Electronics 1 is built on basic principles of physics. Students are assessed both in theory and practical. The learning outcomes of the course are as follow:

Students must demonstrate proficiency in

- Electronic components identification
- Verifying circuit behaviour of AC-to-DC power supply, circuits analysis including capacitor filtering
- Analysing and demonstrating measurement of voltage-current relationship of semiconductor devices such as diodes, Bipolar junction transistors and Field Effect Transistors
- Building working operation amplifier circuit, identify the configurations and predict circuit behaviour in DC domain of multiple operation amplifier circuits

The main objective of this study is to evaluate and compare the performance of foundation students and mainstream students (S1) in Electronics 1 course.
The following research questions are used for the study:

- What is the performance of Foundation and mainstream students in Electronics 1 using continuous assessment evaluation method?
- Is there any significant difference in the performance of the foundation and the mainstream students?
- Are the performances of the foundation students comparable with Electronics 1?

Normally, it would be expected that the mainstream students should be able to perform better in Electronics 1 as compared to FP students because of their performance in their matric results.

The following null hypothesis (H_o) were used for the results analysis:

(i) There is no significant difference in performance in Electronics 1 between FPELC01 2013 students and FPELC01 2014 students
(ii) There is no significant difference in performance in Electronics 1 between FPELC01 2013 students and ELC111T 2013 students
(iii) There is no significant difference in performance in Electronics 1 between ELC111T 2013 students and ELC111T 2014 students
(iv) There is no significant difference in performance in Electronics 1 between FPELC01 2014 students and ELC111T 2014 students
(v) There is no significant difference in performance in Electronics 1 between FPELC01 2013 students and ELC111T 2014 students

2. Course Description

2.1 Electronics 1

This course provides an introduction to Electronics and it is built on basic principles of physics such as atomic theory, electrical charge, electrical voltage, current, resistance, series and parallel circuits, conductors and insulators. It introduces semiconductor devices by studying the operation of P-N junction diodes, bipolar junction transistors, Field Effect Transistors and operational amplifiers. It also includes the identification, characteristics and uses of electronic components for building and analysing circuits so as to understand the combination of the components in Electronic circuits.

The course structure for Electronic 1 is as shown in Table 2. The structure is divided into 5 modules to cover within 15-weeks of semester 1 for mainstream and 30 weeks for the FP. These topics form the introduction to Electrical Engineering (Schultz, 2016).

Table 2. Course outline for Electronics 1

Topic no	Theme	Content
Module 1	▪ Passive and Active Electronic Components	• List of electronic components electronic symbol and function. Classification as active or passive component. • Electronic units
	▪ The Resistor Colour Code.	• Resistor Colour Code and application.
	▪ Introduction to measuring instruments	• Project 1: Using Multimeter and Oscilloscope
	▪ Introduction to DC Signals.	• Ohm's Law: Series, parallel & series-parallel circuits

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		• Voltage Dividers
Module 2	▪ Power Supplies	• Waveform theory. • Power stage block diagram
	▪ Semiconductor theory. ▪ Diode and Application	• Half-wave rectification • Full wave rectification • Centre Tap & Bridge. • Filtering & Regulation
Module 3	▪ Bipolar Junction Transistor Construction & biasing techniques	• Base • Voltage divider • Emitter • DC load line for a transistor circuit. • Locate the Q point on dc load line. • Design a switching circuit using a base bias circuit
Module 4	▪ Field-Effect Transistors ▪ MOSFET	• Construction, Operation & Biasing Techniques • Transconductance curve • Load line
Module 5	▪ Operational Amplifiers	• Electronic Implementation of Simple Mathematical Operations. • Understanding basic Operational Amplifier principles. • Operational Amplifier circuits; choosing OPAMP configurations to satisfy simple processing needs. • Understand basic analogue building blocks using Operational Amplifiers.

3 Methodology

Survey research method was used for this investigation. The year 2013 to 2014 electronics 1 students' (male and female) scores were used for the evaluation. The total number of students' score used was 574 and the same lecturer taught the students in the years under investigation. Electronics 1 results for semester 1, semester 2 for the year 2013 and 2014 were compiled. Also compiled were years 2013 and 2014 foundation students scores in Electronics 1. The scores are graded into high (75% and above), above average (65% - 74%), average (50 % - 64%) and below average (below 49%). Each student's final mark is calculated based on the student's scores after adding all the assessments marks together. The following is the breakdown of the total number (574) of students used in the study.

- Foundation (FPELC01) 2013 = 202; Mainstream (ELC111T) 2013 = 116
- Foundation (FPELC01) 2014 = 158; Mainstream (ELC111T) 2014 = 98

4. Findings

It was found that in both years (2013 and 2014), only three students obtained above 75% marks in the FPELC01 subject. This is the maximum number of students has obtained average marks in both years. In 2013, 11.4% of the students have scored above average marks in comparison to 6.9% obtained in 2014. A 65% of the students have achieved average marks in 2014 compared to 54.4% of the students in 2013. For below average grade, the percentage is similar at around 30% for both years' programs. Figure 1 shows the result distribution for electrical engineering foundation students (FPELC01) in the year 2013 and 2014. Generally, the performances of the students were better in 2013 than 2014.

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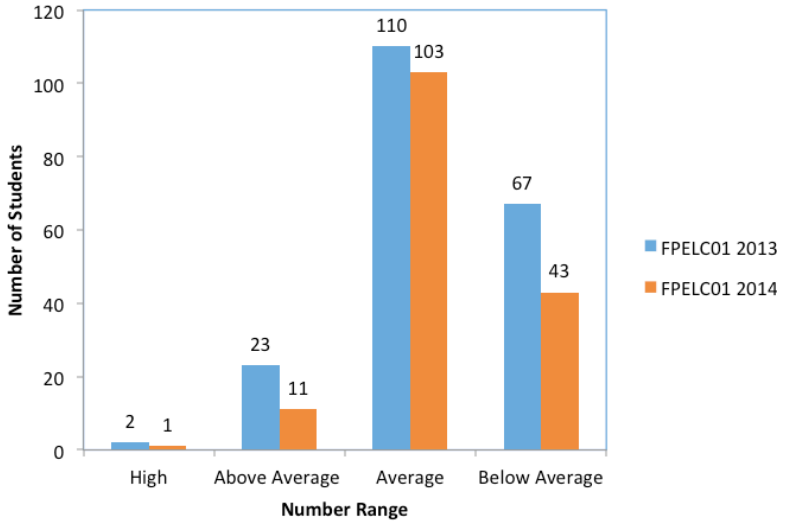

Figure 1: Performance distribution for foundation (FPELC01) students in 2013 and 2014 academic year

For ELC111T 2013 and 2014, it was found that in the year 2014 that only two students obtained more than 75% marks in the subject. This is the maximum number of students obtained average marks in both years. It is also observed that the percentages for above average in both years are almost the same. For below average grade, the percentage is 33.62% in 2013, which is higher than 22.44% in the year 2014. Figure 2 shows the result distribution for electrical engineering students for ELC111T 2013 and 2014. Even for the ELC111T subject, the performances of the students were better in 2013 than 2014.

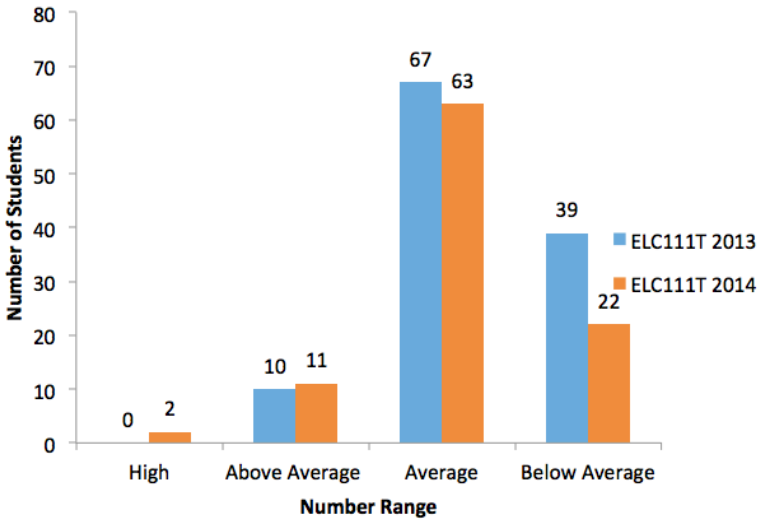

Figure 2: Performance distribution for mainstream (ELC111T) students in 2013 and 2014 academic year

Based on the research hypothesis stated above, T-test statistical analyses were conducted on the results to compare performance score between foundation (subject codes FPELC01) and mainstream (subject codes ELC111T) electrical engineering students. The risk level (Alpha level) was set at 0.05. Tables 3 – 7 presents the hypothesis results. The T-test formula is given as:

$$t = \frac{\bar{X}_T - \bar{X}_C}{\sqrt{\frac{Var_T}{n_T} + \frac{Var_C}{n_C}}}$$

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Where T *and* C represent the two groups under evaluation, $\bar{X}$ represents mean value, Var is the variance and n represents number of counts

Table 3 presents hypothesis (i) statistical result. The results show that there is no significant deference in the performance score between Foundation 2013 (M =51.64, SD =13.32, t (375) = - 0.78, **p=0.43>0.05**) and foundation 2014 (M=52.60, SD=9.978, t(375)= - 0.78, p=**0.43>0.05**) Electronics 1 students. Result reveals that the variance of performance score at 0.05 level of significance between 2013 and 2014 foundation students is not statistically significant. Hence the null hypothesis is rejected.
Note that, from the mean results, the 2013 foundation students has better mean score value compare to the 2014 students.

Table 3. Results of T-Test performance score for hypothesis (i)

Hypothesis (i)	Program	N	Mean	Std. dev	t	df	p	Min. diff
Performance Score for Electronics 1	FPELC01 2013	202	51.64	13.32	-0.78	375	0.43	-0.96
	FPELC01 2014	158	52.60	9.978				

Hypothesis (ii) results are shown in Table 4. Comparing both foundation (M =51.64, SD =13.32, t (375)= - 0.78, **p=0.43>0.05**) and mainstream (M=50.03, SD=14.16, t(228)= 1, **p=0.31>0.05**) scores for 2013, the result shows that there is no significant difference between the two groups. The variance in performance score is not statistically significant between the foundation and the mainstream Electronics 1 students at 0.05 significant level. Hence the null hypothesis is rejected. Also note that from the mean score results, it is evident that mainstream students have better mean score value compare to the foundation students.

Table 4. Results of T-Test performance score for hypothesis (ii)

Hypothesis (ii)	Program	N	Mean	Std. dev	t	df	p	Min. diff
Performance Score for Electronics 1	FPELC01 2013	202	51.64	13.32	1.0	228	0.31	1.61
	ELC111T 2013	116	50.03	14.16				

Show in Table 5 is the hypothesis (iii) results. Foundation 2014 (M=52.60, SD=9.98, t(156)= 0.11, p=0.91>0.05) and Mainstream (M=52.41, SD=14.28, t(156)= 0.11, **p=0.91>0.05**) scores for 2014 are presented. The result in the Table shows that there is no significant difference between the two groups. The variance in performance score at 0.05 level of significance between foundation 2014 and mainstream 2014 Electronics 1 students is not statistically significant (null hypothesis rejected). From the mean results, mainstream 2014 students' mean score value is better compared to the foundation 2014 students.

Table 5. Results of T-Test performance score for hypothesis (iii)

Hypothesis (iii)	Program	N	Mean	Std. dev	t	df	p	Min. diff
Performance Score for Electronics 1	FPELC01 2014	158	52.60	9.98	0.11	156	0.91	0.19
	ELC111T 2014	98	52.41	14.28				

Table 6 presents hypothesis (iv) results. The table compares mainstream 2013 (M=50.03, SD=14.16, t(206)= - 1.22, p=0.22>0.05) with mainstream 2014 (M=52.42, SD=14.28, t(206)= - 1.22, p=0.22>0.05) scores. The result shows that there is no significant difference between the two groups. The variance in performance score is not statistically significant between mainstream 2013 and mainstream 2014 Electronics 1 students at 0.05 significant level. Hence, the null hypothesis is rejected. Also note that from the mean results, it is evident that mainstream 2013 students has better mean score value compare to the mainstream 2014 students.

Table 6. Results of T-Test performance score for hypothesis (iv)

Hypothesis (iv)	Program	N	Mean	Std. dev	t	df	p	Min. diff
Performance Score for Electronics 1	ELC111T 2013	116	50.03	14.16	-1.22	206	0.22	-2.39
	ELC111T 2014	98	52.42	14.28				

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Table 7 presents hypothesis (v). It compares foundation 2013 (M=51.64, SD=13.32, t(181) = - 0.45, p=0.65>0.05) with mainstream 2014 (M=52.42, SD=14.28, t(181)= - 0.45, p=0.65>0.05) scores. The result shows that there is no significant difference between the two groups. Variance in performance score at 0.05 level of significance between the foundation and the mainstream Electronics 1 students is not statistically significant. Hence the null hypothesis is rejected. But from the mean results, it is evident that foundation students have better mean score value compare to the mainstream students.

Table 7. Results of T-Test performance score for hypothesis (v)

Hypothesis (v)	Program	N	Mean	Std. dev	t	df	p	Min. diff
Performance Score for Electronics 1	FPELC01 2013	202	51.64	13.32	-0.45	181	0.65	-0.78
	ELC111T 2014	98	52.42	14.28				

5. Discussion and Conclusion

The t-test analysis reveals that the performance between the foundation and the mainstream students in Electronics 1 for the period under investigation has no significant difference. For all the tests conducted, p values are greater than 0.05 (p>0.05). The result shows that the students' performance does not represent the connection between the program of study and the course content. This could be due to the students' educational background prior to registering for the program or lack of interest as earlier mentioned. It may also imply in the first year of study that students are not yet conscious of the fact that workloads in the higher institution are more challenging as compared to high school workload and methods of study need to be tactically and properly planned.

According to (Hari *et al*., 2016, Simpson and Fernandez, 2014), the lower mean value is better than higher mean value. Consequently, comparing the mean scores obtained in hypothesis (i) and (iv), both mainstream and foundation students' performances are better in 2013 compare to 2014. The low performance in 2014 could be associated with the increased workload that the students had to undergo. For hypothesis (ii), (iii) and (v), the mean scores reveal that the mainstream students performed better than the foundation students. The low performance of the foundation students could be associated to the entering admission point scores. In addition, the students' academic background prior to admission could pay a crucial role in their performances. Furthermore, the results show in general that the continuous assessment evaluation method is not adequate for improving the students' performance since the students' performance did not increase as shown in our findings. Further evaluation work will be conducted to establish these findings.

Acknowledgements

The authors would like to thank the Tshwane University of Technology and the Manufacturing, Engineering and Related Services Sector Education and Training Authority MerSETA for their financial support.

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