Effectiveness use of Mobile Technology of WhatsApp on learners conceptual understanding and problem-solving skills in Thermal Physics: A Case Study of grade 11 pupils at Mufulira secondary school.

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Abstract: Unique methodologies have emerged due to the use of online social media networks in education to support teaching, learning and knowledge gathering. The social media networks have created a virtual teacher community. This study is a small attempt that was made to investigate the effectiveness of problem solving on learners conceptual understanding of thermal physics through mobile technology of WhatsApp (MTOW) collaboration as a pedagogical supplement for conventional instruction in physics education. The study focused on grade 11 learners who were purposively selected at Mufulira Secondary School in Mufulira district of Zambia. Two intact classes were used with the total population of the study 72 pupils. The data collection instruments were Physics save my exam home revision and the Physics Achievement Assessment (PAA). Data was analysed using SPSS 26 version with the significance level (α-level) set at 0.05. The results show that, incorporating Mobile Technology of WhatsApp (MTOW) by educators has a positive effect on students conceptual understanding of Thermal Physics. The results also show the positive effect of mobile technology of WhatsApp on learners problem-solving skills. These results have an implication on educators to teaching and learning of Thermal Physics

Key terms— asynchronous, computer supported collaborative learning, conceptual understanding, Problem-solving, synchronous, Web 2.0, WhatsApp,

1 INTRODUCTION

THIS study explored the effective use of online collaborative through Mobile Technology of WhatsApp (MTOW) on learners conceptual understanding and problem-solving skills of thermal physics. The main reason for this intervention was to help learners to effectively learn and collaborate online without physically meeting during this pandemic of Coronavirus Disease 2019 (COVID 19).

In 2002, the United Nations published the eighth millennium developed goals (MDGs) to support developing countries in achieving parity with developed countries. One parity of the eighth MDGs was aimed at ensuring universal education for all by providing access to quality education in developing countries like Zambia. Providing quality education during the COVID 19 pandemic has proved to be a challenge. This is true because we have seen a situation where non examination classes were left unattended to for six months without any contact with the teachers in 2020.

To help mitigate this problem, Information Communication Technology (ICT) has been identified as a key enabler to accelerate the realization of the MDGs (Christe 2008). With the introduction of ICT in education, a new world of possibilities is available to further assist both teachers and pupils to maximize the learning experiences, especially the introduction of web 2.0 technology which has seen the birth of more dynamic platforms with user-generated content platforms like WhatsApp, Facebook, YouTube and Twitter, etc. Unlike passive web platforms which were on web 1.0, web 2.0 support greater user interactivity and collaboration with improved communication channel (Grant, Owen, Sayers and Facer ,2006).

This advancement in technology due to web 2.0 has seen many teachers and lecturers forming WhatsApp groups with their learners creating a virtual classroom community online. The WhatsApp groups they have formed are not effective to collaborate but are mostly used to give advance organizer information to the learners, sending notes so that they can copy while they are home for the teacher to come and explain when they get back to class. When you go through most of the group chart, there is no learning that takes place, learners fail to collaborate with their peers and the teachers' job is to send notes and tell learners to copy and study. One of the reasons why they fail to collaborate online either synchronous or asynchronous is that many teachers and pupils including lecturers and students are still not trained adequately to make maximum use of ICT and e-learning activities. Capacity building workshops in ICT is urgently necessary (Banda. S et al 2009). This is needed because in this era e-learning has become part of mainstream teaching in most schools globally (Yoon SW. 2003, Boerema C., Stanley M. & Westhorp P. 2007). Thus, this requires new skills of teaching. Many are the ways in which e-learning can be applied on an individual basis to collaborate with an interactive element (Hols W., Bloemendaal P., Bos N., Quaak M., Sijstermans R. & Jong de P. 2008).

Mobile phone technology has seen a rapid growth globally especially to secondary school pupils which has caused a distraction from their learning activities in the class. Many things are done with their phones such as texting, uploading, downloading, reading the flash news, or just browsing. This has made pupils who have smart phones inseparable with their mobile phones, such that, some come with their phones at school despite school rules does not allow. Much attention is put to their mobile phones as a result teacher need to be very creative enough to find alternative ways to impart knowledge in the technological world, we are livening in.

The mobile phone is used as a collaborative tool for students with the support of collaborative learning strategy (Sulisworo, Rahayu and Akhsan 2016). It has been observed that most students use WhatsApp as a collaborative tool for learning especially in this 21 st century system of learning. When we look at this study, it is anchored by activity theory of mobile learning by Vygotsky and theory of connective by George Siemens.

Russian psychologist Lev Vygotsky (1978) propounded the activity theory of mobile learning. This theory helps in understanding how human interact through the use of tools and artefacts. According to the activity theory, artefacts always mediate human activity. Thus Rember (2012) opined that social media provides instructors with personalized learning environments. Akpan, Kufie P, Ezinne Abe (2017) opined that this theory involves three levels of activities which are;

1. The technological level
2. The individual level
3. The community levels

all these works together to facilitate knowledge creation. For this to work, leaners must be provided with a technology rich learning environment which is well equipped with technological tools that support teaching and learning so as to make learning interesting.

George Seimen and Stephen D (2005), calls the theory of connective as learning theory for digital age. Connectivism is a type of learning theory that explains how internet technologies have created new opportunities for individual learners to interact and share information globally. This theory believes that learning is by contact through use of various network in connecting people around the world. Connections need to be created from one person to another using technology as the platform. According to Shumba (2017), learning as connection is a principle that connects learning discipline and relevance in real life context and to problem-solving. The conception of learning as connection is part of the discourse of educational quality that views learning as actively merging context and concept thus making connections to social cultural, sociological, and to personal and communal life worlds and experiences (Lotz-Sisitka, 2008; 2009. 2010; Lotz Sisitika and Lupde, 2012 cited in Shumba 2017). With this new normal of COVID 19, WhatsApp learning can be applicable as a way to reach learners. Even via WhatsApp learning, learning as connection need to be applied not only in the classroom situation but also to social-cultural, contextual and historical dynamics of learners' life worlds and experiences, while simultaneously gaining mastery of educational concepts and content (Shumba 2017). Thus Prensky (2001) opined that the capacity to know more is more critical than what is currently known, therefore connections is the best way to facilitate continued learning. Now the pandemic COVID 19 is bringing the discontinuity to the flow of knowledge between teacher and leaner, and among learners themselves. Thus, the application of this study implies that learners must be actively involved in the learning process by connection to peers using technology of WhatsApp to create and share knowledge in the process.

2. RESEARCH DESIGN AND METHODOLOGY

The research design which was used are pre-test, post-test quasi experimental design. This was due to the inability of the researcher to randomly assign participants in groups. Because of this, intact classes were used. Both classes were pre-tested on the basic concepts in thermal physics to establish the equivalence of the two groups.

WhatsApp groups were created with five members in each group only. Four of the members were learners and the fifth one was the researcher. Small number of members is highly required for effective interaction of group members. It is known that learners collaborate well in small groups and not in large groups.

For the WhatsApp group to be effective, the designed intervention strategies were focused on developing social interaction skills through a series of talk activities and developing problem –solving skills by scaffolding students, to plan, organize and evaluate their joint task. Rules were set in all groups in order for learners to engage in reflective social discourse and deep cognitive processing. Eight rules were adapted from previous studies (Dawes 2004; Wegerif and Mansour 2010). Below are the eight rules which were set for all WhatsApp group members.

1. Sharing information (knowledge with a group member)

2. Asking everyone to express his/her view point
3. Listening and respecting every opinion
4. Providing feedback on each other's ideas
5. Providing reasons and evidence for what is said
6. Negotiating to deal with disagreement
7. Working together to determine the solution
8. Implementing the solution after misconceptions are cleared.

Learners were given chance to add or subtract to the given rules. They were asked to discuss and give reasons for adopting respective rules. This is because learners respect the rules, they have made themselves and as a result, they would try to follow them. Students were reminded of the rules throughout their respective groups to enhance problem- solving.

2.1 Structure of the quasi-experimental design that was employed in this study

Two groups were used and observed, the experimental group and the control group. The experimental group learnt thermal physics via WhatsApp by first sending the specific learning outcomes in the respective groups, and notes accompanied with task to do was sent too. Then the discussion was done as scheduled at 20:30 on Monday, Thursday and Saturday via WhatsApp. The control group learnt the same content without incorporating online discussion.

The following was the structure of the pre-test post-test quasi experimental design that was used in this study.

$$\begin{array}{ccc} O_1 & X & O_2 \\ \hline O_1 & - & O_2 \end{array}$$

Figure 2.0

Where:

O_1 Were the observations that was made during the pre-test measures. Both the experimental and control groups were given first the test from save my exam multiple choice question, and then the Physics achievement assessment test.

X was the treatment that was employed in order to assess its effects on students' conceptual understanding and problem solving of thermal physics test. In this case it was the incorporation of teaching and discussion of thermal Physics via mobile technology of WhatsApp (MTOW).

O_2 Were the observations made during the post-test. Both the experimental and control groups was given first the Thermal Physics test from save my exam, and Thermal Physics achievement test. Then comparisons were made between pre-test and post-test conceptual understanding and problem-solving skills between groups.

2.3 Setting and participants

This study was conducted at Mufulira Secondary school in Mufulira district on the Copperbelt province of Zambia during the academic calendar of the year 2020 through 2021. The researcher selected the school purposively, this is because, that's the working place of the researcher and through experience, it's the place I observed the problem described in the statement of the problem.

Two grade 11 intact classes were selected purposively, (11A1, and 11 S7). The codes A1, and S7, represent the carrier path way at the school. A1 is the carrier path way for academic and S7 is also a class having the carrier path way for skills. The control and the experimental group were assigned purposively from the two classes. The experimental group were those with smart phones which support WhatsApp, while the control group comprised of those without WhatsApp phones. The experimental group was divided into groups of six at randomly. At first learners who usually perform well in physics were seeded randomly into the groups to avoid learners who usually have challenges in physics to be in the same group. The learners who ware seeded, are the ones who were also the more knowledgeable other (MKO) to help their peers by providing the scaffolding so that they can be in the ZPD.

11 A 1 has 40 learners, and 11S7 has 32 learners. This means that the study population for this research was N=72. One of the important factors in determining the sample size was the population size (Cohen etal 2000).

2.4 Research instruments

To adequately address the research question asked, two separate instruments were used in the collection of data. To assess the conceptual understanding in Thermal Physics, a Thermal Physics test was given, whose items were taken from Save My exam home revision prepared by the Cambridge board of examination (www.savemyexam.co.uk) and Thermal Physics achievement test was prepared according to the stand format of the Examination council of Zambia. A Thermal Physics conceptual understanding assessment pre-test was also administered to both groups at the beginning of the research to establish the equivalence of the two groups in their understanding of basics of Thermal Physics. The items in this test were drawn from save My exam home re vision.

2.5 Construction of the Physics Performance Assessment test.

The independent variable which was being tested was the conceptual understanding of thermal Physics using the Physics Performance Assessment test (PPA). The questions were drawn from across the Thermal Physics content using: save my exam! The Home Revision (www.savemyexam.co.uk) . Four papers from save my exam home revision under Thermal Physics were used. In the pre-test, only questions from one to five were selected. Thus, the pre-test had 20 multiple questions from save my exam. Post-test was also drawn from save my exam, this time from question six to ten were selected from all the four papers under Thermal Physics. posttest had also 20 multiple questions from save my exam.

2.6 Construction of the Physics Achievement Assessment test.

The independent variable which was being tested was the problem-solving skills of Thermal Physics using the Physics Achievement Assessment test (PAA). The questions were drawn from across the Thermal Physics content using: save my exam! The Home Revision (www.savemyexam.co.uk), National Examination papers and text books. The test was face and content validated by three experts. They assessed and approved the goodness of the test in terms of: structural, language, readability, content and relevance in line with the Examination Council of Zambia (ECZ) standard format.

2.7 PROCEDUR

Eperimental group

The experimental group was instructed through mobile technology of WhatsApp method of teaching. Learners were instructed to come with their smart phones in order to familiarize them how learning will be done via WhatsApp group. The timetable for online discussion was made and rules for the WhatsApp group were given to the learners as to how WhatsApp group will operate. For example, the timetable is shown in the screenshot below fig 2.70

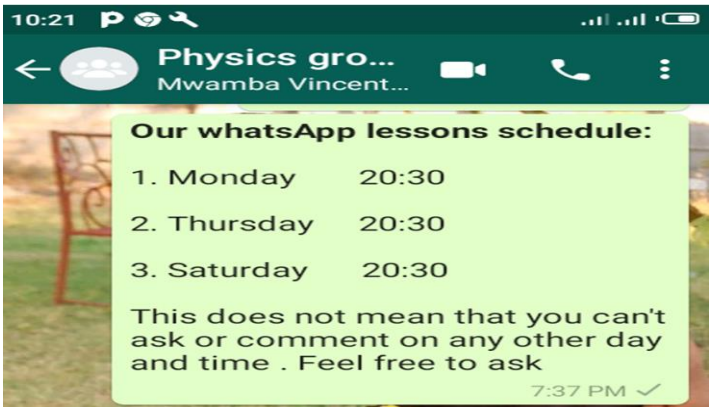

Figure 2.70, showning the timetable

The researcher demonstrated to the learners how learning will be taking place via WhatsApp. To achieve this, the researcher came with the router so that all learners in the experiment group can connect and have internet access. This introduction lasted about 2 hours and learners liked the experience of orientation it was different from the WhatsApp group their teachers have opened in their classes.

The researcher could send first the specific learning outcomes from the syllabus, notes and then questions to the six groups created. Learners will send their findings in the group after the submission time is due. The researcher who happens to be the teacher will send answers and invite for clarification where learners had challenges. Below fig 2.71 showing the screenshot of learning outcomes.

on the melting and boiling Points of substances 11.1.3.7 Demonstrate the effect of varying pressure on volume of a gas	on the melting and boiling points of substances: such as Impurities lower the melting point and increase the boiling point of a substance ΩBoyles law: use of equation PV=a constant at constant pressure	the effect of impurities on melting and boiling points Ω***Organising*** and ***analysing*** the data on graphs	questions for more understanding Ω***Being*** aware of the effects of pressure on boiling and melting points
11.1.3.8 Describe the relationship between temperature and volume of a gas 11.1.3.9 Explain the Kelvin scale from the relationship between temperature and volume.	ΩCharles law: as temperature against volume of a gas $V_1/T_1 = V_2/T_2$ ΩKelvin Scale; volume-temperature change (constant pressure) Graphical extrapolation	Ω ***Organising*** data in the tables to verify the gas laws	Ω***Participating*** in groups discussion Ω***Asking*** more questions for more understanding Ω***Applying*** the use of graphs to relate variables

Figure 2.71, showing the learning outcomes

The researcher used to send videos to help learners conceptually understand key concepts based on the questions asked as shown in fig 2.72. This proved that learners used to enjoy and understand the concepts.

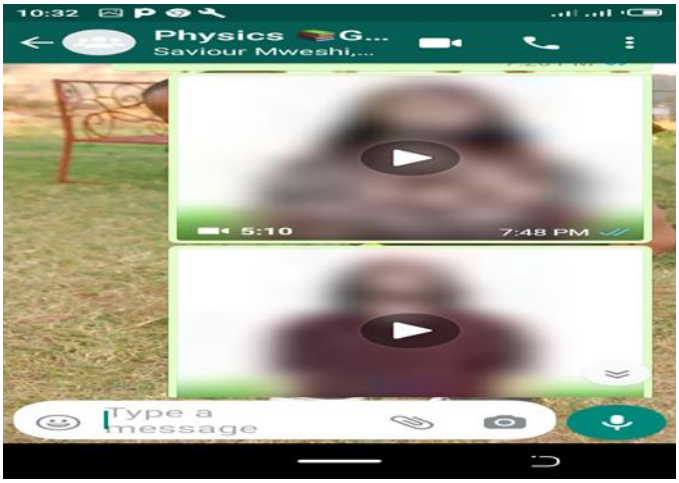

Figure 2.72, showning the videos screenshot sent

Learners were also encouraged to ask question not only on what the researcher sent. This was meant to help learners understand concepts in which they needed help. Below fig 2.73 and fig 2.74 showing the feedback .

Figure 2.73, showing the discussion

Figure 2.74, showing the feedback

Learners were encouraged not only to restrict themselves to texting but also to use voice notes. Voice notes were encouraged to be in the language the learners were comfortable with. This made learning to be more interactive and interesting. Fig 2.75 and fig 2.76 are showing the voice notes and feedback screenshot

Figure 2.75, showing the voice note discussion

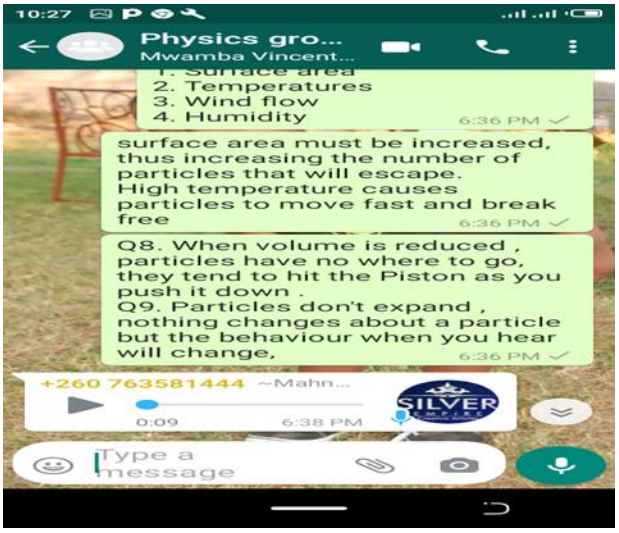

Figure 2.76, showning teachers' feedback

2.8 Data Analysis

Data were analysed using the Statistical Package for Social Scientists (SPSS) software package, version 26. The dependent variables, that is, students' conceptual understanding in Thermal Physics, and students' problem solving in Thermal Physics test were separately analysed. Test for normality was done before an independent t-test was done .The test for normality which was done to ascertain the distribution of the data was the Shapiro- Wilks .The statistical test used to determine if there was a statistically significant difference between the two groups, that is, experimental and control groups, on both conceptual understanding and problem solving in Thermal Physics was the independent sample t-test...This was the best statistical test to test the hypothesis because data for conceptual understanding and problem solving in Thermal Physics was quantitative data (Sherri, 2009).

3.0 PRESENTATION AND FINDINGS DATA

3.1 Effectiveness of MTOW on leaners conceptual understanding of Thermal Physics

The first research question of the study was: What is the effectiveness of MTOW on learners conceptual understanding of Thermal Physics? The question aimed at finding out whether or not there is a statistically significant difference between learners conceptual understanding during the MTOW method and conventional instruction method.

Table 3.10 Shapiro-wilk test for Normality Save my Exam post-test

Shapiro-wilk test for Normality				
Save my Exam post-test	Samples	statistics	df	p- value
	Experimental	0.941	34	0.067
	Control	0.951	38	0.094

The Shapiro-wilks test shows the experimental (p= 0.067) and control (P=0.094) in which (p > 0.05) for both groups and if the p value is greater than 0.05, then it shows that data is approximately normally distributed.

Table 3.11* Independent *t-test Save my Exam post-test

Save my Exam post-test	Levene's test fot equality of variances			t-test for equality of means		
		F	Sig	t	df	Sig (2-tailed) P
	Equal variances assumed	1.184	0.280	3.499	70	0.01
	Equal variances not assumed			2.538	69.421	0.01

Considering the column of Levene's test for equality of variance, the sig value is 0.280 which is greater than 0.05. This means that the variability in the two conditions is about the same. Scientifically, this means that the variability in the two groups is not significant different. The scores in one condition do not vary much more than the second condition.

To tell whether the two groups mean are statistically different, the t-test value was considered. Looking at the sig (2-tailed) value. It was found to (p = 0.01) which is less than 0.05. since the p-value is less than 0.05, it was concluded that there is a statistically significant difference between the two groups. Therefore, based on the results of the p-value, first null hypothesis was rejected which was stating that There is no statistically significant difference in the learners' conceptual understanding of Thermal Physics between those learning through mobile technology of WhatsApp and those learning using conventional instruction methods.

3.2 Effectiveness of MTOW method on learner's problem-solving skills in Thermal Physics

The second research question was: what is the effect of MTOW on learner's problem-solving skills in Thermal Physics? This question aimed at finding out whether or not there was a statistically difference in learners' problem-solving skills in achievement post-test between the experimental and control group. Findings and interpretation of

data is discussed below

Table 3.20 Shapiro-wilk test for Normality Achivement post-test

Shapiro-wilk test for Normality				
Achivement post-test	Samples	statistics	df	p- value
	Experimental	0.952	34	0.231
	Control	0.960	38	0.190

The Shapiro-wilks test shows the experimental (p = 0.231) and control (0.190) in which (p > 0.05) for both groups and if the p value is greater than 0.05, then it shows that data is normally approximately distributed.

Table 3.21 Independent t-test Achiement post-test

Achiement post-test	Levene's test fot equality of variances			t-test for equality of means		
		F	Sig	t	df	Sig (2-tailed) P
	Equal variances assumed	1.333	0.252	2.511	70	0.014
	Equal variances not assumed			2.538	69.526	0.013

On reading the Levene's Test on table 3.21 for equality of variances that determines if the two groups have the same or different amount of variability between scores, the sig value was greater than alpha value 0.05 (i.e., 0.252). a value greater than 0.05 means that the results in experimental do not vary too much from the results in control group, that is the variability in the two groups is not statistically significant different.

Looking at the sig (2-tailed) value, it was found to (p = 0.014) which is less than 0.05. since the p-value is less than 0.05, it was concluded that there is a statistically significant difference between the two groups. Therefore, based on the results of the p-value, second null hypothesis was rejected-which was stating that there will be no significant difference in the problem-solving skills of Thermal Physics between those who learnt using mobile technology of WhatsApp group and those who learnt using the conventional method. on post-test.

This means that there is a statistically difference between the two groups

4.0 DISCUSSION

4.1 Effect of MTOW on learners conceptual understanding in Thermal Physics.

This research study has shown that incorporating the use of MTOW in teaching have an effect on secondary school students conceptual understanding in physics and on the topic of Thermal Physics. Results show that, when MTOW is used effectively with good rules and timetabled lesson has a positive effect on learners conceptual understanding. This can be done either synchronous or asynchronous.

This research is in line with other finding from other research studies. For instance, Akpan et al... (2017) looked at the effectiveness of WhatsApp as a collaborative too for learning among undergraduate students in Nigeria. They found that WhatsApp application is an effective collaborative tool which can be used for teaching and learning in this 21st century system of learning by both students and instructors, WhatsApp was equally seen as an educational tool with the potential of making learning interesting.

4.2 Effect of MTOW method on learner's problem-solving skills in Thermal Physics.

Looking at the results from this research study, it evidently showed that MTOW has an effect on learner's problem-solving skills in Thermal Physics. As Lattanisis, Ajid et al (2018) in their study about the use of collaborative learning to improve English teaching and learning process, showed results which are in line with this study, that WhatsApp is beneficial to students' knowledge. The WhatsApp groups which teachers open can effectively be used to enhance problem-solving skills in learners. This can be achieved when the teachers invite students to have a group or private charts with him or her encouraging the students to help each other, according to Lattanisis, Ajid et al (2018).

However, for learners to have a positive perception of the formal use of WhatsApp to support their learning, the teacher needs to orient the learners first on how WhatsApp will be used and discuss the rules that will be used to guide learning. The teacher needs to be doing what is done in a normal formal classroom. Things like praising students for the good response, acknowledging correct answers, initiate discussion and ask for reflection from learners if they have understood the concept. The study is in line with what

Bouhnik and Deshen (2014) said about the advantages of WhatsApp in teaching, that it ensures the availability of the teachers to the students. The opportunity for students to help one another and the opportunity for more depth acquittance with the students on the educational and personal level.

5.0 Conclusions

The purpose of this study was to determine the effect of MTOW on learners conceptual understanding of Thermal Physics. It was also seeking to establish the effect of MTOW on learners problem-solving skills. The following was the conclusion:

i.. Incorporating MTOW in teaching does have a positive effect on learners conceptual understanding Thermal Physics.

ii. Incorporating the use of MTOW in teaching also has a positive effect on learners problem-solving skills of Thermal Physics. WhatsApp has a positive effect on learning ability of learners if used well as a collaborative tool.

6.0 Recommendations of the study

Based on the results of the study, the following recommendations were made.

i.. Before WhatsApp group is opened, the teacher should first orient the learners on how the group will be operating.

ii. WhatsApp rules should be given to enhance effective collaboration between teacher – learner and leaner -leaner collaboration.

iii. Timetable must be given so that learners and parents know the day and time to synchronous collaborate.

iv. WhatsApp application should be adopted by both teachers and learners as a collaborative tool for teaching in secondary schools in order to embrace the 21st century learning skills into a virtual classroom.

7.0 Recommendation for future research

i. This study may not be a representative of the student populations because it was done at one school. Further research needs to be done in schools and not only at high level of learning institution.

ii. Further research can also be undertaken to find out how effective WhatsApp can be used to pupils in different subjects.

iii. As a way of extension study, research need to be done on the effective use of MTOW on Gender.

REFERENCE

[1] Alavi, M., Wheeler, B. C., & Valacich, J.S. (1995). Using IT to reengineer business education: An exploratory investigation of collaborative telelearning. MIS quarterly,19(3),293-12.hhttps://doi.org/10.2307/249597

[2] Barhoumi, C. & Rossi, PG. (2013). The effectiveness of the instruction orientated hypertext systems compared to direct instruction in e-learning environment. Contemporary Educational Technology, 4(4), 281-308.

[3] Becker, C & Cline P (2005). The advantages and disadvantages of WhatsApp retrieved http://www.quora.com

[4] Boerema C., Stanley M.& Westhorp P. (2007) Educator's perspective of online course design and delivery. Medical Teacher: 29(8)758-765

[5] Boerema C., Stanley M.& Westhorp P. (2007) Educator's perspective of online course design and delivery. Medical Teacher: 29(8)758-765

[6] Crawford, K. (1996). Vygostskian approaches in human development in the information era. Educational Studies in Mathematics., 31(1-2),43-62.

[7] Creswell, J.W. (2008). Research Design: Qualitative, Quantitative and Mixed Methods Approaches (3rd ed.) London: SAGE.

[8] Dawes, L. (2004). Research report: Talk and learning in classroom science. International Journal of Science Education, 26(6).677-695

[9] Deshen M, Bouhnik D. Whatsapp goes to school: Mobile instant messaging between teachers and students. Journal of information Technology Education, 2014
http://www.jite.org/document/vol13/JITEv13researchp217-231 Bouhnik0601.pdf.24/4/2017.

[10] Ellaway R & Master K. (2008) Online AMEE Guide: e learning in medical education part 1: learning, teaching and assessment. Medical teacher, 30: 455-473.

[11] Fraser N, Dutta C. Defining online learning. Retrieved.2008.2017. from http:/www.learning Space.org

[12] Fidel, R. (2003). A comparison of the collaborative information retrieval behaviour of two desing terms". The New review of information Behaviour research, DOI;1080.

[13] Gormley G., Bickle L., Thomson C. and Kate Collins (2009) Online learning in clinical skills: the Belfast experience. The Clinical Teacher; 30: 455-473.

[14] Hege I., Ropp V., Dler m., Radon K., Masch g.,Lyon H. & Fischer M. (2008) experiences with different Integration strategies of case based eLearning. Medical Teacher Medical teacher; 6: 46-55

[15] Hmelo-silver, C. E (2006). Analyzing collaboration learning; multiple approaches to understanding processes and outcomes proceeding of the 17th international conference on learning science, USA

[16] Hogan, k. (1999). Thinking aloud together: A test of an intervention to foster students collaborative scientific reasoning. Journal of research in science teaching,36(10),1085 -1109

[17] Hols W. Bloemendal P., Bos N., Quaak M., Sijstermans R. & jong de P. (2008) twelve tips for computer-based assessment in medical education. Medical Teacher; 30:7: 673-678

[18] Ike GA. Ihebereme C. Role and management of information and communication Technology to achieve quality assurance. Journal of curriculum organization of Nigeria. 2008; 15(4);62-67.

[19] jimoyiannis. A., Tsiotakis, P., Roussinos. D., & Siorenta. A., (2003) Preparing teachers to integrate mobile in school practice: Towards a framework For Pedagogy 2.0 Australasian Journal of educational Technology, 29(2), 248-26.

[20] Johnson, D. w., & Johnson, R. T. (1975). Learning together and alone: Cooperation, competition, and individuation. Englewood Cliffs: Prentice-hall.

[21] Johnson. The theory of cooperative learning. Retrieved on 2007, 2015. From http://www.wikipedia.org

[22]. Khosa, D. k., & Volet, S. E. (2004). Productive group engagement in cognitive activity and metacognitive
Regulation during collaborative learning: can it explain differences in

students conceptual understanding? Metacognition and learning, 9(3), 287-307. https://doi.org?10.1007/s11409-014-9117-z
[23] Khoschmann, T. (1996) CSCL: Theory and practice of an emerging paradigm mahwan Nj: Lawrence Erlbum.
[24] Lwoga, E.T., Ngulube, P. and Stilwell, P(2010),” Information needs and Seeking behaviour of small-scale farmers in Tanzania,”: Innovation Journal of Appropriate Librarianship and Information Work in Southern Africa,40: 82-103.
[25] Nelson, J., Christopher, A., & Mims, C., (2009). TPACK and Mobile: Transformation of teaching and Learning. TeacTrends: Linking Research & Practice to improve Learning, 53(5), 80-87
[26] Olele CN. Using Web Quest Inquiry Based Resources for Teaching and Learning in Classroom. Jeson service publishers, Port Harcourt, Nigeria, 2015.
[27] Pences, H.E(2007). Preparing for the real Web generation. Journal of Educational technology systems
35(3),347-356.
[28] Prensky M. Digital Natives, Digital immigrants. Retrieved forms, 2001 http://edorigami.wikispace.com/file/view/prensky native and immigrants.
[29] Rember P. Activity theory and mediated interaction: Congnitive scaffolding using question-based consultation on Facebook. Australian Journal of education technology. 2012;1333-1361. Retrieved http://www.ascilite.orgua/ajet/28/ramer-2html.
[30] Resta. P; Laferriere, T. (2007). Technology in support of the collaborative learning. Education psychology review.
[31] Scardamalia. M. Bereiter, C & lamon, M. (1994). The CSILE project: Trying to bring the classroom into world 3.
in K. McGilly (Ed), classroom lessons: integrating cognitive theory and classroom practice (pp.201-228). Cambridge, MA: MIT press.
[32] Shumba. O. (2017). Tackling educational quality and epistemological access concerns in science and technology education in africa: l (1),4-21.
[33] Siemens G. Downness S. Connectivism: A learning theory for the digital age. International Journal of Instructional Technology and Distance Learning Retrieved on. 2005, 2017. From http//:mediawiki/resources/2005 _siemens_connectivism_A learning theory for the digital age.
[34] Stahl.G; Kosehmann & Suther.D (2006), computer-supported collaborative learning; a historical perceptive. In R.K sawyer (Ed), Cambridge handbook of learning science. (pp 409-426). UK, Cambridge University Press.
[35] Sulisworo, D.,Rahayu , T., & Akhsan, R. N. (2016). The students' academic writing skill after implementing blended learning using Facebook. Information Technologies and Learning tools, 56(6), 176-191.
[36] Ur. P. (1996). Mind in Society: The development of higher psychological processes. Cambridge, MA: Harvard University Press.
[37] Wegerif, R., & Mansour, N. (2010). A dialogic approach to technology -enhanced education for the global knowledge society. In M.S Khine & I. M. Saleh (Eds),New Science of Learning (pp. 325-339). New York: Springer.
[39] Yoon SW. (2003) In Search of Meaningful Online Learning experiences. New Directions for Adult and Cont. Education Winter :100:930

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