Advancing mobile open learning through DigiBot technology: a case study of using WhatsApp as a scalable learning tool

Elnerine Greeff*

University of Derby Business School,
Derby, UK
Email: e.greeff@derby.ac.uk
*Corresponding author

Levon Rivers and Tamlyn Wilson

Digify Africa,
Johannesburg, South Africa
Email: levon@digifyafrica.com
Email: tamlyn@digifyafrica.com

Abstract: This article presents a case study that outlines the potential of DigiBot technology, an interactive automated response program, in mobile open learning (MOL) for business subjects. The study, which draws on a project implemented in Sub-Saharan Africa, demonstrates the applications of DigiBots delivered via WhatsApp to over 650,000 learners. Employing a mixed-methods approach, the article reports on live event tracking, qualitative observations from facilitators and learning technologists, and a learner survey (N = 304,000). The research offers practical recommendations and proposes a model for scalable DigiBot learning. Findings reveal that in this case, DigiBot MOL had the potential to effectively address two key obstacles in open learning: accessibility and scalability. Leveraging mobile platforms such as WhatsApp mitigates accessibility restrictions, particularly in resource-constrained contexts, while tailored micro-learning enhances scalability.

Keywords: mobile learning; DigiBot learning; WhatsApp learning; scalability; micro-learning; learning technology; micro-credentials; e-learning; innovative learning; mobile open learning; MOL; open learning; distance learning.

Reference to this paper should be made as follows: Greeff, E., Rivers, L. and Wilson, T. (xxxx) 'Advancing mobile open learning through DigiBot technology: a case study of using WhatsApp as a scalable learning tool', *Int. J. Teaching and Case Studies*, Vol. X, No. Y, pp.xxx–xxx.

Biographical notes: Elnerine Greeff is a Senior Lecturer in Marketing at the University of Derby, holds five Corporate Communication degrees from NWU and Unisa. She also has a Diploma in Higher Education Assessment from Unisa and Masters-level Certificate in The Management of Technology Enhanced Learning from Carl von Ossietzky University, Germany. With over 15 years in academia, she has garnered numerous awards in best research, student success, and retention. Passionate about facilitating university-business collaborations, she focuses on branding and marketing projects that drive growth and development in her current role.

Copyright © 20XX Inderscience Enterprises Ltd.

Levon Rivers has worked with leading ad agencies and startups in South Africa, and brings over 16 years of expertise in innovation, technology, creative, and digital marketing. With a strong commitment to leveraging data-driven insights honed through MBA training and business experience, he excels in growth, team performance, resolving organisational challenges, and championing innovation initiatives. His accomplishments include over 50 prestigious awards both locally and internationally, alongside a distinguished portfolio of products, applications, and websites. With a track record of overseeing prominent client accounts and leading large teams, his current mission centres on educating Africa to supercharge its future.

Tamlyn Wilson is the Learning Design Director for Digify Africa. With an award-winning track record in both the advertising and film industries as a senior copywriter and storyliner, Her primary focus is on creating innovative learning experiences that drive impact. Her most notable career highlight being shortlisted at the Cannes Festival for her work on the Digibot. With a degree in Film and English from the University of Cape Town, an honours degree in Digital Art from the University of Witwatersrand, and Master's in Innovation Management, she is currently forging a new life and career path in Berlin, Germany.

1 Introduction

As advances in AI technology proliferate, scholars are increasingly starting to grapple with the implications of its use in various disciplines. What is especially necessary, is empirical research into how this kind of technology can be used to bolster current understandings of education and what its successful application could or should look like. An area currently quite neglected is the use of chatbot and DigiBot technology. A chatbot is an automated response service that simulates human conversation but with limited replies. DigiBots are a step further into this technology. They are interactive, automated response programmes that simulate human conversation to validate or guide users through content (Clark, 2020). There are myriad possible applications of DigiBot technology in education, but one of the most obvious is the potential utilisation of this technology for mobile open learning (MOL). MOL capitalises on mobile device technologies to offer students learning opportunities that are 'untethered'; students are free to access their learning wherever they are and whenever they want to; as an extension of their mobile selves (Witt and Baird, 2018).

This article contributes to the current MOL literature by tracing the roots of MOL from inception, showing how DigiBot technologies can be seated in established principles within this field, and simultaneously advance it to contend with the proclivities of modern learners. To be useful to academics and practitioners alike, the article offers practical, data-driven recommendations for the application of DigiBot MOL, which culminates in a model for scalable DigiBot MOL. The empirical research for the article is based on a project instigated by Digify Africa and Meta (then Facebook), which built four distinct DigiBots to be delivered to students via WhatsApp. As unpacked in the contextualisation section below, to date over 650,000 learners have enrolled in these courses. The project was implemented in 2021 in Sub-Saharan Africa, a region often on the dire side of the digital divide, but with the profuse use of mobile devices. The project

is therefore fertile ground for researching DigiBot MOL in a diverse environment that is simultaneously optimally geared to MOL, yet plagued by many of the obstacles rife in its application – such as access and scalability.

This article thus offers a case study to answer the research question *how can DigiBot technology be used to bridge current constraints of open learning where the primary intention is to enhance access to business education?*

2 A review of literature: the evolution of open learning

2.1 Stage 1: correspondence-based open learning (circa 1840s–1960s)

In the mid-19th century, technological advances in printing press technology and reliable postal services increased access to knowledge and learning. As commercialism, large-scale industrialisation, and urbanisation developed, railways, roads, and post offices made correspondence more accessible and dependable (Peters, 2010). This era coincided with post-World War Two efforts to make education more accessible to those previously excluded due to socio-economic status. The movement's core principle was egalitarianism, advocating for open access to knowledge, skills, and attitudes. Anderson and Simpson (2015) describe this as the initial phase of open learning. Holmberg (1960) retrospectively theorises 'guided didactic conversation' as the prevailing pedagogy of the time. It relied on structured materials and educator-dominated communication (Anderson and Simpson, 2015). Early examples discouraged learners from asking questions, deeming it 'unnecessary' once they engaged with the content (Holmberg, 1960). Holmberg (1960) later emphasised personalised and accessible instruction for greater impact.

These principles, though established before the mobile learning era, remain relevant to MOL. Today, there's a focus on guided learning conversations with empathetic teaching-learning interactions. However, scalability challenges exist in the contemporary learning environment with large class sizes. This often leads to defaulting back to didactic approaches on open learning platforms due to time and class size constraints. The long-term success of Massive Open Online Courses (MOOCs), for example, is questioned by theorists such as Bates (2012) due to these challenges.

2.2 Stage 2: constructivism and transactional distance in open learning (circa 1960s–1995s and beyond)

Peters (2010) points out that the zeitgeist of the 1960s and 1970s saw educators and politicians be exceptionally reform-minded. They believed that the welfare of society could be considerably improved by education. Instructional designers started to believe that radio and television could, not only transport but also innovate and enhance education (Bates, 2011). This brought to the fore innovative teaching methods which included (Peters, 2010; Motiwalla, 2007; Ozdamli and Cavus, 2011) the principles of:

- Learner-orientation: The course of learning should not be stipulated rigidly and independently of the learners but start from, and be shaped by their individual value perspectives, interests and experiences.

- Autonomous learning: learners should not be seen as objects but as the subjects of the teaching process.
- Learning through communication and interaction: Learning itself is not initiated and steered by means of ritualised presentation and reception processes but by discussion and active management of the learner.
- Transactional distance: The structure that expresses the rigidity or flexibility of the learning course's educational objectives, teaching, strategies, and evaluation methods must be scrutinised.

The underlying view of the principles above is that learners construct their knowledge from individual experiences. The term *constructivism* is coined and applied to the learning context. The constructivist model of learning asserts that the learner should have more control over the learning process and that individuals learn better when they discover things on their own (Merve, 2018).

2.3 Stage 3: the internet and web-based open learning (circa 1995–2010)

With the advent of the internet, new pedagogic models were characterised as means to advance the perennial goals of open learning – to widen access to higher education and lower cost, whilst maintaining quality (Garrett, 2016). This leads theorists Garrison et al. (1999) to construct the community of inquiry (CoI) framework. The CoI framework essentially aims to define, describe and measure those aspects that are present during 'worthwhile' educational experiences that specifically make use of text-based online discussions (Garrison et al., 1999). The CoI framework leads to the identification of three presences of collaborative online learning: social presence, cognitive presence and teaching presence. Social presence refers to participants' ability to project personal characteristics of themselves into the community and present themselves as 'real people' (Garrison et al., 1999). Cognitive presence is defined as the extent to which learners are able to co-construct and confirm meaning through sustained reflection and discourse (Garrison et al., 1999). Third is teaching presence, which concerns itself with the design, selection and organisation of course material. It aims to facilitate and direct the aforementioned two forms of presence towards meaningful and supportive learning.

2.4 Stage 4: MOL (circa 2010 and beyond)

MOL characteristically embodies certain attributes that shape the learning experience and product. The fundamental attributes of MOL are (Ozdamli and Cavus, 2011; Witt and Baird, 2018):

- Spontaneity: Most learning that takes place via mobile devices is informal and spontaneous.
- Ubiquitous: The ubiquitous nature of mobile means that learners are never without their devices. These devices also hold much more than just learning – they represent to learners almost all spheres of their existence (social, working, learning life and all others).

- Personal focus: Mobile devices are seen as extensions of the self and a move from general web-based learning to MOL means moving away from the concept of audiences to the concept of individuals.
- Contextuality: There should be an understanding of the context of mobile culture. As in any other context, these cultures 'rule in' and 'rule out' what is appropriate behaviour on a mobile platform.
- Connectedness: The contemporary learner can be described as having a focus on social interaction and 'connectedness' with friends, family and colleagues, and preferring group-based approaches to study.

2.5 Advancing MOL

However much the principles of mobile learning discussed above offer the underwriting philosophies that shape pedagogic practice, many MOL endeavours are still plagued by the very obstacles that were identified in earlier stages of open learning evolution – such as the constraints of scalability and individualisation. Mobile-first literature presents precedence and solutions to some of these obstacles. This article addresses a dearth of case study applications in literature. By examining the ways in which DigiBots can successfully be implemented in MOL environments, the article offers workable recommendations to academics and practitioners alike, utilising the theoretical pedagogic foundation offered in the sections above.

Taking its cue from the CoI model, DigiBots have the potential to imbue the learning experience with both social as well as cognitive presence (Garrison et al., 1999). For this to be successful, however, DigiBots need to hold authenticity and characterisation that aligns with contemporary learners' mobile culture (Witt and Baird, 2018). In order to attain this, Witt and Baird (2018, p.135) promote the use of a 'youth culture engagement playbook' that prioritises content storytelling and live immersive experiences alongside learner collaboration in the process.

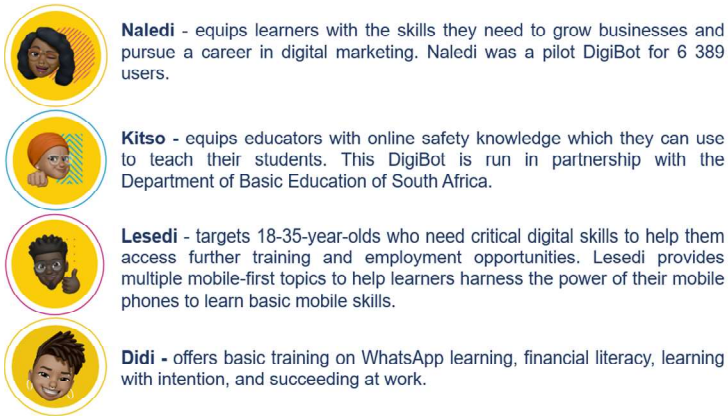
3 Contextualisation

In an economy such as those in sub-Saharan Africa, digital technologies simultaneously act as great equalisers and great discriminators. Considering the notion of egalitarianism, and the thought of Peters (2010) stipulated in the section above, the concept of MOL becomes more nuanced when studied in this context. Although this context has a great digital divide, it is also the market with the most mobile penetration, relative to its connectivity figures, with almost half of the population having access to the mobile Internet (Porter et al., 2020). Of these mobile users, over 95% report the frequent use of WhatsApp – more than any other chat-based platform (Statista, 2022). Leveraging the power of WhatsApp's accessibility and low data costs, the design of a DigiBot for education would allow for an exploration of the fundamental elements of scalable chat-based MOL.

Digify Africa and Meta (then operating as Facebook) began building the world's first WhatsApp Learning Bot in 2020. Using an advanced WhatsApp user experience, the platform allows for comprehensive learning curriculums aiming at upskilling mobile

learners. It does so by delivering micro-lessons to reach learners with minimal data usage and via dynamic menus, gamification and keyword recognition. The creation of the DigiBot-based MOL platforms has resulted in four DigiBots, as outlined in Figure 1.

Figure 1 The four DigiBots learning programs (see online version for colours)



4 Methodology

The empirical methodology of the study included two different data-gathering approaches, each with both quantitative and qualitative components. The first approach was live event tracking utilising metrics quantitatively alongside qualitative observations from facilitators and learning technologists on the development team. A survey was also deployed to all learners who completed their learning via the MOL DigiBot learning, which included quantitative closed-ended questions alongside open-ended questions that were interpreted qualitatively. This amounted to a sequential mixed-methodological approach.

4.1 Live event tracking

Live event tracking was used to track learners through their DigiBot MOL journeys, which allowed for a holistic understanding of how learners progressed through the interaction funnel of connecting, registering, completing topics, continuing engagement, completion and re-engagement. Alongside these metrics, the creator-facilitators of the DigiBots kept logs with qualitative observations regarding the event metrics; noting how engagement faltered or improved with the deployment of certain platform functionalities and activities.

4.2 Learner survey

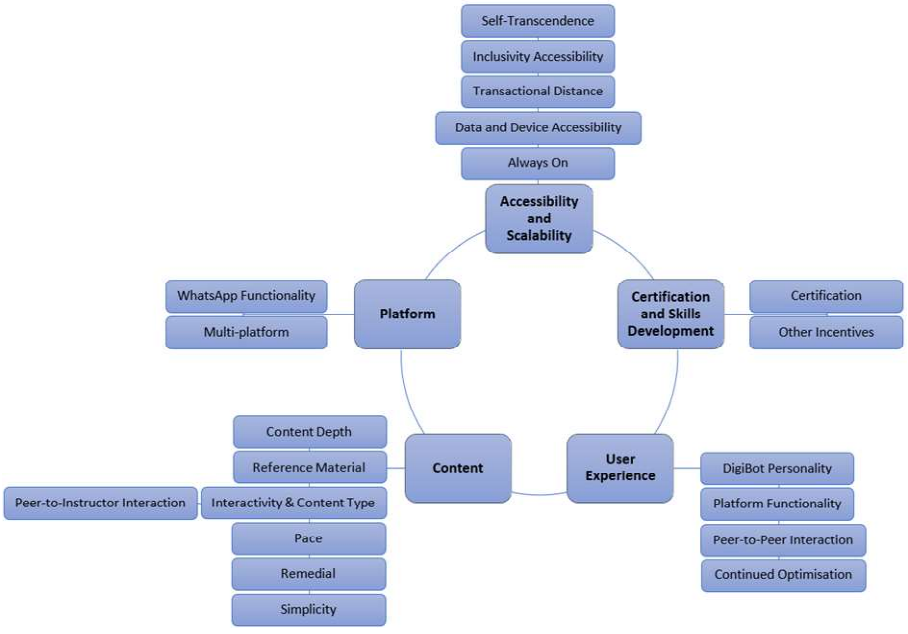
A survey was distributed to all learners who engaged with any of the DigiBot courses beyond registration, with no further exclusion criteria. This meant that the entire population was included in the sampling. With a population of over 304,000 learners, a

completion rate of 12% (with over 37 000 usable surveys) meant that the administration yielded a sampling error below 3% – a confidence level of over 97%. The final survey consisted of demographic items and 18 closed-ended content items, asking about learners' satisfaction and perceptions regarding their learning experience. These items made use of standardised Likert scales. Further to these items, three open-ended questions were also employed, asking learners to comment on their experience interacting with this learning programme.

4.3 The framework approach to data analysis

The framework approach is a form of thematic analysis, which consists of five stages for systematically analysing data from various sources (Bonello and Meehan, 2019). It is an iterative process that utilises a-priori themes from literature as a basis for its construction (Hackett and Strickland, 2018). Whereas traditional models for thematic analysis usually is only employed for qualitative studies, the framework approach is expanded to allow for the integration of various sources of data through five stages of findings mapping. It enables researchers to systematically work through texts, such as the findings from the surveys and event tracking, to identify concepts and draw out issues. These are then organised into key themes, aimed at addressing the overall research aim – for the purposes of this research, to construct a model for DigiBot-enabled learning, that bridges the traditional constraints of open and mobile learning.

Figure 2 Initial framework of themes (see online version for colours)



The framework approach organises data into a hierarchical structure. In this research, it amounted to five main concepts with two to five sub-concepts as detailed and visually displayed in Figure 2. It defines the basis of the model, as refined in the final stage of the empirical methodology.

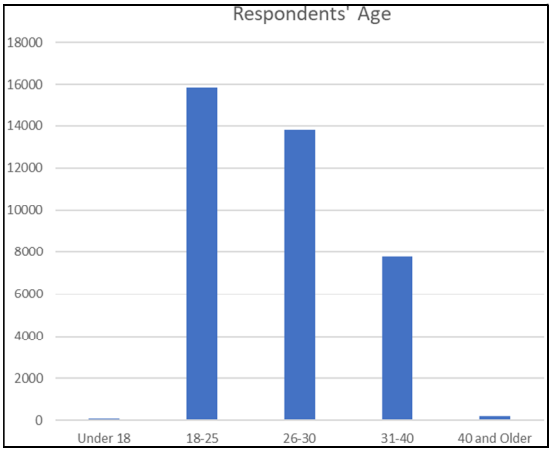
4.4 Reliability, validity and respondent demographics

The questionnaire's reliability was tested using the Cronbach alpha method. This method can be described as a coefficient of reliability, as it measures how well a set of questions measure a single variable. The Cronbach's alpha was measured for each of the two factors returned for the questionnaire. At 0.8 and 0.7 respectively, both factors were found to be statistically reliable measurements.

To enhance the trustworthiness of the qualitative data-gathering methods, and to lower the error of the observers of the data, use was made of inter-rater reliability. This refers to the exclusion of observer error by making use of more than one observer to simultaneously record measurements of the same phenomena (Gravetter and Forzano, 2015). For the observations of the facilitators and learning technologists, as well as the analysis of the open-ended survey questions, three observers were used in the data analysis of the qualitative inputs.

To offer an overview of the respondents, the demographics of the learners who took part in the survey are outlined below. As seen in Figure 3, the majority of respondents were between the ages of 18 and 25 (n = 15,859, 42%), followed closely by those between 26 and 30 (n = 133,836, 37%).

Figure 3 Age of respondents (see online version for colours)



Of these respondents, just over half are in full-time employment (52.5%, where n = 34,948). 45% of the respondents are part-time employed or hold secondary employment alongside being a learner (n = 30,150). Only 2.2% (n = 1,486) are unemployed or only learners, as seen in Table 1.

Table 1 Respondents' employment status

	Employment status		
	Full-time employed	*Part-time employed/secondary employment*	*Student/unemployed*
Value:	34,948	30,150	1,486
Percentage:	52.5%	45.3%	2.2%

The respondents were also from 24 different countries in Sub-Saharan Africa, as seen in Table 2. The overwhelming majority of respondents (n = 37,190, 98.34%) were from South Africa, followed by Nigeria (n = 197, 0.52%).

Table 2 Respondents' country

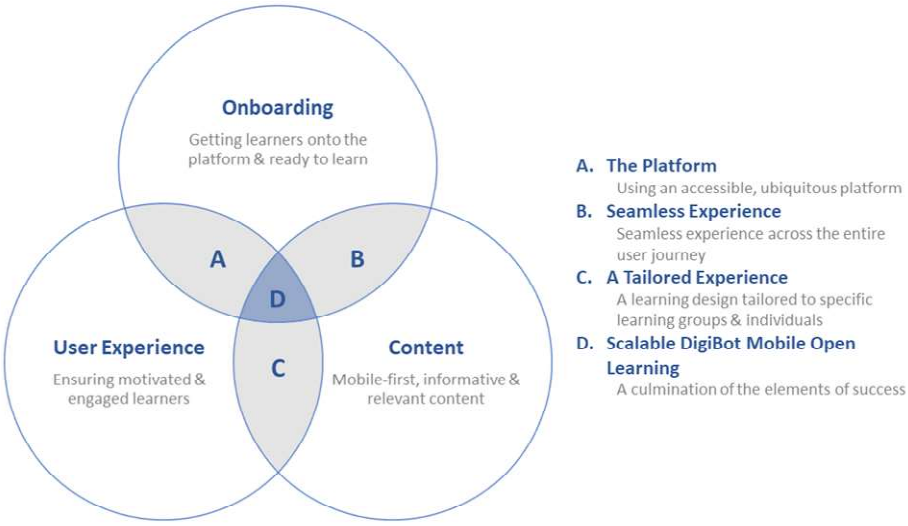
	Frequency	*Percent*
Botswana	4	0.01%
Burkina Faso	1	0.00%
Burundi	5	0.01%
Cameroon	15	0.04%
Eswatini	4	0.01%
Ethiopia	7	0.02%
Gambia	23	0.06%
Ghana	70	0.19%
Kenya	45	0.12%
Lesotho	2	0.01%
Liberia	33	0.09%
Malawi	15	0.04%
Mbediene	1	0.00%
Namibia	8	0.02%
Nigeria	197	0.52%
Rwanda	19	0.05%
Sierra Leone	55	0.15%
Somalia	2	0.01%
South Africa	37,190	98.34%
Tanzania	39	0.10%
Uganda	38	0.10%
USA	1	0.00%
Zambia	15	0.04%
Zimbabwe	27	0.07%

5 Findings

At the conclusion of the methodological exploration, two closely related sub-themes from the model depicted in Figure 2 were collapsed. After this, three main themes with three

overlapping sub-themes remained. This resulted in a model for scalable, accessible DigiBot MOL, as depicted in Figure 4.

Figure 4 Model for scalable, accessible DigiBot MOL (see online version for colours)



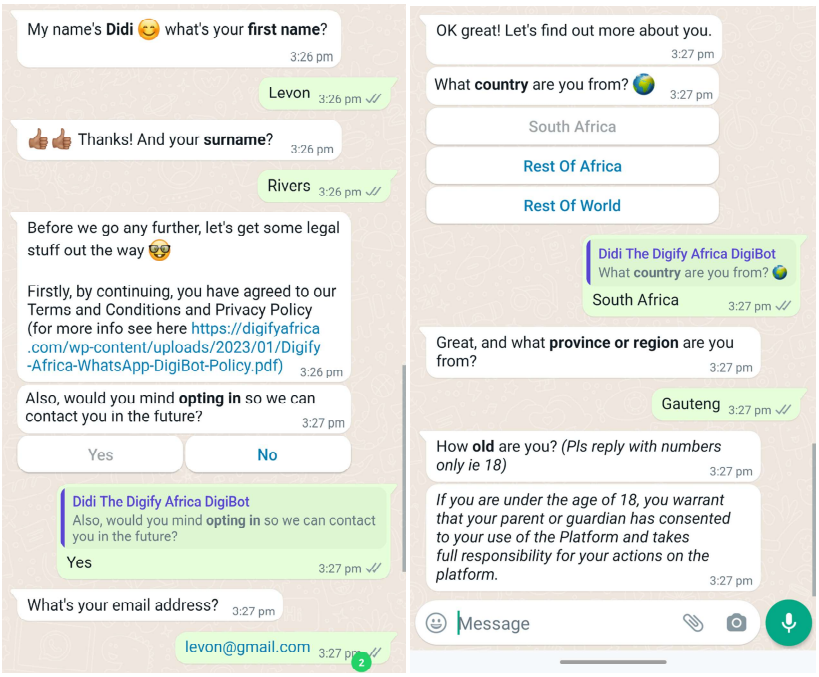
5.1 Circle 1 – onboarding

Findings from facilitator logs especially suggest that there should be a specific onboarding plan that strikes a balance between providing enough orientation to learners without overwhelming them. The qualitative components of the learner survey emphasised the importance of simplicity, with onboarding ideally offering (in the words of the learners) 'important information' in 'short, precise and easy chunks' making it 'straightforward', 'uncomplicated' and 'not time-consuming'. Mobile learners expect information to be concise and relevant, meeting their immediate needs, much like their other mobile interactions. Figure 5 offers an example of complex functionality made easy via the WhatsApp interface.

In practical terms, students were shown how to navigate to the 'Help' function and an adjusted FAQ system. The FAQ option was presented to learners as the main (if not only) option for troubleshooting. Although the FAQ page was integrated into the WhatsApp platform, at present it is still static, rather than dynamic content. For further development, it is recommended that the FAQs be integrated into the DigiBot communication system so that learners are able to pose their questions directly to the DigiBot they are interacting with. The closer these interactions can mirror those that learners would have with moderators or facilitators in more traditional educational experiences the better, as this would go towards establishing both a social and teaching presence on the course, per the CoI model elaborated on above (Garrison et al., 1999). Learners expressed a need for this, stating that the DigiBot would be improved "by programming her to understand some questions" rather than necessitating students to 'go look for' answers in FAQ or Help pages. With the rollout of later DigiBot interactions (thus in instances where it was

possible to adjust for this need), learners expressed their satisfaction with the DigiBot's ability to "give you the exact answer to your question", another stating "I like about Lesedi you get answers at the same time." Interesting to note in all of this feedback is the use of proper nouns and personal pronouns when referring to the DigiBot, seemingly pointing to a perceived facilitator presence that the CoI model speaks of.

Figure 5 Examples of complex functionality made easy via WhatsApp (see online version for colours)



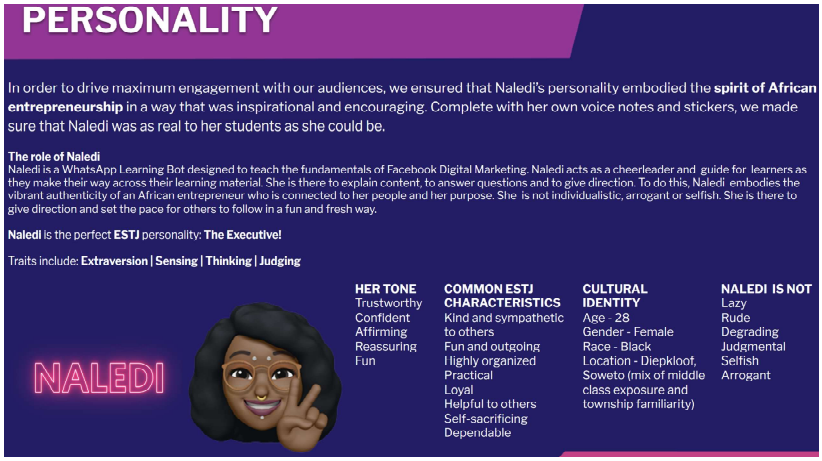
Further to this, there is also the consideration of the 'always on' presence in MOL. As stated in the literature review, mobile learners tend to have expectations about learning opportunities being available whenever they would like to engage. In the learner survey, this was expressed in no uncertain terms by learners indicating that the DigiBots must be "available 24 hours a day and 7 days a week" to engage and 'answer questions'. It is essential to these learners that the learning experience caters to whatever hours they would keep in this mobile learning experience, by 'making sure it's 24 hrs' and ensuring that "the bot [does not] go offline." It is clear that for these learners the idea of *open* mobile learning is not just about being able to learn at any time of their choosing, but also about being instructed and engaged at any time of their choosing.

5.2 Circle 2 – user experience

To address potential drop-off and stagnation that long-distance learners might experience from lack of human engagement, the DigiBots replaced the role of teacher or facilitator with an automated bot personality designed to motivate and guide learners through each

module as if they were engaging with a real person, on WhatsApp. Each bot personality was tailored to its target market, ensuring that it was both culturally relevant and relatable to the learners. Naledi, for example, was a DigiBot personality built to specifically engage with young entrepreneurs across Africa. She embodied a youthful black woman, who with a dynamic, fun and aspirational tone came complete with her own Avatar, voice notes and emojis.

Figure 6 An example of personality framework – Naledi (see online version for colours)



In the section directly above, the fact that learners referred to DigiBots by proper nouns and personal pronouns was raised. This seems to imply that learners anthropomorphise the DigiBots to some degree. This was further reinforced in the survey feedback. While some learners clearly understood the bot personality to be tied to a software programme (e.g., "It's an animated learning bot … and I like it"), other comments raise questions about whether learners understood this to be a bot and not a person. Some examples to this point are; "I liked that Kitso is committed, very flexible, focused, and patient." When asked what could be improved about the bot, one learner even responded "Lesedi is a person", another suggested "by pay him well" and yet another "let him respond personal questions."

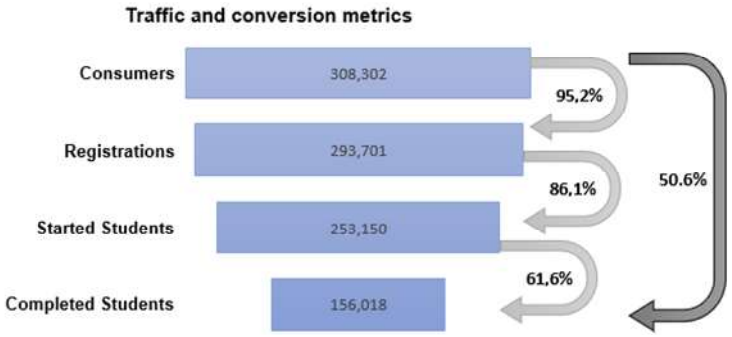
Regardless of whether learners understood that the DigiBots are not real people, they responded positively to their personalities. Some of these responses are, for example; "I liked the fact that she is pretty cool and kept the course vibrant with her gestures", "[I] Like the way she makes learning so easy and fun" and quite simply "he is not boring." Referencing directly back to the CoI model (Garrison et al., 1999) and the different presences that facilitators or teachers should instil in an open learning experience, responses to all three DigiBots imply that both social and teaching presence was experienced by learners. On teaching presence, learners offered comments such as "what I like about kitso is that Kitso is very helpful and kind too help me with the questions", "I like that she explains very well. She's good at giving information or teaching" and "he is the best teacher."

Likewise, learners showed that for them social presence was also present, with one learner even describing what they had with the DigiBot to be a 'good relationship'. Apart

from the purposively engineered traits learners further assigned socially complex attributes to the DigiBots, such as empathy and even guidance or mentorship. Starting with the latter and moving to the former, some examples of this are; "I liked that kitso gives out good advices", "I like about how Kitso guide me", "I just love her she is very patient and kindly", "I love his interaction with me" and "she's kind."

Given the requirements of younger mobile users, it was raised in the literature that DigiBots need to hold authenticity and characterisation that aligns with contemporary learners' mobile culture (Witt and Baird, 2018). This underscores the importance of thorough market research prior to the finalisation of DigiBot personality frameworks. For example, Naledi's personality was derived from the cultural, social and educational bracket within which her target audience sat. These were young, African entrepreneurs aged between 19 and 35, living in peri-urban areas. When done in an unauthentic way, learners will resist the personality of DigiBots as seemingly 'trying too hard' to fit in [Witt and Baird, (2018), p.30]. Survey responses point to the fact that learners found the bot personalities to be aligned with youth culture; three examples of this being learner statements such as "Naledi is a vibe", "she's such a dope honey ♥" and "Naledi was very interactive and youthful, as well as relatable."

Figure 7 Conversion rates of the course (see online version for colours)



As the very nature of the DigiBots is tailored to specific audiences and learning outcomes, a stringent monitoring and analytics process needs to be put in place to measure the engagement levels and behaviours of all learners. Measuring the effectiveness of the DigiBots included metrics around traffic, conversion and content comprehension. In terms of the former, real-time and continuous tracking of the number of learners who started chatting with the bot, and the number of learners who went through the registration of the bot was deemed necessary. For conversion, the rate by which learners started their first learning topic on the bot and the number of learners who completed all their learning topics (and earned their certificate) was tracked. Monitoring the traffic and conversion rate means that improvements could be made in real-time when 'leaks' in the funnel were observed. In the facilitator logs, 'leaks' were identified as those instances where learners 'offboarded' or dropped off. When patterns of offboarding were experienced, facilitators were able to home in on the last learning experience and adjust it to be more user-friendly and offer a better user experience in real time. Lastly, content comprehension was tracked by looking at metrics relating to success in the assessment tasks. These metrics work towards minimising the drop-off that many MOL courses

encounter; encouraging long-term engagement. Figure 7 shows the retention rate of this course (50.5% overall). With slightly less than 50% attrition, the DigiBot course proved to be much more successful on this score than its closest counterpart, MOOCs, which usually have around a 90% attrition rate (Goopio and Cheung, 2021).

5.3 Circle 3 – content

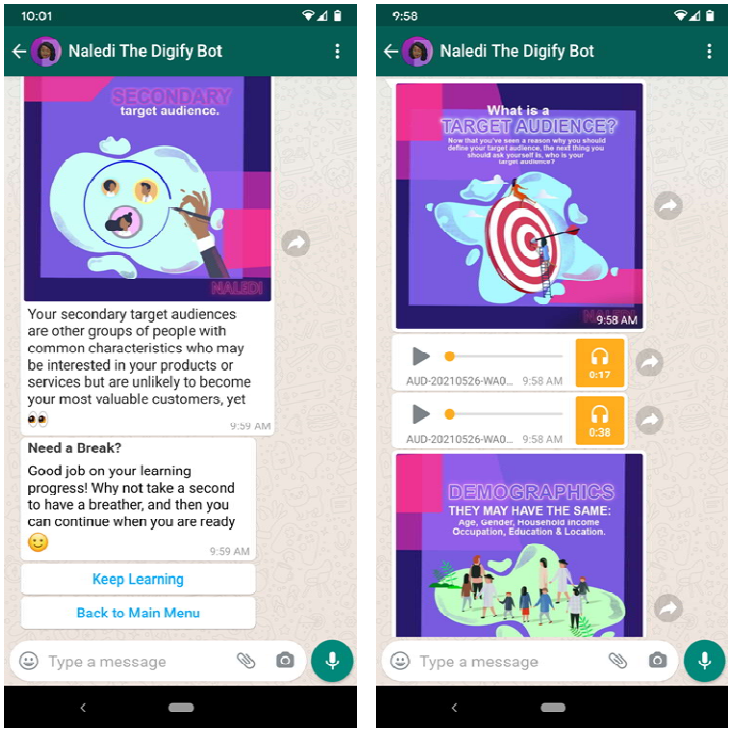
Since mobile content is generally viewed on small screens and while in motion [especially in the Sub-Saharan context, c.f. Porter et al. (2020)], images needed to maximise the screen real estate with bold, striking elements that could be easily read from a distance and very quickly. It was also important that visual content worked across multiple versions of smartphones consistently, meaning key facts and summaries had to be centred horizontally and vertically. It was discovered that 1:1 square-sized images worked best for text-heavy images, while wide landscapes worked better for images with headers. Important also were the accompanying captions to the images that helped provide more context, if and when learners needed it. Learners expressed in the questionnaire that they would like further actions to be taken to ensure that this content is retained in some form for future reference. One learner suggested that the content be available, after the "lecture or training in a pdf or offline for private reading." Another suggested 'cloud base', "so that we can use for future references as just everything in one place unlike if I'll have to always scroll back in the chats if I'm looking for something." Reiterating this point another respondent stated that "Learning on WhatsApp can be difficult when you want to scroll back. Especially if you want to read again at your spare time. Maybe create a template or presentation booklet to download with all the content learned."

The textual content tried to resemble – aspired to have the feel of – a casual WhatsApp conversation, but at the same time uphold key learning concepts. To address this, careful and tactical placement of emojis was applied to text to ensure a sense of natural, relatable conversation in the way they theatrically punctuated the learning concepts. It was also important that the text did not exceed more than 250 characters, as this could potentially make it harder for learners to read on the go. Adding delays between messages created a sense of personal, real-time engagement as it simulated the natural pauses one would expect in a WhatsApp conversation with another human. Delays are also important to the literacy level of the audience. For example, if the learner is a slow reader and the delays are too fast, it could risk the learner's ability to engage and absorb the information effectively. Analytics and feedback are important here so that the DigiBot interaction can be adjusted accordingly. The adjustments made in this learning course were based on pacing comments such as "He should give space for people to read previous messages before adding on. People may be discouraged when they become too overwhelmed with the messages" and "When the information appears. It appears fast without me finishing reading. Naledi must give us more reading time."

Voice notes are another important factor in simulating human connection with learners. Because a voice note is not visual and could be 'quickly scanned', its main function was to bring key learning concepts to life through short case stories designed to bolster comprehension. It was important that the voice-over artist speak clearly and slowly so that it might be heard and understood in locations that might be busy and noisy. Apart from comments in the questionnaire that cautioned against the data toll of voice notes, learners were mostly positive about this feature stating that "they make the content

so easy to understand", and that it is 'really creative'. Some learners, however, called for more interactivity with this feature asking to be allowed to 'record an audio reply'.

Figure 8 Example of the content hierarchy (see online version for colours)



Three principles guided the construction of the content – inspired by the main elements of mobile interaction – these were: simple, snackable and engaging content. Content had to be robust, but not cumbersome to engage with via mobile. Learners showed overall satisfaction with this, commenting that the content was "Quick and clear… Which is easy to understand. Thanks for this." Another commented that "What I liked about Kitso is that it breaks the content to make one to easily understand the topic." Speaking about the importance of the balance between depth and simplicity, one of the learners indicated that "the learning is made simple by not over informing but giving all important information and also by keeping it simple." In the design of learning content, it is therefore beneficial to offer not too much contextualisation and narrative – in order to resemble a mobile experience, the content had to get straight to the point when it offered comprehensive yet exact information on the learning topic. Just so, the content was driven by the mobile principle of 'snackability' (Cortés Quesada et al., 2022). To ensure snackability the content had to be easy to read, listen to and scan for when on mobile. To ensure snackability, the hierarchy dictated that visual content take precedence, followed by text and then voice notes. An example of how the hierarchy was employed is depicted in Figure 8.

5.4 Intersecting spheres

5.4.1 Intersection A – the platform

Overall, learners expressed satisfaction with the platform itself, with comments in the questionnaire such as "This is a great piece of tech and I can't wait to see the future possibilities of using WhatsApp as a platform for learning" and "Doing quiz on WhatsApp is very effective and you can learn any time and any where." With this being said, many learners called for the simultaneous presence of this DigiBot course on other platforms like 'FB and Instagram' – to "Make her accessible on other social media platforms, because not everyone is on WhatsApp." Learners expressed the need to "share on other social media also" the learning experience, content and outcomes. These points again to the fact that learners see an integration of their online lives and express a need for that to be mirrored in their MOL. To these learners, the boundaries between platforms are mostly permeable and they want the same for learning that takes place on it.

5.4.2 Intersection B – seamless experience

Transitioning from the onboarding process to content engagement requires a seamless experience on the part of learners. To achieve this, the innovation team designed a unified visual identity that guided potential learners across all their communication touchpoints, from social media platforms, to the onboarding process and finally to the learning content, and ensured that the learning experience was guided by WhatsApp's functionality – eliminating the need to learn how to navigate new systems. The underlying or core approach to the learning was to ensure that learners perceive the MOL to be ubiquitous, just another feature of their mobile existence. This cannot be achieved if the learning does not feel seamless to learners – if they see a definite difference to their usual mobile activities, or between different elements within the learning experience. The positive user experience, punctuated by authentic interactions with the DigiBot as a facilitator, as well as a high retention rate in the learning, attests to this being accomplished successfully.

5.4.3 Intersection C – the tailored experience

As outlined in the literature review (see Witt and Baird, 2018), and as demonstrated in discussions regarding the user experience and the learning content that followed, the contemporary mobile learner, expects a tailored learning journey, and expresses frustration at any rigid processes or interactions. The intersection between the content put forward to learners and the experience that surrounds it, is thus tailoring. One learner commented that the interaction with the DigiBot and the learning that it returns as a result of that interaction should be "flexible to reason along with people's comments." Even if learners felt satisfied with the presence of the bot as a facilitator, they commented that 'inconsistency with replies' frustrated them and that the bot 'should listen' to them. This all points to a need for a tailored experience, that is bespoke to each learner and not uniform or parallel to the experience of other learners. Like the two foregoing intersecting spheres, this points once again to learners expecting their MOL to function like their other mobile experiences – that it be bespoke to them.

5.4.4 Accessible, scalable MOL

At the point where all the spheres intersect, scalable DigiBot MOL takes place. Although feedback was gleaned from the onset and throughout each of the DigiBot courses' duration (which, by virtue of their open nature, is ongoing), it was important to test learners' overall satisfaction with the course as it stood after the principles discussed above were implemented. Cumulatively 94.2% (n = 21,077) of learners felt that they had a good experience with the DigiBot MOL course that they were enrolled in. Next, learners were asked about the WhatsApp platform, specifically and whether they felt that it was an effective tool to learn through, all things considered. A similar positive response was found, with 93.2% (n = 20,856) of learners feeling that this platform was indeed effective. Lastly, to gauge the success of the learning course overall, learners were, in the survey that they completed once done with the course, asked questions to test their knowledge of the overarching learning outcomes for their DigiBot course. Although the continuous assessment in the course tests the outcomes of the learning units, as learners complete them, the survey questions (which took the form of three multiple-choice questions) endeavoured to discern a more holistic understanding of the learning. For the three content questions, a success rate of 85% (n = 26,561) was seen for the first question, 82% (n = 25,233) for the second and 89% (n = 24,968) for the third. The success rate was deemed high, given the usual rate of learner success and retention in similar open learning courses such as MOOCs (c.f. Goopio and Cheung, 2021).

6 Conclusions

The contribution of this article is seated in the fact that it starts to plot the next iteration and development of MOL, as it contends with the implications of the practical implementation of open learning within a developing context. Tracing the origins of the learning approach through to an understanding of the mobile-first generation of learners bolsters the current understanding of MOL in two main ways. First, it underscores the importance of understanding mobile learners, and how they consume and engage with learning in an increasingly mobile world. The findings presented in this article show how learners want their learning integrated into their everyday mobile lives, not seeing it as a detached activity, but rather as an extension of their already extant mobile selves. The challenge is for facilitators and educators to understand, not only how learners experience learning and tuition, but also how they experience mobile interactions, and endeavour to bring this to them. It is only once such an understanding gives way to insights into learners' predilections and engagement behaviour, that DigiBot MOL can be successfully implemented. In this article, this was demonstrated by foregrounding the importance of an onboarding programme that readies students for the mobile context of the learning that they are to undertake. The article demonstrated how this should be presented on a platform that is accessible and ubiquitous, yet tailored to learners; and responsive to their individual commands/inputs. In this way, the learning responds to students' expectations of always-on technologies that are hyper-individualised to their preferences. Just so, learners expect a seamless flow from one area of learning to another and a seamless flow between their learning and other facets of their mobile lives. The content that learners encounter here should be mobile-first as opposed to mobile-friendly. Lastly, it is of the utmost importance that the user experience of the learning encounter be foremost in the

minds of those designing the learning, as DigiBot technology enables facilitators and educators to overcome some of the obstacles that are remnants of almost every stage of open learning.

The first of these obstacles is accessibility. Social platforms such as WhatsApp – through the use of mobile concepts such as snackability and simplicity – were proven in this article to viably mitigate some of the most pertinent constraints of accessibility to learning and learning content, in developing contexts such as sub-Saharan Africa. The second major obstacle is scalability. This is especially important as constraints around scalability are the reasons why other open learning technologies have been shown not to be as successful as they were once slated to be – MOOCs being the primary example here. Utilising technologies such as DigiBots means that one-to-one approaches can be mimicked to such a degree that students experience a learning situation that feels catered to them specifically. This can only really be done, however, if the thorough understanding of the learners spoken about above is translated to a DigiBot facilitator interface that shows personality and personability as a teaching presence in the MOL environment.

This point closely links to the second way in which this article contributes to the current understanding of MOL. The article shows how the next iteration of MOL is not necessarily about new pedagogy, but rather about using established pedagogies in new ways. Specific to the field of mobile, this adjustment needs to be made along the lines of the mobile generation's requirements of spontaneity, personal focus, contextuality, ubiquitousness and always-on connectedness. These adjustments were shown to successfully, within this population, allow for teaching and personal presence – per the CoI framework – to be embodied by a DigiBot as the student-facing 'facilitator' of the course.

To articulate the ways in which this can be done practically, this article offered a model for scalable DigiBot MOL, with three intercepting spheres. Although the model utilised a sound methodology that spanned the construction of four fully implemented MOL DigiBots, it is still to be empirically verified. A limitation and recommendation for further research is thus that the themes and concepts of the model be tested empirically – ideally through quantitative statistical modelling. Likewise, the model also only represents a very specific population of learners. Although the population is purposively appropriate, it is not in any way meant to be representative of any other context. Further studies on how DigiBot MOL is experienced by learners in other contexts are necessary.

Further to this, the current article – due to feasibility reasons – could not include all pedagogic approaches in its implementation. Although an overview of these approaches was offered in the literature review, only those most pertinent to the context explained above were tested. Further insights into how DigiBots can be designed from other pedagogic stances will be thought-provoking. Lastly, in the qualitative analysis of the open-ended elements of the questionnaire, a theme emerged which fell outside of the purview of this research, but that is important and a recommendation for further study: some of the learners commented on the usability of DigiBots on platforms such as WhatsApp for individuals with cognitive, learning, visual or audio disabilities or adversity. This article made some of the first inroads into understanding DigiBot-enabled MOL, but it is certainly not an exhaustive account of all how this can play out or be affected within learning contexts.

Acknowledgements

The authors would like to extend their sincere thanks to the team and partners who helped with the product, write this research paper, and improve the lives of hundreds of thousands of learners across Africa:

- From Digify Africa: Altar Muzodza; Gavin Weale; Lauretta Mtlomelo; Omphile; Kgwathe; Phila Nyawo; Qhakaza Mthembu; Kele Scheppers; Tina Shabalala; Rofhiwa Maneta; and Xolani Sedibe.
- From Meta: Aviv Weil; Aviwe Komsana; Elizma Nolte; Shafayat Miah; and Tangerine Mathebula.
- From Techsys Digital: Andrew Walmsley and Dane Killian.
- Other Partners: Dr Neo Mothobi (DBE); Prof Tennyson Mgutshini (UNISA); Julie Webb Liatos (Scribble Scrabble); Michelle Kreuger (Scribble Scrabble); Marius Wannenburg (Media Box); and Mixo Ngoveni (Geekulcha).

Funding

Although funding was received for the construction of the DigiBot (from *Facebook*, for example), there is no funding to report for the research component of this project.

References

Anderson, B. and Simpson, M. (2015) *History and Heritage in Open, Flexible and Distance Education*, Learning & Technology Library (LearnTechLib) [online] https://www.learntechlib.org/p/147885/ (accessed 10 May 2023).

Bates, A.W. (2011) *Exemplo: Teaching in a Digital Age* [online] https://opentextbc.ca/teachinginadigitalage/ (accessed 19 April 2024)

Bates, T. (2012) 'What's right and what's wrong about Coursera-style MOOCs | Tony Bates', 6 August [online] https://www.tonybates.ca/2012/08/05/whats-right-and-whats-wrong-about-coursera-style-moocs/.

Bonello, M. and Meehan, B. (2019) 'Transparency and coherence in a doctoral study case analysis: reflecting on the use of NVivo within a 'framework' approach – ProQuest', *The Qualitative Report*, Vol. 24, No. 3, pp.483–498.

Clark, K.B. (2020) 'Digital life, a theory of minds, and mapping human and machine cultural universals', *Behavioral and Brain Sciences*, Vol. 43, p.e98, https://doi.org/10.1017/S0140525X19002838.

Cortés Quesada, J. A., Barceló Ugarte, T. and Fuentes Cortina, G. (2022) 'El consumo audiovisual de los Millennials y la Generación Z: Preferencia por los contenidos snackables', *Doxa Comunicación. Revista Interdisciplinar de Estudios de Comunicación y Ciencias Sociales*, pp.303–320, https://doi.org/10.31921/doxacom.n36a1687.

Garrett, R. (2016) 'The state of open universities in the commonwealth: a perspective on performance, competition and innovation', *Commonwealth of Learning (COL)* [online] https://oasis.col.org/handle/11599/2048.

Garrison, D.R., Anderson, T. and Archer, W. (1999) 'Critical inquiry in a text-based environment: computer conferencing in higher education', *The Internet and Higher Education*, Vol. 2, No. 2, pp.87–105, https://doi.org/10.1016/S1096-7516(00)00016-6.

Goopio, J. and Cheung, C. (2021) 'The MOOC dropout phenomenon and retention strategies', *Journal of Teaching in Travel & Tourism*, Vol. 21, No. 2, pp.177–197.

Gravetter, F. and Forzano, L.A. (2015) *Research Methods for the Behavioral Sciences*, 5th ed., Wadsworth Publishing.

Hackett, A. and Strickland, K. (2018) 'Using the framework approach to analyse qualitative data: a worked example', *Nurse Researcher*, Vol. 26, No. 2, pp.8–13, https://doi.org/10.7748/nr.2018.e1580.

Holmberg, B. (1960) 'On the methods of teaching by correspondence', *Routledge Handbooks Online*, https://doi.org/10.4324/9780203803738.ch3

Merve, K. (2018) 'A systematic literature review: constructivism in multidisciplinary learning environments', *International Journal of Academic Research in Education*, Vol. 4, Nos. 1–2, pp.19–26, https://doi.org/10.17985/ijare.520666.

Motiwalla, L.F. (2007) 'Mobile learning: a framework and evaluation', *Computers & Education*, Vol. 49, No. 3, pp.581–596, https://doi.org/10.1016/j.compedu.2005.10.011.

Ozdamli, F. and Cavus, N. (2011) 'Basic elements and characteristics of mobile learning', *Procedia – Social and Behavioral Sciences*, Vol. 28, pp.937–942, https://doi.org/10.1016/j.sbspro.2011.11.173.

Peters, O. (2010) *Distance Education in Transition: Developments and Issues*, BIS – Verlag der Carl-von-Ossietzky-Univ.

Porter, G., Hampshire, K., Abane, A., Munthali, A., Robson, E., De Lannoy, A., Tanle, A. and Owusu, S. (2020) 'Mobile phones, gender, and female empowerment in Sub-Saharan Africa: studies with African youth', *Information Technology for Development*, Vol. 26, No. 1, pp.180–193, https://doi.org/10.1080/02681102.2019.1622500.

Statista (2022) *WhatsApp Usage in Selected Countries 2022*, Statista [online] https://www.statista.com/statistics/291540/mobile-internet-user-WhatsApp/ (accessed 19 April 2024).

Witt, G.L. and Baird, D.E. (2018) *The Gen Z Frequency: How Brands Tune in and Build Credibility*, Kogan Page Ltd., London.