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Using WhatsApp in Teaching to Develop Higher Order Thinking Skills-a Literature Review Using the Activity Theory Lens

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ABSTRACT

Most universities in Uganda encourage memorization as the predominant method of learning. This has been partly linked to limited practical pedagogical skills among educators, to effectively engage students to develop Higher Order Thinking Skills (HOTS). Consequently, students are not well prepared for the world after university. WhatsApp Enabled Learning (WAEL) has been found to support approaches to learning that promote development of HOTS, like inquiry, creativity, critical reflection and dialogue. Although many universities in Uganda have been using LMSs, there is little evidence that use of an LMS has enhanced development of HOTS. While the Ugandan society is catching on fast with use of WhatsApp due to increased access to mobile technology devices and Internet connectivity, use of WhatsApp in education is still limited. Additionally, there is limited research on the benefits of WAEL to development of HOTS in African countries. This paper examines how WAEL can facilitate development of HOTS through a general literature analysis and using the Activity Theory (AT) framework. The results show that WhatsApp has a great potential to support development of HOTS due to its affordances such as ubiquity, and AT provides a systematic and practical way to demonstrate this potential and how it can be applied.

Keywords: *Higher Order Thinking Skills; WhatsApp; Activity Theory; e-Learning; Higher Education; Makerere University*

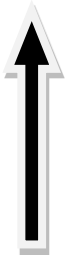
INTRODUCTION AND MOTIVATION FOR THE STUDY

Memorization rather than problem solving is the predominant method of education delivery in most universities in Uganda (NCHE, 2006). This has been partly linked to limited practical pedagogical skills among lecturers to effectively engage students during learning to develop Higher Order Thinking Skills (HOTS) such as critical thinking and problem solving skills (Bunoti, 2010). Consequently, students do not get well prepared for the world after university which is becoming more competitive every passing day due to globalization. Bloom's revised taxonomy (Anderson & Krathwol, 2001) orders thinking skills on a continuum from Lower Order Thinking Skills (LOTS)

(remembering, understanding and applying) to Higher Order Thinking Skills (HOTS) (analysing, evaluating and creating) to represent the process of learning as follows:

Higher Order Thinking Skills (HOTs)

- Creating
- Evaluating
- Analyzing
- Applying
- Understanding
- Remembering



Lower Order Thinking Skills (LOTs)

Anderson and Krathwol's (2001) continuum is based on the thesis that before we can understand a concept we have to remember it, before we can apply the concept, we must understand it, before we analyze it, we must be able to apply it, before we can evaluate its impact, we must have analyzed it, and before we can create something using it, we must be able to evaluate it. Therefore, learning moves along a continuum starting from the LOTS (remembering, understanding and applying) to the HOTS (analysing, evaluating and creating). Hence, acquisition of both levels of skills in the process of learning is vital for effective learning to take place.

Higher-order thinking is a problem solving process and the goal of teaching is equipping students to be able to identify and solve problems in their academic work (solving problems that are set for them) and in life after school (Brookhart, 2010). If students are "able to think", they can apply the knowledge and skills they acquired during their learning, to new contexts (applications that the student has not thought of before, and not necessarily something universally new). This way, they relate their learning to other elements beyond those they were taught. This is important given that life outside a learning environment is better characterized as a series of transfer opportunities than a series of recall assignments to be done. Therefore, there is need to investigate how delivery of university education in Uganda can be improved to facilitate development of HOTS.

In this paper, we adopt Brookhart (2010)'s definition of HOTS, as skills that enable students to make sense of and use the knowledge they have learned (transfer learning to new contexts); engage in reasoning and reflective thinking that is focused on deciding what to believe or do (critical thinking); and use one or both of these two skills when they want to reach a specific outcome or goal, but do not automatically recognize the proper path or solution to use to reach it (problem solving). In Bloom's revised taxonomy by Anderson and Krathwol (2001), 'applying' corresponds to 'transfer of learning to new contexts', 'analyzing' and 'evaluation' skills correspond to 'critical thinking' skills, while the 'creating' skill corresponds to problem solving. For simplicity, the rest of the paper uses transfer of learning to new contexts', critical thinking' and problem solving to refer to the key skill sets of HOTS.

Subran (2013) noted that many educators face the challenge of developing HOTS among learners to make them more disposed to problem solving, raising complex questions, developing consistent arguments and expressing their opinions from critical perspectives. He advised that one way these attributes can be developed, is for educators to expose learners to tasks that will influence them to pursue inquiries from different perspectives (analysis-ability which is part of the critical thinking process), assess the sources of their information (evaluation-ability which is also part of the critical thinking process), reflect on their findings (also an analysis-ability skill), exchange ideas and adopt personal positions based on rational thinking (creation of new meanings/knowledge/solutions which is a problem solving skill).

Makerere University in Uganda has been implementing Technology Enabled Learning (TEL) and Learning Management Systems (LMS) in particular, having started with Blackboard in 2003 and later moved to Moodle. Other universities in the country such as Uganda Martyrs University, Nkozi and Makerere University Business School followed suit (Mayoka and Kyeyune, 2012). However, despite continued investment in the ICT infrastructure, training, and support at Makerere University and other universities in Uganda, there is little evidence that use of the LMSs has indeed enhanced learning, particularly development of HOTS. Although Moodle has several affordances that can be used to engage and support learners to develop HOTS such as communication, collaboration, evaluation and assessment (Griffin and Rankine, 2010), it is still largely used as a repository for lecture notes. The low use of Moodle and other Education Technologies (ETs) to enhance learning at Ugandan universities has been attributed to lack of knowledge and skills, lack of adequate resources like computers and Internet, and resistance to change (Mayoka and Kyeyune, 2012).

Social networks, particularly WhatsApp has the potential to support development of HOTS given its support for inquiry, creativity, critical reflection and dialogue (Subran, 2013).Use of WhatsApp in teaching and learning affords students the opportunity to interact with course content, the instructor, and their peers outside the classroom. These interactions provide students with the opportunity to negotiate the meaning of course content thereby creating the potential for deeper and longer lasting learning. Negotiation of the meaning of course content through the various interactions promotes social learning and nurtures students into critical thinkers whereas deeper and long lasting learning makes them learn better and more meaningfully. This increases their ability to transfer learning to new contexts and to create new meanings/knowledge/solutions using the knowledge and skills attained. According to the fundamental principles of constructivism, learning is an active process of constructing rather than mere acquisition of knowledge, that is, individuals learn through interaction with their world and develop knowledge through social interaction (Berge & Collins, 1996).

Ugandans are catching on fast with the social media trends, largely driven by the increased access to devices such as mobile phones, computers and Internet connectivity (Kanyoro, 2015). Facebook, Instagram, Twitter, YouTube and WhatsApp are among the most popularly used social media platforms. By 2011, Uganda had the world's youngest population with over 78% of its population below 30 years. The largely youthful population in the country, estimated at 23% youth and 55% children is greatly contributing to the increased use of social media. In 2014, mobile subscriptions were 19 million, the number of Internet users was 11.9 million, and Internet penetration was at 32% (Uganda Communication Commission, 2015). In 2017, Uganda had 13,023,114 Internet users (Internet World Stats, 2019) and 21,648,672 mobile subscribers (Uganda Communication Commission, 2019). Other drivers include: fast adoption by the business community and the political events in the country, particularly the February 2016 National Elections (Kanyoro, 2015). Additionally, competition among different telecommunication companies to provide cheaper and faster Internet services has improved the quality and affordability of Internet services. Therefore, the number of people using mobile technology devices especially mobile phones and related applications in Uganda is continuously increasing. On the African continent, mobile technology usage in sub-Saharan Africa is growing faster than any other region of the world due to the gradual fall in the price of smart phones (GSMA, 2017). Due to the widespread use of mobile technology and its applications, transmission of general information through mobile technologies is more frequent at universities and other higher education institutions in areas such as lecture updates, dates of exams, resource sharing and messages by teachers or among students. Building an e-service on a widely used platform is cheaper and has better potential than one that is less widely used and less familiar to the users (Baguma & Eilu, 2017).

Although the use of social media in Uganda is growing, its use in education is still limited. Other than the affordance for social interactions, social media is mainly used in business, particularly marketing, in politics particularly in mobilisation and publicity of individual politicians and party

ideologies, and in the media industry. At Makerere University, the oldest and largest university in Uganda, social media is not yet formally recognised as an education technology in relevant policies but its use is not prohibited.

Globally, use of WhatsApp in teaching and learning has been growing and several studies have been carried out about its usefulness for improving teaching and learning outcomes including HOTS, such as Awada (2016); Nitza & Roman (2016); Kustijono & Zuhri (2018); Gon & Rawekar (2017); Hamad (2017); and Rambe & Chipunza (2013). However, most of this research has been carried out in the Middle East, Asia and some parts of Europe. Research on WhatsApp's contribution to HOTS in higher education in Africa is still limited despite the high adoption of mobile technology and related applications.

This paper examines how WhatsApp Enabled Learning (WAEL) can facilitate development of HOTS. This is achieved through a general analysis of related literature and using the Activity Theory (AT) Framework. Activity Theory (AT) is a conceptual framework in which actors ("subjects") interact with the world ("objects") to achieve a desired "outcome" (Kaptelinin, 2013). In technology enhanced learning, AT is used as a conceptual framework for determining the appropriateness of a particular technology for mediating learning (Barhoumi, 2015).

Results of the analysis (how WhatsApp enabled learning can facilitate development of HOTS) may lead to an increase in the interest of educators, curriculum designers and researchers to incorporate it in teaching, learning and research on development of HOTS.

The paper is organised as follows: an explanation of the methodology; an examination of how WAEL can facilitate development of HOTS using existing literature; an analysis of how WAEL can facilitate development of HOTS in the context of the Activity Theory Framework; and finally, a discussion of the implications of the findings, limitations of the study, and future wok.

METHODOLOGY

The objective of this paper was achieved through a general analysis of relevant literature from peer reviewed journals and conference proceedings published between the 1990's to-date and using the Activity Theory (AT) framework to examine how WAEL can facilitate development of HOTS.

Activity Theory (AT) uses the whole work activity as the unit of analysis, where the activity is broken into the analytical components of subject, tool, and object. The subject is the person being studied, the object is the intended activity, and the tool is the mediating device used to execute the action in question (Hasan, 1998). It is based on the idea that activity is primary, that doing precedes thinking, that goals, images, cognitive models, intentions, and abstract notions like "definition" and "determinant" grow out of people doing things" (Hashim and Jones, 2007). The original theory by Vygostky was modified by Engeström with two additional units of analysis: rules (a set of conditions that help to determine how and why individuals may act), and division of labour (the distribution of actions and operations among a community of workers) (Engeström, 1996). The two additional elements affect a new level of reality known as community, through which groups of activities and teams of workers are anchored, and can be analysed (Hyland, 1998; Verenikina, 2001).

The components of activity theory and their relationships are illustrated in Engeström's Expanded Activity Theory Model in Figure 1 below.

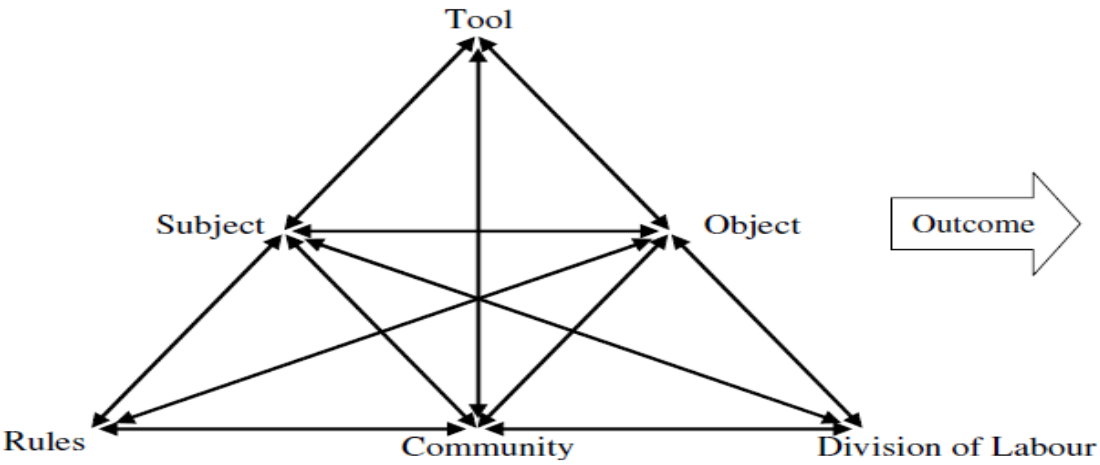


Figure 1: *Engeström's (2001) Expanded Activity Theory Model*

In this paper, the "Subject" is the students engaged in collaborative learning, the "Object" is the objective of the activity system, which is collaboration, the "Tool" is WhatsApp, , the "Rules" are the conventions and guidelines regulating activities in the system, the "Community" refers to the social context of the system which comprises of students and lecturers, the "Division of Labour" refers to the division of activities among students and the lecturer in the system, while the "Outcome" is development of HOTS, in particular transfer of learning, critical thinking and problem solving skills.

Related to components of AT are the principles of activity theory in the context of teaching and learning by Barhoumi (2015) namely:

- The objective of the activity system has social and cultural properties such as collaborative or cooperative learning in an online course.
- Subjects are actors engaged in activities. This is considered the individual level of activity theory. For example, students are contextual subjects engaged in collaborative learning.
- Community or externalization is considered a social context of the system and a community level of activity theory. It covers all actors involved in the activity system, for example a group of students engaged in constructing and sharing of knowledge based on social interaction, teachers, librarians and other actors playing one or more roles in the learning activity.
- Tools are considered a technological level of activity theory.
- The division of labor is considered a hierarchical structure of activity or the division of activities among actors in the system.
- Rules are the conventions and guidelines regulating activities in the system such as rules guiding the discussion between and among students in collaborative learning.

In technology enhanced learning, AT is used as a conceptual framework for determining the appropriateness of a particular technology for mediating learning through describing and analyzing the structure, development and context of learning activities mediated by technology (Barhoumi, 2015). It has also been found a suitable framework for examining the factors that influence students' participation in online interaction (Barhoumi, 2015). This is achieved through examining the factors at AT's three levels namely: technological, individual and community levels. The technological level is concerned with habits of students and usability of the online tool; the individual level is concerned

with the affordances of the tool as perceived by students; while the community level is concerned with the social presence/sense of community and community rules.

In addition to the general analysis of related literature, AT provided a more systematic and practical way to assess the appropriateness of WAEL to the development of HOTS. Further to the general review, the relationship between components of AT and WAEL are reviewed to illustrate the activity system model for WAEL. This is followed by a categorization of the factors that influence students' participation in WAEL according to the three levels of activity theory namely: technological, individual and community. The categorization shows practically what factors need to be considered at what level of the WAEL system in order to facilitate the development of HOTS.

HOW WHATSAPP ENABLED LEARNING (WAEL) CAN FACILITATE ACHIEVEMENT OF HOTS: GENERAL ANALYSIS OF THE RELEVANT LITERATURE

WhatsApp is a cross-platform Smartphone application whose name comes from the English phrase "What's up?" meaning "What's new?" It has become a market leader in messaging applications with over 400 million active monthly users in spite of strong competition for example from iMessage, LINE, BB and Viber (Barhoumi, 2015).

The WhatsApp instant messaging application accesses the users' Internet data plan to help them network socially in real time. It offers various collaborative features namely: exchange of text messages, images, videos, and voice notes with ones' social networks, groups and contacts; creation of social network group(s) where members can engage in discussions; and sending messages without limits. It uses an Internet data plan or Wi-Fi to ensure continuous data transmissions across the WhatsApp mobile system. Therefore, in teaching and learning, WhatsApp provides students with opportunities for online cooperation and collaboration (Barhoumi & Rossi, 2013) as well as communication and knowledge sharing (Nelson, Christopher & Mims, 2009).

WhatsApp can benefit blended mobile learning in various ways as noted by Nelson et al., (2009):

- Online collaboration and cooperation between students connected from school or home
- Sharing of learning objects easily through comments, texting and messaging
- Discussions related to course content taught in-class
- Publishing of individual work in the group
- Easy construction and sharing of information and knowledge

WhatsApp therefore facilitates collaboration/interaction among a group of people around a common area of interest. In teaching and learning, the ability to collaborate/interact can facilitate active learning, a process whereby students engage in activities, such as reading, writing, discussion, or problem solving that promote development of HOTS.

In social networks such as WhatsApp groups, each person has a specific network of direct relationships with other users which support accumulation of social capital, and the capacity to draw resources and assistance from personal relationships with others (Ellison, Steinfield & Lampe, 2007). Students on a WhatsApp group expect to critique others' views and contribute to group discussions blending their ideas and experiences with others to create learning. This is quite different from traditional instruction where the teacher teaches/lectures and students complete their assignments independently. Furthermore, use of social networks in instruction helps to foster social presence which makes students experience a greater feeling of community than when they use course management systems. In collaborative learning using WhatsApp, as students work together

they create new knowledge by sharing ideas and experiences, evaluating ideas and concepts, and building or creating new ideas and new ways of working.
Therefore, use of WhatsApp in learning has the potential to support development of HOTS. Through use of WhatsApp, students may illustrate alternative views and create new ideas in response to comments from others (critical thinking and problem solving), they may reflect on materials to appraise their suitability to the topic of concern, and appraise comments from others to gauge their personal capabilities (critical thinking). Students may also reflect upon their own personal experiences in the light of comments received, to assess their relevance (critical thinking and transfer of learning). Over time, students can gain confidence and be able to defend their positions even when different from the general consensus (critical thinking and problem solving).

The development of these HOTS is facilitated by the various affordances of WhatsApp. Affordances are the perceived and actual properties of a tool/ thing, primarily those fundamental properties that determine just how the tool/thing could be used (Norman, 1988). Bower (2007) classified affordances of e-learning technologies into:

- Media affordances-type of input and output forms;
- Spatial affordances-the ability to resize elements within an interface;
- Temporal affordances-access anytime, anywhere;
- Navigation affordances-capacity to browse to other sections of the resource and move back/forward;
- Emphasis affordances-capacity to highlight aspects of a resource;
- Synthesis affordances-capacity to combine multiple tools together to create a mixed media learning environment;
- Access control affordances-capacity to allow or deny who can read/edit/ upload/download/broadcast/view/administer;
- Technical affordances-capacity to be used on various platforms with minimal/ubiquitous underlying technologies;
- Usability affordances-intuitiveness of a tool;
- Aesthetics affordances-appeal of design, appearance of interface and
- Reliability affordances-robustness of a platform, systems performing as intended whenever required.

The selection of WhatsApp to mediate learning aimed at the achievement of HOTS was based on its numerous affordances as follows:

- WhatsApp accepts common input and output formats hence, it supports all the media affordances,
- Its interface supports zooming in and out of content hence it has a spatial affordance,
- It is Internet-based so it can be accessed anytime and anywhere (temporal affordance),
- It supports various forms of navigation to different parts of content including external sources (navigation affordance),
- It supports highlighting certain aspects of a resource (emphasis affordance), and integration of multiple tools together to create a mixed media learning environment with video, audio, text, etc. (synthesis affordance).
- It also has access control features that facilitate management of who to invite and remove anytime from a private forum (access control affordance).
- It is almost effortless to use with a simple but likeable interface (usability affordance)
- For the time it has been in use, WhatsApp has proved to be a stable platform (reliability affordance).
- It is device and platform independent through the various flavors.

Through its various affordances, WhatsApp can facilitate effective learning which will lead to development of HOTS.

The various ways in which WAEL facilitates better learning, leading to development of HOTs are discussed below.

Information/ Knowledge sharing

WhatsApp based learning provides opportunities for students to share information, knowledge and experiences through discussion and comments which nurtures critical thinking skills through analysis and evaluation of peers' contributions versus an individual student's stand point/contribution. A study to establish to what extent the use of WhatsApp can promote meaningful student academic participation and narrow the articulation gap in higher educational institutions in South Africa found out that its usage enabled students to share information on various issues pertaining to the course (Rambe & Chimpunza, 2013). Another study conducted in 2014 involving an experimental and control group where the former was taught using WhatsApp and the latter taught through face to face lectures found that the majority of students in the experimental group reported that WhatsApp mobile learning activities could help them with easy acquisition, dissemination, and analysis of information and knowledge (Barhoumi, 2015). Hence, the sharing of information through WhatsApp peer groups has the potential to enable the development of a complex hierarchy of individual roles among students such as knowledge brokers, knowledge seekers and givers, and informal mentors, all of which nurture development of transfer of learning, critical thinking and problem solving skills.

Easier access to educational resources

Use of WhatsApp in learning can address some information asymmetries that are often found among university students through increased access to educational resources regardless of distance (Rambe & Chimpunza (2013). Off-campus students with WhatsApp-enabled phones can access academic content anytime, anywhere unhindered by location. In a blended mobile lecture, anything posted by students or instructors is instantly accessible for online students working from school or home (Barhoumi, 2015). Additionally, WhatsApp can serve as an information gateway for linking students to other ICT applications used in the learning process through posts of new activities on other platforms.

Facilitation of deep learning and construction of knowledge

Use of WhatsApp in teaching can make it easier for students to: solve difficult learning tasks; construct and share knowledge; learn from one another and themselves; and to socialize. A study conducted on two groups - one using WhatsApp and the other physical lectures - established that WhatsApp enabled learning makes learning easy and facilitates easier solving of learning difficulties related to the learning process or learning content (Amry, 2014). Students in a social media environment expect to critique others' views and contribute to group discussions, blending their ideas and experiences with others to create learning (Chan, 2005). The ability to access learning resources anywhere, anytime, and in various formats supports deep student learning capabilities and construction of their own knowledge (Amry, 2014). In collaborative learning using social media, students share ideas and experiences, and evaluate ideas and concepts, which supports the creation of new ideas and new ways of working (Amry, 2014). Furthermore, the sense of enjoyment students derive from social interactions on WhatsApp enables them to learn from one another as well as themselves (Chan, 2005). A study to determine whether electronic journaling via WhatsApp can improve writing vocabulary, word choice and voice for undergraduate Saudi students established a significant difference between the overall writing scores of the pre-test and post-test exercise of students that kept and updated their electronic journals/diaries (Alsaleem,

2014). Alsaleem (20214) noted that although students treated the exercise as though they were playing rather than class work, at the end of the experiment, the students knew more about the writing processes of one another and their use of words had improved. A study by Yu et al., (2010) reported that online discussions between students through mobile social learning communities improves students' social connections as well as their self-esteem and boosts their learning performance.

Development of a learning community

In the field of online learning, a community is a group of learners who cooperate and collaborate to participate in course activities with the objective of advancing the construction and sharing of knowledge (Bielaczyc & Collins, 1999; Cross, 1998). Discussion forums which are a key feature of WhatsApp, promote development of learning communities. Individuals who are engaged in a working group believe that their needs can be satisfied through working cooperatively and collaboratively as a community (Rova, 2002). Hence, students are satisfied with online courses that integrate learning communities and have positive attitudes towards such courses (Barhoumi, 2015). Social presence is one of the key factors influencing students' motivation to engage in social interactions for constructing and sharing knowledge (Barhoumi, 2015).Therefore, WAEL is a good strategy for improving community level interaction and social presence among students.

Stimulation of students' active participation

WhatsApp creates an informal learning context which provides students with an opportunity to express themselves freely (Barhoumi, 2015). This can help reduce the low participation of students in the learning process which often characterises lectures (Rambe & Chimpunza, 2013; Webb, 2011; Alsaleem, 2014).

Academic advisory to peers

When using WhatsApp in learning, students sometimes transcended the information sharing role by assuming academic "advisory" roles to their peers via WhatsApp, which supports development of knowledge transfer skills (Rambe & Chimpunza, 2013). Use of social media leads to accumulation of social capital, which is the capacity to draw resources and assistance from personal relationships with others (Ellison et al., 2007).

Social interaction

WhatsApp provides a good channel for facilitating social interaction of learners outside the face to face class room lectures (Amry, 2014).

Academic planning and scheduling

Educators can use WhatsApp for planning and scheduling of learning tasks, such as what the students have to prepare for in the next lecture (Rambe & Chimpunza (2013).

Individualized learning

WhatsApp based learning provides students with the freedom to accomplish the academic commitments they value, at a time of their convenience, which nurtures lifelong learning (Rambe & Chimpunza, 2013).

Challenges

However, there are also challenges associated with using WhatsApp in teaching and learning. Notable among these include: not all students may have smartphones; some WhatsApp groups can generate a very large volume of messages that may be time consuming to process and act on, and teachers may be annoyed by the flood of irrelevant and nonsensical messages; some students may use improper language that they commonly use with peers; students' may assume that their teachers should be available on a 24/7 basis and therefore should answer their questions quickly and effortlessly; extended use may cause eye strain due to the small screens of phones (Bouhnik & Deshen, 2014; Gon & Rawekar, 2017). Additionally, technology enabled learning environments may compromise social relationships between the teacher and student yet they are important for effective learning (Bouhnik & Deshen, 2014). Furthermore, using educational apps makes the students highly susceptible to distraction and sidetracking and poses an increased potential for cheating (Bouhnik & Deshen, 2014). Bouhnik & Deshen (2014) noted that smartphones can be very easy to hide and use inconspicuously, especially if their use is normalized in the classroom. But, the technical, educational and instructional advantages of using WhatsApp in teaching and learning far outweigh the disadvantages. The disadvantages can be managed with strict rules and regulations on mobile phone use.

HOW WHATSAPP ENABLED LEARNING (WAEL) CAN FACILITATE DEVELOPMENT OF HOTS THROUGH THE ACTIVITY THEORY LENS

The Relationship between Components of Activity Theory and WhatsApp Enabled Learning

Drawing on the six components of an activity system, the subject refers to actors engaged in activities who in this case are students; the object is the objective of the activity system which in this case is collaboration on activities; the tools are the devices/artifacts mediating execution of the action which in this paper is WhatsApp; the community is the social context of the system which in this paper is made up of students and lecturers; the rules are the conventions and guidelines regulating activities in the system such as adherence to timelines, using the WhatsApp group for course related communication only, etc., and the division of labor is the division of activities among actors in the system who are lecturers and students. For example, lecturers conventionally provide learning activities and resources, guide learning, and design students' learning experiences. On the other hand, students share their views, comment on the views of peers and share relevant learning resources.

Figure 2 below illustrates the activity system model for WAEL.

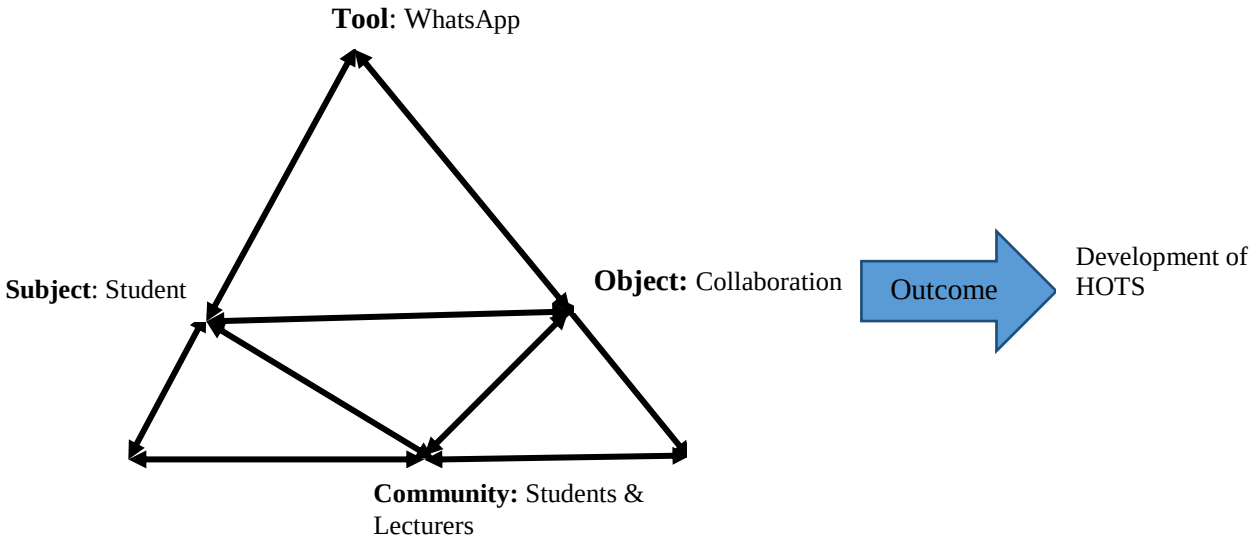


Figure 2: *Activity System Model for WhatsApp Enabled Learning (Source: Engeström, 2001modified by authors)*

We next describe a categorization of the factors that influence students' participation in WAEL according to the three levels of activity theory: technological, individual and community. The aim of this categorization is to illustrate what factors need to be considered at what level of the WhatsApp enabled learning system in order to facilitate development of HOTS.

Levels of Activity Theory and Factors that Influence Students' Participation in WhatsApp Enabled Learning

Activity theory has been found a suitable framework for examining the factors that influence students' participation in online interaction (Barhoumi, 2015). This can be achieved by examining the factors at the three levels of activity theory namely: technological, individual and community levels. The technological level is concerned with habits of students and usability of the online tool; the individual level is concerned with the affordances of the tool as perceived by students; while the community level is concerned with the social presence/sense of community and community rules. This approach can be used to analyse the appropriateness of a given technology for mediating learning through a demonstration of what factors need to be considered at what level of the WAEL system in order to facilitate the development of HOTS.

Figure 3 below shows the three levels of activity theory.

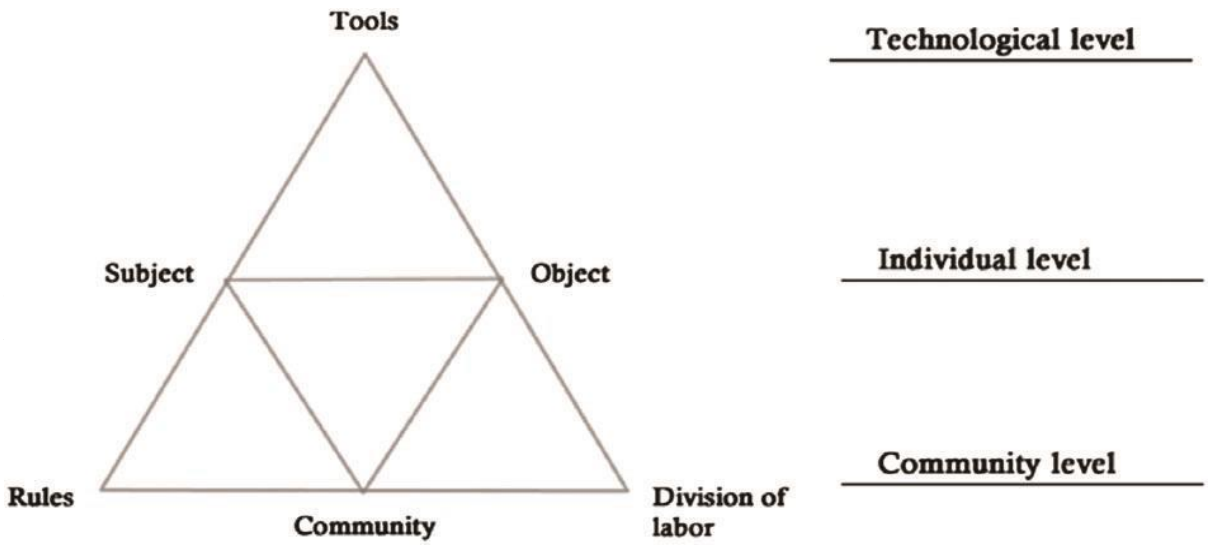


Figure 3: *Levels of Activity Theory*

The factors that influence students' participation in online interaction, particularly using WhatsApp at the three levels of activity theory illustrated in Figure 3 above, are discussed below.

Technological Level

Various authors have attributed the increasing uptake of WhatsApp in learning to its ease of use, user habits and the experience of using WhatsApp in other contexts. Barhoumi (2015) observed that the use of WhatsApp to improve social interaction and knowledge sharing using Smartphones is increasing. In the context of learning, Prensky (2001) noted that today's students are 'native speakers' of the digital language of computers, video games, digital music players, video cams, mobile phones/devices and their various applications, and a variety of other devices and tools which they frequently adopt in learning and constructing knowledge. Amry (2014) added that the transmission of general information through use of mobile technologies is more frequent at universities and other higher educational institutions related to event registration, dates of exams and messages sent by teachers or among students.

On the other hand, Litchfield et al., (2007), and Nitza & Roman (2016), noted that the usefulness and ease of use of the mobile technology are the principal factors influencing students' participation and adoption of online interaction for learning. A comparative study by Barhoumi (2015) with a control group studying through face-to-face lectures and the experimental group studying in a blended mode with face-to-face and WhatsApp based learning activities, established that WhatsApp instant messaging is an easy to use interface for students, many of whom are familiar with its use from everyday life. In that study, it was reported that students in the experimental group used WhatsApp frequently in their daily lives hence found the technology easy to use.

Individual Level

At the Individual level, the increasing up take of WhatsApp in learning has been linked to its various

affordances that support learning. These include its easy-to-use interface, maintenance of privacy in the group and instant access to study material (Nitza & Roman, 2016); a news feed feature which allows students to be quickly informed of updates within the community and to respond in a timely manner (Barhoumi, 2015); and the ability to access learning resources anywhere, anytime, and in various formats which supports ubiquitous and deep student learning (Amry, 2014). Other affordances include: the group chat feature which enables participants to get the same input all at once and facilitates collaboration (Gon & Rawekar, 2017); 24/7 access which facilitates ubiquitous learning (Nitza & Roman, 2016) and simple operation and low cost (Bouhnik & Deshen, 2014).

Community Level

At the community level, the social presence of students in online communities is one of the factors that influence their participation in online learning. Brady et al., (2010) found that use of social media in instruction helped to foster social presence, so that students felt less isolated and experienced a greater feeling of community than when they use course management systems. Even when students treat WAEL activities as though they are playing rather than class work, they still learn from one another and from themselves in the process (Amry, 2014).The sense of enjoyment students derive from social interactions on WhatsApp enables them to learn from one another as well as themselves. Webb (2011) noted that use of WhatsApp in learning creates an informal learning context that students can use for self-discovery and intuitive learning. Furthermore, WhatsApp facilitates collaboration, interaction, synchronous feedback, encouragement and a non-threatening learning environment which improves students' self-confidence that can enable even the shy ones to express themselves (Hamad, 2017; Nitza & Roman, 2016). Hamad (2017) noted that the social setting on WhatsApp groups makes learners more enthusiastic to learn. Additionally, availability of the teacher to answer questions and add comments quickly facilitates better learning (Bouhnik & Deshen, 2014). Other researchers have noted the need for guidelines for effective learning to happen in the social context. For instance, Bouhnik & Deshen (2014) observed that unregulated use of WhatsApp in teaching and learning can create challenges that can negatively affect the intended outcomes. Such challenges include: some students not having smart phones and or regular Internet connection, teachers being uncomfortable with the flood of irrelevant and nonsensical messages, style of communication, for example the use of unfamiliar abbreviations and jargons and last but not least, students' likely assumption that their teachers should be available 24/7. To address such challenges, Barhoumi (2015) recommended negotiation based rules among all the members of the community rather than dictation.

On the roles of the community members, the presence of the teacher in the learning process is necessary for students to effectively construct and share knowledge. In their study, Lu and Churchill (2014) found that the social interaction that helps students construct and share knowledge is achieved through the pertinent role of the instructor. Absence of the tutor in the online community leads to a reduction in the frequency of interactive messages. Therefore, one of the key roles of the facilitator/lecturer in the division of labour component is continuous moderation of the interaction. Studies such as the Canadian Ministry of Education - Capacity building series (2013) examining the impact of the social presence of instructors and students in online communities have also considered the former to be a principal factor influencing students' motivation for social interaction and collaboration in online teaching and learning. Other roles instructors need to play include: a guide and resource provider, expert questioner/intentional modelling of learning tasks, designer of student learning experiences and sharing with the students as a fellow learner (Berge & Collins, 1996; Rambe & Chimpunza, 2013). On the other hand, the students are required to play the following roles: learn collaboratively through cooperative interaction with peers, construction of own knowledge, problem-solving and active participation in learning (Berge & Collins, 1996).

However, there are some disadvantages associated with use of WhatsApp in learning at the different levels of the activity theory system. For example at the technological level, there is a possibility of some students not having smart phones and or regular access to internet, some students may use improper language while others may be distracted or side tracked. At the individual level, there is a potential for the WhatsApp groups to generate a high volume of not necessarily useful information while at the community level, students may assume that the teacher should be available 24/7 and the social relations between the student and teacher may be compromised. But, as elaborated above, the benefits of WhatsApp to the learning activity system far outweigh the disadvantages. Moreover the disadvantages can be well managed by setting rules and regulations under the rules component at the community level.

DISCUSSION

Activity theory provides a good conceptual framework for describing the design and context of learning activities mediated by technologies such as WhatsApp. It also provides a useful approach for examining the appropriateness of a technology such as WhatsApp for mediating learning in general and development of HOTS in particular. The analysis of existing literature revealed that there are several factors that influence students' participation in WAEL and all of them fit under one or more of the three levels of activity theory.

At the technological level that is concerned with the usability of WhatsApp and habits of users, such factors include: increasing use of WhatsApp in social interactions and knowledge sharing; digital savviness of today's students who start using a range of digital devices at an early age, increasing dissemination of general information at universities and other higher institutions of learning through mobile technologies; usefulness and ease of use of the WhatsApp interface; students' familiarity with use of WhatsApp from everyday life and wider adoption in other social-economic activities like business and politics.

At the individual level whose concern is affordances of the tool, factors given include: ease of use; the news feed feature; the synchronous and anytime, anywhere features; and its support for various content formats.

At the community level that is concerned with the social presence/sense of community, and community rules, the factors given include: the sense of enjoyment students derive from social interactions on WhatsApp, informal learning context and the social presence of the instructor in the learning environment. Literature such as Barhoumi (2015) also recommend regulation of students' online interaction, for effective learning to take place, which confirms the usefulness of activity theory's rules component at the community level.

Furthermore, the categorised analysis of factors that influence students' participation in WAEL at the three levels of activity theory simplifies the understanding of the factors that influence students to participate in WAEL compared to the generic analysis. This makes it easier to appreciate the tool and decide whether or not to implement it. Without such a systematic and practical analysis, it is possible to simply jump on the band wagon and implement WhatsApp without understanding what needs to be done practically and at which level of the activity system. This is expected to make it easier to understand how to design and implement WAEL activities that facilitate development of HOTS.

The elaboration of the components of the activity system that is the tool, subject, object, rules, community, division of labour and the outcome also demonstrated how to design and implement WAEL activities that facilitate development of HOTS.

However, activity theory does not consider methods for executing the activity in question. Hence, in the context of learning, it lacks the pedagogy component/level which is necessary to inform educators about the best pedagogies to use for the given learning activity and tool under consideration. This limitation stems from the fact that activity theory is a general conceptual framework for understanding; describing and evaluating human computer interaction applications including technology enabled learning rather than an education technology theory/framework. Therefore, there is a need to study how to address the pedagogy aspect when using AT to study the appropriateness of a technological tool for learning.

Furthermore, there are some disadvantages associated with use of WhatsApp in learning at the different levels of the activity theory system. For example there is a possibility of some students not having smart phones which is at the technological level; a potential for the WhatsApp groups to generate a high volume of not necessarily useful information which is at the individual level and students' assumption that the teacher should be available 24/7 to answer their questions which is at the community level. But, the benefits of WhatsApp to the learning activity system far outweigh the disadvantages and the latter can be well managed by setting rules and regulations under the rules component at the community level.

The main contributions of this paper include:

- A general discussion of how WAEL can facilitate development of HOTS
- A general discussion of the factors that influence students' participation in WAEL
- An illustration of the activity system model for WAEL in general, and for the development of HOTS in particular
- An illustration of the factors that influence students' participation in WAEL that need to be considered, and at what level of the WAEL system, in order to facilitate the development of HOTS
- A demonstration of how to design and implement WAEL for the development of HOTS
- How potential drawbacks of WhatsApp to learning can be addressed in the design and delivery of WAEL system
- A demonstration of the usefulness of activity theory for understanding how technology enabled learning can facilitate development of HOTS and its limitations

The key limitation of this study is reliance on secondary sources of information, that is, existing literature most of which was carried out several years ago. Hence several things could have changed.

FUTURE WORK

Future work will explore how to address the pedagogy aspect when using AT to assess the appropriateness of a technology/WhatsApp for learning in general and for the development of HOTS in particular. This could possibly be achieved by adding a 7th component of methods referring to methods of executing the activity or a 4th level called the methodological level. We also propose validation of the WAEL activity system through an empirical study in relation to the factors shown to influence/inhibit students' participation in WAEL at the various levels of AT.

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