

The impact of MindTap on the academic achievement of first-year software application students

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ABSTRACT: It is argued that technology adoption is prominent among learners born in the digital era. Living in the digital era has given rise to different learning environments, such as mobile learning and e-learning, as well as software applications that can enable learners to experience personal learning. One of these personal learning experiences that is provided by Cengage is called MindTap. MindTap works on any digital device, providing students with access to their course material anywhere and anytime. The purpose of this article is to determine the impact of MindTap on students' academic achievements in a software applications module. The research followed a quantitative study focusing on the grades of first-year African students who enrolled for an IT module at the Central University of Technology in South Africa during 2018 and 2019. Students in 2018 did not use MindTap, while those in 2019 did make use of it. However, the final grade results of these first-year students were similar in both years, with MindTap providing no significant impact.

INTRODUCTION

Living in the digital era has caused advancement in the field of information technology (IT), software applications and communication technologies. These technology advancements have created a wide range of opportunities for the acquisition of knowledge or learning. Learning has since transitioned from traditional face-to-face learning to mobile learning (m-learning) and e-learning.

M-learning transpires as an innovative development based on making use of mobile devices with wireless communications for the purposes of teaching and learning [1]. M-learning also includes learner management systems (LMS) which supports ubiquitous learning. Modern LMS's have the capabilities to include other m-learning software applications, which give rise to a personal learning experience (PLE) [2]. Among others, these software applications include the Cengage MindTap, which is said to provide for a PLE [3].

In the United States of America, a study was performed to determine if MindTap had a positive impact on the performance of students. The results of this study reported that over 70% of students mentioned that using technology applications for studying had a positive impact on their academic achievements, and it saved them a lot of time while studying [3]. This could be related to the high usage of mobile devices and mobile device ownership.

However, there were conflicting results in another study that was motivated by the current generation of students using digital devices more than previous student groups. The results of the study revealed that even though MindTap has potential to offer students greater value than the current generation of textbooks and e-books, 75% of the students still preferred a traditional learning environment and traditional textbooks [4].

Even though there may be a high usage of mobile devices globally, their usage in South Africa are often affected by high data prices [5]. Data costs are a prohibitive factor for m-learning in South Africa and this could be the reason for South Africa being at an early adoption stage of certain technologies [6]. Even though MindTap has shown positive results in some countries, it has not been widely reported on in the context of South Africa.

This has motivated the research question for this study:

- *Can MindTap have a positive impact on the academic achievements of first-year IT students in a software applications module?*

The purpose of this article is to answer this research question and make recommendations based on the results. For the literature of this study, m-learning and MindTap will be discussed. It is then followed by the study context, methodology, results and discussion, and conclusion.

LITERATURE

The literature in this section includes m-learning and MindTap. According to Li et al, m-learning is an innovative initiative that seeks to improve access to education [7]. According to literature, m-learning provides some sense of flexible, personal, interactive and enjoyable learning [6]. This is due to the mobility of such devices that excludes the limitations of desktop computers or the traditional classroom environment [8], thereby making anytime and anywhere learning possible. M-learning has varying results from country to country.

In Asia, research was performed to develop and validate an instrument that measured the motivation of students and the learning approaches used in a seamless learning device. Seamless learning devices are any digital devices used for m-learning, and they provide for personalisation and ubiquity [9]. The findings of another study indicated that mobile-assisted seamless learning is a good strategy as evidenced by a valid and reliable questionnaire [10]. Additionally, it was observed that students' motivation anticipated the learning approaches they applied in the seamless learning environment.

In Africa, a study that was aimed at determining the influence of mobile devices for the purposes of learning was conducted. The purposes of the study included determining the types of interactions that students in Nigerian universities have with their mobile devices [1]. The findings indicated that students use their mobile devices to communicate with their peers about academic related matters, surf the Internet and library databases, practice on-line quizzes and engage in discussions with their peers.

In South Africa, a study was conducted to examine the extent and nature of e-learning and m-learning activities in South African universities. The results indicated that the level of learning practice and adoption differs in universities due to numerous challenges, such as technology and infrastructure [7]. Different institutions use different m-learning applications and methods according to their available infrastructure; hence, the varying results.

MindTap is a personalised learning software application offered on a digital platform that engages students with interactive media content, while offering students and instructors choice in content, platform, devices and learning tools [11]. As indicated in the introduction of this article, MindTap is a software application provided by Cengage, which makes provision for a PLE. It also brings library content to the students.

According to Froeb et al, users of MindTap can benefit from multimedia activities, reading assignments and assessments in a single platform that provides guidance through the curriculum [12]. It was first introduced in 2012 as an on-line cloud-based, course management and instructional support tool [13]. The student course materials are available in one spot for ease of access. The course material includes e-books, exercises and solutions, quizzes and multimedia content [14]. The students can access MindTap on their desktop and mobile devices through a LMS, such as Blackboard [12]. When they login to Blackboard, MindTap is embedded on the particular module.

CONTEXT OF THE STUDY

Software Applications 1 is a programming module offered to students enrolled for Financial Information Systems. It is a module presented in the first semester of a year which consists of 14 weeks. Students have two practical classes and two theory classes per week. The module consist of 12 credits.

Each class is scheduled for 1 hr 25 minutes. The module has three tests of which two are practical tests and one is a written test. Students are primarily evaluated on their skills of Visual C Sharp (C#) programming. In the practical class, the students apply what they have learned in the theory classroom in the form of short programming exercises and tutorials. The syllabus includes three tests that add up to a course mark, which contributes 50% towards the final mark. The key sections in the syllabus include demonstration of an understanding of C# applications, understanding of arithmetic operators, understanding of decision statements and methods.

The outcomes of the practical tests include:

- effective use of the C# compiler to write and compile simple programs; implementing arithmetic operators with relational and equality operators;
- effectively use basic problem-solving techniques; develop algorithms through the process of top-down, stepwise refinement; and
- demonstrate an understanding of control statements; use the if and if ... else selection statements to choose among alternative actions.

The results of this study are based on the performance of the students in these tests and semester examination. The methodology is presented next.

METHODOLOGY

The study followed a quantitative approach. In a quantitative research approach, numerical data is collected and/or the researcher converts what is observed or collected into numeric data [15]. In this study, the use of MindTap at

the Central University of Technology (CUT), Free State, Bloemfontein campus, is explored. The target population are first-year level students in a module called Software Applications 1. The study was done in order to gain a better understanding of the impact that MindTap has on students' academic achievements by observing their practical test results and examination results.

The Information Technology Department of the Faculty Engineering, Built Environment and Information Technology at CUT was given the opportunity of running MindTap for a trial period of six months. The trial period extended between January 2019 and June 2019. The target population who made use of this trial included all the first-year level students in Software Applications 1 during the first semester of 2019. There was no sampling done as the performances of all students registered for the module are considered, and no ethical clearance as it involves only observation of student marks with no personal information of any student required.

MindTap was embedded into the University's LMS, called eThuto, which is built on the Blackboard platform. The students were able to perform some programming exercises as there is a programming simulation available on MindTap. The students completed some self-tests and quizzes and watched multimedia content. MindTap included all the content, as well as the e-books for the module. Students also had access through the MindTap mobile app, which they installed on their mobile smartphones. In the results, the aspects of the module that will be reviewed are the two practical test results and final semester results for the year 2018 and 2019.

RESULTS AND DISCUSSIONS

The results of this study include the final results of the year 2018, in which the students were not using MindTap. This is for the purpose of determining whether MindTap did have an effect on the students' academic achievements in 2019, when it was used for the first time at CUT. Figure 1 represents the final semester marks for 2018. The total number of students was 65, which is 40% more than those for 2019. These students did not use MindTap for any of their practical tests. The marks in Figure 1 are ranked from lowest to highest. The lowest mark was 2% and the highest mark was 98%. The pass rate for these participants was 88%.

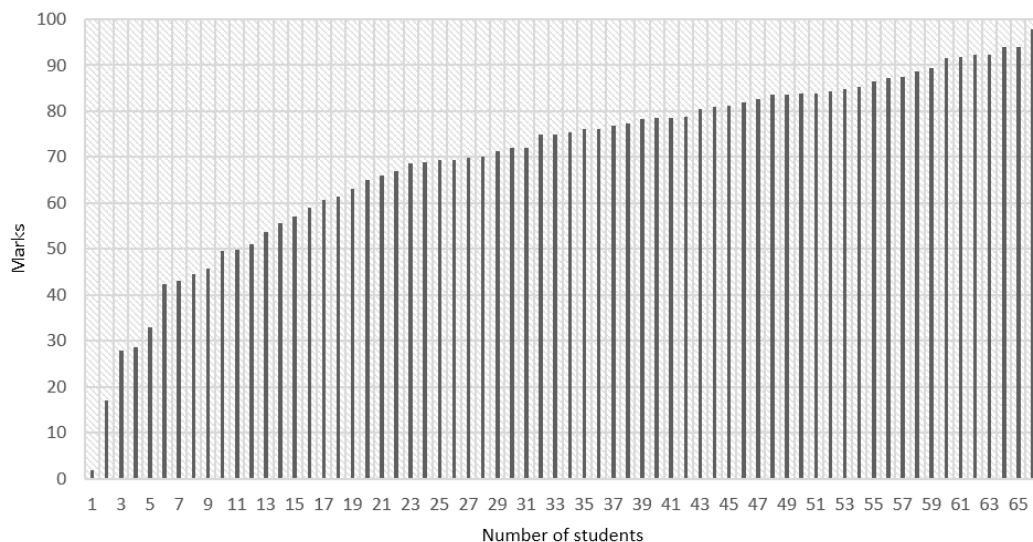


Figure 1: 2018 final semester marks.

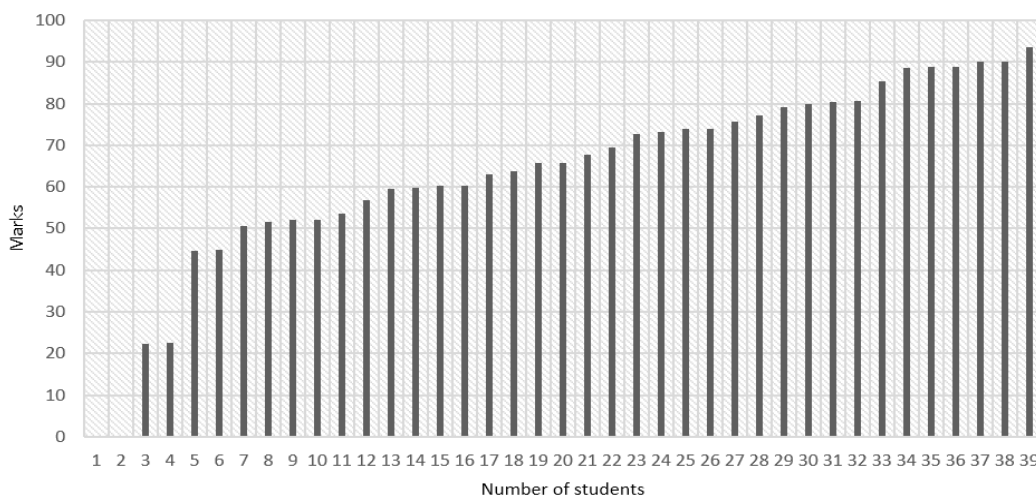


Figure 2: 2019 final semester marks.

Figure 2 represents the final semester marks for 2019. The final semester mark includes the examination mark. This is the year in which MindTap was used. The marks are ranked from lowest to highest. According to Figure 2, the lowest mark was 0% and the highest mark was 94%. The pass rate was 85%.

Figure 3 compares the results of Practical 1 with the final semester marks obtained by the students in 2019. This practical contributes 25% towards the course mark. The final semester mark includes the course mark (50% contribution) and examination mark (50% contribution). The lowest practical mark was 0% and the highest mark was 93%. These results are for the participants who used MindTap in 2019.

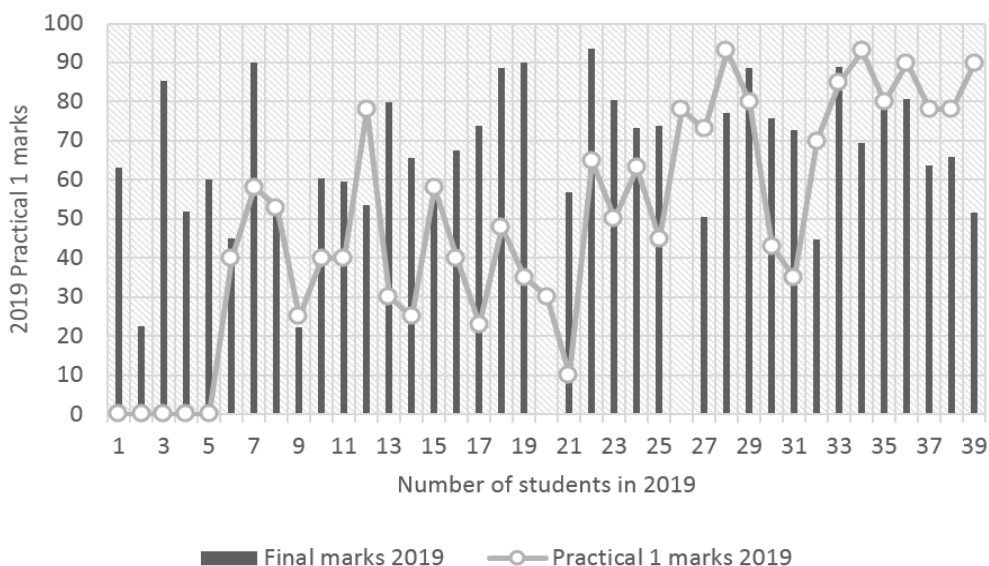


Figure 3: 2019 Practical 1 marks versus the final semester marks.

A Pearson correlation coefficient (r) is used to examine the relationship between two quantitative continuous variables [16]. According to research, a positive correlation indicates that both variables increase or decrease together, while a negative correlation shows that as one variable increases, so the other decreases, and *vice versa*. The value of the Pearson correlation was $r = 0.647$, which indicates a moderate statistical significant relationship between the practical marks and the final semester marks.

The results in Figure 4 contrast the marks for Practical 2 with the final semester marks. This practical also contributes 25% towards the course mark that contributes 50% towards the final semester mark. The lowest mark for Practical 2 was 0% and the highest mark was 100%.

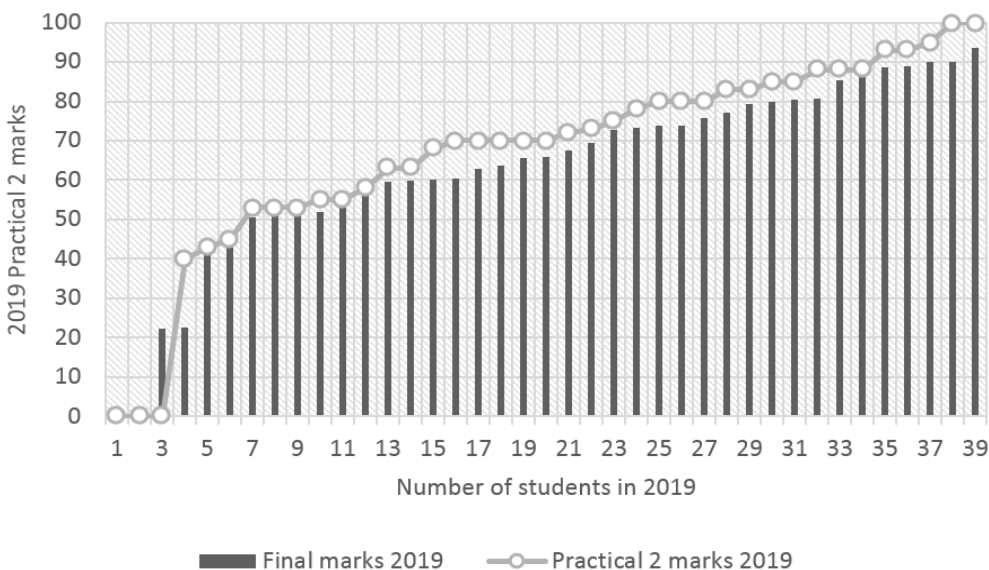


Figure 4: 2019 Practical 2 marks versus final semester marks.

A Pearson correlation was done between the marks for Practical 2 and the final semester marks. The value of the Pearson correlation was $r = 0.102$, which indicates that no statistical significant relationship exists between the test marks for Practical 2 and the final semester mark. Altogether, these results compared those of 2018, where MindTap was not used and 2019 where MindTap was used. The overall results indicate that there is no real significant correlation between the use of MindTap and the academic achievement of the students. This leads to the conclusion of the study.

CONCLUSIONS

The purpose of this article was to determine the impact of MindTap on students' academic achievements in a software applications module. The study followed a quantitative approach. The results of the study focused on the marks obtained by the students in the tests for Practical 1 and Practical 2. The results also included the final semester marks for 2018 and 2019.

According to the results in Figure 1, the lowest mark was 2% and the highest mark was 98%. These participants did not use MindTap for their practical work. The pass rate for these participants was 88%. Figure 2 represents the results of participants who used MindTap for their practical work.

According to Figure 2, the lowest mark was 0% and the highest mark was 94%. The pass rate for these participants was 85%. This, therefore, indicates that MindTap did not necessarily have an impact on students' academic achievements as the difference in the final semester marks pass rate is 3%. No real statistical significant relationship could either be established between the test marks of the practical work done in 2019 and the final semester marks. Altogether, the performance (final semester marks) of participants was similar regardless of whether or not the participants used MindTap. Therefore, MindTap did not necessarily have an impact on the academic achievements of students.

The limitations of this study are that MindTap was piloted at the IT Department for a period of six months only and most of the learners were first-year students. Introducing MindTap to the whole Department may address this limitation, and thereby leading to more informative results. Living in the digital era has caused advancement in the field of information technology. However, improved students' academic achievements may not always be related to m-learning, as shown in this study.

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