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Is Moodle or WhatsApp the preferred e-learning platform at a South African university? First-year students' experiences

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Abstract

First-year students are compelled by South African universities to use the Moodle e-learning management platform. Recent studies outline that this creates challenges during the learning process, since students struggle to use Moodle owing to their disadvantaged school background; however, they are familiar with and good at using the WhatsApp social media platform. While these studies have attempted to provide possible solutions, there is a need for an alternative option. This qualitative case study proposes alternatives and the possible use of WhatsApp to supplement Moodle, depending on the personal needs of the student. Twenty five first-year students doing Physical science education modules were purposively and conveniently sampled, and the data generated from semi-structured interviews, focus group discussion, and emailed reflective activities were thematically coded to produce a theory of e-learning platforms. Technological, Pedagogical, and Content Knowledge (TPACK) theory was used to direct the study and make sense of the data. The findings revealed that a personal e-learning platform which has been neglected in the past could be used to improve e-learning. It also revealed that while students only had the option of using a formal e-learning platform (Moodle), they would prefer to use their more familiar informal e-learning platform (WhatsApp). The study concludes that without considering the use of a personal e-learning platform that blends both Moodle and WhatsApp, the problem might be further escalated.

Keywords Curriculum · Experiences · E-learning · Moodle · Physical science education · WhatsApp

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1 Introduction

The large number of first-year students entering universities to pursue different programmes is a worldwide challenge in higher education institutions (HEIs), particularly HEIs in developing countries because of the students' diverse educational, socioeconomic, and linguistic background. This situation leads to a number of challenges, such as a lack of human resources and of university infrastructure, amongst others. These challenges have been witnessed worldwide; in the United States of America they started to have an impact in the early 1970s and in the United Kingdom in the early 1980s (Hawkins et al. 2018). However, on the African context, particularly in South Africa, this is a much more recent phenomenon which started in the late 1990s and advanced in the early 2000s (Walker 2018).

South African universities are witnessing student protests on funding, housing and other issues, which disturbs the learning process. This suggests that the South African HEIs are still grappling with the effects of these challenges, which affect timeous teaching and learning. Several studies (Barak 2018; Collins and Halverson 2018) assert that these challenges force HEIs to adopt and integrate e-learning platforms with the curriculum for content dissemination, as an intervention in the face of prior-mentioned challenges. These studies further assert that almost all HEIs from developed countries, such as the United Kingdom, Australia, and New Zealand, have made the use of e-learning platforms compulsory for all students, whereas in developing countries such as China, India, Brazil, and South Africa there are still some HEIs that have not done so.

Furthermore, several HEIs in Africa have adopted various formal e-learning platforms, such as Moodle, WebCT, and Blackboard, to facilitate curriculum delivery as an intervention to address challenges during the teaching and learning process. Ngubane-Mokiwa and Khoza (2016) report that HEIs in African countries such as the University of Education in Ghana, National Open University in Nigeria, University of Nairobi in Kenya, Catholic University of Mozambique, and many others have been increasingly adopting the use of the formal e-learning platform Moodle (modular object orientated dynamic learning environment).

In South Africa the University of South Africa, University of Cape Town and University of KwaZulu-Natal are good examples of institutions that have adopted the formal e-learning platform of Moodle and made the use of it compulsory for both first-year students and lecturers. This is evident in a critical action research study conducted by Mpungose (2018) to explore lecturers' reflections on the use of Moodle to teach first-year students. The study revealed that even though the university policy made the use of Moodle (a formal e-learning platform) compulsory, since it is free of charge and is open source software, lecturers struggled to create and maintain a smoother teaching and learning process since most students were struggling to use the Moodle platform. The students were, however, much more responsive when WhatsApp groups (not adopted nor made compulsory by the university) were created. This suggests that while HEIs may be good at compelling first-year students to use Moodle as a formal e-learning platform, they have work to do in realising the benefit to students of engaging WhatsApp groups as informal e-learning platforms in the learning process, particularly for first-year students entering the university. This has implications for how students learn through their experiences.

This paper provides new insights into the value of adopting WhatsApp to supplement Moodle to enhance the quality of teaching and learning particularly in Physical

science education modules. In the next section, the literature on students' experience, e-learning platforms, and curriculum is reviewed.

2 Students' experiences, e-learning platforms, and curriculum

The father of experience in education, Dewey (1986) defines experience as meaning-making behaviour during teaching and learning, which is categorised into formal experience (module knowledge), informal experience (shared ideas), and non-formal experience (personal values). This is witnessed in an interpretive case study conducted by Khoza (2018) to explore the reasons for first-year students using Skype to learn science modules at a South African university. The study affirmed that the use of Skype was driven by the need to address module content knowledge needs drawing from formal experiences, societal communication needs influenced by informal experience, and personal student needs drawing from non-formal experiences. In other words, the use of any e-learning platforms by students at a university should cover these three main needs informed by their own respective experiences.

In order to understand an e-learning platform as a web-based environment used by HEIs to disseminate content, we first need to define curriculum. Hoadley and Jansen (2013) as well as Pinar (2010) assert that the word curriculum originates from the Latin word '*currere*' which implies a plan to conduct a course of disseminating content. Similarly, Khoza (2018) agrees with Berkvens et al. (2014) that a course of disseminating content using e-learning platforms draws from the intended curriculum (planned content), implemented curriculum (taught/shared content) and assessed curriculum (personal written content). A qualitative case study conducted by Khoza and Mpungose (2018a) on the use of an e-learning platform (Moodle) by first-year students at a South African university revealed that they enjoyed using Moodle to download the readings and module outline and doing quizzes. However, the study outlined that students were frustrated by Moodle because they did not find the discussion forum and chat room for active interaction among themselves and lecturers to be user-friendly; instead, they opted to create a WhatsApp group for convenient discussion and sharing of ideas. This suggests that HEIs should consider an informal e-learning platform (WhatsApp) to supplement formal e-learning platforms (Moodle), in order to meet first-year students' personal needs from non-formal e-learning platforms driven by non-formal experience (Bates 2018; Mpungose 2018).

On the one hand, several recent studies outline that formal e-learning platforms are the preferred online method of disseminating the university curriculum to students in order to address content module needs (Bates 2018; Bovermann et al. 2018). These studies further assert that some of the well-known and most adopted formal e-learning platforms used by universities include Blackboard, WebCT, and massive open online courses (MOOCs); however, Moodle is most preferred since it is free of charge. Similarly, Luk et al. (2018) conducted a qualitative research study in China to explore students' perceptions of the acceptance and use of Moodle. The study outlined that students positively accepted the use of Moodle because it easily disseminates content knowledge, which seeks them to use their formal experience to download the readings, module outline and slides. On the other hand, Khoza and Mpungose (2018b) presented pragmatic action research on three lecturers who taught Science and Mathematics

Curriculum at a South African university using Moodle. This study revealed that lecturers created discussion forums for students in order to allow them to use their informal experiences to share their ideas on given module activities, but most students were reluctant to participate in these discussions since the platform was not user-friendly and convenient to them. This suggests that Moodle is good at addressing the content knowledge needs by disseminating the module content, but is somehow lacking the aspect of effective societal communication needs to allow students to share ideas. This indicates the need for the use of social media platforms such as WhatsApp to supplement Moodle.

Annamalai (2019) and Sayan (2016) share the same view that informal e-learning platforms (social media sites) like WhatsApp, Facebook and Twitter play a major role to address the societal communication needs during the learning process at a university, because these platforms allow the creation and exchange of students' experiences. In particular, WhatsApp is the most significant and recent platform used by students worldwide because it transforms the teaching and learning process from a formal to a more social, open and user-orientated process, through connecting and creating social connection networks (Salmon 2013). Thus, the use of WhatsApp can assist HEIs to meet the societal communication needs of new generations of digital age students who are more familiar with these informal e-learning platforms (Junco 2014; Prensky 2001; Saha and Karpinski 2018).

The case study conducted by Benson and Morgan (2018) at Kingston Business School, Kingston University in London highlighted the importance and challenges of adopting WhatsApp (informal e-learning platform) in teaching and learning. The study revealed that WhatsApp serves as a student networking space for collaboration to share ideas on the content. Nevertheless, the study further outlined that university policy should address issues of privacy, information security, and other challenges before use of WhatsApp is adopted. This assertion may hinder HEIs in adopting and using WhatsApp as their official e-learning platform. However, the recent mixed-method study conducted by Basitere and Mapatagane (2018) at Cape Peninsula University of Technology, Cape Town, South Africa, on the influence of the use of WhatsApp on students undertaking an Engineering Physics course gives another take on the issue. The study concluded that even though WhatsApp was not officially adopted by the university, there is a need to integrate it with the curriculum since it has the potential to promote student-lecturer engagement, which may increase student performance/throughput. This suggests that official adoption of the WhatsApp platform by HEIs to supplement Moodle would allow first-year students to choose any preferred platform, based on their non-formal experiences.

It becomes very clear that no single platform (WhatsApp or Moodle) can address all of the needs encountered during teaching and learning. This study aims to tackle this problem by providing ways of enhancing a non-formal e-learning platform that blends WhatsApp and Moodle to cater for students' personal needs.

A current trend seen in various studies (Annamalai 2019; Khoza and Mpungose 2018a) seems to point to platforms that are beyond Moodle (formal e-learning platform) for content knowledge needs and WhatsApp (informal e-learning platform) for societal communication needs – but that put more focus on Moodle/WhatsApp (non-formal e-learning platforms) that support students' personal needs. This suggests that HEIs should make a move to a non-formal e-learning platform that blends Moodle and WhatsApp. In other words, the use of a non-formal online platform may address students' personal needs on the basis of their strengths or limitations, and this may

give them options to choose either the Moodle or WhatsApp platform to unpack the content on the basis of their self-identity and needs based on the preferred experience (Khoza and Mpungose 2018a). In line with this, a qualitative study conducted by Mtebe and Raphael (2017) at the University of Dar es Salaam in Tanzania on the use of e-learning platforms concluded that over and above content knowledge and societal communication needs, personal needs (which emerge from the perceived significance of learning success to the family) should lead the use of e-learning. This seeks student to possess content knowledge, pedagogical knowledge and technological knowledge.

3 Theoretical framework

This study is framed by the Technological, Pedagogical, and Content Knowledge (TPACK) theoretical framework, as depicted in Fig. 1. According to Koehler and Mishra (2005) the TPACK framework was first presented as Technological Pedagogical Content Knowledge (TPCK), as an extension from Shulman (1986) work on Content and Pedagogy Knowledge (CPK). This framework was then refined in 2006 to become TPACK (Mishra and Koehler 2006), which is relevant in any teaching/learning platform that integrates technology with curriculum.

This theory was developed in order to infuse technology into the teaching/learning (pedagogy) of the curriculum (content). It further advocates that it is not enough to know the pedagogy and the content without reflecting on the impact of technological resources (Moodle or WhatsApp). Mpungose (2018) further enhanced/contextualised TPACK to argue that if one has content, technological and pedagogical knowledge without reflection

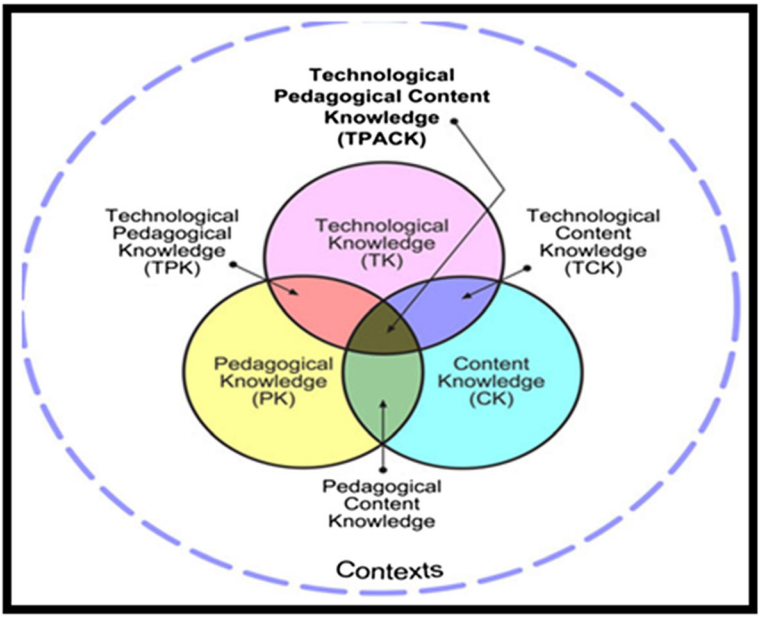

Fig. 1 The TPACK framework and its knowledge components (source: http://tpack.org, 2012, reproduced by permission of the publisher)

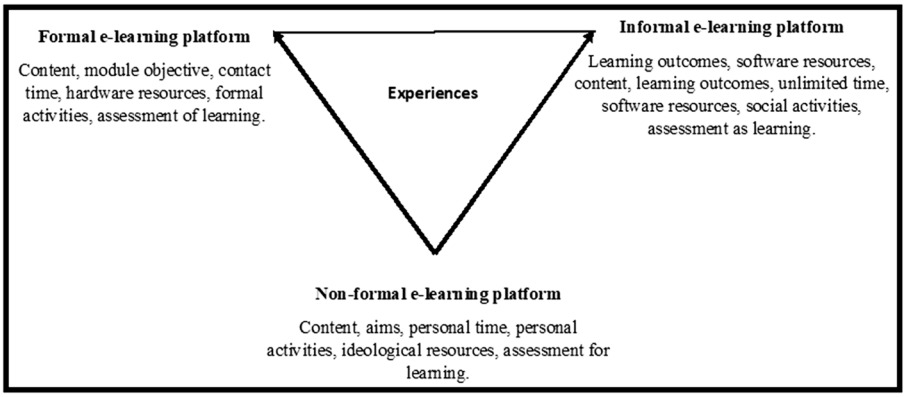

Fig. 2 Non-formal, formal, and informal e-learning (NFI e-learning) framework

on the experiences (informal, formal and non-formal), teaching/learning may be meaningless. This is because students' (particularly first-year students) experiences in South African universities have a major impact on their academic performance, and it also addresses all of the needs (content knowledge, societal communication and personal needs) encountered during the teaching and learning process.

Thus, the new framework of non-formal, formal, and informal online-learning (NFI e-learning), as depicted in Fig. 2, emerged from this study (Mpungose 2018). Moreover, NFI e-learning advocates for use of e-learning platform that must always draw from non-formal e-learning (blended) to address personal needs from non-formal experiences, before opting to use either an informal e-learning platform (informal experience) or formal e-learning (formal experience).

4 Research purpose, objectives, and questions

This study proposes to put forward an alternative way of using WhatsApp to supplement Moodle. The objective of the study was to explore and understand first-year students' experiences of the use of Moodle and WhatsApp online platforms for learning Physical science education modules. The data generated answered the following research questions:

- What are the first-year students' experiences of the use of Moodle and WhatsApp online platforms?
- What informs the first-year students' experiences of the use of Moodle and WhatsApp online platforms?

5 Research design and methodology

5.1 Paradigm and style

This study presents a qualitative interpretive case study of twenty five first-year students who were using Moodle platforms to learn Physical science education

modules at a South African university. Interpretivism is described as a paradigm in which researchers do not aim to predict what people do, but rather to describe how people make sense of their own worlds, and how they make meaning of their particular experiences (Christiansen et al. 2010; Creswell and Poth 2017). Hence I chose this paradigm in order to focus on how first-year students' experiences make meaning of the usage of e-learning platforms from their experiences of learning learn a Physical science education modules. The use of a qualitative case study is important for this study because it is more expressive, explorative, and circumstantial in its design and proposes to generate a rich description of explored phenomena in a single case (Creswell and Poth 2017; Yin 2013). The qualitative case study of twenty five students will reveal the description and deeper meaning of the first-year students' experiences of the use of Moodle and WhatsApp as a formal online platform in learning modules.

5.2 Sampling and ethics

Sampling is described by Cohen et al. (2013) as making decisions about which people, setting, events, or behaviours to observe or study. Purposive sampling was used to select all twenty five first-year students from the university's science education and technology cluster. Convenience sampling was then utilised to choose only twenty five first-year students who seemed to share a similar background in relation to their use of the Moodle and WhatsApp platforms. The first-year students selected for the study were the most accessible and were registered as full-time students registered for science education modules at the university. With respect to ethical observations, the first-year students' names remain private and informed consent letters as well as ethical clearance certificates were obtained from them and the university. In addition, confidentiality was assured, voluntary participation was declared, and anonymity by the university was clarified (Creswell and Poth 2017).

5.3 Data generation, analysis, and trustworthiness

Email with reflective activities, one-on-one semi-structured interviews and focus group discussions were used as data generation methods in order to answer the two research questions (Creswell and Poth 2017; McNiff 2013). Questions for these three methods centred on the integration of the Moodle and WhatsApp platforms with curriculum signals such as goals, resources, assessment, content, accessibility, time, platforms, activities, and students' role. Email with reflective activity was conducted once but both the semi-structured interviews and focus group discussion were each carried out twice and were approximately 35 min in duration. These multiple sources of data generation were administered for the purposes of triangulation in order to ensure the achievement of authenticity and trustworthiness of the generated data (Cohen et al. 2013; McNiff 2013). An audio-recorder device was used to record interviews to enable simple transcription of data in order to avoid data distortion, and transferability, dependability, confirmability, and credibility were maintained to confirm the trustworthiness of the findings (Cohen et al. 2013; Ramrathan 2017). This study utilised qualitative guided analysis that generated a narrative for each student, and there were set categories, but more emerged from the data. The findings are exploratory in nature: three themes with categories were generated from the data as guided by the research questions. All

Table 1 Themes and categories

Themes	Categories
1. Formal e-learning platform	Content, module objective, contact time, hardware resources, formal activities, assessment of learning
2. Informal e-learning platform	Content, learning outcomes, unlimited time, software resources, social activities, assessment as learning.
3. Non-formal e-learning platform	Content, aims, personal time, personal activities, ideological resources, assessment for learning

questions asked were framed by curriculum signals of the three e-learning platforms: informal, formal, and non-formal (Berkvens et al. 2014).

6 Presentation of findings

First-year students in HEIs bring in different experiences in the use of e-learning platforms, since they have different social experiences. In other words, students' learning is driven by different levels of experience (formal, informal, and non-formal), which indicate the degree to which they use e-learning platforms. The findings that emerged are presented in themes and categories in Table 1.

7 Theme 1: Formal e-learning platform

Participants (P) indicated their experiences with the use of Moodle, which was adopted by the university and its use made compulsory for all students entering the university.

P21, P18, and P24 agreed with P1 who indicated as follows: *"... I can hardly use Moodle at home since I do not have wi-fi connection for internet. Sometimes during or after a lecture I access Moodle after we are instructed by a lecturer to access uploaded learning resources. ... to me Moodle is not user-friendly since it has many confusing functions".*

P10, P15, P17, and P4 agreed with P3 who said: *"I normally spend more time on Moodle when I am writing the quiz since I know that it is for grading purpose. I enjoy multiple-choice questions when writing the quiz, particularly for a quick feedback."*

Further to this, P9 shared the same experiences as P5, P25, P19 by stating: "*I use Moodle weekly by the end of each week to download uploaded readings, more especially lecture slide presentations ... I do not use Moodle to access my emails, but emails are accessed through the student email system. I do not use Moodle to communicate with other students*".

P11, P13, P23 agreed with P6 asserted that "*almost the whole semester, I had no laptop and it was hard to access Moodle in the case of emergency; thus I had to go to the local area network to login on the computer so that I can access Moodle. This was frustrating to me up until I was given a laptop by the university towards the end of the semester*".

P1, P17, P7 and P9 supported the opinion of P8 who outlined that *"... most lecturers do not use Moodle to create a platform where we can share our ideas as students. We only access Moodle to download readings and slides ..."*.

These accounts suggest that the use of formal e-learning platforms like Moodle requires students to be driven by formal experiences which address the content knowledge needs through mastering the module content, use of hardware resources, undergoing assessment of learning, engaging with only formal activities, and ability to attend lectures within a contact time from the time table) (Bates 2018; Hoadley and Jansen 2014). Students outlined that the use of Moodle required them to be in possession of laptops (hardware resources), but the delayed distribution of laptops to students by the university caused difficulties in accessing Moodle.

Further to this, it is evident from the findings that Moodle is only used as a 'dumping platform' for students to download materials such as reading matter and slides uploaded for a module. As reported, P1, P17, P7 and P9 supported P8 who said that she only accessed Moodle to download readings and slides. This suggests that first-year students are left with no other option than to login to Moodle in order to access module readings in order to unpack the content.

Seemingly, students enjoyed the use of Moodle when undergoing assessment of learning for the purpose of grading; for instance, P10, P15, P17, and P3 were enjoying quizzes with multiple-choice questions. The formal online platforms such as Moodle use tests and examination in the form of a quiz to establish what is cognitively mastered or not mastered by the students in order to fulfil the needs of the discipline or module (Bates 2017; Budden 2017).

Furthermore, the students were aware that Moodle is not user-friendly, because the lecturers were unable to create platforms for them to socialise and share their ideas (informal experiences) about module content – only emails were used as the mode of communication. These accounts suggest that students had a need for another platform that may bring the social and informal aspects of their experiences into the learning process.

8 Theme 2: Informal e-learning platform

The informal e-learning platform allows students to use their informal experiences to share their ideas in unpacking the module content, and it enhances flexible communication among students. Students were vocal on the use of informal experiences and using an informal online learning platform, irrespective of Moodle being prescribed by the university.

P12, P16, P23 were in line with P1 who asserted: *"Moodle is not convenient, but what is convenient for me is WhatsApp because I can form a WhatsApp group with my fellow students for easy communication purposes, particularly when we need to organise a meeting to complete group works. ... lecturers always refrain from being included in those groups [set up] for ideas purposes"*.

Further to this, P2, P6, P13 and P10 agreed with P4 that *"social networks, especially WhatsApp, makes things easy for me, more especially when we are given an assessment task, [where] we do critique each other in a group before we agree to the right answe*r".

P5, P14, P18 and P8 were of the same opinion as P7 who articulated that *"… social networks (WhatsApp) is not prescribed by the university but I take it as my everyday life, because it is installed in my mobile device (cell phone). … the first thing I do when I wake up in the morning is to open up my WhatsApp messages … thus I access it anytime, anywhere if I want to communicate with other fellow students to unpack the module content, remind ourselves of due dates, and share the most vital articles*".

P3, P4, P 23 and P25 agreed with P9 who stated that *"… given module activities such as project, group presentation, and assignments are made social, because I share with my friends using WhatsApp as a convenient platform … we sometimes speak about our own life opportunities and challenges we are currently facing as students … WhatsApp is not adopted by the university, we use it because it makes convenient communication … I use WhatsApp even if I am in a lecture hall while the lecturer is teaching*".

These accounts suggest that WhatsApp was their preferred social network to complement the Moodle platform, since it is easy to use and flexible for communication. For instance, P1 were supported by other participants on how Moodle was not convenient and WhatsApp was convenient because he could form a WhatsApp group. It is evident from the accounts that the teaching and learning process needs platforms that can draw from social, student-centred, and informal experiences. This allows students to approach assessment tasks differently through critiquing themselves before they construct their own individual answers, as stated by P4.

In other words, WhatsApp allows students to share their experiences during teaching and learning for the purpose of unpacking the module content, and also for sharing life experiences and challenges as indicated by P9 ("*sometimes we speak about our own life and challenges we are facing as students*"). Moreover, the majority of students agreed with P7, who said that although WhatsApp is not adopted by the university, they use it because it makes for convenient communication. This suggests that even though the university has not adopted the use of social networks, students prefer to use WhatsApp over Moodle since it helps them to unpack the module socially, irrespective of time and location, and this makes teaching and learning easier. Most of the participants agreed that WhatsApp is a convenient, cherished platform for collaborative learning to promote discussion of modules inside and outside of the lecture hall.

9 Theme 3: Non-formal e-learning platform

The non-formal online platform addresses the needs of students according to their self-identity (weaknesses and strengths). As P8 asserted (with P2, P5, P9, P18, P24 expressing similar feelings): "*Moodle is adopted and made compulsory by the university, whereas WhatsApp is not and we use it based on our own interests … I can imagine how life could be simple for me if the university can adopt both Moodle and WhatsApp platforms and make it compulsory; my needs can easily be met because I can choose any platform that best suits my personal activities*".

Further to this, all other participants agreed with P7 who posited that *"… if we can be provided with both learning spaces* [Moodle and WhatsApp] *I can have freedom to use any one space at my own personal time that is suitable to unpack the content and prepare myself for assessment. … effective use of Moodle and WhatsApp depends on the flexible ways/ideology of using it."*

Moreover, P2 affirmed that *"... no one* [Moodle and WhatsApp] *is best or innocent because I need both of them, depending on the need I am facing at that time. Currently the university demands us to only use Moodle to unpack the module content ..."*, a sentiment that they(P12, P10, P19, P8, P22) were in agreement with.

These accounts suggest that universities do not provide the option of whether students can use Moodle (formal e-learning platform) or WhatsApp (informal e-learning platform) but seem to adopt and make either of the two compulsory. Almost all participants including P2, P5, P9, P18, P24 and P9 agreed with P8, who asserted that *"... Moodle is adopted and made compulsory by the university, whereas WhatsApp is not ..."*. This suggests that students do need to be given options to choose, so that they use their non-formal experiences to utilise any online platforms to unpack the content according to their needs. Furthermore, the accounts indicate that if students can be given online platform options (Moodle or WhatsApp) they can use their own time to carry out their personal activities, which may assist them to use their own personal experiences to unpack the module content for the purposes of effective teaching and learning.

10 Discussion of findings

The findings seem to suggest that the effective use of e-learning platforms (formal, informal, and non-formal) is influenced by students' experiences (which are also formal, informal, and non-formal). It became evident from the findings that traditionally the adoption and use of formal e-learning platforms like MOOCs, Moodle, and Blackboard by the universities is influenced by experiences which draw from different curriculum presentations (planned, implemented, and assessed curriculum).

The NFI e-learning framework (see Fig. 2) shows what influences the adoption and use of e-learning platforms. This framework asserts that the adoption of formal e-learning platforms is influenced by the planned curriculum in order to address the needs of the module (Hoadley and Jansen 2014). Traditionally, universities are designed to meet the scientific discipline needs of module/subject/course content (Ayers 2011; Ramrathan 2017). As a result, universities end up drawing from formal experiences by adopting and using formal e-learning platforms to unpack the module content. In other words, universities that adopt formal e-learning platforms like Moodle require students to be driven by formal experiences drawn from reading articles, books, and other written text to attain module objectives. Thus these platforms require students to use contact time to attend lectures while they are in possession of their laptops (hardware resources) which encourages them to carry out their formal activities online. This allows them to memorise the content so that it can be reproduced during assessment of learning for the purpose of grading (Hoadley and Jansen 2014).

On the other hand, the NFI e-learning framework affirms the adoption and use of informal e-learning platforms during teaching and learning by HEIs. In line with this, (Basitere and Mapatagane 2018) concluded that the integration of informal e-learning platforms such as WhatsApp with the curriculum has the potential to allow students to use their informal experiences to create interaction between students and greater engagement with the content. Further to this, it is evident from the findings that informal e-learning platforms draw much from the implemented curriculum, where

teaching and learning of the module content is driven by learning outcomes to meet the societal communication needs. This then allows students to use WhatsApp (software resource), which is convenient and accessible to them at any time, for unlimited time. Findings further indicated that WhatsApp helps students to socialise with the module activities so that they can bring them into their informal experience corroboratively in order to undergo assessment as learning. As a result, informal e-learning platforms (WhatsApp) seem to be the most appropriate to complement the formal e-learning platforms (Moodle).

However, the findings also indicate that Moodle as a formal e-learning platform has its own strengths and limitations, which is also applicable to WhatsApp as an informal e-learning platform. This seems to suggest that Moodle may be good in formally unpacking the module content, like downloading readings and slides, but not good in creating convenient social group discussions like WhatsApp does, which allows students to bring their informal experiences into teaching and learning. Nevertheless, findings further suggest that universities seem to adopt and use only one of these platforms, i.e. Moodle, which does not give students any option to choose from – they are bound by university policy to use the e-learning platforms that have been adopted and used by the HEI. This seems to be a hindrance to effective use of any adopted e-learning platforms.

The NFI e-learning framework asserts that in order to bring in balance between formal e-learning platforms and informal e-learning platforms, HEIs should consider non-formal e-learning platforms which blend both formal and informal e-learning platforms. Non-formal platforms cause students to be driven by their non-formal experience, which draws much from the personal experiences of the student rather than the discipline and social experience (Khoza and Mpungose 2018a). This suggests that students' different ideas (ideological resources) may assist them to choose the best e-learning platform (Moodle or WhatsApp) according to their strengths and limitations in order address their personal needs.

11 Conclusion and implications for education

The study concludes that most HEIs' policies compel students to use formal e-learning platforms (Moodle) which are structured to address the content knowledge needs, and this requires students to be driven by formal experiences. However, students are more exposed to informal e-learning platforms such as WhatsApp, which is social and addresses societal communication needs, and leads to students being driven more by informal experiences in unpacking the content. This discrepancy then makes students reluctant to use of the formal e-learning platforms adopted by HEIs, particularly in South African universities, since most of the universities have adopted formal online learning platforms like Moodle, Blackboard, and others.

This study therefore recommends the adoption of informal e-learning platforms (WhatsApp) to complement formal online learning platforms (Moodle) for teaching and learning of Physical science education Modules, to offer students a choice according to their learning strengths, limitations, and needs. Furthermore, the NFI e-learning framework has proven to be most useful in the balanced use of e-learning platforms at HEIs. It ought to start with the use of a non-formal e-learning platform which draws

from the non-formal experiences of students, before moving to either a formal or informal e-learning platform. The framework thus leads to the blended usage of both a formal e-learning platform (Moodle) and an informal e-learning platform (WhatsApp) by students during the teaching and learning process; this may give students the option to choose to use any e-learning platform, depending on their experiences.

In this way students become effective and treasure the use of any e-learning platform, if teaching and learning is done on the platform that they are comfortable with, and which is convenient for them (Budden 2017; Mpungose 2018).

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Data availability The datasets used and/or analyzed during the current study are available from the authors on reasonable request.

Compliance with ethical standards

Competing interests The authors declare that they have no competing interests.

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