A Correlational Study of Candidates' Practical and Theory Examination Scores in Information Technology

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Abstract

Information Technology is a compulsory course unit offered by all candidates to attain National Diploma in Accountancy and Business Management programmes. The examination consists of practical and theory aspects. These two aspects are vital and expected to complement each other. For a candidate to do well in any of the courses, he/she must perform well in both the practical and theory examination. This paper investigated the correlation between candidates' theory and practical Examination scores in the two courses. Data were analyzed using the Pearson Product Moment Correlation Coefficient; the results showed a statistically significant positive correlation between the candidates' theory and practical examination scores. Correlation was measured between the theory and practical scores for Information Technology for NDA candidates, r = 0.478 and r = 0.758 at P_value .01 was obtained in 2016 and 2017 respectively. The correlation between theory and practical scores in Information Technology for NDBM candidates, r = 0.267 and r = 0.634 at P_value .01 was obtained in 2016 and 2017 respectively, as a result of which the null hypotheses were rejected. The results showed a very weak negative correlation, r = -0.04 at P_value .01 between the practical scores for NDA candidates while a weak positive correlation, r = 0.11 was obtained for the NDBM candidates in 2016 and 2017. The study further established a very weak negative correlation, r = -0.06 at P_value .01 between theory papers in Information Technology for NDBM candidates while a very weak positive correlation, r = 0.02 at P_value .01 was established between theory papers for NDA candidates. The results of the study indicated a very strong positive correlation, r = 0.896 for the overall performance of candidates in Information Technology in 2016 and 2017 as a result of which the null hypotheses were rejected.

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1. Introduction

Educational systems around the world are under increasing pressure to use Information Technology (IT) to teach candidates the knowledge and skills needed in the 21st century (Omwenga, 2007). Development and application of IT in higher institutions of learning in Africa is critically important so as to reduce the knowledge, technological and economic gaps between Africa and developed countries (Farrell and Shafika, 2007). Uganda has for the past decades focused on a phased curriculum review with a view of imparting practical knowledge and skills to enable the youth to become job creators at all levels of education with a focus on Business, Technical, Vocational Education and Training (BTVET). BTVET programs continue to be plagued by various challenges. They have remained largely theory since most lack the infrastructure for undertaking practical lessons. The reform led to the introduction of Information Technology as a mandatory subject in all Diploma programmes such as Accountancy, Business Management and Procurement among others. The subject has theory and practical aspects that are vital and are expected to complement each other. In other words, for a student to do well in any of the courses, he/she must perform well in both the theory and practical aspects of the examination.

It is argued that the theory examination results for a given set of candidates would be highly correlated to their practical examination results. Disturbingly, studies conducted by Nawaz et al., (2013) examined the relationship between Post-Graduate Science candidates' achievements in theory and practical examinations. Their study analyzed the exams of candidates enrolled in a two-year master's program in the Department of Basic Sciences (Botany, Chemistry, Zoology and Physics) at the University of Punjab, Pakistan. A sample of 1114 candidates was used. Their results showed that there is a weak correlation (<0.5) between the theory and practical scores of the candidates in all subjects except Zoology (>0.5). Other studies reported in (Nawaz, Mahmood, & Akram Rana, 2013) and (Jaishree, Saee, & Usha, 2014) have also given low correlation values. On the other hand, some other studies such as those in (Ajayi & Omole, 1999) and (Uwaifo, 2012) had fairly strong correlation coefficient.

In this research, we tried to investigate the correlation between the theory and practical examinations of candidates taking Information Technology course at BTVET. Generally, such courses are offered in order to equip candidates with knowledge of computer applications in their day-to-day personal and working lives. Yet, in most cases, the examinations at the end of courses are theory rather than practical due to technical and logistical challenges. In this research, if the correlations are weaker, it would suggest that examinations should focus more

on the practical aspects of using Information Technology rather than dwelling on theories. With the emphasis being put on Information Technology at all levels of education by the government of Uganda, it is vital that examinations are aligned with both theories and practical to benefit the candidates. This research investigated the correlation between Candidates' theory and practical Examination scores in the two courses.

1.1 STATEMENT OF THE PROBLEM
Candidates' learning and performances remains central in any academic achievement debate. Information Technology provides a window of opportunity for educational institutions and other organizations to harness and use Technology to complement and support teaching and improve on examination scores of candidates. However, despite the enormous importance of IT in higher institutions of learning, there are many debates as whether IT can improve the academic performances of candidates offering practical and theory courses. Empirical evidence from various studies indicated mixed results (Mukhtar, 2017; Uwaifo, 2012; (Mohammad, 2011). Although it is believed that a candidate who has acquired practical skills in IT is able to translate the same knowledge efficiently to theory paper in Examinations and vice versa, this relationship has not been well documented among candidates in BTVET in Uganda. It was against this backdrop that the study investigated the correlation between Candidates' theory and practical Examination scores in 2016 and 2017.

1.2 OBJECTIVES OF THE STUDY
The main objective of the study was to investigate the correlation between Candidates' theory and practical Examination scores in the two courses in 2016 and 2017.
The specific objectives of the study are:
  i. To examine the correlation between candidates' theory and practical Examination scores in Information Technology papers in 2016 and 2017.
  ii. To examine the correlation between candidates' practical and practical scores in Information Technology papers in 2016 and 2017.
  iii. To investigate the relationship between candidates' theory and theory scores in Information Technology papers in 2016 and 2017.
  iv. To investigate the correlation between candidates' overall performances
      (Practical plus theory paper) in Information Technology in 2016 and 2017.

1.3 RESEARCH HYPOTHESES
  i. Ho1: There is no significant correlation between candidates' theory and practical Examination scores in Information Technology in 2016.
  ii. Ho2: There is no significant correlation between candidates' theory and practical Examination scores in Information Technology in 2017.
  iii. Ho3: There is no significant relationship between candidates' Examination scores in practical 2016 and practical 2017 in Information Technology.
  iv. Ho4: There is no significant correlation between candidates' Examination scores in Theory 2016 and Theory 2017 in Information Technology paper.
  v. Ho5: There is correlation between candidates' overall performance (Theory plus Practical) in Information Technology in 2016 and 2017.

2.0 LITERATURE REVIEW
Various studies have tried to analyse the correlation between candidates' theory and practical scores in the same course. The results appear to be mixed as far as the level of correlation is concerned. For example, Uwaifo (2012) investigated the relationship between candidates' theory and practical performance in Technology based subjects for a total of 75 candidates of Ambrose Alli University, Ekpoma, Nigeria. Correlation values of 0.61, 0.54 and 0.44 were obtained in Technical Drawing, Metal-Work Technology and Wood-Work Technology respectively. Their results showed that there was a statistically significant relationship between candidates' performance in theory and practical papers.

On the contrast, a study conducted by Brijal Patel et al., (2013) on correlation of candidates' performances in theory and practical of final summative pharmacology examinations in M.B.B.S curriculum in 2010 and 2011 indicated that there was a lack of significant association in performances in written and practical examination among candidates in different categories in all six batches (P>.05).

Omole and Ajayi (1999) also investigated the correlation between the theory and practical scores of candidates in some basic science courses at Kwara State College of Education, Nigeria. A sample of 110 candidates was used in their research. The correlations obtained were 0.41, 0.56, and 0.66 for Chemistry, Physics and Biology respectively, as a result of which their null hypotheses were rejected. Their results showed that there was a statistically significant relationship between candidates' theory and practical scores.

A study by Jaishree et al., (2014) on the other hand on the correlation between 40 candidates that have enrolled in the Bachelor of Dental Sciences (BDS) program in the year 2009 at the University of Maharashtra, Nagpur indicated different results. The theory scores of these candidates in final year university examinations in the subject of Prosthodontics and Conservative Dentistry were compared with their scores in practical examinations of the same subject. Correlation coefficients of 0.177 and 0.250 were obtained. Their results showed that there was no correlation between candidates' theory and practical scores in the two courses.

With these diverse results, there is clearly no definitive answer as to whether or not there is a strong correlation between theory and practical examination scores of courses and subjects taken in secondary and tertiary educational institutions. Neither are there reasons to explain this large diversity ranging from strong correlation to no correlation at all. Moreover, Information and Technologies (ITs) offer newer and easier methods of evaluating and testing the performance of candidates, especially on the practical side, and as the theory and practical skills required for different professions keeps on changing. Based on the above, it is necessary to investigate further into the correlation between theory and practical examination scores in Information Technology in 2016 and 2017.

3.0. METHODOLOGY

This research investigated the correlation between the theory and practical examinations for candidates offering Information Technology. Data used were from the UBTEB examination results Information system obtained for candidates enrolled in the National Diploma Accountancy and National Diploma in Business Management programmes. As part of their program, they take two courses on Information Technology aimed at giving them practical working knowledge on popular office automation packages such as Microsoft Word, Microsoft Excel and Microsoft PowerPoint. Descriptive statistical analysis includes percentage; Mean, SD and Median were calculated by Microsoft Office Excel 2007. Association between the percentage of scores in theory and practical in each category was assessed by Pearson's correlation coefficient (Weir, 2019). Both courses focus on the same applications but the second course, after reviewing the contents of the first course, goes deeper and covers more advanced topics. At the end of each of these courses, candidates take theory examinations as well as practical examinations.

The study employed "ex post facto" techniques in which the researcher cannot manipulate the variables because their manifestations have already occurred. One hundred and forty candidates participated in the study. The results of candidates in Information Technology were obtained from the UBTEB Information system for 2016 and 2017. The study was conducted after UBTEB Examination was administered and there is no way the variables could be manipulated. Thus, this ex post facto study that adopted a desk survey design using candidates' scores for 2016 and 2017.The data from two sets of candidates that have taken the two papers namely Information Technology 1 and Information Technology II were analyzed using Pearson Product-Moment Correlation Coefficient (r).

Pearson Product-Moment Correlation Coefficient (r) analysis was used to find the relationship between their theory and practical examination scores. Correlation is a statistical method that is simple to calculate and interpret which is used to determine a possible linear association between two continuous variables (Trochim, 2006). Pearson correlation is the most widely used correlation statistic to measure the degree of relationship between linearly related variables and whether and how strongly pairs of variables are related (Trochim, 2006). The Pearson correlation coefficient is a single value that measures the strength of the linear relationship between two variables.

A positive relationship signifies that the two variables increase at the same time while a negative relationship signifies that when one increases the other decreases. Most of the variables show some kind of relationship; however, correlation can measure in one figure the degree of the relationship. Pearson correlation is ideal for this research which was designed to measure the linear relationship between theory and practical examination scores. The main focus was to find out how much the score of a student in a theory exam is related to his/her practical results. Pearson correlation was selected because the examination scores are normally distributed. The normality of the data was determined using Kolmogorov-Smirnov (K-S) and the Shapiro-Wilk (S-W) tests as shown in Table 1.

Table 1

	Tests of Normality of Data *. This is a lower bound of the true significance. a. Lilliefors Significance Correction					
	Kolmogorov-Smirnov			**Shapiro-wilk**		
	Statistic	**df**	**Sig**	**Statistic**	**df**	**Sig**
Practical scores	.061	100	.200	.980	100	.060
Theory scores	.070	100	.200	.980	100	.327

The calculated values for the normality test were then tested for significance using $p < .05$ level of significance. Since the p-value is greater than .05, we conclude that our data were normally distributed.

In determining the relationships, the calculated correlation coefficients (r) are tested for significance at the

p< .05 level. The p value is taken from similar projects (Galadanci & Mukhtar, 2017). It determines whether or not the null hypotheses would be accepted or rejected. The correlation coefficient (r) was assigned qualitative interpretation based on Table 2 below:

Table 2
Correlation Coefficient (R) Interpretation
17th Australasian Computing Education Conference, ACE 2015, Sydney, Australia, January 2015, 2015; *A.T, 2003*; *Hauke J. & table., 2011*; *Uwaifo, 2010*)

Correlation coefficient	Interpretation
.0 to +0.3	A weak positive relationship
.4 to +0.5	A moderate positive relationship
.6 to +0.7	A very strong positive relationship
-.0 to -0.3	A weak negative relationship
-.4 to -0.7	A very strong negative relationship

The following null hypotheses were formulated for this study;

i. Ho1: There is no significant correlation between candidates' theory and practical Examination scores in Information Technology in 2016.

ii. Ho2: There is no significant correlation between candidates' theory and practical Examination scores in Information Technology in 2017.

iii. Ho3: There is no significant relationship between candidates' Examination scores in practical 2016 and practical 2017 in Information Technology.

iv. Ho4: There is no significant correlation between candidates' Examination scores in Theory 2016 and Theory 2017 in Information Technology paper.

v. Ho5: There is no correlation between candidates' overall performance (Theory plus Practical) in Information Technology in 2016 and 2017.

4.0. RESULTS AND DISCUSSIONS

The results for this study are presented in both tables and figures; in table 3, the analysis is for 140 candidates for both National Diploma in Accountancy and National Diploma in Business Management who sat for Information Technology in (2016, n=140) and (2017, n=140).

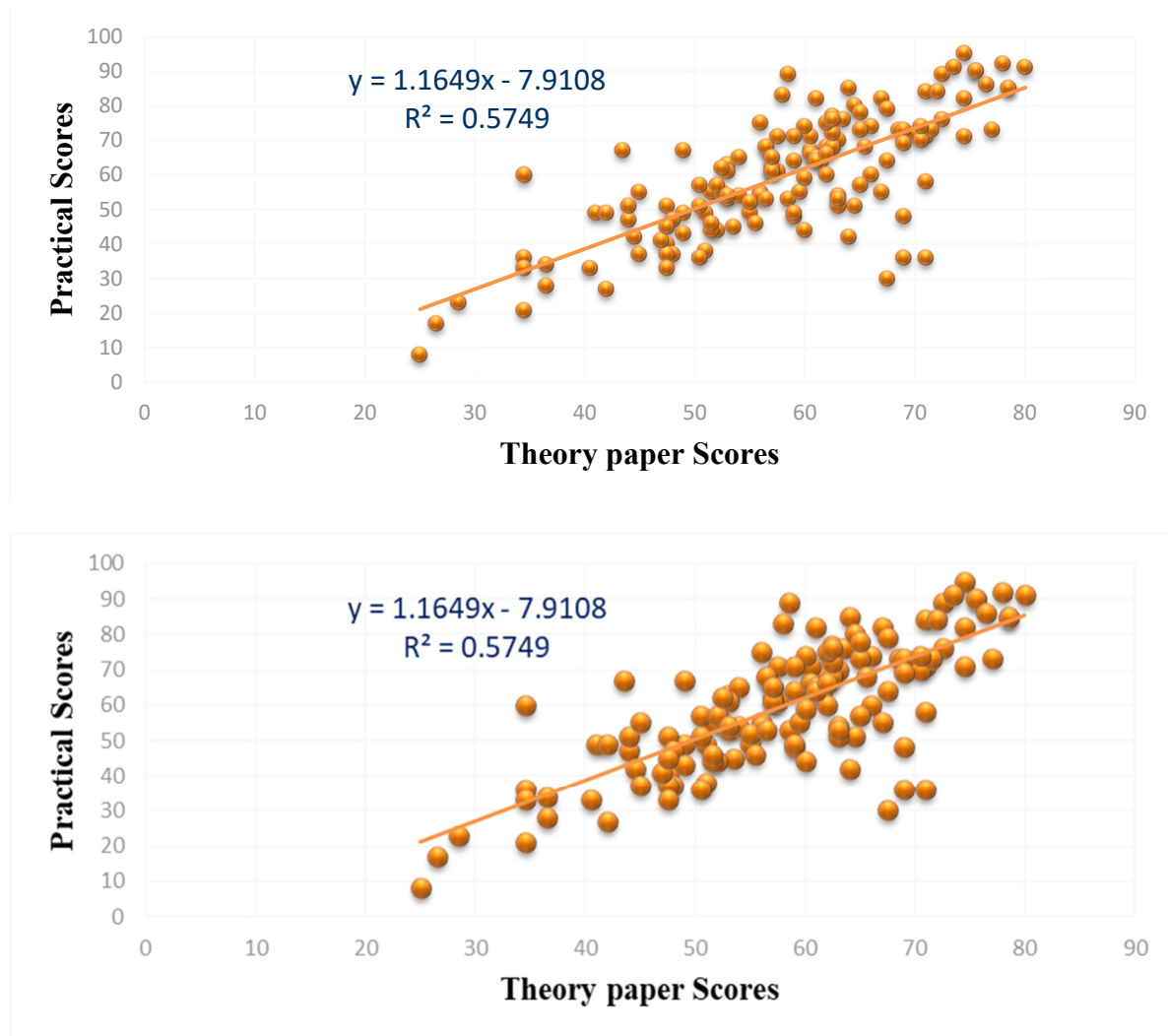$$y = 1.1649x - 7.9108$$
$$R^2 = 0.5749$$
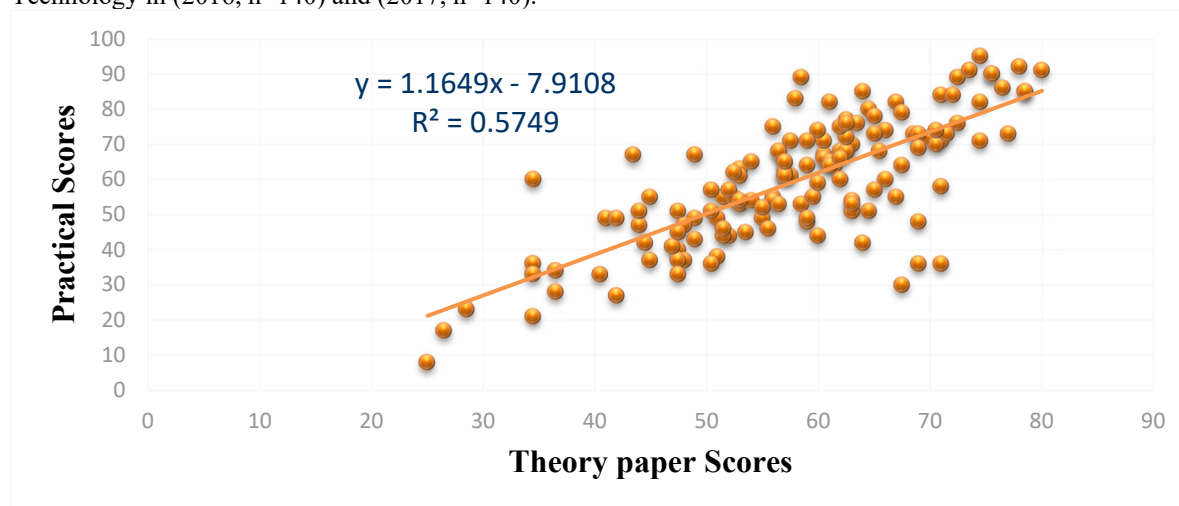
Figure 1: Scatter plot showing 140 Candidates

Figure 1 shows a very strong positive correlation between candidates' theory and practical scores in Information Technology. The outliers were removed in this research because Pearson correlation is very sensitive. The exam scores of the outliers were so low that we believed their occurrence were suspicious. The remaining data set of 140 students was what was used for the analysis.

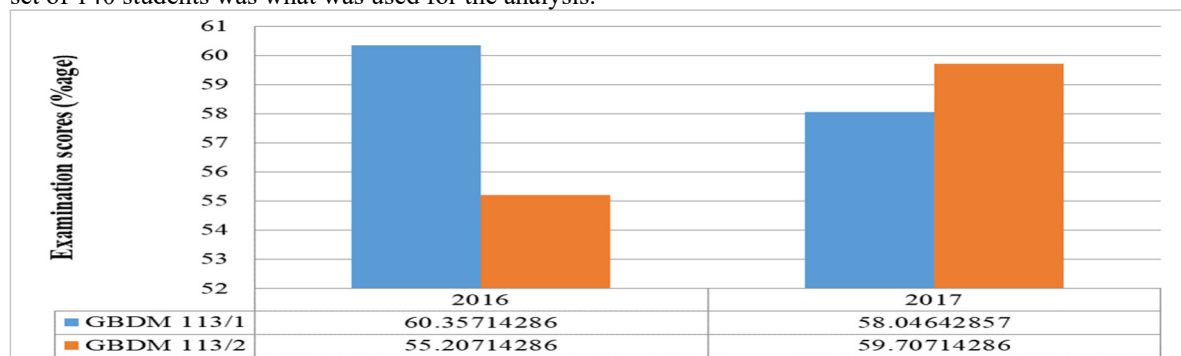|	2016	2017
GBDM 113/1	60.35714286	58.04642857
GBDM 113/2	55.20714286	59.70714286

Figure 2: Bar Chart showing Performance of candidates in theory and practical Information Technology papers.

Figure 2 shows performance of candidates in theory and practical papers in 2016 and 2017 whereby GBDM 113/1 refers to the theory paper and GBDM 113/2 refers to the practical paper. Overall candidates perform better in theory paper compared to the practical paper. It is also noted that candidates' performance in the practical paper improved in 2017 which is their final year of study. There is a slight difference in performance of the two papers and we conclude that performance in theory and practical is almost the same for all candidates regardless of the programme of study.

4.1. Ho1: There is no significant correlation between candidates' theory and practical Examination scores in Information Technology in 2016.

Table 3

Correlation between Candidates' Theory and Practical Examination Scores in Information Technology in 2016.				
Category	Year	Pearson Correlation coefficient (r)		
National Diploma in Accountancy (NDA)		(r)	P_value	Significance
	2016	.478	.01	Moderate positive relationship
National Diploma in Business Management (NDBM)	2016	.267	.01	Weak positive relationship

From Table 3, the results of the study showed p-values that are less than the alpha value of .05, the null hypotheses were rejected. The correlation coefficient (r) =0.478 was obtained at a P-Value of .01 the null hypothesis is rejected indicating a statistically moderate positive relationship between examination scores in theory and practical in 2016 for candidates of National Diploma in Accountancy (NDA). Therefore, we conclude that there is a statistically significant positive relationship between 2016 candidates' theory and practical examination scores.

In the case of National Diploma in Business Management (NDBM), the correlation coefficient (r) =0.267 was obtained at a P-value of .01 the null hypothesis is rejected meaning that there is a statistically weak positive relationship between examination scores in theory and practical in 2016 for candidates of NDBM. Therefore, we conclude that there is a statistically weak positive relationship between 2016 candidates' theory and practical examination scores as it was the case in (Galadanci & Mukhtar, 2017).

4.2. Ho2: There is no significant correlation between candidates' theory and practical Examination scores in Information Technology in 2017.

Table 4

Correlation between Candidates' Theory and Practical Examination Scores in Information Technology in 2017				
Category	Year	Pearson Correlation coefficient (r)		
National Diploma in Accountancy (NDA)		(r)	P_value	Significance
	2017	.758	.01	Very strong positive relationship
National Diploma in Business Management (NDBM)	2017	.634	.01	Very strong positive relationship

In table 4, For National Diploma in Accountancy (NDA) candidates in 2017, The correlation coefficient (r) =0.758 was obtained at a P-value of .01 the null hypothesis is rejected meaning that there is a statistically very strong positive relationship between examination scores in theory and practical in 2017 for candidates of National Diploma in Accountancy (NDA).

In 2017, the correlation coefficient (r) =0.634 was obtained at a P-value of .01 the null hypothesis is rejected indicating a statistically very strong positive relationship between examination scores in theory and practical in 2017 for candidates of NDBM. Therefore, we conclude that there is a statistically very strong positive relationship between 2017 candidates' theory and practical examination scores.

The results of the study are in conformity with earlier findings (Uwaifo, 2010) which means that the score obtained by a student in the theory aspect of an examination can be used to predict his/her score in the practical examination of the same course. The fact that both the practical and theory examinations are being done together on the same day may explain the high correlation values compared to the other related studies such as (Nawaz, Mahmood, & Rana, 2004) where the examinations were not done at the same time.

It is also interesting to note that in Information Technology I which is taken by the candidates in their first year of study (2016), the correlation between candidates' performance in theory and practical examination is less than for Information Technology II that is taken when the candidates are in their second year of study (2017).

4.3. Ho3: There is no significant relationship between candidates' Examination scores in practical 2016 and practical 2017 in Information Technology.

Table 5

Correlation between Candidates' Practical Examination Scores in 2016 and Practical Examination Scores in 2017 in Information Technology			
Examination score	Sample size	Pearson correlation coefficient	P_value
National Diploma in Accountancy (NDA) IT	140	-.04	.01
National Diploma in Business Management (NDBM) IT	140	0.11	.01

From Table 5, the results of the study showed p-values that are less than the alpha value of 0.05, the null hypotheses are rejected. The correlation coefficient (r) = -0.04 was obtained at a P_value of .01 practical scores in 2016 and 2017 for candidates of National Diploma in Accountancy (NDA), the null hypothesis is rejected meaning that there is a very weak negative relationship between practical examination scores in 2016 and practical scores in 2017. Therefore, we conclude that there is a very weak negative relationship between 2016 candidates' practical scores and 2017 practical examination scores for candidates of National Diploma in Accountancy.

The results still showed p-values that are less than the alpha value of 0.05, the null hypotheses are rejected. The correlation coefficient (r) = 0.11 was obtained at a P_value of .01 practical scores in 2016 and 2017 for candidates of National Diploma in Business Management (NDBM), the null hypothesis is rejected meaning that there is a weak positive relationship between practical examination scores in 2016 and practical scores in 2017. Therefore, we conclude that there is a weak positive relationship between 2016 candidates' practical scores and 2017 practical examination scores for candidates of National Diploma in Business Management.

4.4. Ho4: There is no significant correlation between candidates' Examination scores in Theory 2016 and Theory 2017 in Information Technology paper.

Table 6

Correlation between Candidates' Theory Examination Scores in Information Technology in 2016 and 2017			
Examination score	Sample size	Pearson correlation coefficient	P_value
National Diploma in Accountancy (NDA) IT 2016 &2017	140	.02	.01
National Diploma in Business Management (NDBM) IT 2016&2017	140	-.06	.01

From Table 6, the results of the study showed p-values that are less than the alpha value of 0.05, the null hypotheses are rejected. The correlation coefficient (r) = 0.02 was obtained at a P_value of .01 practical scores in 2016 and 2017 for candidates of National Diploma in Accountancy (NDA), the null hypothesis is rejected meaning that there is a very weak positive relationship between practical examination scores in 2016 and practical scores in 2017. Therefore, we conclude that there is a very weak positive relationship between 2016 candidates' practical scores and 2017 practical examination scores for candidates of National Diploma in Accountancy.

The correlation coefficient (r) = -0.06 was obtained at a P_value of .01 practical scores in 2016 and 2017 for candidates of National Diploma in Business Management (NDBM), the null hypothesis is rejected meaning that there is a very weak negative relationship between practical examination scores in 2016 and practical scores in 2017. Therefore, we conclude that there is a very weak negative relationship between 2016 candidates' practical scores and 2017 practical examination scores for candidates of National Diploma in Business Management.

4.5. Ho5: There is no correlation between candidates' overall performance (Theory plus Practical) in Information Technology in 2016 and 2017.

Table 7

Correlation between candidates' overall performance (Theory plus Practical) in Information Technology in 2016 and 2017.			
Examination score	Sample size	Pearson correlation coefficient	P_value
IT Theory plus practical 2016 &2017	140	.896	.01

This tested the correlation between the candidates' overall Examination results (theory plus practical) in Information Technology in 2016 and 2017. A correlation coefficient r = 0.896 at a P_value of 0.01. This indicates that the relationship between candidates overall scores in Information Technology is a very strong positive correlation. Since the P_value is less than the alpha value of 0.05, the null hypothesis is rejected. Therefore, we conclude that there is a statistically significant relationship between a candidate's theory and practical examination

scores.

5.0 CONCLUSION

The results of the study established positive correlation between the practical and theory candidates Examinations scores in Information Technology for National Diploma in Accountancy and Business Management Programmes. The correlation was measured from five different dimensions. Positive correlations were obtained between the scores of practical and theory in 2016 and 2017 in both programmes of study. A higher positive correlation was obtained in 2017 than in 2016. The fact that both the practical and theory examinations are being done together on the same day may explain the high correlation values compared to the other related studies such as (Nawaz, Mahmood, & Rana, 2004) where the examinations were not done at the same time. It is necessary to place importance on candidates in their first year of study.

The results showed a very weak negative correlation between the practical scores for NDA candidates while a weak positive correlation was obtained for the NDBM programme. The practical aspects of Information Technology as a course of study should be emphasized since the skills enhance employability in the world of work. The study further established a very weak negative correlation between theory papers in Information Technology for NDBM candidates while a weak positive correlation was established between theory papers for NDA candidates.

The results of the study indicated a very strong positive correlation for the overall performance of candidates in Information Technology in 2016 and 2017. There is a possibility of improving overall academic performance in Information Technology if the practical aspect is greatly emphasized since the scores were positively correlated.

The results of the study are in conformity with earlier findings (Uwaifo, 2010) which means that the score obtained by a student in the theory aspect of an examination can be used to predict his/her score in the practical examination of the same course. There must be more research on how to set practical and theory examinations that would exactly test the knowledge and skill sets of students that are being prepared to optimally operate in our increasingly complex knowledge society of today.

5.1 RECOMMENDATIONS

i.   The findings indicated a statistically significant correlation between theory and practical scores, the study recommends that the Examination Bodies should consider separating the days when the two examinations are administered so as to improve on performances.

ii.   The assessment bodies should consider testing different content in Information Technology papers for both theory and practical papers.

iii.   Assessment bodies need to devise means to enhance practical assessment and hence improve overall performance in Information Technology.

iv.   Average performance in Information Technology requires further analysis to review the current assessment practices of Information Technology and address the unique challenges faced by both the candidates and instructors.

v.   A comprehensive study should be carried out on how to set practical and theory examinations that should exactly test the knowledge and skill sets of candidates to optimally operate in our increasingly complex knowledge of today's society.

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