Namibia Journal for Research, Science and Technology
VOLUME 3 Issue 1
May 2021
p-ISSN: 2026-8548
e-ISSN: 2026-8912

Original Research Article

Facebook as a Learning Support Tool for NSSCO Physical Science Grade 12 Learners in Selected schools in the Oshikoto Region, Namibia

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ARTICLE INFO

Received: May 2020
Accepted: May 2021

Keywords:
Facebook for education, social media for education, learning support tools, education digital tools, social networking sites, 21st century learning support

ABSTRACT

Facebook remains a popular social media application for Namibian youth (Peters, Winchiers-Theophilus & Mennecke, 2015). Thus, it is important to investigating using Facebook as a support tool for academic performance. The purpose of the study was to explore whether Facebook has the potential to support learning and mastery of Physical Science content to improve learners' academic performance on the topic of stoichiometry at Grade 12 level in selected schools in the Oshikoto Region. The study uses a quasi-experimental design with pre-test, Facebook intervention with experimental group and post-test. The results show there exists a significant difference in favour of the experimental experimental group's score marks when Facebook was used as a learning support tool. Furthermore, data from the study revealed anecdotal evidence of learner collaboration and communication. The relevance of this study shows that teachers should embrace a pedagogy of using Facebook to support learning outside of the classroom.

1. Introduction

Social media allows users to create online communities and to share various forms of media content such as: pictures, video, ideas, personal messages, and other sources of information (Kaplan & Haenlein, 2010). In Namibia, the use of Facebook increased various web-based interactions, such as maintaining contact for friends and relatives, allowing people to conduct business, learn new skills and get updated with daily news (Peters, Winschiers-Theophilus & Mennecke, 2015). Among all the social media sites, Facebook has become the most commonly used application to support interpersonal interactions, communications, entertainment, and social bonding among its users (Jonson, 2014). Similarly, 80% of Namibian university students indicated Facebook as the social media of choice (Peters, Winchiers-Theophilus & Mennecke, 2015).

A belief that technology positively impacts the students' learning has led to the Namibian government creating programs for ICT integration at schools, intended to strengthen 21st century skills of critical thinking, lifelong learning, and social responsibilities (Bingimlas, 2009). Furthermore, it is important for the Namibian educational systems to seek innovative learning methods that integrate the use of supportive technologies for the purpose of mastery of content, development of critical thinking, communication, collaboration and creativity (Partnership for 21st century learning, 2016).

The Oshikoto Region in Namibia is a heterogeneous region which consists of 8 school circuits that comprise various secondary, combined and primary schools. The Oshikoto Educational Region is a multicultural region with learners from different geographical locations, backgrounds, financial status, and levels of access to technology. Social media and technology is accessible in some schools in the region through the use of school computer labs or through the use of personal mobile devices. Even though cell phones and personal devices are not permitted in Namibian schools, learners have access to them after school when they are at home or during holidays. It is against this background that the purpose of the study was to explore whether Facebook has the potential to support learning and mastery of Physical Science to improve learners' academic performance on

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the topic of stoichiometry at Grade 12 level in selected schools in the Oshikoto Region.

1. 1. Statement of the problem

Academic failure is not only frustrating to the learners and the learners' parents, but it affects the society in terms of resulting in a lack of manpower in all spheres of the economy (Aremu, 2000). In addition, teachers whose subjects performed well are awarded prizes at regional and circuit levels, while teachers whose subjects performed poorly are labelled by learners and parents as the reasons why learners could not go to institutions of higher learning. Just like other learning support systems such as tutoring and studying in groups, Facebook can enhance learners' understanding of subject content and it can be a learning environment where 21st century skills such as collaborative learning, communication, critical thinking and creativity are developed (Partnership for 21st century learning, 2016).

In a recent study of Facebook used by Namibian youth, the prevalence of Facebook usage was 80% with an average of 2.6 hours per day active time on Facebook (Peters et.al, 2015). It was found that 23% of Namibian youths' time was used for updating their Facebook status (Peters et.al, 2015). The Namibian youth perceived Facebook as more fun and less expensive than SMS/texting. The study further revealed that the learning component was of less importance to Namibian youth; however, this could simply be because it is not commonly used as a learning support system (Peters, Winschiers-Theophilus & Mennecke. 2015).

The 2016/2017/2018 Directorate of National Examinations and Assessments (DNEA) examination reports indicated that the overall performance in NSSCO Physical Science was poor. From the list of questions reported in the 2017/18 report, when matched with the question paper, it was clear that Stoichiometry is one of the areas of poor performance. The common difficulties identified on the topic are: Learners finding it difficult to write correct chemical equations or formulae (DNEA examiner reports, 2016, 2017 and 2018). The above-mentioned examination reports further indicated that most students have trouble finding the difference between the bonding forces (Intramolecular, Intermolecular, and Electrostatic), strength of bonding forces, and between ions, electrons and atoms. These difficulties can be reduced through discussions, pictures and video sharing on Facebook.

Given the rationale indicated above, Facebook could be an inexpensive, accessible and effective support tool to improve learners' academic performance, if it is used in an appropriate way. This study is therefore intended to explore a model of best practice, approach and strategies on how Facebook can be used effectively to enhance understanding and improve academic performance of learners in Physical Science on the topic of stoichiometry.

1.2 Hypothesis

H_0– There is no significant difference in the learners' academic performance in NSSCO Physical Science on the topic of stoichiometry when Facebook is used as a learning support tool.

H_1 – There is a significant difference in the learners' academic performance in NSSCO Physical Science on the topic of stoichiometry when Facebook is used as a learning support tool.

2. Literature Review

Due to an increase in online accredited courses and E-learning, the use of portable technology and mobile phone applications is perceived to play a major role in enhancing effective learning (Dunn, 2014). Different people have different views on the effect that social networks may have on academic performance of the learners. Some people perceive the use of social media such as Facebook by learners as a distraction from learning while others view Facebook as learning support tool that may boost academic performance. The expectation placed on the role of technology or mobile devices and social media on education is ascending gradually, hence their use among students and educators have been the topic of greater concern and discussion worldwide (Aydin, 2012). This resulted in numerous studies being conducted to assess the impact of technology on the education system.

Facebook is an interactive environment having diverse learners, educators and experts hence students communicate and get engaged in interaction with experts online, or in collaborative peer discussions. These equip them with adequate knowledge and information (Siemens, 2014). Through the interaction with knowledgeable members, collaboration with peers and availability and acquired information, learners think critically and hence enable to construct quality and meaningful content that foster learning in them and in others in a well-known and used technology enabling environment. The framework for 21st century offers learning environments as a basis to create the (1) learning practices, (2) human support, and (3) physical environments that will support the teaching and learning of 21st century skill outcomes.

In Africa, Facebook is a popular social networking site (Wang, Woo, Quek, Yang, & Liu, 2012). Youth use Facebook for different reasons, for example, to communicate and connect with friends, for marketing,

work, social enrichment and entertainment, or as a space for information sharing and updates through video, notes, pictures and get notification of parties, events, and social functions (Christy, Cheung, Chiu, & Lee, 2011). Among other social networks such as Twitter and Instagram, the majority choose to use Facebook instead. This is because Facebook is affordable (Wang, et.al, 2012), people can access Facebook either on the Web or through mobile devices using wireless networks or little data. In Namibia Facebook uses cheaper data, the internet provider of Namibia MTC sell data for social media at a lower cost than the price for general data for internet use.

Educators do not only teach students subject content but also prepare students how to be responsible citizens of the nation in future, hence apart from improving academic performance Facebook can be a tool to develop cognitive, psychosocial, morals and ethics among students (Junco, 2012). In addition, learners spend much time in an informal learning environment interacting with peers and receiving content more than they do with teachers in traditional classrooms (Phillips et.al, 2011). Facebook offers an environment that helps engage students and enriches the quality of student's experience and support their academic & social goals through interactive learner's activities (Irwin, et.al, 2012). In addition, Facebook can help with LMS (Learning Management System - Facebook group) as teachers can easily create new courses and enrol students. LMS have a lot of benefits as it shifts the focus from content-based learning to process–based learning. Facebook facilitates change from passive to active learning, it further promotes interaction between students and faculty members and (Wang et.al, 2012).

The use of Facebook should meet the needs of digital natives and digital learning style (Phillips, Baird, & Fogg, 2011). This is because it allows students to create their own content through interact and to express their identity and creativity. Facebook improves reading habits and texting frequency among the learners (Aydin, 2012) and it demolishes the communication barriers between educators, between educators and students as well as between learners and their peers (Aydin, 2012). Dunn (2014) further states that Facebook boosts learners' motivation, connectivity and engagement with materials that accelerate information sharing. It also equips students with the 21st century skills that enable them to suit in digital community (Dunn, 2014), as it gives the students the freedom to use it in any way that best suits their individual learning style (Phillips, et.al, 2011).

3. Methodology

The study uses a quantitative approach with a quasi-experimental design, constituted of a Non- Equivalent-Groups Pre-test, Intervention and Post-test design to gain insight in the impact of Facebook as a learning support tool on the performance of learners in Physical Science on the topic of stoichiometry. The population of the study was all the senior secondary schools in the Oshikoto region offering Physical Science. The sample was selected using stratified random sampling method in order to ensure that not all students of the same academic ability are in the same group. The intervention group consists of 19 learners and 19 learners where used as a control group while the remaining did not take part in the study. These 38 learners represented grade 12 Physical Science learners at the selected school.

A pre-test and a post-test after the intervention tools were used to obtain data from the sample. The intervention consists of a Facebook group on which the support materials were uploaded and where discussion on the topic took place. The control group received worksheets and exercises on the topic, which is the traditional support mechanisms usually provided by teachers. The participating learners were divided into two groups: the control group and the experimental group. During normal class time, all learners received the same presentation, the same notes, and the same oral and written activities based on the specific learning objectives as stipulated in the syllabus. The researcher created a closed group on Facebook and added the participant learners of the experimental group. The researcher further uploaded the instruction which explained the primary purpose of creating the group, the expectations from the group members and a brief logic to be followed. The researcher conducted a pre-research questionnaire aiming at acquiring the participants' demographic information. In the pre-research questionnaire students were asked to indicate their age, gender and the device through which they access Facebook.

3.1 Pre-test

All the learners who participated in the study wrote the same pre-test on the topic of stoichiometry at the same time, irrespective of whether they fell under control or experimental group. The test was set following the guidelines of assessment and the required level of difficulty as specified in the syllabus.

3.2 Intervention

During the intervention, the participant learners of the control group were supported in a traditional way of teaching, i.e. they received notes, Power Point presentations, as well as exercises and homework in the afternoon. The experimental group received notes and they were given exercises and homework in the afternoon just like the control group. However, they

additionally received a Facebook intervention, where they were given the opportunity to listen to videos and audio presentations, and participate in postings, uploading pictures, as well as additional PowerPoint presentations and further study materials on the topic. They were also allowed to interact with fellow group members and teacher on Facebook around the topic.

3.3 Post-test

After 5 teaching days, a post-test was conducted. Both the control group and experimental group wrote the same post-test to test the effect of the interventions on the learners. The post- test results were then used to assess if there exists a significant difference between the control and experimental group score outcome. Whatever difference that might arise, it is believed to be caused by the interventions.

3.5 Analysis

The data from the pre-test and post-test are compared, and statistical significance levels (the p-value or t-value) are calculated. The correlation is calculated in order to indicate a possibly significant level of Facebook use for learning support. In addition, the discussions from Facebook are analysed by tallying categories of 21st century learning support and providing a frequency table or graph to indicate what type of curricular learning support was identified on Facebook.

4. Findings

The researcher observed the actions of the participants during the intervention period. These involved the types of device the participant used or willing to use, the interaction between participants and between the participants and the teacher, amount of time spent online, participation, motivation among participants during the study, behaviour and ethical conduct of learners on the group, contribution and freedom of expression.

Devices used: Despite the school making 7 computers available in the library, participant learners preferred taking along and using their personal mobile devices. Only 10.5 % of the participant learners opted to use school desktop computers, while 18.4 % of the participant learners used laptops and the majority of participant learners forming 71.1 % of the sample utilised their smartphones.

4.1 Pre-test outcome score

The pre-test was piloted to assess the initial learners' level of understanding and the level of equivalence between the control group and experimental group before the intervention. As shown in Table 1, only 4/19 participants in the experimental group scored 50% and above in the pre-test. The average score in the pre-test for experimental group participant learners is 14.7 out of 40, forming up 36.8 % average percentage score in the pre- test.

Table 1: Pre-test scores

Statistical Calculations	Value	
	Control Group	Experimental Group
No of participants	19	19
Mean	16.1578	14.7368
Variance	38.0292	67.0935
Standard deviation	6.1667	8.1910
Standard error	2.3521	
Degree of Freedom	36	
T-value critical	2.750	
T-value calculated	0.6041	

4.2 Control group

On average, participant learners of the control group performed poorly in the pre-test. Only 6 learners (31.6%) of the control group participant learners 19 scored 50% and above in the pre-test. The average score of the control group in the pre-test is 16.2 out of 40; this made the average score percentage to be 40.5.

4.3 Post Test

The control group participant learners performed quite well in the post-test, with 11 of the 19 participant score above 50%. The average outcome score for the control group in the post-test is 20.6 out of 40 (forming up 51.5%).

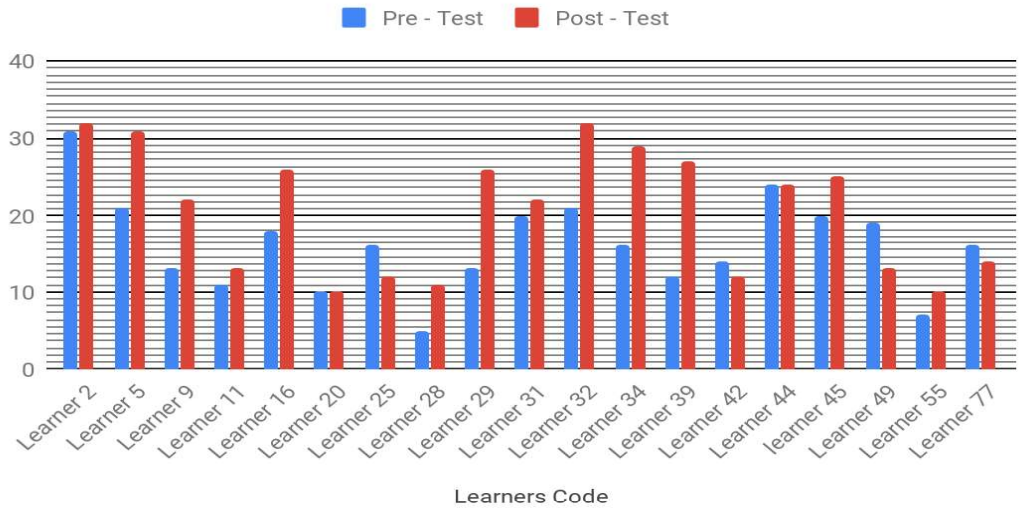
4.4 Experimental group

All participants in the experimental group have scored above 50% in the post-test, the mean post test score for the experimental group is 30.7 out of 40.

4.5 Pre-test vs post-test

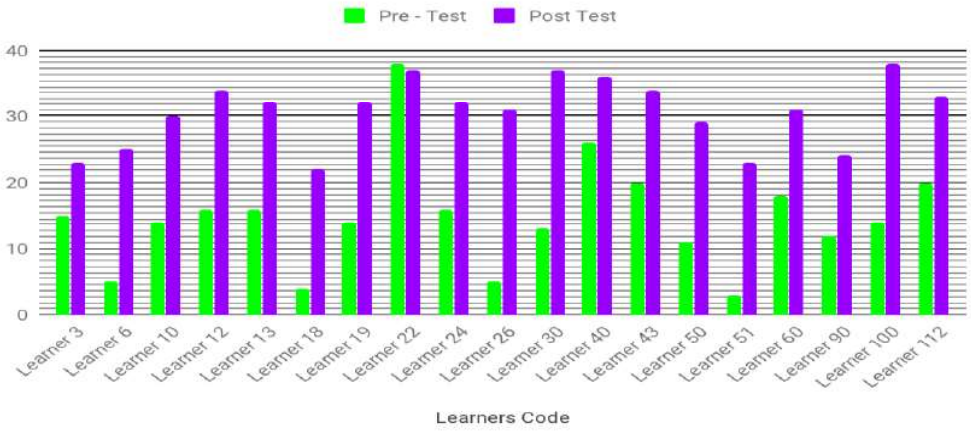
On average, both the control group and experimental group participants performed better and demonstrated a better level of understanding in the post-test than in the pre-test. These results show that learners earn better understanding during the study time when appropriate support is provided. The results can be compared with each other in Fig. 1 (Control group) and Fig. 2 (Experimental group) below. The aim is to detect any change in outcome score of participants during the two stages of the research [before and after the intervention].

Figure 1: Control group pre-test and post-tests score



There is an increase in outcome score obtained in the post-test when compared to the outcome scores of the pre-test. 15 to of 19 participants increased their outcome score, 2 out of 19 participant learners maintained their score and 2 dropped after the intervention. On average, there is a difference of 4.4 outcome scores between the pre-test and post-test, this forms 27.1 % outcome score increment.

Figure 2: Experimental group pre-test and post-test score



4.6 Experimental group

In Table.2 below, the t - critical value = 2.750 as obtained from the table at p = 0.05 and t- calculated value = 4.5802363101 with a degree of freedom equal to 36. T - critical is less than t - calculated.

Table 2: Post Test scores

Statistical Calculations	Value	
	Control Group	Experimental Group
No of participants	19	19
Mean	20.57894	30.6842
Variance	66.4795	26.0058
Standard deviation	8.1534	5.0995
Standard error	2.206	
Degree of Freedom	36	
T-value critical	2.750	
T-value calculated	4.5802	

Most of the participants preferred using smartphones to participate in the study. The pre-test score showed low average for both control and experimental group. Also the t-critical value is greater than the t-calculated value. However, the post-test score shows a big difference between the mean score for the control group and the experimental group, of which the experimental group had a greater average than the experimental group.

4.7 Before the Intervention

All participants of the study (the experimental and control group) had an equivalent level of knowledge and understanding. This was proven by the pre-test results in which both groups of participant learners scored marks below 50 percent, which resulted in a low average. In addition, the calculated statistical value (t-value = 0.604141249) at p = 0.05 with a degree of freedom of 36 was less than the critical t-value (t=2.750). Therefore, there was no significant difference between the experimental and control group score marks at the initial stage of the study.

4.8 After the intervention

It was observed that the mean score of the experimental group highly increased exceeding the mean score of the control group. Secondly, all the participant learners in the experimental group scored above 50% in the post-test while only 11 out of 19 of the control group participant learners scored 50% and above in the post-test. In addition, although there was an increase in marks for both the control and experimental group result from pre-test to post-test, the average mark increased for the experimental group (t= 16 or increase by more than 100%) and was higher than the average marks increase of the control group (t= 4.42 or increase by 27.4%).

It is further noticed that the calculated statistical value after the intervention (t-value = 4.5802363101) at p = 0.05 with a degree of freedom of 36 is greater than the critical value (t - critical =2.750). Therefore, it can be stated that a significant difference between the control and experimental score marks existed when Facebook was used as a learning support tool. *These results reject the null hypothesis and accepts the alternative hypothesis, that there is a significant difference in the learner's academic performance in NSSCO Physical Science on the topic of stoichiometry when Facebook is used as a learning support tool.*

5. Limitations

In setting up the learning support environment, there were certain limitations that required highlighting in order for future studies to improve upon. The following were the limitations of the study:

Technological Resources

Personal telephones are not allowed in schools, even though permission was granted, learners could only use the mobile devices (smartphone) at specific given time and at identified place in order to adhere to the school rules and regulations. As the researcher had to keep the devices and only hand them to the participants during a specified time frame, Facebook was not used anytime and anywhere as in a real-life setting.

Learners conduct with the phone and online behaviour

It was out of the researcher's power and scope of this study to monitor the behaviour and activities that learners may have be engaged in during the study. However, the researcher was in a position to monitor what the learners were posting in the group, but not other activities that learners could be doing with their phones that may not have given insight to the learning behaviour of learners.

Internet connectivity and access

At times the school Wi-Fi was slow which made it difficult for the participant to log in and participate in

the discussions and activities on the Facebook platform. However, the researcher took the responsibility to use Tethering and Portable Wi-Fi hotspot to connect the participant learners to the Internet.

Support from school teachers and management

Due to the belief that Facebook is the main source of ill-discipline in Namibian schools, school teachers and management members where neither interested, motivated nor involved in the intervention or study period. Instead they distanced themselves from the study, reasoning that the researcher should be accountable for any wrong-doing that may arise from the activity.

Gender equity and protection

Although more girls are enrolled on Facebook than boys amongst the study sample, most of the girls in the classroom indicated not being comfortable to use their Facebook account to interact with the teacher and they indicated that they do not want the teacher to know their Facebook names. They preferred to use their account for social means with their peers and not for education where teachers were involved.

6. Conclusion

The use of Facebook as a support tool has shown that it has the potential to support learning and mastery of Physical Science to improve learners' academic performance on the topic of stoichiometry at Grade 12 level. Additionally, this study showed that the learning support environment encourages the 21st Century learning skills (4 Cs). Further research is needed to show teachers how they can approach and setup Facebook for learning support. Strategies and approaches are needed to engage the female learners to participate in Facebook from a learning perspective. Furthermore, research on mobile pedagogies and strategies are needed for teachers if they were to integrate Facebook as their learning support tool. The relevance of this study shows that teachers can no longer hide from using technologies that learners are so easily attuned to.

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