

Research Article

Correlational Analysis Between Students' Performance in Theory and Practical Summative Examinations

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Abstract

The study investigated the relationship between Candidates' performance in theory and practical papers. Specifically, it determined the performance differences across gender and examined factors that influence the performance of candidates in theory and practical papers. The study employed both qualitative and quantitative approaches. The study used the: Karl Pearson's correlation coefficient, to investigate the relationship between candidates' performance in theory and practical papers; and Student's t-test technique, to determine performance difference across gender. Different perceptions on the performance of candidates in practical and theory assessments from the students, instructors, assessors, principals and curriculum specialists using questionnaires and key informant interviews were obtained. Findings revealed a weak correlation between the performance of candidates in theory and practical papers. Descriptive statistics of candidates' scores between 2017 and 2019 for NCES, showed that 76% of first year candidates scored below 50% in the theory papers compared to 43% in practical papers. For the Second-year candidates, 72% of the candidates scored below 50% compared to 0.7% in the practical papers. While for NCBC, NCAM and NCET, candidates performed better in practical papers than in theory. There was similar performance observed for all Programmes in year one and two. Additionally, the findings on theory and practical performance across gender established a significant difference in performance across gender. Factors that influenced students' performance centered on availability of well-stocked libraries, workshops and equipped laboratory, adequate training and practical materials. The study recommended instructors' retooling, stocking of libraries, and use of open spaces for practical training, practice and assessment.

Keywords

Assessment, Candidate, Examinations, Performance Practical, Theory

1. Introduction

Assessment approaches focus on evidence of achievement rather than the ability to regurgitate information. The greatest part of assessment instruments should not only hinge on just recall of facts, but also on learners' abilities to apply the knowledge they have learnt in educational institutions to real situations [1]. Assessments are either formative or summative

and the latter is the most visible in institutions of higher learning. The authors Raupach et al. note that summative assessments have a paramount role in promoting student learning and educators need to be aware of this fact [2]. Examinations are often administered to students for various reasons. Firstly, they act as a means of classifying individuals

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according to their abilities in definite directions. Secondly, they are a window for further activities. Thirdly, they serve as a means of stimulating effort amongst students in the educational system. The work by Nurlina, notes that summative assessments help to measure what students have learnt at the end of a term, promote students, assess that students have acquired required standards on the way of attaining certification for completion or enter definite occupations, or as a method for selecting learners for entry into education [3]. According to Mackatiani, examination-based approaches do not address the attainment of relevant practical skills, attitudes and values amongst learners [4]. The approach focuses on passing national examinations. Examinations are also offered to test the level of students' understanding of courses taught to them over a given period of time. In addition to the above, some assessments are both theoretical and practical. Theoretical knowledge is a foundation for practical knowledge. Therefore, one would expect that theoretical examination results for a given set of students would be highly correlated with practical examination results. Surprisingly, a very low correlation exists between the performance of students in their theory and practical examinations [5]. While other studies found fairly strong correlation figures. Further, theory examination results for a given set of candidates at the postgraduate level were found to be highly correlated with practical examination results. To carry out a correlational study of summative assessment there is a need to have examination scores for papers, such as those examined by Uganda Business and Technical Examinations Board (UBTEB). Some of the assessments conducted by UBTEB are for both theory and practical papers. This paper aimed at finding out whether a correlation exists between students' theory and practical performance in selected Programmes, namely: National Certificate in Automotive Mechanics (NCAM), National Certificate in Electronics Technology (NCET), National Certificate in Electrical Installation Systems and Maintenance (NCES) and National Certificate in Building Construction (NCBC). Further, the paper aims at finding out whether the performance was different across gender.

1.1. Statement of the Problem

Since its inception in 2011, UBTEB has been assessing candidates in Technical Vocational Education and Training (TVET) Programmes in practical and theory papers both at the Certificate and Diploma level. Among the Certificate Programmes that are assessed are; NCAM, NCET, NCBC and NCES. The curricula for these Programmes were designed in such a way that there are some subjects assessed in both theory and practical papers with related content. Because of this curriculum design, it is quite natural to believe that candidates' performance in both theory and practical papers is correlated with minimal variations in performance across gender. To date, there is no study that has been conducted to analyze the relationship between theory and practical candidates' scores. This

study aimed at analyzing the correlation in performance of UBTEB assessments in theory and practical papers from 2017 to 2019.

1.2. Objectives of the Study

The overall objective of this study was to analyze the correlation in performance of Uganda Business and Technical Examinations Board (UBTEB) candidates in theory and practical papers from 2017 to 2019.

The specific objectives of the study were;

- 1) To investigate the relationship between students' performance in theory and practical papers.
- 2) To determine whether academic performance differs across gender.
- 3) To examine factors that affect the performance of UBTEB candidates in theory and practical papers.

1.3. Research Hypotheses

- 1) There is no significant relationship between students' performance in theory and practical papers.
- 2) There is no significant difference in academic performance between female and male students.

1.4. Research Question

What are the factors that affect the performance of UBTEB candidates in theory and practical papers?

2. Literature Review

This section reviews the literature on the relationship between theory and practical assessments.

2.1. Relationship Between Performance in Theory and Practical Assessments

Various studies have tried to analyze the correlation between candidates' theory and practical scores in different areas of study. The results appeared to be mixed as far as the level of correlation is concerned. For example, investigated the relationship between candidates' theory and practical performance in Technology-based subjects for a total of 75 candidates of Ambrose Alli University, 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.

In contrast, a study conducted by Al-Asmar et al. on the correlation of candidates' performances in theory and practical of final summative pharmacology examinations in 2010 and 2011 indicated that there was a lack of significant association in performances in written and practical examinations

among candidates in different categories in all six batches [5].

Statistically significant weak to moderate positive correlations were found between academic and practical courses in each year and between the practical courses in preclinical and clinical years ($P < 0.01$) [6].

A study by Jaishree et al. that examined correlation between theory and practical scores of 40 students that enrolled in the Bachelor of Dental Sciences (BDS) program in the year 2009 at the University of Maharashtra, Nagpur, indicated different results. A comparative analysis of theory and practical examinations score in Prosthodontics and Conservative Dentistry revealed Correlation coefficients of 0.177 and 0.250 respectively. The results showed that there was no significant correlation between candidates' theory and practical scores in the two courses.

There are, however, those who doubt the value of practical experience and it is true that the type of practical experience, and not just any practical experience for the sake of inclusion in a curriculum, is important [7]. An effective way of integrating practical experience as part of an undergraduate degree in workplace-integrated learning (WIL). It is important to allow students to do the practical work involved in WIL with as little interference by the professional as possible to gain the maximum benefit of practical training [8]. However, this is often difficult in the medical fields where lives as well as the professionals' practice reputation are at stake.

It was confirmed that practical knowledge is contextual and it is important for students to understand the link between theory and practice so as to apply theoretical knowledge in the practical aspects of training and assessment. 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, Technical courses 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 keep on changing. Based on the above, it is necessary to investigate further into the correlation between theory and practical examination scores.

2.2. Performance Across Gender

Gender dissimilarity is apparently one of the most demanding issues. This is largely as a result of people's ideologies that constitute a set of beliefs about the proper order of society in terms of the roles women and men should fill [9]. Globally, it is a known fact that women are underprivileged relative to men, not only at an organizational level of power and at a social level but also in academia.

Academic performance differs across gender at different levels of education ladder. Empirical studies have been conducted to establish the effect of gender on academic perfor-

mance. Goni et al. examined the differences between students' gender and academic achievement in Colleges of Education in Borno State, Nigeria [10]. The results revealed that there were no significant differences existing between gender and academic performance in Colleges of Education in Borno State. The study by Ayotunde et al. examined the possible influence of gender and entry qualification (EQ) on academic performance of engineering students (POES) [11]. Data collected from 491 undergraduate engineering students from two universities were statistically analyzed. The study revealed female to male population ratio of 1:9. The result of the statistical analysis showed a significant effect (0.05). Unfortunately, the focus of the study was comparative gender performance, but the majority of the studies focus on investigating performance correlation between practical and theory papers. This study will jointly focus on both gender and correlation analyses unlike other studies. A cross-sectional study which examined gender differences, personality traits, academic performance, and motivation in Ukrainian and [12] Polish students of physical education, employing a hierarchical multiple regression was conducted [13]. The findings indicate that women and men studying displayed unique personality traits, academic performance, and motivation while studying physical education. Female students showed a higher GPA relative to their counterparts (males). Relative to academic motivation, the young adult women in the study excelled better than men, as evidenced by the higher scores of women in intrinsic and extrinsic motivation scales. The results conformed to the previous study findings on gender differences in academic motivation [14]. found that females appear to have higher school grades in language-based subjects and STEM subjects than males [13]. Empirically, the results are fully in agreement with the findings of [15]. Duckworth et al. showed that girls appeared to be more self-controlled than boys [16]. This was attributed to masculine and feminine behaviors to roles rather than traits. Generally, gender differences in neuroticism, agreeableness, and conscientiousness may be determined by phenotypic variance, rather than genetic and environmental factors that contribute to sex differences in any personality traits. In contradiction is a study by Anteco et al. where no significant effect of the female proportion in the classroom on achievement, irrespective of students' gender [17]. Finally, a higher fraction of female peers in the classroom was found to improve girls' math test scores but only in less-advanced courses [17].

2.3. Factors that Influence the Performance of Candidates

Albert, et al. investigated the factors that influence the performance in Kenya Certificate of Secondary Education (KCSE) Biology in selected secondary schools [12]. The study was conducted through descriptive survey using both quantitative and qualitative approaches, targeting a population of seven hundred and thirty Form four students, eighteen Biology teachers, and fourteen Principals. The study sought to

find out the relationships between; teacher characteristics and performance in Biology; teaching/learning resources and performance in KCSE Biology; motivation and performance in KCSE Biology; and students' attitudes towards KCSE Biology and performance in KCSE Biology. The findings revealed that there was positive relationship between: teacher characteristics and performance, teaching / learning resources and performance, motivation and performance, student's attitude towards Biology and performance in KCSE Biology. The authors Neemati et al. assessed factors affecting learners' performance in course examination with a focus on their attitude. Data was collected from 30 freshman learners from Razi University, and was analyzed using descriptive statistics [18]. The findings revealed that difficulty level of the test, the environment of the examination administration, lack of familiarity with the examination objectives, anxiety and family problems were among the most cited factors. A study to assess factors affecting students' academic performance in Colleges of Education in southwest, Nigeria was carried out [19]. The study concluded that factors as parental background, school factors, and teachers' factors have serious influence on students' academic performance. According to Brew et al. it was revealed that academic performance, an insight into factors and their influences on academic outcomes of students at senior high schools, show that factors such as students' parental levels of education and income, textbooks availability and accessibility, libraries, practical laboratory, meals provision and teachers have tremendous effects on the academic performance of students at school [20].

The study by Dania et al. assessed the acquisition of employability skills by vocational students in Malaysia [21]. The study found that vocational students in Malaysia had a moderately high level of employability skills, which was influenced by students' self-perception, their level of industrial training, and their participation in career development activities.

3. Methodology

The study employed both qualitative and quantitative approaches. The first objective of investigating the relationship between students' performance in theory and practical papers relied on the use of Karl Pearson's correlation coefficient. Examination results of first- & second-year students who sat from 2017 to 2019 were retrieved from UBTEB data base/information system. The examination scores in this regard, were used as secondary data. Examination scores fit the "ex post facto" description. The "ex post facto" approaches are techniques in which the researcher cannot manipulate the variables because their manifestations have already occurred. The selected Programmes, namely, NCES, NCET, NCAM and NCBC had both practical and theory examination scores for each student. Hence, this ex post facto study adopted a desk survey design using candidates' scores from 2017 to 2019. Association between the percentage of scores in theory and practical in each category was assessed using Karl Pearson's correlation coefficient using Stata

software. Correlation is a statistical approach that is simple to compute and interpret which is used to determine a possible linear association between two continuous variables [22]. 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 [22]. The Pearson correlation coefficient may be defined as 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. The P-value is the probability that you would have found the current result if the correlation coefficient were in fact zero (null hypothesis). If this probability is lower than the conventional 5% ($P < 0.05$), the correlation coefficient is statistically significant. 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 were normally distributed. In determining the relationships, the calculated correlation coefficients (r) are tested for significance at the $p < 0.05$ level. The p value is taken from similar projects. It determines whether or not the null hypotheses would be accepted or rejected. The correlation coefficient (r) was assigned qualitative interpretation based on table 1 below.

Table 1. Correlation Coefficient (R) Interpretation Guide.

Correlation coefficient	Interpretation
.00 - 0.19	Very
.20 – 0.39	Weak
.40- 0.59	Moderate
.60-0.79	Strong
0.80-1.0	Very Strong

Adapted from Hauke & Kossowski (2011).

The second objective was to determine whether academic performance differs across gender. Testing the difference in academic performance across gender was done using the student's t-test and not Mann-Whitney U test because the examination scores across gender had a normal distribution and were not very small enough to guarantee use of the latter test. Assuming the P-value were less or equal than the level of significance, the null hypothesis was rejected and we concluded that there was a difference in academic difference across gender, otherwise we would fail to reject the null hypothesis.

To address the third objective, the study based on the table of Gill to select the sample size. The table 1 recommends that with a population of 2000, confidence level of 95%, margin error of

3 percent and population of the population variance, $p=50\%$, it is appropriate to choose as a sample of 696. Some studies have used the formula to determine the sample size. The study that argues that the formula for determining sample size of the population virtually has no effect on how well the sample is likely to describe the designed to measure the linear relationship between theory and practical examination scores is presented [23]. The main focus was to find out how well the sample is likely to describe the population. The secondary data from UBTEB examination results show that 21, 428 candidates had examination results for NCES, NBC, NCAM and NCET in 2019. These courses constituted a niche for the selected sample. After data cleaning, we settled on the sample size of 583 respondents for analysis. To obtain the different perspectives on the assessment of practical and theory assessments, we used the questionnaires to capture students' perceptions. We also carried out purposive sampling, this was aimed at obtaining key information from heads of training institutions, instructors and curricula specialists. Informed consent of the students, instructors and heads of institutions was solicited. The participants were briefed on the purpose of the research and that they were free to participate in the study, if they so wished. The students were surveyed in the lecture hall with the help of four research assistants who had been groomed in the administration of the instruments/questionnaires. The researchers took time to brief the participants in the process of answering the items in the questionnaires. Key informant interviews were also con-

ducted to obtain the perspective of Curriculum specialists.

4. Results

4.1. Descriptive Statistics

In tables 2 and 3, we present summaries of students' scores between 2017 and 2019 for NCES, NCBC, NCAM and NCET assessments. Grading has been categorized to indicate scores $<50\%$, $50\% - < 60\%$; $60\% - < 70\%$, $70\% - < 80\%$ and 80% and above. The data in Table 2 show that for the period ranging from 2017 to 2019, approximately 76 percent of first year candidates scored below 50 percent in the NCES theory paper compared to 43 percent of NCES practical paper. Similar performance was observed in NCBC, NCAM and NCET papers. A large proportion of candidates failed theory papers compared to practical papers for all the selected papers. For one to perform well in theory papers, he/ she should have higher level cognitive skills, and in case students have less cognitive skills, they are likely to register poor performance in theory papers. Learners who have exposure to practical skills tend to gain practical competencies and hence perform well in practical papers. The summaries in Table 3 are for second year students who sat between 2017 and 2019 for NCES, NCBC, NCAM and NCET papers.

Table 2. Summary of Scores for Year I Students between 2017 and 2019.

Paper		NCES		NCBC		NCAM		NCET	
Year		Year 1	%	Year 1	%	Year 1	%	Year 1	%
Theory	<50	8325	75.8	6984	65.3	8937	81.1	117	38.1
	50 - <60	1709	15.6	2381	22.3	1613	14.6	72	23.5
	60 - <70	719	6.5	1076	10.1	409	3.7	60	19.5
	70 - <80	200	1.8	224	2.1	63	0.6	42	13.7
	80 & above	28	0.3	33	0.3	2	0.1	16	5.2
	Total	10981	100	10698	100	11024	100	307	100
Practical	<50	43	0.4	199	1.9	191	1.7	9	2.9
	50 - <60	212	1.9	1132	10.6	573	5.2	19	6.2
	60 - <70	1143	10.4	2281	21.3	1654	15.0	62	20.2
	70 - <80	3169	28.8	3731	34.9	3622	32.9	112	36.5
	80 & above	6414	58.4	3355	31.4	4984	45.2	105	34.2
	Total	10981	100	10698	100	11024	100	307	100

Source: Researchers' computations from Secondary Data.

Table 3. Summary of Scores for Year II Students between 2017 and 2019.

Paper		NCES		NCBC		NCAM		NCET	
Year		Year 2	%	Year 2	%	Year 2	%	Year 2	%
Theory	<50	69	0.7	6408	70.7	6038	65.5	171	68.7
	50 - <60	367	3.8	1569	17.3	2038	22.1	47	18.9
	60 - <70	1490	15.4	768	8.5	918	10.0	20	8.0
	70 - <80	3553	36.6	263	2.9	191	2.1	8	3.2
	80 & above	4227	43.6	60	0.7	28	0.3	3	1.2
	Total	9706	100	9068	100	9213	100	249	100
Practical	<50	6966	71.8	171	1.9	96	1.0	0	0.0
	50 - <60	1995	20.6	719	7.9	300	3.3	7	2.8
	60 - <70	655	6.7	1971	21.7	1103	12.0	39	15.7
	70 - <80	86	0.9	3299	36.4	2859	31.0	77	30.9
	80 & above	4	0.04	2908	32.1	4855	52.7	146	50.6
	Total	9706	100	9068	100	9213	100	249	100

Source: Researchers' computations from Secondary Data.

Table 4 indicates that the performances in almost all the first year and second year theory papers were below the average score of 50 (except for NCET where the average theory score was 53.3 in year 1 and NCES where the average theory score was 77.0 in year 2). On the other hand, almost all practical papers for all years had performances above average

(except for NCES second year where the average practical score was 41.4). Generally, by looking at the means, practical results were better than the theory results. The descriptive statistics presented in Table 4. show that a very low correlation is likely to exist between practical and theory assessment scores.

Table 4. Descriptive Analysis of Performance for selected Theory and Practical Papers.

Paper		NCES		NCBC		NCAM		NCET	
Year		Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
Theory	Mean	34.5	77.0	42.5	41.5	36.5	42.4	53.3	43.6
	Standard deviation	18.5	9.8	15.3	14.9	14.5	14.7	17.3	14.2
	Minimum	0	0	0	0	0	0	6	13
	Maximum	92	99	91	89	82	92	85	92
Practical	Mean	80.5	41.4	73.2	73.7	76.7	78.8	74.4	78.8
	Standard deviation	9.4	13.3	11.5	11.2	11.4	10.2	11.4	10.1
	Minimum	4	0	0	0	0	4	15	54
	Maximum	100	82	100	100	100	100	96	100

4.2. The Correlation Analysis Between Performance in Theory and Practical Papers

Table 5: Pearson Correlation Coefficients for selected Theory and Practical Papers. From **table 5** the correlation coefficients at 1% level of significance are far below 0.5 which indicates a weak positive relationship between theory and practical results. This implies that an improvement in the performance of a student in one paper (theory or practical), is

associated with a slight improvement in performance in another paper (practical or theory). Based on the guidelines presented in **table 1** all correlation coefficients were very weak, positive, and significant for most of the selected Programmes except NCET which has a significant weak positive correlation. This means that the knowledge of one aspect has little effect on the other. Therefore, we conclude that there is a statistically weak positive relationship between candidates' theory and practical examination scores from 2017 to 2019.

Table 5. Pearson Correlation Coefficients for selected Theory and Practical Papers.

Paper	Year 1	N1	Year 2	N2
NCES	0.0942***	10981	0.1155***	9706
NCBC	0.1148***	10698	0.1039***	9068
NCAM	0.0477***	11024	0.0702***	9213
NCET	0.3491***	307	0.2034***	249

***significant at 1%

4.3. Theory and Practical Performance Across Gender

Statistics in **table 6** show that female students offering selected science subjects are few compared to their counterparts. We note that only 10.6 percent (1,165) of the female students offered NCES against 89.4 percent (9,815) of male students.

The table further shows that 4 percent of the students offering NCBC were female, while 1.3 percent (142) offered NCAM, and 7.2 percent of the students were female. These statistics show that very few female students undertake engineering-Programmes. Similar statistics are presented in **table 7** showing very low proportions of female science students doing science subjects.

Table 6. Summary of Scores for Year I Students between 2017 and 2019.

Paper	Grading	NCES		NCBC		NCAM		NCET	
		M	F	M	F	M	F	M	F
Theory	<50	7419	905	6667	315	8810	119	108	9
	50 - <60	1540	169	2307	74	1592	21	68	4
	60 - <70	646	73	1043	33	408	1	55	5
	70 - <80	184	16	218	6	62	1	41	1
	80 & above	26	2	32	1	2	0	13	3
	Total	9815	1165	10267	429	10874	142	285	22
Practical	<50	36	7	191	8	189	2	9	0
	50 - <60	184	28	1097	34	568	2	19	0
	60 - <70	1028	115	2192	89	1638	16	58	4
	70 - <80	2807	361	3581	150	3580	39	104	8

Paper	Grading	NCES		NCBC		NCAM		NCET	
		M	F	M	F	M	F	M	F
	80 & above	5760	654	3206	148	4899	83	95	10
	N	9815	1165	10267	429	10874	142	285	22

Source: Primary Data.

Results in [table 7](#) show descriptively, males performed better than females in both theory and practical. In terms of enrollment, the males are more compared to females in all Programmes. This could be due to the fact that most Pro-

grammes are science based. Additionally, both males and females performed better in practical and theory. Therefore, there is no difference in performance across gender.

Table 7. Summary of Scores for Year II Students between 2017 and 2019.

Paper	Grading	NCES		NCBC		NCAM		NCET	
		M	F	M	F	M	F		
Theory	<50	56	13	5090	227	5952	80	157	14
	50 - <60	317	50	1117	53	2006	32	42	5
	60 - <70	1312	178	622	23	907	11	19	1
	70 - <80	3136	417	241	10	190	1	7	1
	80 & above	3808	419	57	2	28	0	3	0
	Total	8629	1077	7127	315	9083	124	228	21
Practical	<50	6122	844	146	7	95	1	0	0
	50 - <60	1831	164	595	28	297	3	6	1
	60 - <70	594	61	1550	74	1089	14	34	5
	70 - <80	78	8	2548	110	2815	38	68	9
	80 & above	4	0	2288	96	4787	68	120	6
	N	8629	1077	7127	315	9083	124	228	21

To determine whether performance differs across gender, we used the student's t-test statistic. This t-test was used because the samples were independent and large enough with normal distributions. The independent samples t-test probability values for selected and practical papers are presented by

gender are presented in [table 8](#). P-values are presented in [table 6](#). P-values with asterisks (*) are significant. This implies that there is a significant difference in the average score of the theory/practical papers between males and females.

Table 8. Student's t- test P-values showing Difference in Performance across Gender.

Paper	NCES		NCBC		NCAM		NCET	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
Theory	0.6912	0.0028***	0.0001***	0.361	0.2850	0.4799	0.9685	0.9369

Paper	NCES		NCBC		NCAM		NCET	
Year	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
Practical	0.0165**	0.0000***	0.0286**	0.2955	0.0030***	0.1819	0.1145	0.1173

P<0.05, *P<0.01

The significant difference in performance was noticeable for NCES theory second year paper and NCBC first year paper, NCAM and NCET theory papers show that there is no significant difference in performance across gender. Significant differences in performance are noticeable in NCES, NCBC and NCAM practical papers except NCET. The difference in performance across gender is not surprising. Other previous studies have established similar findings, such as [24, 25] who found out that female students tend to have higher academic achievement than male students across education levels. In contrast, [26] found out that male students use social media more than female students for education and information purposes, and hence this increases male students' academic achievement. In this study, we established that there is a significant difference in performance across gender.

4.4. Factors That Affect the Performance of Candidates in Theory and Practical Assessments

The study further investigated the factors that affect the performance of UBTEB candidates in theory and practical assessments. The data was collected through administration of questionnaires, and key informant interviews. The participants included: 583 students who sat their second-year examinations of in 2019; one curriculum specialists; 170 instructors and 97 heads of training institutions. Out of the 583 student respondents, 93% were males (with an average age of 22 years) while only 7% were females (with an average age of 21 years). Overall, respondents had an average age of 21 years. The results affirm that there are few female students offering science-based courses. The findings showed that over 79 percent of the respondents dwelt within the premises of their learning institutions, while 21 percent commuted from their homes as shown in Figure 1.

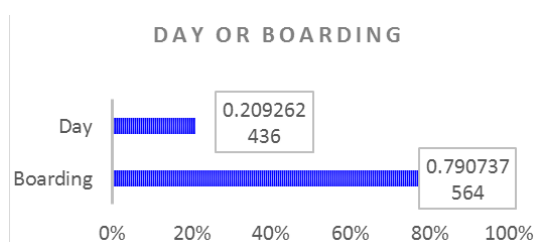


Figure 1. Students' Boarding status.

Residing on campus increases student's concentration and hence increased academic performance. On the other hand, day scholars are met with different challenges ranging from unfavorable weather conditions, walking long distances and dedicating time for home chores.

4.4.1. Students' Perception

On the Likert Scale's ranking, over 23 percent and 31 percent of the respondents strongly disagree and disagree respectively, that the resources are enough. Lack of sufficient resources such as textbooks, library and good instructors among others have negative effect on academic theory scores while 45 percent believe that candidates are not given individual equipment during examination, when it comes to electrical related Programmes. Further, 51 percent of the respondents noted that there are plenty of deficiencies in the equipment, while 76 percent revealed that institutions provide materials for practical assessment in time.

4.4.2. Heads of Institution's Perceptions

According to the heads of institutions, the correlation and performance between theory and practical scores is influenced by mainly inadequate provision of training materials and basic workshop tools and equipment for practical lectures/lessons. This was raised by all principals that participated and were 100% in agreement. 90 percent of the heads of institutions raised gender-related issues as a key factor influencing performance in theory and practical papers. Female students prefer theory papers. Due to their social (mothers) and biological roles (e.g., pregnancy), they perceive theoretical education as a means towards academic progression which would get them into offices and not manual (practical) work in their fields. Workshops/laboratories and practical materials not being readily available for the candidates to practice at any time, was also raised as a key factor influencing the performance and correlation between theory and practical scores. Further, over 80 percent of the respondents revealed that various other factors affect academic performance negatively, such as: incompetency of teachers in teaching and evaluating their students in both practical and theory papers. It is also reported to be due to poor attitude of students towards theory lectures at the level of certificate. Further, the majority of the students have a poor command of the English language and comprehension, which makes them not to express themselves in theory examinations. For some programs, the performance

in practical is reported to be due to lack of practical equipment, such as materials and tools, which are necessary for teaching and practice before examinations. In institutions without laboratory equipment, students only access practical equipment during examinations. Candidates prepare for the two aspects of examinations as separate subjects and not parts of a whole, giving little attention to theory examinations. Some content areas that are in the last part of the syllabus are not being attempted by the candidates in the examinations, which implies that they are taught late or not taught at all. This calls for strict supervision such that instructors do teach and complete syllabus in time.

4.4.3. Instructors' Perceptions

Instructors agreed that instructors' preparedness, appropriate teaching methods and availability of enough teaching resources have a greater positive impact on academic performance.

Instructors believed to some extent that candidates sharing of equipment during UBTEB examinations, lack of alternative power sources such as generator/power and deficiencies of equipment contribute to poor performance during UBTEB practical assessments, especially for electrical related Programmes.

4.4.4. Curriculum Specialist's Perceptions

The study further investigated the curriculum related factors that could explain the academic performance of the learners. If curriculum materials are not provided, there is a likelihood of considerable variation between what the curriculum specifies that students should learn, what teachers teach, and what students actually learn. This situation is likely to cause indifference in the teaching of practical subjects due to the absence of instructional materials and effective instructional strategies, leading to inefficient use of instructional time. As a result, many instructors may not be able to cover the intended curriculum, so will only cover those parts that they expect to be examined.

Additionally, the curriculum specialist explained that the time allocated for practical (workshop practice) is more than the time allocated for theory at certificate level (60% practical and 40% theory). At certificate level learners learn faster when they are doing in reference to learning hierarchy. The attitude of the certificate level learners is mainly practical oriented and teaching emphasizes practical skills and assessment. They have poor attitude towards theory papers, they come with a focus on practical. At certificate level practical lessons are studied on a daily basis compared to the diploma level. The curriculum specialist recommended that curricula reviews should be done every after 5 years since the world of work is very dynamic and instructor training should be a continuous exercise.

The curriculum specialist highlighted the following factors that affect academic scores or achievement. The factors are

grouped as system/school, teacher and student factors. The school factors included the following: lesson time allocated by the school to the subject, workload of formative assessment, good leadership of the school management, while the teacher factors included: teacher's ability to adapt curriculum to cater for learner diversity, implementation of formative assessment, collaboration among teachers of the particular subject and professional capacity of teachers. The student factors include: personal student motivation and interests, student's foundation knowledge acquired at secondary level, peer influence and parental involvement in the student's academic affairs.

5. Conclusions and Recommendations

5.1. Conclusions

The correlation coefficients are significant at 1% and far below 0.5 which indicate significant low positive relationships between theory and practical results. This simply implies that an improvement in the performance of a student in one paper (theory or practical), is associated with a slight improvement in performance in another paper (practical or theory). All correlation coefficients were very weak, positive, and significant for most of the selected modules except NCET which had a significant weak positive correlation. This means that the knowledge of one aspect has little effect on the other. Therefore, we conclude that there is a statistically weak positive relationship between candidates' theory and practical examination scores from 2017 to 2019.

The student's t-test statistic was used to determine whether performance differs across gender. There was a significant difference in the average score of the theory/practical papers between males and females. The significant difference in performance was noticeable for NCES theory second year paper and NCBC first year paper, NCAM and NCET theory papers show that there is no significant difference in performance across gender. Significant differences in performance are noticeable in NCES, NCBC and NCAM practical papers except NCET. In this study, we established that there is a significant difference in performance across gender and not the gender that performs better. The latter investigation requires use of econometric logistic regression investigation to arrive at that specific conclusion.

The following factors were identified as factors affecting performance in both theory and practical papers. Resources such as textbooks, well stocked libraries, workshops, laboratory equipment, training/practical materials, competent teachers to handle teaching and evaluation of students in both practical and theory papers, are not readily available for the candidates. Due to inadequate provision of training materials and basic workshop tools and equipment for practical lectures/lessons, institutions without laboratory equipment, students only access practical equipment during examinations.

Late or no coverage of syllabus affect performance. This

was indicated by some content areas that were in the last part of the syllabus and were not being attempted by the candidates. It is more likely the topics were taught late or not taught at all. This has a negative effect on performance especially for theory-based papers. This calls for strict supervision such that instructors do teach and complete syllabus in time. Poor attitude of students towards theory lectures at the level of certificate negatively affect academic performance. Further, the majority of the students have a poor command of the English language and comprehension, and fail to neither comprehend nor interpret the questions correctly. Candidates prepare for the two aspects of examinations as separate subjects and not parts of a whole, giving little attention to theory examinations and hence poor performance. Instructors believe to some extent that candidates sharing of equipment during UBTEB examinations, lack of alternative power sources such as generator/power and deficiencies of equipment contribute to poor performance during UBTEB practical assessments. Finally, gender-related issues such as social roles of mothers and biological roles such as pregnancies cause female students to perform poorly compared to male students.

5.2. Recommendations

In view of the findings of this study, the following recommendations are made:

- 1) There is need for constant instructor retooling so as to equip them with good mastery and evaluation technique of all components of the papers both theory and practical examined so that students would approach them with equal ability.
- 2) There is need to equip training institutions with learning resources e.g. textbooks and e-libraries.
- 3) The Ministry of Education and Sports & other relevant authorities should ensure that the necessary teaching tools plus practical equipment are always available for routine teaching, practice and assessment.
- 4) The Ministry of Education and Sports and the Board should adopt a mechanism of industrial attachment of instructors to ensure exposure to the world of work so as to enhance their practical skills and introduction to new equipment and technology.
- 5) Training Providers should create showrooms with real life project products which can be used for income generation to contribute towards purchase of costly practical materials.
- 6) Institutions should improvise by operating in open spaces for practical skills practice in cases where the workshops are not yet constructed, for example in Carpentry and Joinery, Electrical Installation, Brick Laying and Concrete Practice.
- 7) Institutions through MOUs can come into understanding to use industrial facilities in other institutions.

Abbreviations

NCAM	National Certificate in Automotive Mechanics
NCBC	National Certificate in Building Construction
NCES	National Certificate in Electrical Installation Systems and Maintenance
NCET	National Certificate in Electronics Technology
UBTEB	Uganda Business and Technical Examinations Board
TVET	Technical Vocational Education and Training

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Author Contributions

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Wilfred Karukuza Nahamya: Visualization, Funding acquisition, Supervision

Onesimus Oyesigye: Project administration, Resources

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Data Availability Statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Conflicts of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Biography



Lilian Nakawala is currently a Senior Research Officer at Uganda Business and Technical Examinations Board. She formerly worked at Federation of Uganda Employers (FUE) as a policy and research Officer. While at FUE she won the Employer of the Year Awards (EYA) Survey Project Coordinator 2015-2016. She obtained a Post Graduate Diploma in Monitoring and Evaluation from Uganda Management Institute 2020 and a Diploma in Law from Law Development Centre in 2012. She completed her Masters of Arts in Economic Policy Management in 2014 and a Bachelor's Degree in Development Economics in 2009 respectively from Makerere University. Lilian has several publications in reputable journals and has attended and presented several papers at international conferences.



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