Consistent engagement from the start of a semester enables academic student success - a case study of first-year engineering students

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ABSTRACT: Consistent student engagement with the content of a course is fundamental to academic success. When this engagement occurs from the start of a semester until its end, then the chances of success should improve. The purpose of this article is to highlight the positive results that come to students who are consistently engaged with the content of a course from the very start of a semester. A time-lag study is used where quantitative data (n = 2,608) covering a nine-year period is presented that covers the pre-COVID, COVID and post-COVID times. This data is primarily based on assignments and on-line assessments that students needed to complete, starting from the second week of the semester. Students who complete these assessments on time tend to score a course mark of more than 60 marks, thereby giving themselves an 88% chance of successfully completing the course. Students who miss some of the early assessments or who fail to consistently engage with the content, often score a course mark of between 40 and 60 marks, which only gives them a 33% chance of academic success. It is recommended to create awareness among first-year engineering students of the importance of engaging with the content of a course from its outset, putting in the required effort and study to complete all the required assessments rather than engaging in an intensive study session just prior to the examination.

Keywords: On-line assessments, course marks, time management, COVID

INTRODUCTION

Consistency is often a mark of quality [1].

Academic scientific writing must adhere to a given standard for it to be acceptable for publication. This standard, or level of quality, is often influenced by the perceived presence of consistency. For example, an author may start an article using the APA standard of referencing, and then change to the IEEE standard. This is not indicative of consistency and may suggest that the article has further flaws within it. However, when consistency is detected by a reviewer in even small matters (e.g. always using a pre-defined acronym throughout an article or persistently formatting paragraphs and text in the same way), it engenders confidence that the research work has attained a specific level of quality. This is even truer in the lives of first-year engineering students.

Students who consistently engage with the course content of a module or subject over time increase their chances of achieving academic success. In fact, a focus on interactivity and consistent engagement is now more paramount than ever before [2]. This requires academics to create more activities for their students to engage with, both inside and outside of the classroom environment. Gone is the time where teachers expect students to simply sit and listen to a lecture or read a given textbook. Students need to be involved in the teaching process, forming their own opinions, voicing their own thoughts, and becoming agents of their own learning. Indeed, developing, sustaining and improving student engagement is of vital importance to higher education instructors [3].

Sustaining student engagement cannot materialise when many activities are scheduled near the end of a course or semester. Students should also no longer be required to study for intensive periods of time prior to a final examination but should rather be encouraged to engage with the content from the outset of the course. It has been noted that a decrease in student motivation and student engagement over time may be linked to the end of the semester approaching and students becoming less energised in their studies [4]. This reinforces the argument to get students engaged with the module from the start of the semester, which includes scheduling assessments and assignments during this time.

The purpose of this article is to highlight the positive results that come from consistently engaging students with the content of a course from the very start of the semester. This consistent engagement often leads to achieving academic success, as is evident in this time-lag study covering nine years. The article starts with a discussion of time management,

and how early starters usually reap the benefits of their consistent engagement. The study context is then given, along with the methodology, results and conclusions.

EARLY *VERSUS* LATE ENGAGEMENT

Early engagement is defined, in this study, when students start to engage with the content of a course during the first week of a semester. These are typically students who register on time or attend class within the first week. Their commitment to the course is often noted in the high course mark which they achieve.

A study in 2021 examined and quantified the relationship of early participation in course activities with students' learning performance [5]. Using multilevel logit modelling, the relationship of early participation in on-line courses and student final performance were modelled with student log data and other individual information from over 30,000 students enrolled in 22 on-line university courses. Results showed that early participation in on-line course activities is significantly correlated with student final performance.

There is even a fair amount of scientific evidence that starting early is beneficial for learning [6]. In fact, a well-known idiom states that *the early bird catches the worm*. Starting early ensures that the students do not miss any instruction, that they are optimally exposed to the experience of the lecturer during class time, and that they can start forming friendships and study groups during the early part of the semester. Starting early is important because children or students, get better at learning and become more motivated to learn with every educational experience [7].

Late engagement is defined, in this study, when students start to engage with the content of a course after a few weeks of the semester have already passed. These are typically students who register late or who attend class haphazardly. Their lack of commitment to the course is often noted in the low course marks which they achieve.

A study in 2021 reported on a summer vacation programme that made use of temporal remote learning [8]. The analysis of the recorded data revealed that early engagement at the beginning of the vacation was important for their academic performance after the vacation, when students would return to their normal studies. Conversely, late engagement (students who did little until the end of the vacation) did not reveal a similar result.

Another study in 2022 found that non-engagement with a virtual learning environment in the first three weeks of a semester was the strongest predictor of failure and that early engagement correlated most strongly with the final grade [9]. The use of such an on-line learning environment (also called a learning management system or LMS) is mandated by many universities around the globe. These systems usually feature several tools across the four main pillars of such a system [10]. Academics who effectively use many of these tools from the start to the end of a semester provide their students (and especially first-year students who are still adapting to higher education) with the best possible opportunity for success, as student engagement is maintained over an extended period.

STUDY CONTEXT

The study context focuses on a compulsory first-year module in a two-year Diploma qualification offered at the Central University of Technology (CUT). This Diploma resides in the Faculty of Engineering, Built-Environment and Information Technology, which is one of four faculties on the main campus of the university in Bloemfontein, South Africa [11]. This module is called Electronic Fundamentals 1 (ELE1), with the approximate number of registered students being 500 during the first semester of the qualification. Students need to spend a minimum of 2,400 notional hours on this Diploma (240 credits) which is an NQF (National Qualifications Framework) Level 6 qualification. These credits are split among several modules, with ELE1 contributing 14 credits that required students to spend a minimum of 140 hours engaging with it (class time, study time, assessment time, doing practical assignments, etc). The syllabus covers seven main theoretical concepts, including the oscilloscope, resistors, diodes, transistors, the design of a power supply and an amplifier, and basic digital logic.

The module comprises a blend of both theory and practical instruction. The theory contributes 65% to the course mark, comprising six on-line self-assessments and a main test (week 10 in Table 1). The practical contributes 35% to the course mark and requires students to submit four practical assignments on-line via eThuto (the learning management system of the University built on BlackBoard^{TM}) within the first ten weeks of the course. The use of Information and Communications Technology (ICT) has become an integral and important element of everyday life for many people [12], including students in higher education.

A closer consideration of Table 1 reveals that 80% of the practical work (called T3) and 83% of Test 1 (called T1) is completed within the first six weeks of the semester. These two grades (T3 and T1) contribute 60% (35% and 25%, respectively) to the course mark of the student that has a significant impact on whether the student will achieve a moderate (40-60) or high result (more than 60). The minimum required course mark to gain access to the final examination at the end of the semester is 40.

This illustrates the importance of early engagement, as the first week of the semester already features an on-line self-assessment that contributes to the course mark. In fact, the final course mark can be calculated by the end of week 10

(another three weeks of class exist in this 13-week semester but is not shown in Table 1 as it does not contribute to the course mark). The results of this study focus on the relationship between the course mark and the final grade awarded to the students after their main examination. Please note that the final grade is calculated using 50% of the course mark and 50% of the main examination.

Table 1: Semester programme for ELE1.

Time period	Theory 2 x 90 minutes/week	Assessment on-line	Weightings	Practical work 1 x 40 minutes/week
Week 1/2	Unit 1 - Introduction and basic frequency measurements	Academic student support - on-line anywhere	Six on-line self-assessments make up Test 1 (T1) which contributes 25% to the course mark	Laboratory introduction
Week 2/3	Unit 2 - Basic analogue electronic components	Unit 1 - on-line anywhere		P1 - on-line (10%) Extra work in the laboratory
Week 4	Unit 3 - Semiconductors and light propagation	Unit 2 - on-line anywhere		P2 - on-line (10%) Extra work in the laboratory
Week 5	Unit 4 - BJT and MOSFET	Unit 3 - on-line anywhere		P3 (20%)
Week 6/7	Unit 5 - Basic design principles for power supplies and amplifiers	Unit 4 + Unit 1 - on-line anywhere		P3 (20%)
Week 8	University recess			
Week 9	Unit 6 - Concepts of digital electronics	Unit 5 + Unit 2 - on-line anywhere		P4 (10%)
Week 10	Main assessment (Test)	Units 1 - 5 - controlled laboratory	Main assessment (T2) contributes 40% to the course mark	P4 (10%)

METHODOLOGY

A time-lag study is used focusing on quantitative data gathered over a nine-year period. Time-lag studies are commonly used for data collection processes to reduce common method bias and temporal effect [13]. Gathering data over a nine-year period which includes the pre-COVID, COVID and post-COVID times removes any temporal effects, as a wide range of student circumstances exist. The quantitative data includes the course marks and final marks of 2,608 students. No sampling is required as all registered students are considered in the analysis which was done in MS EXCEL. No ethical clearance was required from the University, as only student marks and grades were used with no student numbers or names attached to them.

RESULTS

Figure 1 presents the student profile for the nine-year period. Male students dominate the gender profile, outnumbering females by 2:1. The largest number of students are younger than 24 years of age, which is indicative of first-year students around the globe. The most common home language is Sesotho, which is the dominant language spoken in the Free State province of SA, where the main campus of CUT is located.

Figure 2 shows the first set of results for the pre-COVID period from 2016 to 2019. The x-axis represents the course marks, and the left-hand y-axis gives the number of students who fall in each course mark (CM) bracket. The right-hand y-axis provides the percentage of students who passed the module for each CM bracket. For example, 233 students obtained a CM between 70-80, of which 100% of them eventually passed the module with more than 50% for their final mark. Students who obtained a CM of more than 60 had an average success rate of 96% (100+100+89/3). Students who obtained a CM of between 40 and 60 marks (40 is the minimum required to gain access to the final examination) had an average success rate of only 44% (62+22/2). Students with a CM of more than 60 engaged consistently with the course content from the start of the semester, completing the first on-line self-assessment on time during the second week of the semester. They also submitted their first practical assignment on time during the second week of the semester. They maintained this engagement throughout the semester, completing six on-line self-assessments and four practical assignments on time.

Figure 3 illustrates the results for the COVID period between 2020 and 2021. The graph looks different when compared with Figure 2 in terms of the number of students in the different CM brackets. Obviously, more support was given to

these students, while their main assessment was written on-line in an environment where they could not be well monitored. This may have resulted in academic dishonesty, as students may have completed the on-line main assessment in groups, sharing each other's answers. However, what is somewhat similar is the percentage passing graph. Students who obtained more than 60 for their CM achieved an average success rate of 92% (99+95+83/3), while those who obtained between 40 and 60 achieved an average success rate of 49 (60+37/2).

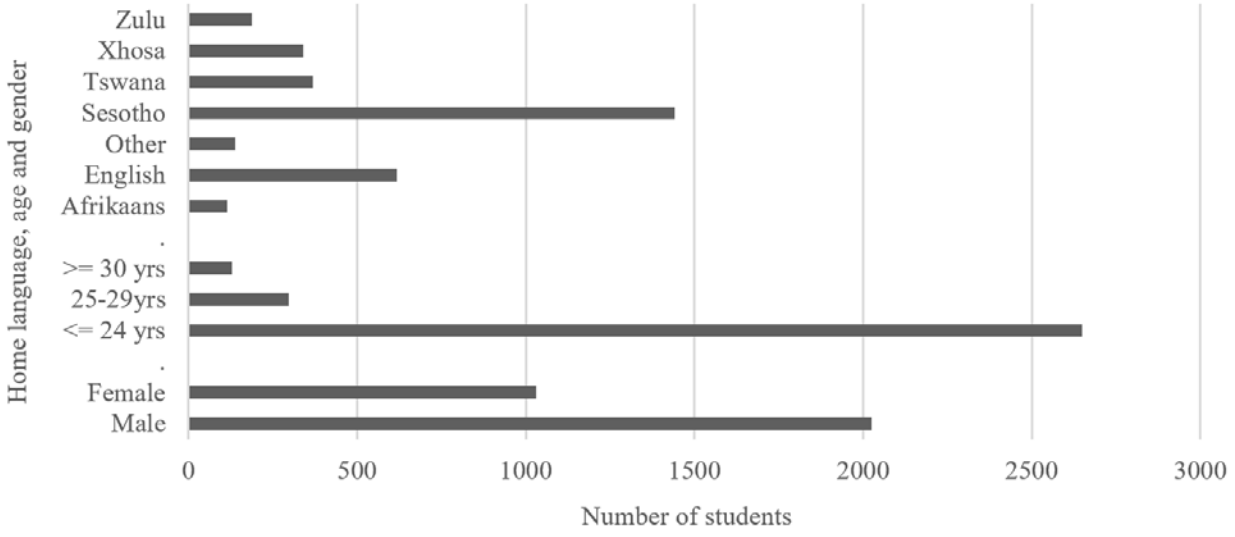

Figure 1: Student profile for the nine-year period.

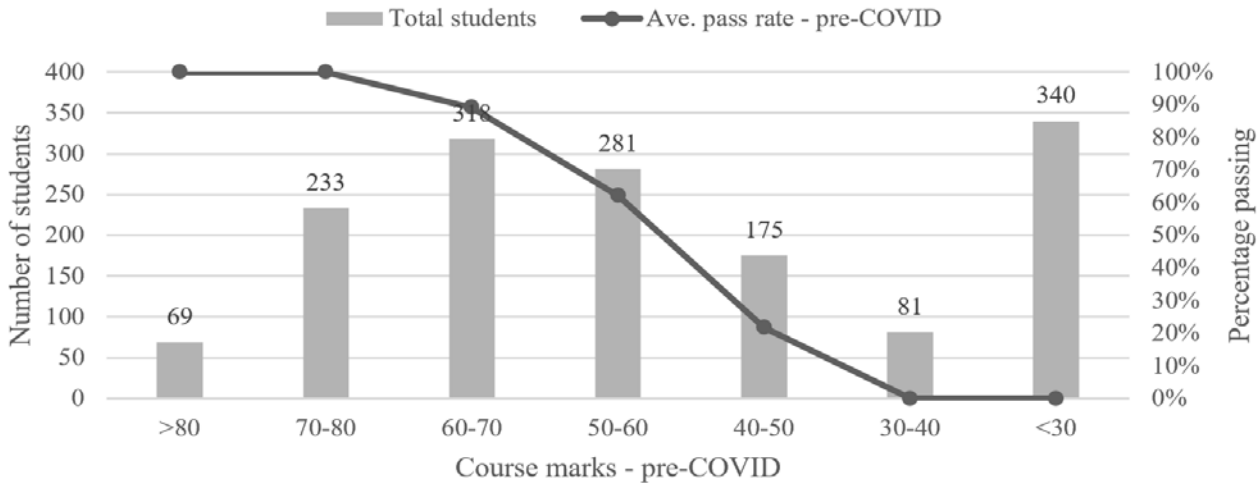

Figure 2: Student results for 2016 - 2019.

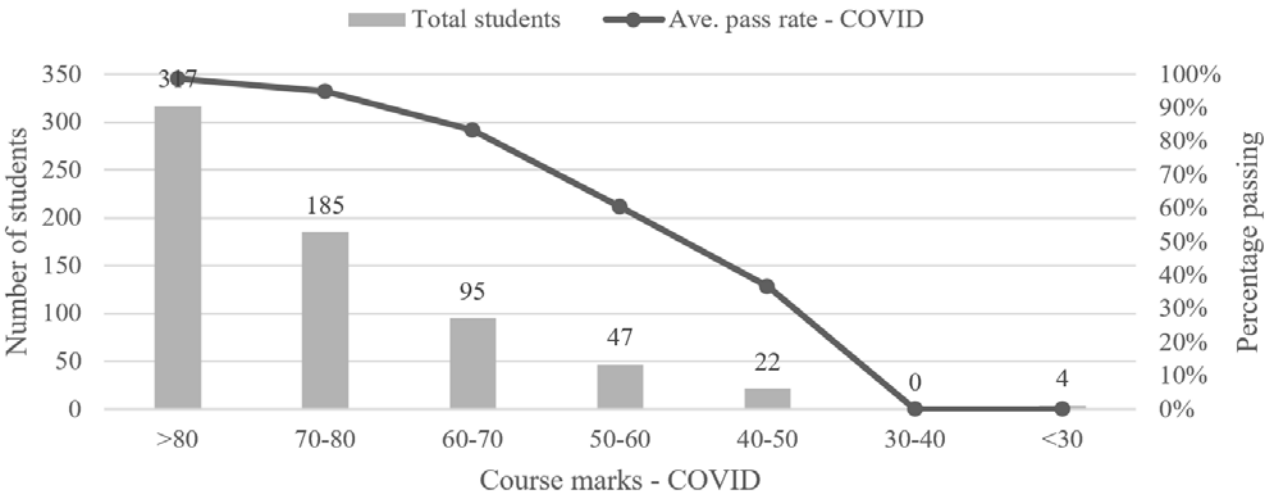

Figure 3: Student results for 2020 - 2021.

Figure 4 indicates the results for the post-COVID period between 2022 and 2023. The graph now looks more like the pre-COVID graph shown in Figure 2 in terms of the number of students per CM bracket. However, the percentage

passing graph has changed. Students who obtained more than 60 for their CM achieved an average success rate of 75% (94+82+49/3), while those who obtained between 40 and 60 achieved an average success rate of 7% (13+1/2).

Figure 5 compares the percentage passing graphs of the three periods within the nine-year period. Although a significant change occurred in the post-COVID (post-C) period in terms of the success rate of students in the module, a similar curve pattern is visible. Students who consistently engaged with the course content from the start of the semester until the end reaped a higher CM and thus a higher success rate. Students who were less consistent in their engagement reaped a lower CM and thus a lower success rate. On average, students who obtained a CM of more than 60 achieved an average success rate of 88% (96+92+75/3), while students who obtained a CM of between 40 and 60 achieved an average success rate of 33% (44+49+7/3). The dotted line intersection on the three graphs indicates the average pass rates for the three periods (75% for both pre-COVID and COVID and 48% for post-COVID).

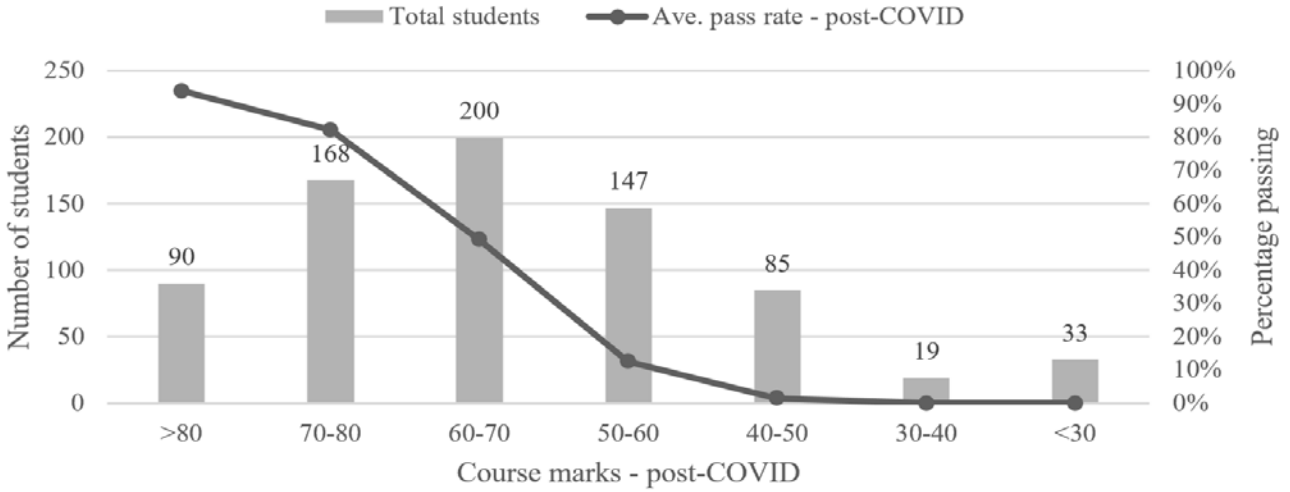

Figure 4: Student results for 2022 - 2023.

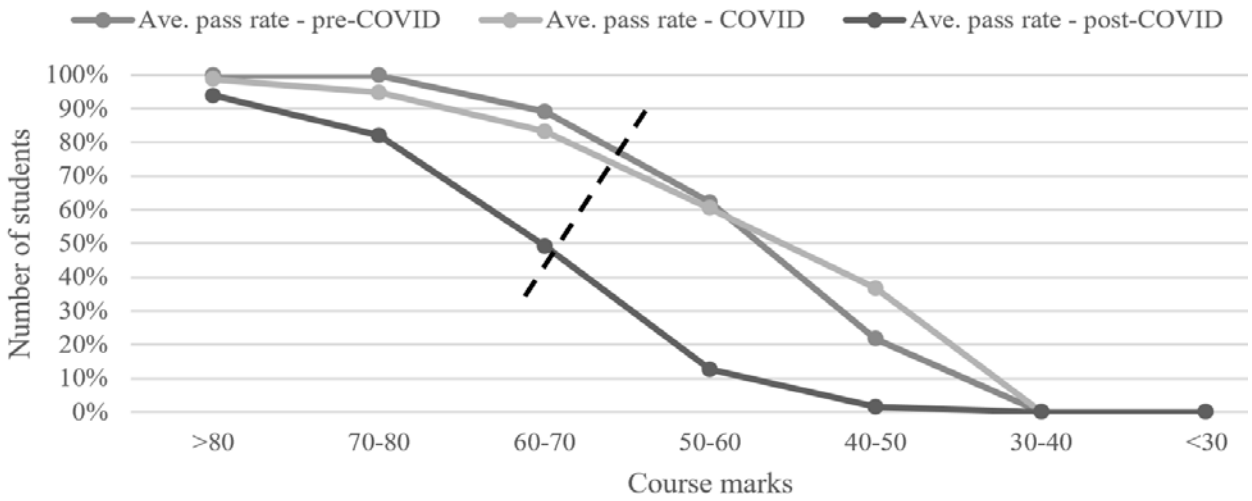

Figure 5: Average pass rate comparison for students with different course marks over the three periods.

CONCLUSIONS

The purpose of this article was to highlight the positive results that come to students who consistently engage with the content of a course from the start of a semester until its end. Results indicate that students who consistently engage with the course content during the first six weeks of the course (early engagement was defined) tend to score a high course mark of more than 60 marks. During this time 80% of the practical work (called T3) and 83% of Test 1 (called T1) is completed which contributes 60% toward the course mark. These early engagement students give themselves an 88% chance of successfully completing the course. Students who miss some of the early assessments in the semester or fail to engage consistently over the first six weeks (late engagement was defined) tend to score a lower course mark of between 40 and 60 marks, which only gives them a 33% chance of academic success.

The study was limited to only one module in electrical engineering. However, the significant sample size of 2,608 over an extended time that included a pre-COVID, COVID and post-COVID period provides reliable and consistent data pointing to the importance of early engagement and consistent engagement by first-year students.

It is recommended to create awareness among first-year engineering students of the importance of engaging with the content of a course from its outset, putting in the required effort and study to complete all the required assessments

rather than engaging in an intensive study session towards the end of the semester. This consistent engagement may improve the quality of the lives of first-year students, as they reap academic success that can enable them to enter the workforce immediately after completing the allotted time for their qualification.

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BIOGRAPHY

Arthur James Swart completed his Master's degree in education in 2007 and his doctoral in electrical engineering in 2011. He is currently an Associate Professor at the Central University of Technology in South Africa, where he mentors staff members regarding the scholarship of teaching and learning. His educational research focuses on the effective use of educational technology to help students fuse theory and practice. His field discipline research focuses on energy monitoring. James has published close to 200 conference papers and journal articles within the fields of electrical engineering and engineering education. He has a passion for life-long learning and holds the motto that *consistency is often a mark of quality*.