) as having featured as some of the primary devices used for learning purposes. For example, in a systematic review study conducted by Crompton et al. (2016), mobile phones and PDAs were found to be the most regularly used mobile devices. These were followed by digital cameras and iPads, handhelds, and iTouches, respectively. Mobile phones (especially smartphones) and PDAs are also reported as some of the prominent mobile devices utilised in Burston's (2015) meta-analysis of twenty years of mobile-assisted language learning (MALL) and in the review of trends from mobile learning studies by Wu, Wu, Chen, Kao, Lin & Huang (2012). Another study, a systematic review of mobile learning in the higher education (HE) sector of eleven African countries by Kaliisa and Picard (2017), reports mobile phones and tablets as the main mobile devices employed for learning in this sector of education (see also, Saleh & Bhat, 2015).

From the foregoing, it is apparent that mobile devices used in the seven studies varied according to each case and according to each focus. In all of these studies, mobile phones seem to be the anchor mobile device common to all of them. This use of mobile phones as either anchor or common mobile devices tend to dovetail with studies by Burston (2015), Crompton et al. (2016) and Wu et al. (2012) in which mobile phones featured as one of the mobile devices used.

Regarding study types, all studies reviewed were implementation projects, with one study combining both implementation and evaluation. In her review of mobile learning in teacher education in different countries, Baran (2014) identified implementation and survey as the two main study types employed in the 37 articles she reviewed. In a different but related instance, Burston (2015) distinguished 19 mobile learning implementation projects in his

meta-analysis study. Given this, it seems the implementation projects outnumber the other types of mobile learning projects not only in the current study but also in others such as those reported by both Baran (2014) and Burston (2015).

Educational Level and Educational Context

All seven studies were conducted at secondary schools in different grades. Two studies were conducted at junior secondary schools in eighth grade and one study involved eighth- and eleventh-grade learners, while the other study had ninth- and tenth-grade learners as its participants. The other two studies focused on tenth-grade learners and eleventh- and twelfth-grade learners, respectively. Finally, the last study involved learners in eighth, ninth, tenth and eleventh grades from two public secondary schools and one private secondary school. The two studies by Burston (2015) and Liu, Scordino, Geurtz, Navarrete, Ko & Lim (2014) incorporated a school level as their educational level. Burston's (2015) study, for example, found in its meta-analysis that the school educational levels at which mobile learning was employed more were the intermediate and beginner levels, respectively (see also Crompton, et al., 2016). These were followed by the beginner level. In this case, the study by Liu et al. (2014) reports that 55% of the K–12 education studies it reviewed were carried out at an elementary school level. These studies outnumbered those conducted at other levels such as middle (sixth to eighth grades) and high school (ninth to twelfth grades) levels, respectively. Elsewhere, Korkmaz's (2015) literature review of new trends on mobile learning in Turkey found more studies were conducted in the HE band than those carried out at the primary, secondary and high school levels. So, studies conducted in both the HE and (elementary) school levels as educational level variables tend to outnumber each other depending on a given review study's focus (see also Kaliisa & Picard, 2017; Wu et al., 2012). While the present study's focus was only on the secondary school level as a variable, both the junior and secondary school levels featured as the prominent educational levels in the studies it reviewed.

Six studies were conducted under informal school learning environments that were not part of the mainstream curriculum, while one study was conducted under a formal educational context. This particular trend resonates with the systematic review by Crompton et al. (2016) in which they state that the majority of the studies they had reviewed occurred in informal educational contexts (51%) as opposed to formal, or a combination of formal and informal educational settings. However, it contrasts markedly with the systematic review by Saleh and Bhat (2015) in which mobile learning at the informal educational level accounted for only 16% compared to both the formal setting (67%) and the non-formal setting (17%) (see also Wu et al., 2012).

Subject Domain, and Conceptual/Theoretical Framework and Focus

The subject domains of the seven studies included two areas: language and mathematics. One study had English first language (L1) as its subject domain. Two studies had English first additional language as their subject domain, and the other study had both English L1 and English L2 as its subject domains. The last three studies had mathematics as their subject domain. One review study relevant in this instance is Liu et al.'s (2015) study. This study ranks the subject domains of mobile learning in the K–12 educational arena it reviewed as follows: natural sciences = 29%, maths = 18%, language arts = 16%, social studies and general = 11%, and ELS / foreign language = 6%. Some of the review studies consulted in

the current study incorporated different bands of education (school and HE bands or HE only) (e.g., Bin Sinen, 2015; Korkmaz, 2015; Wu et al., 2012; Kaliisa & Picard, 2017). Others focused on an exclusive area such as teacher education (e.g., Baran, 2014) or such as science education (e.g., Crompton et al., 2016). As such, their subject domains are mostly incomparable with those of the present study. Nevertheless, two review studies by Burston (2015) and Viberg and Grönlund (2012) focused exclusively on MALL. In a different but related scenario, in their systematic review, Saleh and Bhat (2015) mention at least two studies whose research focus was (English) language learning.

In respect of a conceptual/theoretical framework, three studies mention their theoretical frameworks while four studies do not. These three studies employed the following theoretical frameworks: conversation theory, presence learning, relationality, new media writing and mobiles for sustainable learning environments (M4SLEs); conversation theory and new media literacy; and variations on mobile learning configurations. In their meta-analysis, Kaliisa & Picard (2017) found that of the 31 studies they reviewed in the South African HE sector, 14 were grounded in a given theoretical framework, while 17 of them were not based on any specific theoretical framework. They point out that most of the frameworks had to do with technology adoption and acceptance, whereas others were concerned with such learning theories as constructivism and social learning. Some of the examples of these frameworks included a Bourdieu-based framework and the unified theory of acceptance and use of technology. In a similar vein, in their review of 54 MALL studies, Viberg and Grönlund (2012) report that only two of them had a theoretical framework. Likewise, Baran (2014) states that her review study on mobile learning research into teacher education discovered scant reporting of theoretical perspectives. She highlights that of the 37 studies she reviewed, only five reported using a pedagogical or theoretical framework. While the current review study mentions that three of the studies it reviewed had theoretical frameworks, it appears that this aspect of mobile learning is still one of the missing links in most mobile learning studies.

The research focus of the seven studies ranged from writing, spelling and learning concepts to implementation and evaluation. Two studies focused on writing and English writing and spelling, respectively, while two more had SMS paragraph writing and paragraph writing as their research focus apiece. Another study concentrated on learning Setswana–English mathematical concepts (code-switching), while the last two studies each focused on implementation and evaluation. Of the review studies considered here, two MALL review studies by Burston (2015) and Viberg and Grönlund (2012) have resonance with the current study. For instance, Burston (2015) reports that vocabulary acquisition, reading competency, listening/speaking skills and writing skills constituted key areas of focus in his meta-analysis of MALL. Similarly, Viberg and Grönlund (2012) identify second and foreign language acquisition and learner attitudes towards and/or learner perceptions of mobile technologies as some of the key areas of focus in their review of MALL (see also Saleh & Bhat, 2015).

Research Design, Sample Groups and Data Collection Tools

Of the seven studies reviewed, four utilised case study designs, and two employed a quasi-experimental design and a quantitative research design, respectively. One study does not mention its research design. Three review studies are relevant regarding research design: Korkmaz (2015), Saleh and Bhat (2015) and Wu et al. (2012). For example, Korkmaz (2015) reports that in his review of mobile learning trends, the experimental design was the most

used design, followed by the descriptive survey and case study designs, respectively. He points out that the experimental design was mostly used in studies evaluating the effect of mobile learning, while both the descriptive survey and case study designs were employed in studies assessing the cognitive variables related to mobile learning. Additionally, he highlights that very few studies utilised the combination of the three research methodologies or a mixed methodology. The same sentiment is echoed by Saleh and Bhat (2015) who state in their systematic review that experimental designs outnumbered both survey/experimental designs and survey designs. Nonetheless, they point out that in the period under review, survey/experimental designs were utilised slightly more than survey designs. By contrast, Wu et al. (2012) indicate that survey designs outnumbered experimental designs in a meta-analysis that they conducted which involved evaluation-dominant with application-mino*r* and design-dominant with evaluation-minor studies. These two research designs were followed by descriptive and case study designs. While in the current study, case study designs are reported to be slightly more than other designs, the general trend from other review studies is that experimental designs—followed by survey designs—are used more predominantly than any other research design.

In terms of the sample groups of the seven studies reviewed in the present study, one study had 1,950 learners from 30 schools, while the other two studies had 512 learners and 72 teachers from 25 schools and 288 learners, respectively. Two more studies employed 90 learners (from four schools) and 88 learners (43 eighth-grade learners and 45 eleventh-grade learners), apiece. Lastly, the other two studies each had 29 and 20 eighth-grade learners as their participants. In this case, in their review of trends in mobile and ubiquitous learning between 2001 and 2010, Hwang and Tsai (2011) found that the sample sizes reported in the journals they reviewed were as follows: HE students (59), elementary school students (41), high school students (17), teachers (six) and working adults (six). Contrastingly, Baran (2014) indicates that studies he reviewed on mobile learning and teacher education had small sample sizes and limited scope. What becomes apparent here is that mobile learning studies that employ large sample sizes are needed, especially in the South African secondary school sector.

Each of the seven studies utilised the following data collection tools: questionnaires and essay samples; usage data, learner results, questionnaires and interviews; SMSs and IMs; questionnaires, interviews, exercises and tests; *Moodle* and school maths results; and a proofreading protocol. This means that questionnaires as response tools are common in three studies. They are followed by interviews, SMSs and IMs as common data collection tools in two studies. Other data collection tools appear once in one of the seven studies. In this instance, Wu et al. (2012) observe that surveys (questionnaires) outnumbered other data collection tools such as experimental research methods, interviews and observations in their review study. Similarly, Kaliisa and Picard (2017) state in their review study that questionnaires were the most frequently used data collection method compared to other methods such as interviews and focus groups. Elsewhere, Crompton et al. (2016) report in their systematic review that questionnaires ranked among the most? often used data collection tools. On this score, a critical point to make is that a data collection tool or method used in a given mobile learning study needs to be informed by the purpose, the focus and the research questions of the study in question.

Summary of Findings of the Studies Reviewed

Firstly, of the seven studies reviewed, the study by Winzker et al. (2009) (see Table 3) points out that many of the learners (eighth- and eleventh-grade learners) reported having used SMS language in their written school work. Nonetheless, it notes that participants' written work samples did not contain many SMS language features. Secondly, Roberts and Vänskä's (2011) study reports a substantial variation in uptake, use and attainment of mobile learning? by schools, with very high uptake and use in some schools, but very low uptake and use in other schools. Additionally, it indicates that on average, the mathematics results of learners who used the mobile service less or did not use it declined more than those of the learners who used it more or frequently.

Thirdly, Chaka's (2012) study indicates that SMSs and MIMs served as enablers of mobiles for sustainable learning environments in varying degrees. In addition, it highlights that SMSs serve as a space for a sustainable asynchronous learning environment while MIMs offer a sustainable synchronous learning environment. Fourthly, Chaka's (2015) study reports that SMS paragraphs had more contextual textisms than IM paragraphs, while the latter (IM paragraphs) had more linguistic textisms than the former (SMS paragraphs). It also observes that IM paragraphs had more compound and complex sentences than SMS paragraphs.

Fifthly, the study by Jantjies and Joy (2015) argues that mobile learning could be used to support learners to code-switch mathematical concepts in Setswana and English. For its part, the study by Roberts et al. (2015) reports that there was a mean decline in mathematical attainment from ninth grade to tenth grade of 15 percentage points. It also points out that there was a significant difference in the percentage point shifts of non-users (a 19 percentage point mean decline) compared to regular/extensive users (an 11.5 percentage point mean decline). Lastly, findings from the study by Steyn and Evans (2015) report that the 288 respondents managed to identify textisms, meaning that they had an adequate grasp of the required register to refute claims that textese leads to language decay (see Aziz, Shaim, Aziz & Avais, 2013; Mahmoud, 2013; Thubakgale & Chaka, 2016).

The findings of the studies reviewed in this paper vary in that the studies themselves had different foci and varied purposes. Their foci ranged from language learning—especially English L1 and English L2 (English first additional language)—on the one hand, to mathematics, on the other hand. The studies had one of the following three primary purposes: the uptake and use of mobile learning by schools and the attendant learner attainment; mobile phone applications as learning tools outside school and mobile learning as support tools. The specific school grades in which the seven studies employed mobile learning were eighth, ninth, tenth, eleventh and twelfth grades. In relation to the first purpose, there was varying uptake, use and attainment by schools, with attainment plummeting in schools with lower uptake and use. With regard to employing mobile phone applications as learning tools outside school, it emerged that these applications varyingly served as learning tools and that SMS paragraphs had more contextual textisms than IM paragraphs. Allied to this is that learners (in one of the studies) were able to identify textisms and that written textisms were fewer than reported textisms. Finally, concerning the third purpose, it was found that mobile learning lent itself well as a medium for code-switching mathematical concepts in Setswana and English.

CONCLUSION AND RECOMMENDATIONS FOR FUTURE RESEARCH

There are certain conclusions to be drawn from this review study. The seven studies reviewed focused mainly on three areas: English L1, English L2 and mathematics. In the instance in which code-switching took place between Setswana and English, this was with reference to mathematical concepts. This means that mobile learning at secondary schools seems to be targeted primarily at three school subjects: English L1, English L2 and maths, and not at other school subjects. In this context, two school levels, the junior and secondary school levels, had featured, in varying degrees, as the prominent school levels at which mobile learning occurred. Here, preference was given to eighth, ninth, tenth, eleventh and twelfth grades.

Moreover, studies conducted at the secondary school level seem to be isolated "silo" studies, and appear to be one-off initiatives. Sample groups employed in these review studies ranged from 20 to 1,950 participants, while the number of schools used as research settings ranged from one to thirty schools. In addition, some of the studies were of shorter duration (two days) and had fewer participants, whereas the others had both a comparatively longer duration (six weeks) and more participants. All the reviewed studies were implementation projects.

There seems to be a dearth of studies with experimental research (treatment and control group) designs and a lack of long-term mobile learning projects. Besides, mobile learning is still being deployed as an add-on mode of learning. It is not yet mainstream nor is it implemented as a standalone form of learning at a secondary school level. This means that more experimental mobile learning studies and more mobile learning studies that have a longitudinal orientation are needed so that a comparative analysis of such studies can be conducted. Most importantly, there is a need to mainstream mobile learning, in terms of curriculum and as a form of learning, at school level.

As is the case with most review studies, the current study has limitations. Firstly, the study relied exclusively on online search engines and on online databases to search for journal articles that it reviewed. As such, it had a bias toward online journal articles as it used no hard copies of the journal articles. Secondly and finally, the study had a bias towards peer-reviewed, DHET-accredited journal articles.

REFERENCES

ATKINSON, KM., AC KOENKA, CE SANCHEZ, H MOSHONTZ & H COOPER. 2015. Reporting standards for literature searches and report inclusion criteria: Making research syntheses more transparent and easy to replicate. *Research Synthesis Methods* 6(1): 87-95. doi:10.1002/jrsm.1127

AZIZ, S, M SHAIM, MF AZIZ & P AVAIS. 2013. The impact of texting/SMS language on academic writing of students - What do we need to panic about? *Elixir Linguistics and Translation* 55:12884-12890.

BARAN, E. 2014. A review of research on mobile learning in teacher education. *Educational Technology & Society* 17(4): 17-32.

BARNETT-PAGE, E & J THOMAS. 2009. Methods for the synthesis of qualitative research: A critical review. *BMC Medical Research Methodology* 9(59): 1-11. doi:10.1186/1471-2288-9-59

BIN SINEN, H. 2015. A literature review on mobile learning. *International Journal of Social Media and Interactive Learning Environments* 3(3): 219-229.

BURSTON, J. 2015. Twenty years of MALL project implementation: A meta-analysis of learning outcomes. *ReCALL* 27(01): 4-20. doi:10.1017/S0958344014000159

CHAKA, C. 2012. Mobiles for sustainable learning environments: Mobile phones and MXit with a South African school context. *Journal for Community Communication and Information Impact* 17: 161-182.

CHAKA, C. 2015. Textisms, grammatical features, and sentence types in the SMS and IM paragraphs of EFAL learners. *Per Linguam* 31(3): 65-85.

CHAKA, C. Skills, competencies and literacies attributed to 4IR/Industry 4.0: Scoping review. *IFLA Journal* XX(X): 1–32. doi: 10.1177/0340035219896376

CHAKA, C. 2020. Translanguaging, decoloniality, and the Global South: An integrative review study. *Scrutiny 2*. 1-34. doi: 10.1080/18125441.2020.1802617.

CHAKA, C, M LEPHALALA & N NGESI. 2017. English studies: Decolonisation, deparochialising knowledge and the null curriculum. *Perspectives in Education* 35(2): 208-229. https://doi.org/10.18820/2519593x/pie.v35i2.16.

CONN, VS, JC VALENTINE, HM COOPER & MJ RANTZ. 2003. Grey literature in meta-analyses. *Nursing Research* 52(4): 256-261.

CROMPTON, H, D BURKE, KH GREGORY & C GRÄBE. 2016. The use of mobile learning in science: A systematic review. *Journal of Science Education Technology* 25: 149-160. doi:10.1007/s10956-015-9597-x

DEUMERT, A & O MASINYANA. 2008. Mobile language choices – The use of English and isiXhosa in text messages (SMS), evidence from a bilingual South African sample. *English World-Wide* 29(2): 117-148.

DUSEK, GA, YV YUROVA & CP RUPPEL. 2015. Using social media and targeted snowball sampling to survey a hard-to-reach population: A case study. *International Journal of Doctoral Studies* 10: 279-299. Available from http://ijds.org/Volume10/IJDSv10p279-299Dusek0717.pdf [Accessed: 12 April 2016]

EGGER, M & GD SMITH. 1998. Meta-analysis: Bias in location and selection of studies. *British Medical Journal* 316: 61-66.

FORD, M & J BATCHELOR. 2007. From zero to hero – is the mobile phone a viable learning tool for Africa? [Online]. Available from http://hdl.handle.net/10204/1568 [Accessed: 05 November 2020]

FORD, M & A BOTHA. 2007. MobilED – an accessible mobile learning platform for Africa [Online]. Available from http://hdl.handle.net/10204/1777 [Accessed: 05 November 2020]

FREUDENBERG, K. 2009. Investigating the impact of SMS speak on the written work of English first language and English second language high school learners [Online]. Available from http://scholar.sun.ac.za/bitstream/handle/10019.1/2052/freudenberg_investigating_2009.pdf?sequence=1 [Accessed 20 January 2019]

GEERTSEMA, S, C HYMAN & C VAN DEVENTER. 2011. Short message service (SMS) language and written language skills: Educators' perspectives. *South African Journal of Education* 31: 475-487.

GUY, R, C CHAKA, N NGESI, TJ MEHIGAN, I PITT, MS SIMBULAN … PW WILLIAMS. 2010. Mobile learning reviewed. In Guy R (Ed), *Mobile learning: Pilot projects and initiatives,* pp. 59-74. Santa Rosa, CA.: Informing Science Press.

HUTTON, B, G SALANTI, DM CALDWELL, A CHAIMANI, CH SCHMID, C CAMERON C … D MOHER. 2015. The PRISMA extension statement for reporting of systematic reviews incorporating network meta-analyses of health care interventions: Checklist and explanations. *Annals of Internal Medicine* 162(11): 777-784. doi:10.7326/M14-2385

HWANG, G-J & C-C TSAI. 2011. Research trends in mobile and ubiquitous learning: A review of publications in selected journals from 2001 to 2010. *British Journal of Educational Technology* 42(4): 65-70.

JANTJIES, M & M JOY. 2015. Mobile enhanced learning in a South African context. *Educational Technology & Society* 18 (1): 308–320.

KALIISA, R & M PICARD. 2017. A systematic review on mobile learning in higher education: The African perspective. *The Turkish Online Journal of Educational Technology* 16(1): 1-18.

KORKMAZ, Ö. 2015. New trends on mobile learning in the light of recent studies. *Participatory Educational Research* 2(1): 1-10.

KORPERSHOEK, H, T HARMS, H DE BOER, M VAN KUIJK & S DOOLAARD. 2016. A meta-analysis of the effects of classroom management strategies and classroom management programs on students' academic, behavioral, emotional, and motivational outcomes. *Review of Educational Research* 86(3): 643-680. doi: 10.3102/0034654315626799

LE ROUX, S. 2013. Mobile learning as a paradigmatic mechanism to facilitate technology-based learning in a developing country [Online]. Available from https://etd.cput.ac.za/bitstream/handle/20.500.11838/1412/193007185_LeRoux_s_DTech_IT_fid_2013?sequence=1&isAllowed=y [Accessed: 05 November 2020]

LORENC, T, L FELIX, M PETTICREW, GJ MELENDEZ-TORRES, J THOMAS, S THOMAS … M RICHARDSON. 2016. Meta-analysis, complexity, and heterogeneity: a qualitative interview study of researchers' methodological values and practices. *Systematic Reviews* 5(192): 1-9. doi:10.1186/s13643-016-0366-6

LIU, M, R SCORDINO, R GEURTZ, C NAVARRETE, Y KO, & M LIM. 2014. A Look at research on mobile learning in K-12 education from 2007 to the present. *Journal of Research on Technology in Education* 46(4): 325-372. doi:10.1080/15391523.2014.925681

MAHMOUD, SS. 2013. The effect of using English SMS on KAU foundation year students' speaking and writing performance. *American International Journal of Social Science* 2(2): 13–22.

MAJORA, C. & M SAVIN-BADEN. 2010. Exploring the relevance of qualitative research synthesis to higher education research and practice. *London Review of Education* 8(2): 127-140.

MCETYWA, ML. 2014. The use of mobile technologies for mathematical engagement in informal learning environments [Online]. Available from http://hdl.handle.net/10210/10345 [Accessed: 05 November 2020]

OK, MW & KT RATLIFFE. 2018. Use of mobile devices for English language learner students in the United States: A research synthesis. *Journal of Educational Computing Research* 56(4): 538–562. https://doi.org/10.1177/0735633117715748

OKOLI, C, K SCHABRAM. 2010. A guide to conducting a systematic literature review of information systems research. *Sprouts: Working Papers on Information Systems* 10(26). http://sprouts.aisnet.org/10-26

POPAY, J, H ROBERTS, A SOWDEN, M PETTICREW, L ARAI, M RODGERS & S DUFFY. 2006. Guidance on the conduct of narrative synthesis in systematic reviews: A product from the ESRC methods programme [Online]. Available from http://journals.plos.org/plosone/article/file?type=supplementary&id=info:doi/10.1371/journal.pone.0177549.s001

REYNOLDS, ME. 2010. The effect of context on teachers' ability to innovate with information and communication technologies in secondary schools [Online]. Available from http://hdl.handle.net/2263/24869 [Accessed: 05 November 2020]

RING, N, K RITCHIE, L MANDAVA & R JEPSON. 2011. A guide to synthesising qualitative research for researchers undertaking health technology assessments and systematic reviews [Online]. Available from http://www.nhshealthquality.org/nhsqis/8837.html

ROBERTS, N & R VÄNSKÄ. 2011. Challenging assumptions: Mobile learning for mathematics project in South Africa. *Distance Education* 32(2): 243-259. doi:10.1080/01587919.2011.584850

ROBERTS, N, G SPENCE-SMITH, R VÄNSKÄ & S ESKELINEN. 2015. From challenging assumptions to measuring effect: Researching the Nokia Mobile Mathematics Service in South Africa. *South African Journal of Education* 35(2): Art. # 1045, 13 pages. doi:10.15700/saje.v35n2a1045

ROTHSTEIN, HR, AJ SUTTON & M BORENSTEIN. 2005. Publication bias in meta-analysis. In ROTHSTEIN, HR, AJ SUTTON & M BORENSTEIN (Eds.) *Publication bias in meta-analysis – Prevention, assessment and adjustments* pp 1-7. Chichester, UK: John Wiley & Sons.

RUSSELL, CL. 2005. An overview of the integrative research review. *Progress in Transplantation* 15(1): 1-6.

SALEH, SA & SA BHAT. 2015. *International Journal of Computer Applications* 114(11): 1-5.

SCHICK-MAKAROFF, K, M MACDONALD, M PLUMMER, J BURGESS & W NEANDER. 2016. What synthesis methodology should I use? A review and analysis of approaches to research synthesis. *AIMS Public Health* 3(1): 172-215. doi: 10.3934/publichealth.2016.1.172

SCHLOSSER, RW. 2007. Appraising the quality of systematic reviews. *Technical Note 17*: 1-8.

SHARMA, G. 2017. Pros and cons of different sampling techniques. *International Journal of Applied Research* 3(7): 749-752.

SNYDER, H. 2019. Literature review as a research methodology: An overview and guidelines. *Journal of Business Research* 333-339. https://doi.org/10.1016/j.jbusres.2019.07.039

STEYN, H & R EVANS. 2015. Textese and secondary school learners' formal written English: Is the media hype about language decay justified? *Journal for Language Teaching* 49(1): 199-221.

THUBAKGALE, K & C CHAKA. 2026. Possible effects of text messaging on Grade 11 EFAL learners' written work. *Language Matters: Studies in the Languages of Africa* 47(2): 223-245. http://dx.doi.org/10.1080/10228195.2016.1185139

VAN DEN BERG, T, MW HEYMANS, SS LEONE, D VERGOUW, JA HAYDEN, AP VERHAGEN & HCW DE VET. 2013. Overview of data-synthesis in systematic reviews of studies on outcome prediction models. *BMC Medical Research Methodology* 13:42 http://www.biomedcentral.com/1471-2288/13/42

VAN DER KLEIJ, FM, RCW FESKENS & TJHM EGGEN. 2015. Effects of feedback in a computer-based learning environment on students' learning outcomes: A meta-analysis. *Review of Educational Research* 85(4): 475-511. doi:10.3102/0034654314564881

VEVEA, JL, & CM WOODS. 2005. Publication bias in research synthesis: Sensitivity analysis using a priori weight functions. *Psychological Methods* 10(4): 428-443. doi:10.1037/1082-989X.10.4.428

VIBERG, O & Å GRÖNLUND. 2012. Mobile assisted language learning: A literature review. In SPECHT, M, M SHARPLES & J MULTISILTS (Eds.), *Proceedings of the 11th International Conference on Mobile and Contextual Learning* pp. 9-16. Helsinki: Finland.

VOSLOO, S, M WALTON & A DEUMERT. 2009a. m4Lit: A teen m-novel project in South Africa [Online]. Available from http://marionwalton.files.wordpress.com/2009/09/mlearn2009_07_sv_mw_ad.pdf

VOSLOO, S, M WALTON & A DEUMERT. 2009b .Mobile literacies and South African teens: Leisure reading, writing, and MXit chatting for teens in Langa and Guguletu [Online]. Available from http://m4lit.files.wordpress.com/2010/03/m4lit_mobile_literacies_mwalton_20101.pdf

WHITTEMORE, R, & K KNAFL, 2005. The integrative review: Updated methodology. *Journal of Advanced Nursing* (52(5): 546-553.

WINZKER, K, F SOUTHWOOD & K HUDDLESTONE. 2009. Investigating the possible effects of SMS speak on the written work of English first language and English second language high school learners. *Per Linguam* 25(2): 1-16.

WRIGHT, K, S GOLDER & K LEWIS-LIGHT. 2015. What value is the CINAHL database when searching for systematic reviews of qualitative studies? *Systematic Reviews* 4(104): 1-8. doi.10.1186/s13643-015-0069-4

WU, W-H, Y-C J WU, C-Y CHEN, H-Y KAO, C-H LIN & S-H HUANG. 2012. Review of trends from mobile learning studies: A meta-analysis. *Computers & Education* 59: 817-827. doi:10.1016/j.compedu.2012.03.016

WU, Y-T, H-T HOU, F-K HWANG, M-H LEE, C-H LAI, G-L CHIOU … C-C TSAI. 2013. A review of intervention studies on technology-assisted instruction from 2005-2010. *Educational Technology & Society* 16(3): 191-203.

WYBORN, C, E LOUDER, J HARRISON, J MONTAMBAULT, J MONTANA, M RYAN … J HUTTON. 2018. Understanding the impacts of research synthesis. *Environmental Science and Policy* 86, 72-84. https://doi.org/10.1016/j.envsci.2018.04.013

BIOGRAPHICAL NOTE

Chaka Chaka is a Full Professor in the Department of English Studies, College of Human Sciences, at the University of South Africa. His research interests include the following: language studies; literacy studies; computer-mediated communication (CMC); electronic learning (e-learning); computer-assisted language learning (CALL); mobile learning (m-learning); and mobile-assisted language learning (MALL).