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While the ubiquity and usage of Mobile Instant Messaging (MIM) applications such as WhatsApp has recorded unprecedented growth, their role for teaching and learning remains unclear. To address this gap, this paper systematically reviews empirical studies by examining the educational effects, designs, tools and settings of MIM. For this purpose the databases of PsycINFO, ERIC, Ovid MEDLINE, Web of Science and Google Scholar were systematically searched. Thematic analysis was adopted to analyze and synthesize qualitative data. Findings suggest that MIM is primarily used as group learning platform to enhance pre-existing education formats in a wide range of subjects. The use of MIM in education settings augments the transactional roles of students and requires learners and educators to balance the social and cognitive dimensions of interactional engagement.

Keywords: mobile instant messaging, systematic review, educational technology, mobile learning

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This systematic review examines the role of MIM for teaching and learning especially in view of the paucity of research on this subject that considers such systematic approaches. The use of MIM applications such as WhatsApp, Snapchat, iMessage, KaKaoTalk and WeChat has grown tremendously in the last five years and represents a dominant mode of contemporary communication. For example, WhatsApp, an instance of MIM, is considered to be one of the most trafficked applications on the internet. An estimated population of 800 million users spend on average more than three hours per week on WhatsApp, exchanging massive amounts of data. While the scope of functionalities of MIM is constantly expanding, contemporary applications typically allow for real-time and asynchronous communication between two or more users using text, audio, video, emoticons and URLs, i.e. links to additional online resources. Main features include pop-up mechanisms and sound or vibration that immediately alert the users to incoming messages, presence features that display information about online or offline status and profile information or status messages that are used to construct the users' identity, for example, reflecting changes in their mood (Quan-Haase, 2008).

In extant literature, there is a surprising knowledge gap about the role of MIM for authentic teaching and learning. Rambe and Bere (2013a) note that despite the popularity of mobile learning, MIM remains one of the least researched and understood applications in higher education. Apart from Cameron and Webster's (2005) non-systematic overview of empirical research on instant messaging, there is only one previous systematic review, conducted in 2008, which summarizes research literature on the use of instant messaging in campus life. In this work, Quan-Haase (2008) observes that students use IM predominantly for social purposes, i.e. maintaining distant and proximate social ties. From an education perspective, she observes that, while it can be helpful for students to interact with peers, lecturers, librarians, technicians and other academic staff in real time and over long distances, there are a number of concerns. These include the students' "improper" writing using IM, and the detrimental effects of distraction and multitasking on academic performance. In that sense, IM is often portrayed as an ambivalent technology that supports and hinders student academic work simultaneously (Quan-Haase, 2008; Rambe & Bere, 2013a; Rambe & Nel, 2014).

In the absence of previous systematic reviews on MIM, the current study examines the role of MIM for teaching and learning by addressing the following the research questions:

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2.1. Research questions, search techniques and inclusion criteria

Given the focused questions, a systematic, stepwise review approach was adopted in this study (Cook & West, 2012). The search for eligible studies was conducted in the databases of PsycINFO, ERIC, Ovid and MEDLINE (via Ovid®) and Web of Science (including the Social Science Citation Index, the Arts and Humanities Index and the Conference Proceedings Citation Index). These were searched in May 2015 using the key term ⁹ ^s ^{ss} ⁹ In the Web of Science database, the field "topic" was used and in the other databases the search was carried out using "All fields". The time span was not limited and no other limits were set in both databases. In addition, a second round of searches in September 2015 covered the popular instant messaging applications. The Web of Science database was searched combining the following applications with "or" using the "topic field": WhatsApp, imessage, KaKaoTalk, WeChat, BlackBerry messenger, Facebook messenger and snapchat. The search was refined by including the research area "education and educational research". The time span of 2010-2015 was used on the grounds that most of the popular MIM applications were created in the last few years. For example, WhatsApp was founded in 2009. Using the same time span and

keywords in "all fields" Eric, Ovid MEDLINE(R), PsycINFO and PsycARTICLES were searched again. Further searches with the keywords indicated above, i.e., mobile instant messaging and a combination of the MIM applications provided with learning, teaching and education were carried out in Google Scholar.

Abstracts were reviewed and eligible studies were retrieved and analyzed against the following criteria: (1) Generation of primary, i.e., empirical data through qualitative, quantitative or mixed-study designs; (2) Sound methodological design: due to the limited number of publications on MIM in journals, the scope was not restricted to peer-reviewed publications. However, if a study were to be considered, it needed to be of acceptable quantitative and qualitative design, i.e., it needed to describe data-gathering procedures as well as analytical techniques; (3) Studies were expected to focus on teaching or learning in a broader sense. To account for the potentially broad use of MIM in informal learning environments, the scope was not limited to school-based education but also included work-based, informal or life-long learning environments; (4) The studies considered used MIM as specified in the previous sections. Most importantly, the definition of MIM did not involve investigations that examine the application of more traditional text messaging applications such as SMS or MMS because different dynamics play out (Church & de Oliveira, 2013).

A total of 11 studies matched the above stated criteria. In the next step, key information was extracted from these studies relating to RQ1. These included the educational effects (e.g. deep and critical learning); educational design (e.g. inquiry-based learning in small groups of learners guided by teacher as part of a lecture in a blended learning arrangement), tools (e.g. WhatsApp groups) and setting: learners and education institution (e.g. undergraduates), subject (e.g. business) and geographical location. In addition, information regarding the country and research method were documented for each paper. (Table 1).

2.2. Data analysis and underlying framework

In order to pool and make sense of the predominantly qualitative research data of this emerging field of educational research, thematic analysis as an approach of formal qualitative synthesis methodology was applied. In qualitative synthesis, study findings are systematically interpreted through a series of expert judgements to represent the meaning of the collected work, including qualitative studies – and sometimes mixed-methods and quantitative research (Bearman & Dawson, 2013). Thematic analysis involves repeated reading and analyzing of the studies and the identification of key themes and concepts related to the research questions. The second author independently evaluated the inclusion of the studies according to the criteria indicated and analyzed the content with regard to the research questions. Diverging interpretations were resolved upon discussion (Pope, Ziebland, & Mays, 2000).

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3.1. Educational design, tools and settings

MIM supported a broad spectrum of educational designs in diverse subjects, including collaborative solving of ill-structured pedagogical problems by students in an educational technology course (Kim, Lee, & Kim, 2014). Other MIM-mediated designs enhanced the moderation of discussion and reflection of teaching methods by pre-service Arabic language teachers (Aburezeq & Ishtaiwa, 2013) and promoted language learning through engagement in dialogic writing activities (Castrillo, Martín-Monje, & Barcena, 2014). Further designs involved the development of research skills through the co-creation of group research assignments (Ngaleka & Uys, 2013; Rambe & Chipunza, 2013) and the

facilitation of academic lecturer–student and peer consultations among IT students (Bere, 2012; Rambe & Bere, 2013a, 2013b).

Although MIM spaces allow bilateral and multilateral conversations, the most common social formation involved group learning approaches (all but one study), most frequently on WhatsApp (all but two studies). These spaces were created by educators in addition to face-to-face teaching, thereby creating blended learning environments. While teachers facilitated and moderated these groups, for example by setting goals, responding to questions, correcting or disciplining students, much of the interactions were reported to be peer-to-peer in nature. Peer conversations were found to transcend and augment the roles of students who often contributed to teaching presence - with and without the involvement of teachers (Lam, 2015; Timmis, 2012). The shift manifested in complex hierarchies of knowledge brokers, knowledge seekers and givers as well as informal mentors assumed by students (Rambe & Chipunza, 2013).

The sample of the studies suggests that MIM has been predominantly researched in higher education settings with university students. Only one study involved teachers from high school environments (Bouhnik & Deshen, 2014). Two studies were situated outside formal educational environments, focusing on the nature of communication amongst students in informal learning settings (Lam, 2015; Timmis, 2012). Timmis alludes to the high relevance of MIM for student communication, as it represented the most frequent and constant digital communication practice (Timmis, 2012). Also in the study of Lam (2015), WhatsApp was used by more students than Skype and Facebook in informal learning environments (Lam, 2015). The geographical scope was broad, including investigations from Europe (Castrillo et al., 2014; Timmis, 2012), Middle east (Aburezeq & Ishtaiwa, 2013; Bouhnik & Deshen), Asia (Kim et al., 2014; Lam, 2015) and especially South Africa (Bere, 2012; Ngaleka & Uys, 2013; Rambe & Bere, 2013b; Rambe & Chipunza, 2013). This observation resonates with the statistics, which highlight the dominance of that South Africa in WhatsApp usage (Smith, 2015).

3.2. Educational effects

The integration of MIM in teaching and learning results in a range of ambiguous effects. In their content analysis, Rambe and Bere (2013a) identified critical engagement with learning resources, which culminated in transformative learning. This finding was corroborated through the post-surveys in the same study, in which a majority of students associated the academic use of WhatsApp with knowledge creation and deep reflection. Students deemed the MIM conversations to allow for sufficient time to review other team members' contributions and provide thoughtful feedback compared to offline discussions (Kim et al., 2014). Even in peer-to-peer settings not prescribed by educators, students engaged in MIM to discuss content-related issues (Timmis, 2012), for instance using WhatsApp groups to perform calculation exercises (Lam, 2015).

However, in contrast to promoting cognitive and metacognitive activities, considerable parts of the conversations in other studies tended to be lightweight involving socializing and playing (Aburezeq & Ishtaiwa, 2013; Kim et al., 2014). Aburezeq and Ishtaiwa (2013) note that nearly half of all postings had less than 20 words and were rather based on brief and quick interactions than on reflective, critical or deep thoughts. Also Kim et al. (2014) confirm the socializing dimension of MIM usage in the quantitative content analysis of their mixed-method study. They found that mobile and non-mobile IM groups were associated with more social and affective but less cognitive and metacognitive interactions compared with the bulletin board messages (Kim et al., 2014). The ambiguity between deep engagement and light conversations can be also noticed in the qualitative part of their investigation. Some learners in the MIM groups tended to state their opinion without reviewing or

considering other members' postings, which resulted in a lack of recursive, deep and convergent utterances (Kim et al., 2014).

The educational implications and consequences of messages with playful and socializing content were twofold. On one hand, they culminated in dialogical messages not directly relevant to education, which were criticized by students (Aburezeq & Ishtaiwa, 2013) and deemed to be upsetting by teachers (Bouhnik & Deshen, 2014). However, drawing on content analysis, some authors observed that lightweight discussions and socializing, although lacking strong intellectual qualities, are critical to social immersion into the productive use of MIM and lay a foundation for more intellectual conversations (Rambe & Bere, 2013b). Timmis (2012), who found playfulness and enactments of existing relations in the discourse analyses, shared a similar view. She concluded that this performativity, in turn, enhanced the creation and maintenance of a shared experience, a relevant component of collaborative learning. A strategy that was used by educators in balancing learning vs. socializing was to orient their learners towards more focused and productive learning interactions by establishing specific posting requirements and evaluation criteria. In Aburezeq and Ishtaiwa's (2013) study, the messages of the pre-service language teachers' needed to reflect the course content and to include new ideas, reflections, opinions and critical thinking beyond mere description or summary. In fact, the established criteria were deemed relevant, and tied to deeper levels of reflection and critical thinking.

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Authors Country	Learners/subject/technology/ educational method and setting	Research method	Key Findings
(Kim et al., 2014)/ South Korea	University students enrolled for an introductory educational technology course resolved ill-structured problem cases using either (1) MIM application, KakaoTalk; or (2) MSN Messenger on desktop computers; or (3) Bulletin Board System (BBS) on LMS	48 students randomly assigned to 3 groups. Content analysis used to determine differences in cognitive and social interactions and in task work Post-surveys with scales on teamwork and open-ended questions	Cognitive and metacognitive interactions prevailed in BBS group; social and affective interactions were major forms of interactions in the MIM group and the PC IM group; MIM group had significantly higher teamwork scores than IM group. Significantly better task work was found in the BBS compared to MIM group.
(Timmis, 2012)/ England	Third year undergraduates from E-Business or IT Audit modules used communication technology, especially instant messaging via MSN and Skype on portable and desktop devices in informal education settings	Repeated, qualitative, student-led investigation: conversation data, video reflection and group interviews. Thematic analysis using multi-level framework	Except for IM, a limited use of communication tools was observed; IM manifested in the form of long, textual, intimate peer communications for affirmation as well as more practical support between existing friends on the same module.
(Rambe & Bere, 2013a)/ South Africa	WhatsApp groups set up to facilitate extended, lecturer–student and peer consultation during and after hours for third year university students from an information technology course	Analysis of IT lecturer's diarised reflections, semi-structured questionnaire (n=77) and in depth interviews with 15 students	Academic appropriation of MIM triggered meaningful involvement in learning, fostering social constructivist environments.
(Bouhnik & Deshen) / Israel	Teachers used WhatsApp group in addition to face-to-face lectures to support high school	12 semi-structured interviews with teachers; developing categories	Groups used for 4 main purposes: communicating with students; nurturing social atmosphere;

Authors Country	Learners/subject/technology/ educational method and setting	Research method	Key Findings
	students.	from data	encouraging sharing among students; and as a learning platform.
(Rambe & Bere, 2013b) / South Africa	WhatsApp groups set up to facilitate extended, lecturer–student and peer consultation during and after hours for third year university students from an information technology course	Case study: thematic content analysis of WhatsApp conversations using social embeddedness as interpretive framework;	Use of WhatsApp enhanced the externalisation of cognitive, emotional and political capacities. Digital divide manifested in physical divide, limited networked connectivity and skewed social networks after work hours.
(Ngaleka & Uys, 2013) / South Africa	Third year undergraduate Information Systems students use WhatsApp to collaboratively work on a group research assignment in between face-to-face meetings	Analysis of interactions of one group using Have's conversation analysis framework (2007)	WhatsApp used to arrange meetings, make decisions and discuss projects. Application facilitates learning conversations where students can be speaker and listener concurrently, leading to multiple conversation threads
(Aburezeq & Ishtaiwa, 2013)/ United Arab Emirates.	Female pre-service Arabic language teachers were requested to make collaborative and individual weekly contributions to the WhatsApp group in addition to the face-to-face meetings	17 semi-structured interviews and content analysis. Verbal analysis method Validation: peer debriefing techniques	Use of platform can enhance students' instructional interaction, especially student-student interaction; Challenges: extra work load, distraction to learning, lack of students' commitment for effective participation
(Castrillo et al., 2014)/ Spain	85 (out of 450) university students of "German as a foreign language" course participated in WhatsApp groups. The teacher made the topical proposal, proposed text corrections and facilitated participation.	Mixed-method content analysis of one group (12 students, 1 teacher); quantitative and qualitative analysis to examine participation patterns and meaning making	Use of WhatsApp group contributed to the language learning activities (co-constructing knowledge), but also supported one another and built relationships in the group. Utterances bear resemblance with more informal, "spoken" style of writing.
(Rambe & Chipunza, 2013)/ South Africa	Fourth year human resource management students enrolled for a research methodology module were encouraged to interact on WhatsApp anonymously among themselves, with the lecturer, and the online facilitator	Data analysis of student (n = 72) and student-lecturer conversations and students' blog postings; connected with Sen's conceptualisation of functionings and freedom	WhatsApp used to bridge access to learning resources, peer and lecturer support and leveraging on-task. Impediments: limited access to Web-enabled smart phones and erratic network connectivity
(Bere, 2012)/ South Africa	Third year IT students and facilitators used both WhatsApp and the institutional learning management system (LMS) Blackboard to post questions and relevant information regarding course topics.	Mixed method approach to compare WhatsApp and LMS usage; semi-structured questionnaire survey (n=98 of 183). 4 questions for follow up interviews (n=20)	WhatsApp instant messaging perceived as richer ubiquitous learning environment than the LMS, especially by young undergraduate tertiary students who are conversant with mobile information technology and whose marital status is single.

Authors Country	Learners/subject/technology/ educational method and setting	Research method	Key Findings
(Lam, 2015)/ China	Students from a blended learning accounting course students from a full-time higher diploma programme used social media; in particular WhatsApp not prescribed by teachers.	Interpretive approach: semi-structured interviews, purposeful sampling (n=8), thematic data analysis	Small groups (n=2-10) used mainly to ask peers for content-related problems ad-hoc, especially before exams using text, photograph, voice messages; limited teacher involvement

4.1. Pedagogical implications: The educational role of MIM

The pedagogical implications of this review are manifold. The studies suggest that MIM in its current form is a predominantly welcome group learning activity. However, MIM does, not serve as a main conduit in most education settings. Instead it has been used as a complementary learning platform created to aid pre-existing education formats and compensate for their shortcomings. MIM groups cannot only help students achieve direct learning goals but they also facilitate engagement in collaborative problem solving in virtual groups (Lam, 2015). This is a paramount skill in the 21st century, where work is increasingly performed in mobile and distributed settings (Brodth & Verburg, 2007), that have been considered to be underdeveloped in the traditional class (Bounnik & Deshen, 2014). The playful and flexible use of MIM can also compensate for the limited access to and restricted communication in more static learning management systems (Bere, 2012). The specific and confined role of MIM for education has been further substantiated by students who valued the WhatsApp usage but were ambivalent about its wide-scale roll-out in different academic programs (Rambe & Bere, 2013a).

It was suggested that MIM can be used in particular to support social and affective interactions that are relevant in the first phases of an educational activity. To promote cognitive and metacognitive interaction, more structured applications such as Bulletin Boards or face-to-face group work could be used in later phases (Kim et al., 2014). This staged approach is in line with Salmon’s (2000) five step model of online facilitation of authentic activities, such as online discussions. In her model, which ranges from *ss / w / so* and */ l*, step two emphasizes online socialization as a necessary ingredient for building trust and rapport among acquaintances and socially distant participants and for the fostering and sustenance of a networked online community. At this stage, the role of moderators’ is facilitating and familiarizing students with the online environment through socialization, and providing bridges between social-cultural aspects of offline and online learning environments, in ways that increase familiarity with peers and break social distance among them. Moreover, socializing can be seen as an inherent part of effective learning itself. This is broadly reflected, for example, in the "social presence" dimension of the community of inquiry theory (Rourke, Anderson, Garrison, & Archer, 2007) and also forms the essence of the "learning as participation" metaphor, where the main route of learning is seen as socializing with and growing into a social community (Lave & Wenger, 1991; Paavola, Lipponen, & Hakkarainen, 2004).

4.2. Limitations and future research

While we hope that this synthesis has provided a more complex and nuanced picture of the implications of the educational appropriation of MIM technologies, several limitations need to be acknowledged that also point to directions for future research. Firstly, MIM is a rapidly evolving and

changing family of technologies and thus the investigation at hand can only represent a snapshot in time. This goes hand in hand with the limitation that, despite its increasing popularity, the literature search strategy revealed only a limited number of MIM papers and hence may not necessarily represent the full range of experiences that are currently being felt with the ongoing appropriation of this application in educational settings. With the body of literature that is primarily made up of qualitative studies and descriptive quantitative investigations, there is an obvious need for more rigorous quantitative research designs that, for example, compare the differences between MIM and other communication modes more systematically. Compared to the previous review that points to the meaning of IM for displaying and playing with identity (Quan-Haase, 2008), this aspect was not evident in the present study. Another possible gap that could be addressed by future research is the lack of MIM studies outside higher education settings, especially considering the intensive use of MIM by the age group of 13-16 years, and to a lesser extent also by the cohort of 9-12 year old learners (Mascheroni & Ólafsson, 2014).

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One of the main contributions of this study is to systematically summarize and synthesize literature on the educational usage of MIM, one of the most dominant modes of contemporary student communication. Its integration in teaching and learning can support group learning approaches in a wide range of subjects. MIM serves as complementary learning arrangement to enhance pre-existing education formats. The use of MIM in education settings transcends and amplifies the roles of students and requires learners and educators to balance between the social and cognitive dimensions of interactional engagement.

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