

**RELATIONSHIPS BETWEEN UTILIZATION OF SELECTED RESOURCES
AND ACADEMIC PERFORMANCE IN ENGINEERING COURSES IN
TECHNICAL AND VOCATIONAL INSTITUTIONS IN NAKURU COUNTY,
KENYA**

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**A Thesis Submitted to the Institute of Postgraduate Studies of Kabarak University
in Partial Fulfillment of the Requirements for the Award of Master of Education
(Management and Leadership) Degree**

KABARAK UNIVERSITY

NOVEMBER, 2024

DECLARATION

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ACKNOWLEDGEMENT

I am grateful to God for His grace and unwavering love, which enabled me to undertake this research thesis. I thank my wife, Magdalene, and children, Dan, Joy, Abigael, and Ian, for their support and encouragement throughout my studies. I appreciate and thank my colleague and friend, Jackline Atieno Ong'injo, for the guidance throughout the writing of this thesis. I also sincerely appreciate the guidance and supervision provided by my supervisors, Prof Frederick B.J.A. Ngala, and Prof Henry Kiptiony Kiplangatof Kabarak University.

DEDICATION

I dedicate this work to my wife, Magdalene, and my children, Dan, Joy, Abigail, and Ian, for their invaluable support during my studies. Your unwavering support, conducive environment, and moral encouragement kept me going when I faced challenges, and I appreciate the sacrifices you made throughout the completion of this work.

ABSTRACT

The high failure rate in engineering within technical and vocational institutions constitutes a critical challenge threatening educational and economic goals. This study aimed to analyze the relationships between the utilization of selected resources and academic performance in engineering courses in technical and vocational institutions in Nakuru County, Kenya. The study's objectives were to analyze the relationships between the utilization of human resources, information Communication Technology (ICT) resources, material resources, time resources, and academic performance in engineering courses in Technical and Vocational institutions in Nakuru County, Kenya. Resource Dependency Theory and Equity Theory guided the study. The study used a descriptive survey design utilizing closed-ended questionnaires and interview schedules. The sample size consisted of 331 students, 11 technicians, and 22 administrators (11 Heads of Departments, 7 Deputy Principals, and 4 Principals). Administrators were interviewed and the study findings were used to facilitate triangulations. A proportionate sampling technique was used to obtain the sample size of the students per institution. Participants were selected through simple random sampling. A pilot study was conducted within the scope of the study, and 10% of the sample took part in it. The reliability of the instruments was assessed by a test-retest technique, yielding a correlation coefficient of 0.7402. Qualitative data was analyzed using NVIVO and were presented in verbatim and percentages. Quantitative data was encoded and analyzed with SPSS version 29. Descriptive and inferential data were presented in tables. The hypotheses were tested and it was established that there was a positive ($r = 0.291$) and statistically significant relationship between utilization of human resources and academic performance in engineering ($p = 0.000 < p = 0.05$); that there was a positive ($r = 0.179$) and statistically significant relationship between utilization of ICT and academic performance in engineering ($p = 0.000 < p = 0.05$); that there was a positive ($r = 0.323$) and statistically significant relationship between utilization of material resources and academic performance in engineering ($p = 0.000 < p = 0.05$) and that there was a positive ($r = 0.201$) and statistically significant relationship between utilization of time resources and academic performance in engineering ($p = 0.001 < p = 0.05$). It was concluded that human and material resources have a greater significant effect on academic performance than ICT and time resources. The study, therefore, recommended that school administrators find ways to properly utilize human, ICT, material, and time resources in the learning institutions. The government should also allocate specific funding to support the procurement and maintenance of these resources in the technical and vocational institutions in Nakuru County, Kenya.

Keywords: *Academic performance, Human resources, ICT resources, Material resources, Time resources, Technical and Vocational Training, and Utilization.*

TABLE OF CONTENTS

DECLARATION	ii
RECOMMENDATIONS	iii
COPYRIGHT	iv
ACKNOWLEDGEMENT	v
DEDICATION	vi
ABSTRACT	vii
TABLE OF CONTENTS	viii
LIST OF TABLES	xii
LIST OF FIGURES	xiii
ABBREVIATIONS AND ACRONYMS	xiv
CONCEPTUAL AND OPERATIONAL DEFINITIONS OF TERMS	xv
CHAPTER ONE	1
INTRODUCTION	1
1.1 Overview	1
1.2 Background of the Study.....	1
1.3 Statement of the Problem.....	6
1.4 Purpose of the Study	7
1.4.1 Objectives of the Study	7
1.5 Research Hypotheses	8
1.6 Scope of the Study	8
1.7 Significance of the Study	9
1.8 Limitations of the Study.....	10
1.9 Assumptions of the study.....	10
CHAPTER TWO	11
LITERATURE REVIEW	11
2.1 Introduction.....	11
2.2 Theoretical Review	11
2.2.1 Resource Dependency Theory.....	11
2.2.2 Equity Theory.....	13
2.3 Empirical Review.....	15
2.3.1 Utilization of Human Resources and Academic Performance	15
2.3.2 Utilization of ICT Resources and Academic Performance	23

2.3.3 Utilization of Material Resources and Academic Performance	27
2.3.4 Utilization of Time Resources and Academic Performance	31
2.4 Conceptual Framework	36
CHAPTER THREE.....	38
RESEARCH METHODOLOGY	38
3.1 Introduction	38
3.2 Research Design.....	38
3.3 Location of the Study	38
3.4 Target Population	39
3.5 Sample Procedure and Sample Size.....	40
3.5.1 Sample Procedure.....	40
3.5.2 Sample Size	41
3.6 Instrumentation	42
3.6.1 Validity of the Research Instrument.....	43
3.6.2 Pilot Study	44
3.6.3 Reliability of Research Instrument.....	44
3.7 Data Collection and Procedures	45
3.8 Data Analysis and Presentation.....	46
3.9 Ethical Considerations	49
CHAPTER FOUR	51
DATA ANALYSIS, PRESENTATION AND DISCUSSION	51
4.1 Introduction.....	51
4.2 Response Rates	51
4.3 Reliability Analysis.....	53
4.4 Demographic Characteristics	54
4.4.1 Characteristics of the Students	55
4.4.2 Characteristics of Technicians.....	56
4.4.3 Characteristics of Administrators.....	58
4.4.4 Students' Academic Performance	59
4.5 Descriptive Statistics.....	61
4.5.1 Students' Descriptive Statistics on Utilization of Human Resources	61
4.5.2 Technicians' Descriptive Statistics on Utilization of Human Resources	66
4.5.3 Administrators' Qualitative Responses to Utilization of Human Resources ...	70

4.5.4 Students' Descriptive Statistics on Utilization of ICT Resources.....	77
4.5.5 Technicians' Descriptive Statistics on Utilization of ICT Resources.....	82
4.5.6 Administrators' Qualitative Responses Utilization of ICT Resources.....	86
4.5.7 Students' Descriptive Statistics on Utilization of Material Resources	93
4.5.8 Technicians' Descriptive Statistics on Utilization of Material Resources.....	98
4.5.9 Administrators ' Qualitative Responses to Utilization of Material Resources	103
4.5.10 Students' Descriptive Statistics on Utilization of Time Resources	109
4.5.11 Technicians' Descriptive Statistics on Utilization of Time Resources.....	113
4.5.12 Administrators' Qualitative Responses to Utilization of Time Resources ...	118
4.6 Inferential Statistics.....	125
4.6.1 Relationship between Utilization of Human Resources and Academic Performance in Engineering Courses.....	125
4.6.2 Hypothesis One Testing	127
4.6.3 Relationship between Utilization of ICT Resources and Academic Performance in Engineering Courses.....	128
4.6.4 Hypothesis Two Testing	129
4.6.5 Relationship between Utilization of Material Resources and Academic Performance in Engineering Courses.....	130
4.6.7 Relationship between Utilization of Time Resources and Academic Performance in Engineering Courses.....	132
4.6.8 Hypothesis Four Testing	134
4.6.9 Relationship between the Human, ICT, Material and Time Resources and Academic Performance	135
4.6.10 Summary of Hypothesis Testing	137
CHAPTER FIVE	139
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS	139
5.1. Introduction.....	139
5.2 Summary of Findings.....	139
5.2.1 Utilization of Human Resources and Academic Performance in Engineering Courses	139
5.2.2 Utilization of ICT Resources and Academic Performance in Engineering Courses	140

5.2.3 Utilization of Material Resources and Academic Performance in Engineering Courses	141
5.2.4 Utilization of Time Resources and Academic Performance in Engineering Courses	142
5.3 Conclusions.....	143
5.4 Reccommendations	144
5.4.1 Recommendation for Policy.....	145
5.4.2 Recommendations for Further Research	146
REFERENCE.....	147
APPENDICES.....	161
Appendix I: Letter of Introduction	161
Appendix II: Informed Consent	162
Appendix III: Questionnaires for Students	165
Appendix IV: Questionnaires for Technicians.....	169
Appendix V: Interview schedules for Administrators.....	173
Appendix VI: Table for Determining Sample Size.....	177
Appendix VII: Geographical Locations (Maps)	178
Appendix VIII: KUREC Approval Letter.....	179
Appendix IX: NACOSTI Research Permit	180
Appendix X: Evidence of Conference Participation	181
Appendix XI: List of Publication	182

LIST OF TABLES

Table 1: A Summary of Failure Rates in the Kenya National Examination Council.....	6
Table 2: Study Population.....	41
Table 3: Sample Size for Administratorsand Technicians.....	42
Table 4: Sample Size Students Per Institution using Proportionate Sampling Method.....	42
Table 5: Summary of Statistical Tests and Analysis of Objectives for Quantitative Data	48
Table 6: Summary of Statistical Tests and Analysis of Objectives for Qualitative Data..	49
Table 7: Instruments Return Rate	52
Table 8: Reliability of Student Instruments	53
Table 9: Reliability of Technician Instruments	54
Table 10: Reliability of Administrators Instruments	54
Table 11: Characteristics of the Students	55
Table 12: Characteristics of the Technicians	57
Table 13: Characteristics of the Administrators	58
Table 14: Student’s Academic Performance for the Years 2020 to 2023	59
Table 15: Students’ responses to items on the Utilization of Human Resources	62
Table 16: Technicians’ Responses to Items on Utilization of Human Resources	67
Table 17: Students’ Responses to Items on Utilization of ICT Resources.....	78
Table 18: Technicians’ Responses to Items on The Utilization of ICT Resources	83
Table 19: Students’ Responses to Items on Utilization of Material Resources.....	94
Table 20: Technicians' Responses to Items on Utilization of Material Resources.....	99
Table 21: Students’ Responses to Items on Utilization of Time Resources.....	110
Table 22: Technicians’ Responses to Items on Utilization of Time Resources	114
Table 23: Regression Test on Human Resources on Academic Performance.....	126
Table 24: Regression Test on Utilization of ICT Resources and Academic Performance.....	128
Table 25: Regression Test on Utilization of Material Resources and Academic Performance.....	130
Table 26: Regression Test on Utilization of Time Resources and Academic Performance.....	133
Table 27: Regression Test on Utilization of Selected Resources and Academic Performance... ..	135
Table 28: Summary of Hypothesis Testing.....	138

LIST OF FIGURES

Figure 1: Conceptual Framework	36
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ABBREVIATIONS AND ACRONYMS

BETA	Bottom-Up Economic Transformation Agenda
CIPO	Context Input-Outputs Model
COVID-19	Coronavirus Disease 2019
GPA	Grade Point Average
HEIs	Higher Education Institutions
HOD	Head of Department
HR	Human resources
HRM	Human Resource Management
ICT	Information and Communication Technology
KCSE	Kenya Certificate of Secondary Education
KNA	Kenya News Agency
KNEC	Kenya National Examinations Council
KUREC	Kabarak University Research Ethics Committee
MSLQ	Motivated Strategies for Learning Questionnaire
PMCC	Product Moment Correlation Coefficient
RDT	Resource Dependency Theory
SDG	Sustainable Development Goals
SDTVET	State Department for in TVET
STEM	Science, Technology, Engineering, and Mathematics
SPSS	Statistical Packages Social Sciences
TLM	Teaching and Learning Materials
TPAD	Teacher Performance Appraisal and Development
TVC	Technical and Vocational College
TVET	Technical and Vocational Education and Training

CONCEPTUAL AND OPERATIONAL DEFINITIONS OF TERMS

Academic The demonstrated competence and success of students in KNEC exams in

Performance: Engineering courses in technical and vocational institutions in Nakuru county, Kenya.

Administrators: These include Principals, Deputy Principals and Head of Departments in technical and vocational institutions.

Human These are personnel involved in educational processes, encompassing

Resources: principals, deputy principals, heads of departments, trainers, and technicians contributing to the delivery of engineering courses in technical and vocational institutions in Nakuru County, Kenya

ICT Information and Communication Technology tools and platforms

Resources: utilized for training in engineering courses in technical and vocational institutions in Nakuru County, Kenya.

Material Tangible assets and supplies employed in the TVET Institution, such as

Resources: Laboratory/ workshop equipment, instructional materials, and physical facilities.

Selected Resources: These are resources provided, managed, and controlled by the TVET Institutions in Nakuru County, Kenya. This includes material, time, and human and ICT resources.

Time Resources: This is the allocation and management of time including classroom instruction, self-study, and exam preparation in the TVET institutions in Nakuru county, Kenya.

Technical and Education and instruction geared towards developing specific technical

Vocational Training: skills and knowledge in engineering courses in technical and vocational institutions in Nakuru County, Kenya

Utilization: The effective and efficient use of various resources, including material resources, time resources, human resources, and ICT resources, to support educational processes in engineering courses within Technical and Vocational institutions.

CHAPTER ONE

INTRODUCTION

1.1 Overview

This chapter discussed the study's background, statement of the problem, research objectives, research hypothesis, scope, significance, assumptions, and study limitations.

1.2 Background of the Study

Technical and Vocational Education and Training (TVET) is essential in developing a skilled workforce to advance Kenya's economic goals, particularly toward achieving Vision 2030. The TVET sector aims to prepare skilled, competitive, and employable individuals with the attitudes and values needed to support the growth and success of various economic sectors. TVET plays a vital role in the country's social, financial, and technological progress by providing foundational vocational skills, promoting entrepreneurial abilities and a positive work ethic, offering practical, relevant training that aligns with Kenya's sustainable economic and industrial needs (Mwancha, 2023). Over the years, the Kenyan government has provided funding for state-of-the-art equipment, capitation, and competent managers (Osidiye, 2019). However, there is a gap in practical usage and underutilization of resources, which may affect academic performance and, as a result, hinder the alignment of education with workforce demands (Stella et al., 2022).

Resources in TVET institutions may include human capital, ICT, material, financial, environmental, and time resources. Understanding the dynamics of resource use improves the efficacy of vocational training programs and academic performance in TVET institutions (Hendrawijaya, 2020). Efficient resource utilization involves coordination, planning, sourcing, storage, inventory, and control, as well as providing cost-effective services (Mbatha, 2021). The administration, particularly managers, must optimize the

limited resources for effective student learning. Ekundayo et al. (2022) emphasized the importance of resource utilization in educational institutions, highlighting its role in ensuring efficiency, minimizing waste, and contributing to academic success. This study focused on using human, ICT, material, and time resources by students, trainers, and technicians. These resources were selected because they are provided, managed, and controlled by the managers in TVET institutions.

Countries are on the path to implementing the TVET and industry linkages and Sustainable Development Goal 4 (SDG 4) by 2030, emphasizing guaranteeing education for all. Nevertheless, education systems worldwide have faced significant challenges in the 21st century, especially in underdeveloped nations where problems like poor academic performance and limited access to quality education are still prevalent. Education is often recognized to profoundly affect individuals and society, acting as a powerful instrument to promote economic productivity, alleviate poverty, and propel social progress (Jevons, 2022). The significance of higher education, extending beyond secondary school, is underscored as a pivotal phase in the learning journey, occurring in various institutions such as universities, colleges, and technical institutes (Chankseliani & McCowan, 2021). This recognition emphasizes the crucial role that advanced education plays in shaping the trajectory of individuals and contributing to broader societal progress (Žalėnienė & Pereira, 2021).

In the United States, Nagahi et al. (2020) explored the influence of systems thinking skills and proactive personality on the academic performance of engineering students. Their research emphasized the ongoing attention given to the academic performance of college students, especially those pursuing engineering, due to their average performance and the imperative to meet the engineering demands of the national economy. The authors recommended a continuous assessment of academic performance to address gaps

proactively. However, a notable gap in the literature was the need for a direct link between the utilization of resources and academic performance in engineering courses.

In Ghanaian technical universities a study by Lassong et al. (2022), investigated the factors that influenced engineering mathematics performance and revealed that several factors influence students' performance in engineering mathematics, including age, terrible strain, and level of interest. Furthermore, it was established that students from senior high school like engineering mathematics, while those from technical high school do not like engineering mathematics because of their poor background in mathematics. They suggest that Ghanaian technical universities have established mechanisms to reinvigorate students' performance. However, the study was conducted in universities in Ghana and focused on engineering mathematics.

Govindasamy (2021) posits that a study conducted at TVET College in Kwa-Zulu Natal, South Africa, exposes persistent challenges in the TVET sector, such as poor student performance and underutilization of resources despite substantial government funding. Highlighting factors like lack of motivation, theoretical curricula, and resource challenges, it aligns with the recent circular SDTVET (2024, January 10) from the Principal Secretary, State Department for TVET (SDTVET), emphasizing the opportunity cost arising from underutilization of resources. The circular urges institutions to enhance efficiency, aligning with Govindasamy's (2021) findings to create a more productive learning and training environment in the TVET sector. The government provides adequate resources; however, it still has low performance. The above study focused on the provision of resources by the government. In contrast, the present study examines the relationship between the utilization of selected resources and academic performance in engineering courses within the TVET institutions in Nakuru County.

In the region, Namayanja et al. (2021) investigated the teaching of engineering science before and after the lockdown and its impact on students' confidence in passing national exams. Multiple regression analysis examined the association between syllabus coverage, practical sessions, students' liking for engineering science courses, and confidence in passing school and national exams. The study identified that inadequate proper time and insufficient curriculum coverage are frequently linked to low pass rates in science disciplines. While these factors are significant, the research revealed that students' liking for the subject is a crucial element influencing their confidence in succeeding in national exams. The study specifically focused on practical time concerning scheduling and instructors' syllabus completion, but it is still being determined if these factors directly contribute to academic performance.

In Kenya, a study by Ojera et al. (2021) assessed the impact of institutional facilities on academic achievement in engineering at National Polytechnics in Kenya. Recognizing the multidimensional nature of engineering, the research highlighted the importance of adequate facilities. Despite this, the study uncovered unsatisfactory performance among engineering students, with only 6.2% earning credits, 22.2% passing, 38.3% being referred, and 33.3% failing based on a decade's diploma examination results for 645 candidates. The research attributed 4.2% of the variation in academic achievement to institutional facilities, primarily focusing on Physical Facilities. However, it did not delve into the broader relationship between low engineering performance and the utilization of various resources, indicating a notable gap in understanding comprehensive factors influencing outcomes in engineering courses. The research explored resource utilization holistically for a deeper insight into the complexities surrounding academic performance in engineering courses.

Khajeha (2017) looked at how the amenities at Kenya's National Polytechnics affected learners' performance in engineering classes. Their research showed that the outcome was poor, with only 6.2% receiving credits in the last decade, though they acknowledged that engineering courses are resource-dependent. Only one percent of students who did not major in engineering received honours, indicating a significant achievement difference. The study highlighted the critical need for better academic results, highlighting that such school resources explained only 4.2% of the variance in students' engineering course grades. Improving resource utilization and academic achievement in engineering depends on addressing this gap.

Academic performance in engineering courses at TVET colleges in Nakuru County, Kenya, continues to be a significant concern despite these investments and coordinated efforts. This circumstance calls for a more thorough investigation into the relationships between the utilization of selected resources and academic performance in engineering courses, as Aggrey et al. (2022) pointed out. The high failure rates in engineering courses show that the expansion of TVET institutions in Nakuru County has not yet translated into improved academic performance. In comparison to fields such as applied technology, business, and the applied sciences, engineering courses have an average failure rate of 60.31 per cent, according to a survey of public vocational and technical institutions that offer engineering courses. The graduation rate for engineering courses is below 50 per cent. A summary of failure rates in Kenya National Examination Council (KNEC) in sampled TVET institutions in Nakuru County over the past four years is shown in Table 1.

Table 1*A Summary of Failure Rates in the Kenya National Examination Council (KNEC)*

Department	2020	2021	2022	2023	Average
	Fail (%)	Fail (%)	Fail (%)	Fail (%)	Fail (%)
Engineering	63.5	66.48	57.15	55.59	60.31
Applied Technology	34.9	31.61	32.26	29.26	31.33
Applied Science	37.16	51.66	48.23	35.41	43.14
Business	42.45	34.68	37.49	27.54	34.92

Source: County Director TVET, Nakuru (2023)

Table 1 shows a high failure rate of academic performance of trainees in engineering courses: 63.50% in 2020, 66.48% in 2021, 57.15% in 2022, and 55.59% in 2023. On average, the failure rate of engineering trainees is 60.31% compared to 31.33% in applied technology, 43.14% in applied science, and 34.92% in business. This demonstrates that 60.31% of the students fail to attain the KNEC pass mark of 40% (www.knec.ac.ke), which is a challenge in TVET institutions in Nakuru County, Kenya. Over 50% of the students have failed in the last six years, showing a negative skewness of performance. The performance is expected to obey the standard curve whereby few students pass highly, most in the middle pass, and few students fail.

1.3 Statement of the Problem

The problem that the study addressed was the high failure rate of students in engineering courses in TVET institutions in Nakuru County, Kenya. It is evidenced by consistently high failure rates, posing a critical challenge to attaining educational and economic goals. The failure rate, as shown in Table 1, exemplified by a 60.31% average failure rate of students in engineering compared to other disciplines, not only falls below the 40% pass mark set by KNEC but also deviates from the standard curve. If unaddressed, this

alarming situation threatens to exacerbate issues such as increased dropout rates, financial burdens on government and stakeholders, and a shortage of skilled workers in the industry, jeopardizing the government's commitment to achieving Vision 2030. Despite the recognition of TVET institutions as pivotal economic drivers, their rapid growth over the last decade has yet to translate into optimal academic performance due to challenges such as suboptimal resource utilization and low completion rates. Addressing this problem was crucial for aligning technical and vocational institutions with the market and industry demands, fostering economic development, ensuring students' success in engineering courses, and producing skilled professionals contributing to infrastructure, technology, and innovation. The study sought to analyze the relationships between utilization of selected resources (human, ICT, time, material) and academic performance in engineering courses in technical and vocational institutions in Nakuru County, Kenya.

1.4 Purpose of the Study

The study analyzed the relationships between the utilization of selected resources and academic performance in engineering courses in technical and vocational institutions in Nakuru County, Kenya.

1.4.1 Objectives of the Study

The following objectives guided the study:

- i. To analyze the relationship between the utilization of human resources and academic performance in engineering courses in technical and vocational institutions in Nakuru County, Kenya.
- ii. To determine the relationship between utilization of ICT resources and academic performance in engineering courses in technical and vocational institutions in Nakuru County, Kenya.

- iii. To find out the relationship between utilization of material resources and academic performance in engineering courses in technical and vocational institutions in Nakuru County, Kenya.
- iv. To assess the relationship between utilization of time resources and academic performance in engineering courses in technical and vocational institutions in Nakuru County, Kenya.

1.5 Research Hypotheses

The study attempted to test the following hypotheses:

H0₁: There is no statistically significant relationship between the utilization of human resources and academic performance in engineering courses in technical and vocational institutions in Nakuru County, Kenya.

H0₂: There is no statistically significant relationship between the utilization of ICT resources and academic performance in engineering courses in technical and vocational institutions in Nakuru County, Kenya.

H0₃: There is no statistically significant relationship between the utilization of material resources and academic performance in engineering courses in technical and vocational institutions in Nakuru County, Kenya.

H0₄: There is no statistically significant relationship between the utilization of time resources and academic performance in engineering courses in technical and vocational institutions in Nakuru County, Kenya.

1.6 Scope of the Study

The study was carried out in Nakuru County, Kenya, and was limited to public TVET institutions that have been in existence for over five years and offer engineering courses.

It confines itself to the utilization of human resources, ICT resources, material resources,

and time resources. Utilization of resources is the independent variable, and academic performance is the dependent variable.

1.7 Significance of the Study

The study findings may offer multifaceted benefits to various stakeholders. Government decision-makers may acquire insights into the effective use of resources in TVET institutions, aligning with their goal of stimulating economic growth through efficient resource allocation. This understanding aids in making informed decisions on budgetary allocations, ensuring value for money and overall societal development. TVET institutions and managers stand to benefit by identifying and highlighting essential resources influencing academic performance, empowering them to optimize resource utilization. This optimization leads to improved educational outcomes, enhanced institutional reputation, and better preparation of students for the workforce, contributing to industry growth. Students may be significant beneficiaries, as the study promotes better resource management, potentially leading to higher success rates in technical and vocational training courses.

The study may contribute to the body of knowledge for academics and researchers interested in the field, providing empirical data on the impact of resource utilization on academic performance. Industry stakeholders may benefit by understanding how well TVET institutions utilize resources, contributing to a more skilled and competitive workforce. Parents may gain insights into how resources impact their children's academic performance, allowing them to advocate for improved resource allocation and support their children's educational success.

1.8 Limitations of the Study

Using standardized research instruments may not capture the details of specific engineering disciplines, limiting the depth of insights. Furthermore, the study focuses on four TVET institutions that have been in existence for five years, limiting institutions that were started in less than five years in the study. The researcher mitigated these limitations by investing much time in ensuring sufficient and representative information was obtained. Using interview schedules as a data collection tool minimized the dishonest information that may arise in using questionnaires only.

1.9 Assumptions of the study

The study assumed that:

- i. Respondents shall give accurate and honest responses
- ii. The sample institutions have adequate resources
- iii. The trainers employed in TVET institutions are competent

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter provides a comprehensive review, exploring the interconnections among human, ICT, material, time, and academic performance. Exploring theoretical and conceptual frameworks, the review aims to elucidate the theoretical underpinnings and structures that form the basis of the research study.

2.2 Theoretical Review

This section discussed the theories that guided the study.

2.2.1 Resource Dependency Theory

Resource Dependency Theory (RDT) emerged in the 1970s, and Jeffrey Pfeffer and Richard Salancik developed it. It focuses on internal dynamics that characterize most organizational studies by emphasizing the critical role that external resources play in influencing organizational behaviour and decision-making procedures. RDT postulates that various resources, including human, ICT, material, and time resources, are necessary for the operation of organizations.

Regarding TVET institutions that provide engineering courses, RDT proposes that the presence and quality of these external resources substantially impact student achievement. For example, institutions lacking highly skilled teachers may need help providing effective instruction and support, which can eventually impede students' learning and academic success. Likewise, access to ICT resources, such as computers and software, may help students' capacity to participate in experiential learning actively and realistically apply theoretical information.

Moreover, RDT underscores the importance of effectively securing and utilizing resources to create an environment conducive to student success. This involves acquiring and managing resources efficiently to meet the institution's educational objectives. Thus, TVET institutions must prioritize resource allocation and utilization to optimize student learning outcomes and overall academic performance.

Furthermore, RDT emphasizes the significance of efficiently safeguarding and utilizing resources to establish a favourable setting for student achievement. It entails procuring resources and effectively administering them to fulfil the institution's educational goals. Therefore, TVET institutions must carefully plan and distribute resources to maximize student learning outcomes and overall academic performance.

Although it has faced criticism, its focus on external factors overlooks critical internal dynamics such as organizational culture and leadership. At the same time, its static view of resources fails to address the evolving demands of engineering education (Ghosh, 2019). Additionally, RDT's limited consideration of systemic resource inequalities and intangible assets, such as institutional reputation and student motivation, restricts its practical application. To maximize relevance, RDT should be complemented with other theories and adapted to address local contexts, internal dynamics, and long-term sustainability.

A study by Cappelen and Pedersen (2021) applied RDT to understand the dynamics of "mission drift" in nonprofit organizations. This study examined how funding sources, management practices, and organizational stigma influence nonprofits' ability to manage external dependencies and maintain their mission focus in resource-constrained environments. This demonstrates how RDT has been used to analyze external resource dependencies and the strategic responses organizations employ to achieve stability and growth, which can be referred to as academic performance in learning institutions.

2.2.2 Equity Theory

Equity Theory, created by J. Stacey Adams in the 1960s, provides a thorough conceptual framework for appreciating the concepts of fairness and justice in social interactions, specifically in educational environments such as TVET institutions. The idea postulates that individuals evaluate and compare their contributions, such as effort, abilities, and experience, to the rewards they receive in return, which may include access to resources, recognition, and other benefits. This comparison is conducted based on their subjective assessment of how individuals in comparable roles are treated to attain an impression of equity in the relationship.

Equity Theory posits that a need for fairness in allocating resources and opportunities drives students in the context of engineering courses in TVET institutions. Students evaluate the correlation between the effort they put into their studies and the benefits they obtain, such as the availability of skilled teachers, educational materials, and technology tools. When students notice a difference between what they put into their work and what they get out of it compared to their classmates, they may feel that things are unfair. This might make them less motivated and engaged.

On the other hand, if students believe that there is a fair balance between their effort and the rewards they receive, they are more inclined to feel motivated and content. Fairness motivates students to dedicate more energy to their academic pursuits, leading to enhanced scholastic achievement and an increased probability of successfully finishing their engineering courses. The Equity Theory emphasizes the significance of establishing a nurturing learning environment where resources are allocated equitably, and students are acknowledged for their contributions.

When analyzing the application of Equity Theory to engineering education in TVET institutions, evaluating several factors related to the distribution of resources,

management of workload, and assessment methods is crucial. To assist students' learning and development, institutions must ensure that resources, such as highly skilled teachers and advanced technical tools, are allocated fairly and equally. Furthermore, when distributing workload, it is essential to consider individual variations in learning styles and capacities to avoid any sense of unfairness among pupils.

Moreover, assessment techniques should be formulated to accurately, unbiasedly, and non-discriminatively represent students' knowledge and skills. TVET institutions may foster an equitable and just environment by ensuring fair distribution of resources and implementing unbiased educational techniques. This would give all students an equal chance of academic success and fulfil their potential in the engineering field.

However, the theory's reliance on subjective perceptions of fairness and social comparisons can lead to varied interpretations, potentially fueling dissatisfaction or unhealthy competition among students (Young, 2020). Furthermore, it oversimplifies educational dynamics, neglecting systemic inequalities and intrinsic motivators. For practical application, TVET institutions must contextualize Equity Theory, integrating mechanisms like feedback loops and complementary theories to address diverse student needs and structural challenges.

A study by UNESCO used equity theory to conduct a study focusing on equity in TVET, addressing barriers such as systemic discrimination and unequal access to resources for marginalized groups, including women and individuals with disabilities. The study emphasized the importance of equitable resource distribution and fair assessment practices, highlighting the role of equitable environments in fostering student success and motivation; research into gender disparities in related TVET programs underlines the need to ensure fair opportunities for all learners. The study links the principles of Equity

Theory to strategies that promote gender balance and inclusivity, such as targeted career guidance and resource allocation to underserved populations (Alla-Mensah et al., 2021).

2.3 Empirical Review

Efficient educational resource utilization involves coordination, planning, sourcing, purchasing, storage, inventory and control, and providing cost-effective services. The administration, particularly managers, faces challenges in optimizing limited resources like human, equipment, and buildings for effective student learning (Mbatha, 2021).

Kapur (2019) posits that resource utilization evaluates how efficiently available resources are utilized in an institution, often measured as a percentage. It holds significant importance in college operations by ensuring smooth functioning, minimizing waste, contributing to project success, facilitating the achievement of institutional goals, and crucially impacting students' overall academic performance. According to the State Department for TVET(SDTVET, 2024, January 10), emphasis was placed on the rationale for prioritizing resource utilization in educational institutions, which stems from the economic and social returns garnered through investing in education. Additionally, the effective use of resources hinges on their initial availability.

2.3.1 Utilization of Human Resources and Academic Performance

Francis (2018) posits that human resource management involves planning, recruitment, selection, training, and motivation, focusing on an organization's workforce. The author defines human resources as an organization's workforce, emphasizing its importance as a significant investment for stable continuity and success. Additionally, human resources are crucial for a nation's development, encompassing values, attitudes, and universal norms. Adequate human resources are essential for political, economic, and social stability, quality products, and profitability across various sectors.

In the USA, Wolff et al. (2021) emphasize that trainers significantly impact classroom conditions and learning outcomes, working within an environment shaped by the administration, curriculum, infrastructure, and available resources. This support network influences the quality of education, where the direct effectiveness of teachers is tied to student achievement. Adriani and Hikmah (2022) add that employee performance, synonymous with work achievement, derives from the quality and quantity of tasks completed. However, the complex relationship between teacher performance and student success remains underexplored.

In Indonesia, Pusvitasari (2021) highlights how strategic human resource management—focused on planning and development can elevate educational quality, although this research didn't extend to TVET institutions. Similarly, Ahmad and Essien (2021) emphasize ongoing training for TVET teachers in Malaysia, proposing practical, industry-based retraining as essential for performance improvement. Despite these studies, limited research connects human resource strategies to student performance, particularly in engineering education, motivating this study's focus. Trainers play a crucial role in managing classroom conditions to achieve goals.

The school's administration, curriculum, infrastructure, learning facilities, and teachers collectively influence learning activities and outcomes. Consequently, the effectiveness of teachers directly impacts student achievement. Employee performance, synonymous with work achievement, results from the quality and quantity of work completed while fulfilling assigned duties (Adriani & Hikmah, 2022). In conclusion, teacher success is determined by the outcomes of their assignments, consequently influencing student achievement through teachers' performance. The study lacks exploration into the intricate dynamics between teacher performance and student achievement. While Wolff et al. (2021) emphasize the pivotal role of trainers and Adriani and Hikmah (2022) stress the

importance of employee performance, there remains a significant gap in understanding how these factors interact and influence academic outcomes.

According to the study by Ahmad and Essien (2021), the impact of teacher training on TVET performance in Malaysia emphasizes retraining for experienced teachers. The research highlights the importance of ongoing training, proposing a 6-month industrial component for practical learning (Ahmad et al., 2018). It advocates for diverse pedagogical approaches, including problem-based and work-based learning, to enhance teaching quality and make TVET a preferred choice. While the study does not focus on student performance in engineering, it emphasizes the critical need for continuous training, proposing national standards for TVET teacher training for lifelong professional development. However, it acknowledges its limitation to human resources without student performance evaluation, which the current study seeks to fill.

Adriani and Hikmah (2022), further illustrated that teacher performance refers to the ability of instructors to showcase their skills in the educational setting. The primary responsibility of teachers is to facilitate student learning in the classroom. Beyond imparting knowledge, educators also serve as role models and mentors for students and their surroundings (Cheung, 2020). Moreover, teachers must adapt to the needs of their students and environment, demonstrating the ability to make independent decisions, particularly in matters related to learning and competency development. However, their study did not concentrate on utilizing resources but on the teacher's role in modelling the students and enabling learners to adapt to the environment.

According to Kemal and Rosyidi (2019), HRM significantly affects a company's performance. This research was carried out at STKIP Bina Bangsa Getsempena (STKIP BBG) Banda Aceh, an institution of higher learning in Indonesia. Utilizing and developing human resources is crucial to improving organizational strategies and

accomplishing goals. To achieve optimal performance outcomes, the study stresses the need to coordinate HR strategies with organizational objectives (Anwar & Abdullah, 2021). However, it is crucial to note that this study was conducted in a different context, did not specifically address TVET institutions, and was limited to human resources. While it establishes a relation to overall performance, it does not explicitly explore the impact of human resource utilization on academic performance in engineering courses.

Nuzli et al. (2023) explore education as a deliberate effort to cultivate future well-rounded individuals. The focus is on adapting to contemporary needs through educational innovations, highlighting the significance of resource utilization for achieving educational goals. The research evaluates resource usage, aims to enhance teacher skills, and assesses organizational effectiveness at State Senior High School 6 Merangin in Indonesia. Findings indicate that existing resources need effective control, suboptimal use by some educators, and improved organizational management and communication. The study emphasizes refining existing resources and organizational aspects to enhance teaching and student performance. However, the study showed that utilization of resources enhances teachers' productivity but was not associated with academic performance in engineering courses.

In Croatia, according to Lacmanović (2017), a proactive personality is someone who takes proactive measures in advance that have a beneficial effect, helping employees handle job responsibilities and available resources properly, ultimately leading to significant personal and organizational growth. It is recommended that companies offer sufficient job resources, such as social support, a diversity of skills, opportunities for professional development, and feedback, to boost employee engagement. The demands of a job and the resources available to it are both significantly impacted by management. Last but not least, having a sense of psychological meaningfulness at work is linked to

people feeling respected and not taken for granted and having value, usefulness, and worth from their work. They completed their research in a different setting, narrowed their emphasis to HR, and did not examine TVET institutions specifically. Nevertheless, they conducted their research in a foreign nation and did not assess engineering students' performance.

AsKapur (2019)explains in India, all of the things teachers do to help students learn are part of teacher resource usage. At a time when the world is facing threats from climate change, resource mismanagement, and insecurity, it is more important than ever. Effective use of teacher resources becomes crucial for the growth and survival of institutions. This utilization is pivotal in shaping and implementing school and government policies and relies on school managers' coordination and supervision efforts. Strategies, delegation of duties, and adherence to standards ensure efficient utilization of available resources for schools to achieve their goals. The study fails to explore the practical implementation of efficient human resource utilization in Nakuru County's technical and vocational institutions despite the emphasis on its importance in India (Kapur, 2019).

Employee engagement is generally low, particularly in South Africa, where only 9% of the workforce feels engaged, with 46% disengaged and 45% actively disengaged (Motyka, 2018). This widespread disengagement, particularly in TVET colleges, poses a significant risk to achieving TVET goals, emphasizing the urgency of addressing employee disengagement in public TVET colleges to fulfil the government's vision for economic development. (Amoo, 2021). However, their study was undertaken in South Africa, did not focus on students' performance in engineering, and was limited to human resources.

In South Africa, Amoo (2021) defined employee engagement as the state where employees are fully and consciously present in their work roles, demonstrating complete dedication of their spirit, soul, and body to their job responsibilities. As per Amoo, engaged employees bring their entire selves (cognitive, emotional, and physical) to work, actively executing their duties. In this context, engagement involves a person's psychological presence at work, encompassing work-focused attention, connection, integration, and focus. Conversely, disengaged individuals are emotionally and mentally detached from all aspects related to their work. Amoo (2021) concentrated on the engagement of human resources and its relation to dedication to work. However, there is no finding to indicate that the engagement of employees is equivalent to utilization, and it is not clear how it influences academic performance. Research was also not done on engineering students in TVET institutions.

In different Nigerian states, Kuku (2022) delved into the influence of human resource management on academic performance. Kuku highlighted the significance of teachers' training and promotion, emphasizing the need for government-sponsored initiatives. Similarly, Wanjala et al. found a positive correlation between principals' human resource management practices and academic achievement in public secondary schools. Nonetheless, both studies omitted TVET institutions, leaving a gap in understanding how human resource practices uniquely impact academic outcomes in engineering courses.

Saputri et al. (2023) note that the primary asset for any organization lies in its human resources, which is crucial for achieving goals. However, many organizations must pay more attention to this vital resource's effective management and development. As Francis (2018) emphasizes, Human Resource Management focuses on recruiting, directing, and managing people within an organization. In the dynamic business landscape, intelligent and creative employees are crucial for success, and HR knowledge forms the basis for

gaining a competitive edge. Efficient HR managers strategically hire individuals to contribute to organizational goals, providing a unique competitive advantage. Human resource utilization ensures the effective use of staffing, a key factor for organizational growth and development in the face of challenges like globalization, tribalism, and corruption (Francis, 2018). However, the study emphasized the utilization of human resources but was not linked to academic performance in engineering courses.

In Uganda, Eton et al. (2019) shed light on the correlation between poor pupil performance in primary schools and the need for pedagogical interventions to enhance teacher effectiveness. The researcher explored the impact of teacher competence on performance in Ugandan primary schools. A sample of 217 respondents was selected, revealing a correlation coefficient of ($r = 0.575$). The study recommends encouraging teachers to develop pedagogical skills for effective classroom delivery, emphasizing including pedagogical skill development in performance appraisals. Attention to classroom organization, time management, and minimizing disruptions during class is also crucial. Recognition and rewards should be extended to teachers, fostering a positive school-community relationship, addressing absenteeism, and promoting teamwork. However, the study did not explore the utilization of resources and its relationship to engineering courses in TVET institutions, leaving a significant gap in understanding how these aspects impact academic performance in engineering courses. This research aims to fill this gap by explicitly examining the utilization of resources and their relevance to the context of engineering courses in TVET institutions.

This study by Okemwa et al. (2022) addresses the significance of skill training for TVET graduates, particularly in electronics, emphasizing the importance of a suitable laboratory environment. Focusing on eight public TVET institutions in Nairobi County, the research investigates the impact of management and utilization of electronic

laboratories and equipment on the skill acquisition of technician trainees. Utilizing mixed methods, the study reveals that effective management and utilization were neglected, moderately influencing skill acquisition. Recommendations include increased investment in electronic laboratories and equipment by TVET institutions, supported by government initiatives, to enhance skill acquisition among technician trainees. This study focused on the workshop's management and the technicians' retooling. The study did not relate the quality of the technicians to the academic performance of engineering courses by students doing practicals in workshops or laboratories.

Agnetta et al. (2022) used a mixed-methods approach to examine the impact of teacher resource utilization on academic performance in Makueni County secondary schools. Niamatullah et al. (2020) stated that academic performance remains low despite teacher availability. The research, with 316 respondents, indicated a moderate influence of teacher resource utilization on academic performance. Qualitative data supports this correlation, emphasizing that effective teacher resource utilization enhances academic performance. The author recommends that the Ministry of Education train teachers in resource use and offer insights for policymakers in educational resource allocation to improve overall academic outcomes. However, their study did not focus on TVET institutions.

Thus far, several studies have concluded that there is no connection between using resources and students' academic achievement in engineering courses. To close this gap, the current study looks at the connection between the use of human resources and student's academic performance in engineering courses at public TVET institutions in Nakuru County, Kenya.

2.3.2 Utilization of ICT Resources and Academic Performance

According to Das (2019), Information and Communication Technologies (ICT) refers to various technological tools for communication, information creation, dissemination, storage, and management. According to the United Nations Development Programme, ICTs encompass various hardware, applications, and services employed for information handling. Quality education is contingent upon the development of information technology, which contributes to learner motivation, enhanced basic skills, and improved teacher training. Information and Communication Technology create learner-centred environments when appropriately utilized as a transformative curriculum and subject matter tool. Teachers employ ICT to introduce students to new pedagogical approaches, making ICT an integral part of the education system. The evolving landscape poses challenges and prompts educational stakeholders to reconsider roles, teaching methodologies, and future visions in pursuing quality education facilitated by ICT.

A study done in Pakistan by Batool et al. (2021) employed a survey methodology and quantitative analysis. It investigated the use of ICT by research students and its impact on academic performance. The research focused on students from public sector universities, with a sample size of 600 postgraduate research students selected through purposive sampling. Although the findings indicated a significant positive impact of ICT resource usage on research students' performance, it is crucial to note that the study was conducted in a different country, excluding TVET institutions. The study also failed to address other potential contributors to students' academic performance, so it is still not known much about the dynamics at play in TVET settings and how they relate to students' overall academic success. Taking a broader view, the study in TVET institutions investigated some potential variables that influence students' grades.

At the University of Jordan, a study conducted by Alameri et al. (2020) delves into students' perceptions of e-learning, specifically using Moodle, Microsoft Teams, and Zoom platforms. The research involves 450 students who participated in a questionnaire, with findings analyzed through a multiple regression model. Alameri et al. (2020) further emphasized the strategic design of the university's e-learning program, revealing that this design is more crucial than individual context variables in influencing student perception. Positive attitudes towards e-learning were observed among students with prior computer knowledge and those studying technology-related fields. The study concludes that the strategic design of the e-learning program, supported by Moodle, Microsoft Teams, and Zoom platforms, positively impacts students' self-study abilities and academic achievements during the COVID-19 pandemic. However, a gap exists as the study does not explicitly address the utilization of these platforms and their impact on academic performance in engineering courses within the context of TVET.

The study by Ishaq et al. (2020) investigated the impact of Information and Communication Technology (ICT) on tertiary education in Pakistan, studying 300 students from public and private universities. Results show widespread ICT availability, with positive correlations between productive ICT use and academic performance. The study recommends high-speed internet access, online cloud availability, and mandatory ICT training. Ishaq emphasizes ICT's significant contribution to enhanced academic performance and suggests comprehensive integration measures, including improved infrastructure and faculty training. The findings underscore ICT's positive influence on students' learning experiences, organizational behaviours, and overall academic outcomes, emphasizing its crucial role in shaping the future of education. However, this study examined the availability of ICT and did not explore its utilization in engineering courses.

The gap in the study by Hanaysha et al. (2023) lies in its context and focus, as it primarily explores the influence of classroom environment, teacher competency, ICT resources, and university facilities on academic performance and student engagement in higher education institutions (HEIs) within the United Arab Emirates. The research does not address the context of engineering courses in TVET institutions, offering insights relevant to a broader academic setting. Given the unique nature of engineering education and the TVET framework, the study's findings may not directly apply to understanding the dynamics of resource utilization and academic performance in engineering courses within the TVET context. Therefore, there is a distinct gap in the relevance of the research to the specific domain of engineering education in TVET institutions.

El Yazidi (2023) investigated the influence of Information and Communication Technologies (ICTs) on academic performance in Moroccan universities, departing from previous studies by explicitly examining the correlation between ICT use and educational outcomes. The study surveyed 108 students across four major universities and revealed a positive relationship between ICT implementation and academic performance. Emphasizing the importance of integrating ICTs into higher education for enhanced student outcomes, the research provides valuable insights for educators and policymakers. However, a notable gap exists in the study's lack of specificity regarding using various ICT tools or platforms on distinct academic outcomes, urging more detailed and context-specific analyses to understand and address this correlation comprehensively.

In Nigeria, Eze et al. (2018) posit that despite innovative teaching methods in the Western world, traditional approaches persist in Nigerian tertiary institutions. The adoption of e-learning is hindered, limiting the use of innovative teaching methodologies and research. This study focuses on the adoption and use of e-learning by lecturers at M-

University in Nigeria, employing a qualitative approach with 15 semi-structured interviews. While M-University's e-learning facilities are deemed adequate and accessible, the utilization falls short due to factors like user attitude, inadequate internet, and insufficient training. The study recommends continuous upgrades and training to maximize usage. However, the research overlooks the specific utilization of these resources in engineering courses within TVET institutions, leaving a crucial gap. The current research intends to explore the relationship between the utilization of ICT resources and academic performance in engineering courses within the TVET context.

In Uganda, Edison and Kasujja (2020) examined the impact of ICT usage in teaching on academic performance among Uganda Certificate of Education (UCE) students in the Kasese District. It focused on ICT accessibility, infrastructure utilization, and the ICT knowledge and skills of secondary school teachers in the district. Utilizing a cross-sectional design and analyzing data from 291 respondents through the Chi-square test, the study revealed that accessibility significantly influences students' academic performance. However, the limited coverage of ICT hampers learning at the Ordinary Secondary Level in Kasese District. Recommendations include providing ICT facilities and training teachers in ICT skills. Notably, the study needed to explore how these resources are utilized or their relevance to engineering courses in TVET institutions. This research aims to fill this gap by investigating ICT resource utilization and its impact on academic performance in engineering courses in TVET institutions.

The Kenyan Ministry of Education acknowledges technology's benefits but grapples with equitable distribution challenges. A study in Dadaab sub-county Muema (2018) reveals insufficient ICT due to budget constraints. Effective ICT resource utilization faces barriers like low digital literacy, motivation, and resistance to change. European studies suggest that ICT access may not significantly impact academic performance beyond a

threshold. Despite widespread ICT access in Kenyan schools, general utilization remains occasional, particularly in computer labs designated for computer studies. Teachers perceive ICT as a learning catalyst, enhancing motivation and comprehension. Gatama et al. (2022) advocated for a holistic approach, addressing resource adequacy and effective utilization to optimize ICT's impact on academic performance. The study needs to specifically address how insufficient ICT resources and challenges in utilization impact TVET programs and engineering, leaving a gap in understanding the specific dynamics and needs of these fields regarding technology integration.

Overall, the study noted the need for a comprehensive approach, addressing both resource adequacy and effective utilization, to enhance the impact of ICT on academic performance in Kenyan public secondary schools. However, this study was not done in a TVET institution and did not consider engineering courses.

2.3.3 Utilization of Material Resources and Academic Performance

Lawan et al. (2020) posit that investment in education is vital for academic progress and national development. Educational institutions, crucial for achieving goals, require adequate resources, optimal utilization, and effective management (Ikonne et al., 2022). These papers underscore the significance of education resources in enhancing the quality of the teaching-learning process. However, they do not specifically address the impact of resource utilization on academic performance, creating a notable gap in understanding the relationship between resource management and educational outcomes in engineering courses and TVET Institutions.

Globally, research was done in China on school resources, as postulated by Tian and Yao (2020), which encompasses everything utilized and consumed to sustain educational and teaching activities, categorized into human, material, time, and financial dimensions. Human resources involves the school's teacher and student teams, focusing on the impact

of full-time teachers on student performance Tanjung (2020). Material resources encompass tangible assets like buildings, land, books, and materials. Financial resources pertain to the monetary aspects of human and material resources (Lawan et al., 2020). This comprehensive understanding underscores the multifaceted nature of educational resources, emphasizing their role in shaping the learning environment and influencing student outcomes.

In Beijing, Aggrey et al. (2022), educational resources play a crucial role in mitigating the influence of socioeconomic factors on academic success and ensuring equal opportunities for all students. Therefore, the availability of teaching and learning resources enhances the effectiveness of educational institutions, as these components are vital for students to attain excellent academic outcomes. However, this study dwelt on the availability of resources and not the utilization of resources.

Undergraduates in Nigeria have to utilize the university library well if they want to succeed academically, according to Okpa et al. (2022). Regular library usage is associated with better grades, which is excellent news for university students nationwide. Literature, infrastructure, orientation, and dependable electricity cannot be provided without resolving access issues. Access and utilization were vital in this research but unrelated to academic performance in engineering in TVET institutions. The current result establishes the relationship between using Material resources and academic performance in engineering courses.

In Nigeria, Mbatha (2021) investigated the adequacy of material resources and the utilization of instructional resources for effective teaching and learning in TVET programs. With 700 randomly selected participants, the study found inadequacies in both physical and instructional resources. Mbatha recommended the inclusion of collaborative efforts with stakeholders to secure funding for improved facilities in TVET programs.

However, their study focused on the adequacy of the facilities but did not address the relationships between the use of these facilities and academic performance in engineering courses.

In South Africa, a study by Adebayo et al. (2020) posits that poor student performance, high dropout rates, and inequality between wealthy and poor schools are hallmarks of South Africa's educational system. Educational funding for low-income schools has increased twofold over the past few decades, yet student achievement has remained stagnant. The average performance of the wealthy schools is significantly higher than that of the poor schools. This research used the 2015 Trends in Mathematics and Science Study (TIMSS, 2015) to analyze the factors affecting student performance in schools with little money. It also looked at how the resources available to schools affect students' grades. According to the study, educational resources significantly affect students' performance. However, the effect is negligible when weighed against other considerations like school administration, responsibility, and student agency. So, it is not just educational resources that can enhance South Africa's academic performance; the study found that several other factors also play a role. However, the study did not focus on academic performance in engineering courses in TVET institutions, which this current study explores.

In Ethiopia, quality education hinges on a skilled human capacity capable of effectively utilizing resources. Resource management, involving acquisition, allocation, utilization, and evaluation, is crucial for efficient activities and schedules in every field. Inadequate management of educational resources threatens the quality of education (Gebremeskel, 2019). The study dwelt on material resources, while this present research addresses how material resources relate to academic performance.

In Kenya, Konyango et al. (2018) identified inadequately trained physics instructors and unsuitable laboratory equipment as significant contributors to low grades in physics. The study revealed a need for learner-centered teaching approaches, and teachers and students held negative perceptions about success in the subject. The adverse impact of inadequate teachers and insufficient teaching and learning resources on effective pedagogy and academic performance was emphasized. The author further highlighted the persistence of low learner educational outcomes when instructors, students, and administrators improperly and ineffectively utilized available resources. These results show the importance of having qualified teachers and enough materials to support their lessons. This research had some limitations, including its focus on secondary schools rather than TVET institutes and its narrow focus on Physical Facilities.

The proper upkeep of laboratories/workshops, equipment, and other facilities influences resource utilization. Consequently, TVET management should be aware of and attuned to these considerations to oversee laboratory and workshop facilities efficiently. A well-maintained workshop and laboratory spaces can contribute positively to the academic success of the institution (Okemwa et al., 2022). This study was specific to laboratories and equipment, which is limiting. Research has not been done on utilizing these facilities to improve academic performance in engineering courses.

In summary, despite the valuable insights provided by these studies, there is a noticeable gap in the literature concerning the utilization of resources and their impact on academic performance, specifically within the context of TVET institutions. Understanding these dynamics is crucial for addressing the unique challenges faced by students in education settings.

2.3.4 Utilization of Time Resources and Academic Performance

Time management is viewed as a self-management form, emphasizing clear awareness of time in deciding what activities to undertake, how to execute them efficiently, and when to perform them (Khan et al., 2020). Effective Time management behaviours or skills are crucial for students to navigate their curriculum and achieve learning objectives, positively impacting academic performance (Agormedah et al., 2021). Previous studies consistently highlight the positive effect of time management on student learning and outcomes.

In the USA, recent research by Hershner (2020) highlights the substantial impact of sleep on academic performance. While traditional studies primarily examined the adverse effects of shorter sleep duration and poor sleep quality on Grade Point Average (GPA), newer metrics, such as sleep consistency, have emerged. These suggest that students with more regular sleep patterns achieve better academically. Recognizing the significance of addressing sleep disorders for struggling students, upcoming devices may offer solutions to monitor and enhance sleep behaviours, potentially improving academic performance. While the author recommends implementing sleep-friendly policies and interventions, their study lacks focus on technical and vocational institutions. It does not explore the relationship with academic performance in Engineering courses, highlighting a notable gap in the current research landscape.

In Germany, a study by Wedel (2021) sheds light on the impact of instruction quantity and quality on academic success, emphasizing the advantages of additional instruction time, Resources, and teacher expertise in diverse educational settings. However, a noticeable gap exists when considering the study's limited exploration of the comprehensive utilization of various resources crucial for academic performance, particularly within the distinct realm of engineering courses. Wedel's focus on instruction

time resources does not offer a holistic understanding of how time resources are optimally employed in engineering education. Consequently, there is a need for a more detailed investigation into the broader spectrum of resource utilization in engineering courses, addressing the unique challenges they present and uncovering the relationship between resource use and academic performance in TVET institutions.

Vosniadou (2020), a study done in Australia, agrees that the nature of the material necessitates students to cultivate a high level of self-discipline in managing their time effectively. With a need for deep understanding and application of theoretical knowledge, students in engineering programs must allocate dedicated time for classroom instruction and self-guided study. This dual focus emphasizes the importance of self-discipline, as Simeon and Nnaa (2020) posited adhering to a well-organized schedule and balancing lectures, practical work, and personal study. Successful navigation of engineering hinges on students' ability to prioritize tasks, stay focused, and maintain a proactive approach to Time management, factors crucial for academic success in these rigorous programs. No results demonstrate that this study influenced academic achievement, allowing the current study to explore further.

In England, Burgess *et al.* (2023) delved into teachers' class time allocation in English secondary schools, specifically in classes preceding GCSE exams. The study disclosed that dedicating more time to individual practice and assessment correlated with higher math scores, while elevated English scores were linked to increased discussion and collaborative work. Class time allocation independently predicted test scores, offering a potential avenue for enhancing student achievement regardless of instructional quality. However, the study's contextual differences, exclusion of technical and vocational institutions, and limited time underscore a significant gap. Further research should explore the applicability of these findings in technical and vocational settings, especially

in addressing the unique challenges of Time allocation and instructional strategies in such institutions.

To improve training experiences, Pirzada et al. (2021) investigated how well TVET instructors in Pakistan understood engaging instruction. Training can be enhanced when trainers and trainees take the time to prepare and engage in collaborative learning. Focusing on learner-centric techniques in modern TVET practices, the research aims to tackle the difficulty of effectively engaging different learners. Competency-based training underscores the importance of effective interaction and feedback between trainers and participants (Shamin Akhtar, 2019). The study conducted in Lahore, Pakistan, with 21 trainers, reveals a consensus on the need for effective interaction and clarity on trainers' expected roles to enrich the training experience. The findings provide valuable insights and guiding recommendations for improving TVET training practices. However, their study was undertaken in a different geographical context, did not focus on student performance in Engineering courses, and was limited to time resources.

Wedel (2021), a study at the University of Munich, Germany, highlights the crucial role of time in TVET, particularly in Engineering courses, for a comprehensive understanding of complex concepts and practical skills. Despite this importance, Lorimom et al. (2023) identified a research gap regarding the influence of time allocation in the syllabus, schedule of units, industrial training, and trainer availability on the overall academic performance of TVET trainees. Burgess et al. (2023) emphasize that adequate time facilitates deeper comprehension and hands-on practice, accommodates individual learning paces, and supports practical assessment and feedback. Notably, no specific studies have explored the relationship between time resources and academic performance in TVET institutions, creating a pertinent gap that forms the basis of this research.

Addressing this gap promises valuable insights that could enhance curriculum design and teaching methodologies in TVET settings.

Adams and Blair (2019) investigated the relationship between academic achievement and time management skills among engineering undergraduates at the University of Toronto. Their findings reveal a positive correlation between higher academic standing and students taking fewer and shorter breaks, suggesting a connection between sustained task focus and academic success. Although the study does not establish causation, it highlights the positive correlation between perceived control over time resources and academic performance across demographics. However, time management behaviours only account for a small portion of GPA variability. The research underscores the influence of nonacademic factors on academic success, including study skills, problem-solving abilities, socioeconomics, and personality. It positions time management as a stress-buffering nonacademic skill contributing to higher performance and lower stress in higher education (Buckley & Lee, 2021). Despite these insights, the study lacks focus on Technical and Vocational Training, creating a significant gap in understanding the dynamics of time management and academic success in this context.

Oguguo *et al.* (2020) conducted a study in Nigeria involving 150 senior secondary school students (70 males, 80 females) from five schools to examine the relationship between social media use and academic achievements in accounting. The research found that students predominantly used social media for making friends, academic research, and staying updated. Regular use of social media, even at two to four hours a day, had no discernible effect on students' grades. However, there were gender differences, so it is clear that people need help figuring out how to use social media responsibly. Important gaps are highlighted by the study's shortcomings, which include its location in a different country, its failure to concentrate on students' performance in Engineering classes, and

its limited examination of available time and resources. This current research focused on utilizing resources and problems in engineering education related to students' social media usage and academic achievement. According to Mukwevho (2018), the tertiary education environment overwhelms many students.

This was agreed upon by Kayode and Adedokun (2019) in a study that looked at how sandwich students in Nigerian universities managed their time resources and academic performance. A study tool known as the "Questionnaire on Sandwich Students' Time Management" (QSSTM) was employed to gather data on 40 sandwich students who were chosen at random regarding their abilities in organizing, planning, and regulating their time. The results showed a substantial correlation between the academic achievement of the sandwich students and all of the time management skills that were assessed. Respondents did not plan their time management or pay attention to tasks that would have resulted in grades.

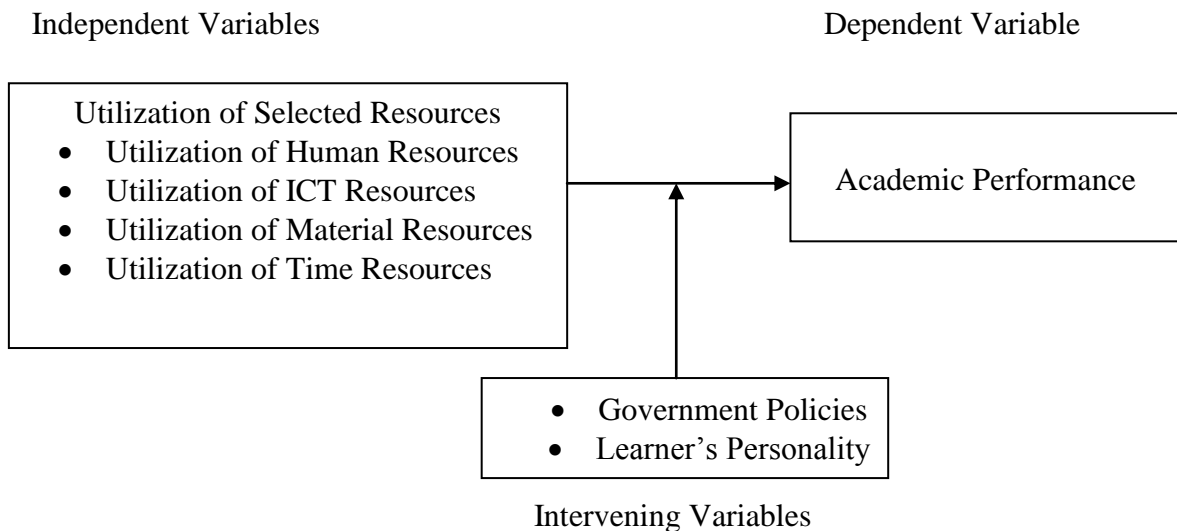
In Kenya, Fundia *et al.* (2023) research looks into how Teacher Performance Appraisal and Development (TPAD) affects students' performance in public high schools, specifically in rural parts of West Pokot Sub County. The research shows that effective time management has a considerable impact on academic and non-academic results, with a focus on instructors' time management and lesson attendance. It highlights the importance of instructors' ability to manage their time well in raising students' test performance. There is a significant difference between this study and the one by Lorimom *et al.* (2023), which also stressed the significance of instructors' time management. However, it was carried out differently and did not concentrate on engineering courses. Further research is needed to determine the exact effect of performance appraisal systems on student performance within the TVET framework, as the report mentions that TVET institutions employ PAS rather than TPAD. Addressing

this gap contributed valuable insights to the discourse on effective time management in TVET institutions.

2.4 Conceptual Framework

Figure 1

Conceptual Framework



Source: Author, (2024)

According to Kivunja (2018), a conceptual framework is an organized diagram that shows how components under study, independent variables, relate to a dependent variable or outcome. It serves as a foundation for research design, the development of hypotheses, and the interpretation of data, assisting investigators in comprehending and examining the dynamics of their investigation. The study sought to analyze the relationships between the utilization of selected resources and academic performance in engineering courses at TVET institutions in Nakuru County, Kenya. Selective resource utilization is the independent variable, and academic performance is the dependent variable. Fig 1 illustrates the relationship between the two variables and other intervening variables likely to influence the study's outcome. The independent variables are human resources utilization, ICT use, time, and physical resource utilization. For the TVET institution to

achieve its objectives of getting good academic performance in engineering courses, all the independent variables must be provided and sufficient. Improved academic performance requires proper utilization of human, ICT, material, and Time Resources. However, the intervening variables, which include government policies and learners' personalities, define and complete the cycle between the variables. Motivated students utilize resources more effectively, improving academic performance. Positive learning attitudes enhance resource use while disciplined students manage time better, improving academic results.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter details the study's research design and methodology. This section delved into the research design, study location, target population, sample size, sampling procedures, research instruments, data collection, analysis, and ethical considerations.

3.2 Research Design

According to Huntington-Klein (2021), researchers use a research design as a roadmap to address specific research problems. The study used a descriptive survey design to gather data. The design enabled a mixed-method approach (qualitative and quantitative data) to collect a wide range of information. The design was suitable for the study because it finds out what is happening and reports it without trying to influence the respondent's thoughts or feelings (Asenahabi, 2019). Descriptive statistics (frequencies and Percentages) were used to show the frequency of the outcome from the respondents. Inferential statistics (regression analysis) was used in the study to determine the relationship between the utilization of selected resources and academic performance.

3.3 Location of the Study

The research took place in Nakuru County, County Number 032, one of the 47 counties in Kenya situated in the former Rift Valley Province. Encompassing an area of 7,462 km², Nakuru County is home to Nakuru City. The latitude of Nakuru is in Kenya with GPS coordinates of -0° 18' 11.156" N and 36° 4' 48.094 E. The county is divided into 11 sub-counties, each serving as a decentralized unit for service delivery. These sub-counties, namely Nakuru Town East, Nakuru Town West, Njoro, Molo, Naivasha, Gilgil, Kuresoi North, Kuresoi South, Rongai, Subukia, and Bahati, are led by sub-county administrators appointed by the County Public Service.

Nakuru is a cosmopolitan region, and the predominant occupations include agriculture, tourism, trade and investment, forestry, and real estate. Nakuru County boasts a population of 2,347,849, with a population density of 314.6/km² and an annual population change of 2.2%. Notably, 51.6% of the population resides in rural areas, while 48.6% is in urban areas. Nakuru County is a fast-growing county, with Nakuru Town recently upgraded to become a city. Many industries have been on the rise recently, demanding both skilled and semi-skilled labour that is expected to be supplied by the TVET institutions. This was confirmed by launching a skills database to address workforce challenges in Nakuru County as a pilot. The study results were significant to these industries and the growth of the institutions in the region. The location was selected because of the consistently low student performance in engineering courses in TVET institutions, with an average failure rate of 60.31% over the last four years.

3.4 Target Population

As highlighted in Table 1, the region has experienced a notable high failure rate among engineering students from 2020 to 2023. This concerning trend significantly shaped the study objectives.

As highlighted by Siqeca et al. (2021), the research concentrated on TVET institutions that provide engineering or are associated with distinctive characteristics. The target population in the county's four TVET institutions offering engineering comprises 2386 engineering students, 22 administrators (4 Principals, 7 Deputy Principals, and 11 Heads of Departments), and 11 Technicians. These data were obtained from the TVET institutions. The accessible population included students and staff within the research scope, comprising all students doing engineering, administrators (Principals, deputy principals, and HoDs), and technicians.

Principals were sampled because they are the accounting officers responsible for managing the institution; deputy principals supervise academics and allocation of resources; and heads of department are responsible for loading staff, scheduling, and managing the students. The technicians require materials for practical maintenance of the workshops/ laboratories. The study included the students because they utilized the resources for academic achievement. Therefore, the study respondents included Students, administrators (Principals, Deputy Principals, and Heads of departments), and Technicians. This study did not involve a vulnerable population because all participants were over 18 years old.

3.5 Sample Procedure and Sample Size

3.5.1 Sample Procedure

This study employed purposive sampling to carefully choose the institutions to be included, precisely four public TVET institutions that have existed for the last five years and offer engineering courses to obtain the students' academic performance to facilitate the study. Purposive sampling is a technique in which the researcher selects the sampled units who, by their judgment, meet the specific purpose of the study (Campbell et al., 2020). The census method was applied to administrators (Principals, Deputy Principals, and HoDs), as well as Technicians. Census was used because the population of this category was small. To establish the sample size for students, the researcher referred to the Krejcie and Morgan table and then employed a proportionate sampling technique to guarantee equitable representation from each institution. Participating students were selected through a simple random sampling method to get samples from each institution. Willing students picked a yes or no. Those who picked yes participated in the study.

3.5.2 Sample Size

In this research, the sample size definition is pivotal in ensuring the reliability and accuracy of the study's outcomes and the potential for the study to be replicated (Vozzi et al., 2021). In this context, the sample size denotes a carefully selected number of subjects from a target population to represent that population aptly. The census technique involved engaging the entire population, with each individual invited to participate in the study (Stratton, 2021). The sample included 22 administrators (4 Principals, 7 Deputy Principals, 11 Heads of Departments (HoDs)), and 11 Technicians. The census method was employed to determine these figures, covering the complete population of each respective group. Table 2 shows the sample.

Table 2

Study Population

TVET	Administrators			Technicians	Students
	Principals	D/Principals	HODs		
Institution R	1	2	3	4	1729
Institution S	1	1	2	2	177
Institution T	1	2	2	2	250
Institution U	1	2	4	3	230
Total	4	7	11	11	2386

To determine the sample size for the students, the researcher refers to the Krejcie and Morgan table (Morgan, 1970), which provides a convenient way to estimate the sample size for a given population. The sample size of 331 students was calculated using this table. Proportionate sampling was then applied to allocate the sample size for each institution based on their population relative to the total number of students in four institutions. A simple random sampling technique was used to select the students to participate in the study.

Table 3*Sample Size for Administrators and Technicians*

Respondents	Sampling Techniques	Sample Size
Principals	Census	4
Deputy Principals	Census	7
Head of departments	Census	11
Technicians	Census	11

Table 4*Sample Size Students Per Institution using Proportionate Sampling Method*

Institution	Student Population	Sample size per Institution
	N	Proportionate Method $\frac{N}{T} \times \text{Sample Size}$ $\frac{\text{Student Population of each Institution}}{\text{Total}} \times 331$
Institution R	1729	239
Institution S	177	25
Institution T	250	35
Institution U	230	32
Total	2386	331

3.6 Instrumentation

A research instrument is a systematically designed tool for collecting, measuring, and analyzing data aligned with research interests. The choice of instrument depended on the study type: quantitative, qualitative, or mixed-methodology (Oben, 2021). This study collected data using questionnaires and interview schedules. Interview schedules were

administered to administrators (Principals, deputy principals, and heads of departments), while questionnaires were used to collect data from students and technicians.

The questionnaires were structured into six parts aimed at collecting information. The first part included general instructions to be followed by the respondents, stating the study's objectives, confidentiality, and anonymity to be observed. The second part contained section A-E. Section A included demographic questions on each participant's background information. Section B-E has items adopted from the study's objectives and was on a Likert scale. The item of the questionnaire had a 5-degree scale (Never = 1; Rarely = 2; Sometimes = 3; Frequently = 4 and Always = 5) while others contain a 4 degrees scale (None = 1, Few =2, Many =3 and All = 4).

The Likert scale is a generally accepted standard for assessing one's opinions and attitudes about specific issues. The interview schedules for principals, deputy principals, and heads of departments are structured in two parts. The first part contained the instructions to be followed, including informing them of the study objective, confidentiality, and anonymity needed to be applied in the study procedure. Part two contained section A, which had demographic information about the respondents' background, while section B-E was based on the items adopted from the objectives. All the participants complete the questionnaires within 10-15 minutes, making this the most efficient method of reaching many respondents in the least amount of time.

3.6.1 Validity of the Research Instrument

Sürücü and Maslakci (2020) state that the validity of a measuring device is related to how accurately it measures its target function. It measures how well the data represents the phenomenon under study (Mugenda & Mugenda, 2003). Data and its findings must be genuine, accurate, and relevant for content validity, as posited by (Almanasreh et al., 2022). The instruments were evaluated for content validity only. The items' clarity and

content were examined, ideas were discussed, and the supervisors checked the items' conformity with the study objectives. Through discussion, the researcher and the supervisor agreed on relevant suggestions and improved the instruments to measure the right ideas per the stated objectives.

3.6.2 Pilot Study

Conducting feasibility and pilot studies helps build and test effective implementation strategies (Pearson et al., 2020). The researcher conducted a pilot study within the scope of the study, taking 10% of the respondents and ensuring that the respondents who participated in the pilot study were not involved in the final study (Gathii et al., 2019). During the pilot study, the researcher ensured that the respondents were issued with informed consent, confidentiality was assured, risks were minimized, transparency was maintained, and respondents adhered to debriefing. The pilot study used a sample of 37 respondents. The pilot study enabled the researcher to remove ambiguity that would have gone unnoticed, identified instruments' shortcomings, and reviewed wrong responses, blank gaps, and inconsistencies.

3.6.3 Reliability of Research Instrument

Ensuring the dependability of research instruments was a critical focus of the study, as emphasized by Mellinger and Hanson (2020). Piloting enhanced reliability, refining the instruments' consistency, accuracy, relevance, and sufficiency. Using the test-retest method, Mugenda and Mugenda (2003) were pivotal in this pursuit, involving the administration of the same questionnaire twice to the piloting institutions' respondents. The questionnaires and interview schedules were issued to the respondents in the institution, and after two weeks, they were repeated to the same respondents (Ahmed & Ishtiaq, 2021). The data from the two tests were collected, and a reliability coefficient

was calculated using the Product Moment Correlation Coefficient (PMCC) formula. A correlation coefficient of 1 is considered reliable, and -1 is unreliable.

The larger the number, the stronger the relationship, indicating a solid reliability of the instrument. When the results yielded a value approaching -1, it showed a negative relationship, indicating a weak reliability. A correlation coefficient of value approaching zero shows a weak relationship between the two tests. However, a correlation of at least 0.7 and above reflects that the instruments were reliable and can give valid results when used to conduct the research (Septiyana & Aminatun, 2021).

Pearson Product moment correlation coefficient,
$$r = \frac{n(\sum XY) - (\sum X)(\sum Y)}{\sqrt{[n(\sum X^2) - (\sum X)^2][n(\sum Y^2) - (\sum Y)^2]}}$$

Where n is the number of items in the test and X and Y is the result of the two tests. Kerl Pearson (1948)

The r values are distributed as follows: $r = 0-0.25$, very low correlation; $r = 0.26-0.49$, low correlation; $r = 0.5-0.69$, moderate correlation; $r = 0.7-0.89$, high or strong correlation; $r = 0.9-1.0$, a very high or strong correlation (de Barros Ahrens et al., 2020).

3.7 Data Collection and Procedures

The researcher diligently adhered to ethical protocols before initiation. Initial steps involve obtaining permission from the Kabarak University Institute of Postgraduate Studies and seeking ethical clearance from the Kabarak University Research Ethics Committee (KUREC). A permit from the National Commission for Science, Technology, and Innovation (NACOSTI) was also pursued. Consent was secured from the County Director's TVET office before venturing into the field for data collection. Principals of the involved institutions were approached, the research's purpose was outlined, and

approval for the study was sought within their institutions. Before data collection, all respondents received a consent form, which ensured they were fully informed and willing to participate. The ethical measures safeguard participant rights and welfare, upholding the research process's integrity. The researcher did not pay anyone to participate in the study. However, voluntary involvement from the respondents was requested, and all respondents were asked to remain anonymous by being instructed not to write their names on the questionnaires. Since the researcher was not collecting data from vulnerable populations, each one gave their consent to participate in the study. Following respondent consent, the researcher personally distributed questionnaires, providing instructions for completion and emphasizing the importance of honest responses. Considering the brevity of the questionnaire, respondents should be able to complete it within 10-15 minutes. Subsequently, the researcher collected the issued questionnaires, ensuring they were handed in safely.

3.8 Data Analysis and Presentation

The study's data analysis process encompassed quantitative and qualitative data. According to Consortium (2021), data analysis involves the entire process from data collection to interpretation and processing. The study used closed-ended questionnaires to yield quantitative data. The data from interview schedules was recorded in narrative form from the respondents. After collecting the questionnaires and interview schedules from the field, the researcher checked them for completeness and accuracy.

The qualitative data was analyzed using the content analysis method facilitated by NVIVO analysis software. Every data source was examined carefully to capture all the content. Subsequently, inductive coding was utilized to explore further the relationships between the utilization of selected resources and academic performance in engineering courses, aligning with the open-ended format of interview schedule responses. The

thematic analysis was conducted to find patterns and relationships among the codes. These codes were then grouped into themes that best capture the essence of the data. Framework matrices promote comparisons across themes to identify relationships, inconsistencies, and variances. Taking notes at every stage guarantees that insights are recorded, which facilitates the detection of patterns and discrepancies. After that, NVIVO tools were used for data visualization, including cluster analysis, to identify themes' linkages. To improve understanding, the analyzed data was displayed using percentages and verbatim, as shown in Table 6.

Quantitative data from closed-ended questionnaires was coded and entered into Statistical Packages for Social Scientists (SPSS) version 29. Table 5 shows statistical analysis using frequencies, percentages, and regression analysis (Ongige, 2021). Inferential statistics were employed for analysis, and regression analysis was used to test the relationship between the utilization of selected resources and the academic performance of engineering courses in TVET institutions. It helped to look for the relationship between interval variables. (Saunders et al., 2007). The following is the regression model.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon \dots \dots \dots (1)$$

Where:

Y= Dependent Variable (Academic Performance),

X = Independent Variable (Utilization of resources)

β_0 = Constant Term; $\beta_1, \beta_2, \beta_3$ and β_4 = Beta coefficients

X_1 =Human Resource Utilization

X_2 = ICT Resource Utilization

X_3 = Material Resource Utilization

X_4 = Time Resources Utilization

ε = Error term

The findings are then presented using tables and narrations. The researcher draws conclusions based on the statistical tests and analyses and makes further research recommendations. The questionnaires and interview schedules were securely stored for one month before being shredded.

Table 5

Summary of Statistical Tests and Analysis of Objectives for Quantitative Data

Objectives	Independent Variable	Dependent Variable	Statistical Test	Presentation
To analyze the relationship between the utilization of human resources and academic performance in engineering courses in TVET institutions in Nakuru County, Kenya.	Utilization of Human resources	Academic Performance in Engineering Courses	Frequencies, Percentages, and Regression Coefficients	Tables
To determine the relationship between the utilization of ICT resources and academic performance in engineering courses in TVET institutions in Nakuru County, Kenya.	Utilization of ICT	Academic Performance in Engineering Courses	Frequencies, Percentages, and Regression Coefficients	Tables
To find out the relationship between the utilization of material resources and academic performance in engineering courses in TVET institutions in Nakuru County, Kenya.	Utilization of Material	Academic Performance in Engineering Courses	Frequencies, Percentages, and Regression Coefficients	Tables
To assess the relationship between the utilization of Time Resources and academic performance in engineering courses in TVET institutions in Nakuru County, Kenya.	Utilization of Time	Academic Performance in Engineering Courses	Frequencies, Percentages, and Regression Coefficients	Tables

Table 6*Summary of Statistical Tests and Analysis of Objectives for Qualitative Data*

Objectives	Independent Variable	Dependent Variable	Analysis	Presentation
To analyze the relationship between the utilization of human resources and academic performance in engineering courses in TVET institutions in Nakuru County, Kenya.	Utilization of Human resources	Academic Performance in Engineering Courses	Frequencies, Analysis of Themes and Content	Percentages and Verbatim
To determine the relationship between the utilization of ICT resources and academic performance in engineering courses in TVET institutions in Nakuru County, Kenya.	Utilization of ICT	Academic Performance in Engineering Courses	Frequencies, Analysis of Themes and Content	Percentages and Verbatim
To find out the relationship between the utilization of material resources and academic performance in engineering courses in TVET institutions in Nakuru County, Kenya.	Utilization of Material	Academic Performance in Engineering Courses	Frequencies, Analysis of Themes and Content	Percentages and Verbatim
To assess the relationship between the utilization of Time Resources and academic performance in engineering courses in TVET institutions in Nakuru County, Kenya.	Utilization of Time	Academic Performance in Engineering courses	Frequencies, Analysis of Themes and Content	Percentages and Verbatim

3.9 Ethical Considerations

According to Mugenda and Mugenda (2003), ethics is defined as a branch of philosophy that deals with one's conduct and guides one's behaviour. The study adhered to the ethical requirements of the Republic of Kenya, mainly due to the sensitive data obtained

from institutions. The study did not include any vulnerable population. The researcher sought consent from the principal to conduct the research with staff and students. Participants do not receive any financial incentives to maintain ethical standards. The researcher ensured informed consent and voluntary participation, as well as a consent letter explaining the study's goals, purpose, privacy, anonymity, potential risks, and data handling. Participants retain the right to decline participation at any stage.

Maintaining anonymity in the study involved excluding names from questionnaires, replacing institution names with codes during data analysis, and ensuring participant responses remain confidential, accessible only to the researcher, and stored securely. The study poses no risks because data collection occurred within the safe institutions for all respondents. The data was used solely for academic purposes, with the option of sharing the findings with interested participants. Lastly, the researcher fostered honest, transparent feedback to obtain accurate results.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND DISCUSSION

4.1 Introduction

This chapter presents the study's findings on the relationship between utilization of selected resources and academic performance in engineering courses in technical and vocational institutions in Nakuru County, Kenya. The results were structured into six sections, including questionnaire return rates, characteristics of the respondents, and the relationship between academic performance and utilization of human, ICT, material, and time resources. The data was collected by administering close-ended questionnaires and interview schedules to the respondents. The study used frequencies, percentages, and regression analysis to describe the responses to the independent and dependent variables of the study.

4.2 Response Rates

The study used four instruments to gather data: questionnaires for students and technicians and interview schedules for administrators (principals, deputy principals, and heads of departments). The sample size comprised 331 trainees, 11 technicians, and 22 administrators (11 heads of departments, 7 deputy principals, and 4 principals). Closed-ended questionnaires were distributed to trainees and technicians, while interview schedules were given to administrators (principals, deputy principals, and the heads of departments). The number of questionnaires filled out and returned for each sample group is summarized in Table 7.

Table 7*Instruments Return Rate*

Instruments	Administered	Returned	Returned rate percentage
Students' Questionnaire	331	262	79.2
Technicians' Questionnaire	11	10	90.9
Administrators' Interview schedule	22	18	93

Table 7 shows the response rates for the questionnaires and interview schedules returned for different respondents. Questionnaires were administered to 331 students, and 262 (79.2%) were returned. The return rates for the technicians were 10(90.9%) out of 11. The response rate for administrators (principals, deputy principals, and HoDs) interview guides was 18 (93%) out of 22. The results indicate that the return rates of the instruments issued to trainers, technicians, students' questionnaires, and administrators' interview schedules were above 73.6%. This is evidence that the research did not suffer from low instrument return rates (McLeod, 2018). The data gathered using these tools was deemed adequate for the investigation as they were above the 60 % "good" mark set by (Eduwem & Ekoiso, 2021).

The high number of respondents who participated indicated a comprehensive overview of the study. A high response rate aided the researcher in getting an unbiased estimate of a phenomenon under study(Pius et al., 2021). According to Fulton (2018), a low response rate may undermine the sample's representativeness of the population attributes. A high response will enable this study's findings to be generalized to the target populations.

4.3 Reliability Analysis

The scores from the two tests in the pilot study were analyzed to check for consistency in responses from students and technicians, as well as administrators' interview schedules. The Pearson Product Moment correlation coefficient (PPMC) was calculated to determine how consistent the responses were when the instruments were administered. The initial test scores were compared with the final test scores. For the entirety of the test-retest period, this reliability test presumes that the quality or construct tested remains unchanged (Mugenda & Mugenda, 2003). According to Revelle and Condon (2019), the stability and consistency of measurements are the main aspects of reliability. The test-retest approach was used to measure reliability, which assesses the consistency of outcomes across items within a test. Table 8, Table 9 and Table 10 show the test results.

Table 8

Reliability of Student Instruments

Variable	N	Pearson Moment Correlation Coefficient	Decision
Utilization of Human resources	10	0.9285	Reliable
Utilization of ICT Resources	10	0.7667	Reliable
Utilization of Material Resources	10	0.7514	Reliable
Utilization of Time Resources	10	0.9821	Reliable

Table 9*Reliability of Technician Instruments*

Variable	N	Pearson Moment Correlation Coefficient	Decision
Utilization of Human resources	10	0.7478	Reliable
Utilization of ICT Resources	10	0.7332	Reliable
Utilization of Material Resources	10	0.7828	Reliable
Utilization of Time Resources	10	0.7446	Reliable

Table 10*Reliability of Administrators Instruments*

Variable	N	Pearson Moment Correlation Coefficient	Decision
Utilization of Human resources	10	0.7839	Reliable
Utilization of ICT Resources	10	0.7604	Reliable
Utilization of Material Resources	10	0.7522	Reliable
Utilization of Time Resources	10	0.7305	Reliable

The tests indicated a correlation coefficient of more than 0.7305 for all variables in all instruments, as indicated in Table 8, Table 9, and Table 10. These suggest that the instruments were of sufficient quality for data collection. The items in the instruments remained unchanged, indicating that an internal reliability coefficient above 0.7 is acceptable (Mugenda & Mugenda, 2003).

4.4 Demographic Characteristics

The researcher sought to establish the general and demographic information of the respondents who participated in this study to understand the study variables fully. In general information, the researcher sought to know the background information of all the

respondents. Before testing the study hypotheses, the characteristics of the respondents were analyzed as described in the subsequent sections. This study included three respondent groups: administrators, technicians, and students. Korir (2022) argues that examining the characteristics of a study sample group is crucial as it gives a better insight into the context in which the study was conducted.

4.4.1 Characteristics of the Students

This study collected data regarding respondents' general characteristics. The information was grouped according to program of study, year of study, co-curricular activities, and age. The attributes of the students are summarized in Table 11.

Table 11

Characteristics of the Students

Scale	Characteristic	Frequency	Percentage
Program of Study (n=262)	Electrical and Electronic	105	40
	Automotive	20	8
	Mechanical	11	4
	Building and Civil	126	48
Year of Study (n = 262)	Module 1	22	8.4
	Module 2	101	38.5
	Module 3	118	45.0
	TEP	21	8.0
co-curricular Activities (n = 262)	Yes	153	58
	No	109	42
Age in Years (n = 262)	Under 20	30	11.5
	21 – 22	158	60.5
	23 – 25	64	24.5
	Over 25	10	3.4

Table 11 indicates that (40%) of students were electrical and electronics engineering students, (8%) were automotive engineering students, (4%) were mechanical engineering students, and (48%) were civil engineering students. The program's findings indicate the spread of data collected from various engineering disciplines in the institution. This

spread will enable the collection of vast information on resource utilization. From Table 11, (11.5%) of respondents were below the age of 20, (60.5%) were between the ages of 20-22, while (24.5%) were of age 23-25, and (3.4%) were over the age of 25. The majority (88.4%) of students were of age above 20. A higher percentage (83.4%) of the students were in modules 2 and 3, indicating maturity and experience to give accurate and correct information about the utilization of resources. This aligns with the study by Chang et al. (2019), who said that age influences the accuracy of responses and that mature respondents give more accurate information. Of the responses, (58%) participated in co-curricular activities as a talent or for physical fitness. This is in line with Anjum (2021), who said that co-curricular activities contribute to the success of students' lives, including students' conduct, academic performance, test scores, regular attendance, and self-image.

The students' characteristics imply a broad and reliable analysis of how resource utilization impacts academic performance across engineering courses. The diversity in disciplines allows for comprehensive insights into varying resource needs. At the same time, the maturity and experience of students suggest that the data collected is credible and reflects accurate perceptions of resource utilization. Additionally, the active participation of students in co-curricular activities points to a well-rounded student experience, indicating that factors beyond academics, such as engagement in extracurriculars, may also play a role in enhancing academic outcomes. These factors strengthen the overall reliability and relevance of the findings.

4.4.2 Characteristics of Technicians

The information was grouped according to gender, age, and years of service in the institutions and departments they worked in. Table 12 summarizes the technicians' attributes.

Table 12*Characteristics of the Technicians*

Scale	Characteristic	Frequency	Percentage
Gender (n = 10)	Male	8	80.0
	Female	2	20.0
Age (n = 10)	10 - 29 years	2	20.0
	30 – 39 years	3	30.0
	40 – 49 years	2	20.0
	50 years and above	3	30.0
Years of service (n = 10)	Less than 5 years	3	30.0
	5 - 10 years	4	40.0
	16 years and above	3	30.0
Department (n = 10)	Mechanical engineering	2	18.2
	Electrical engineering	3	36.4
	Building and civil engineering	3	27.3
	agricultural engineering	2	18.2

In Table 12, (80%) of the technicians were male, while (20%) were female. This finding suggests that gender diversity affects approaches to resource utilization. This concurs with Reddy and Jadhav (2019), who state that gender diversity leads to more creative problem-solving and resource management. The results also indicate that (20%) of the respondents were below the age of 29, (30%) were between 30-39, (20%) were between 40-49, and (30%) were 50 years and above. The respondents who had worked for less than 5 years were (30%), 5-10 years (40%), and 16 years or more (30%). Mechanical engineering experts were (18.2%), electrical and electronic experts (36.4%), building and civil engineering experts (27.3%), while (18.2%) were agricultural engineering experts. By including diverse voices, the study captures a broader representation of the population's challenges and preferences (Husband, 2020).

4.4.3 Characteristics of Administrators

The administrators comprised principals, their deputies, and HoDs. Table 13 shows the characteristics examined: gender, age, and years as institution administrators.

Table 13

Characteristics of the Administrators

Scale	Characteristic	Frequency	Percentage
Category of administrator (n = 18)	Principal	4	22.2
	Deputy	7	38.9
	HoD	7	38.9
Gender (<i>n</i> = 18)	Male	16	88.9
	Female	2	11.1
Age (<i>n</i> = 18)	Under 30 years	2	11.1
	31 – 40 years	7	38.9
	41 – 50 years	8	44.4
	51 and above years	1	5.6
Duration as institution head <i>n</i> = 18	Less than 5 years	1	5.6
	5 – 10 years	4	22.2
	11 – 15 years	9	50.0
	16 and above years	4	22.2

Based on Table 13, the administrators comprised principals (22.2%), deputy principals (38.9%), and HoDs (38.9%). Administrators (11.1%) were female, while (88.9%) were male. The distribution of administrators, particularly deputy principals and heads of departments, implies a collaborative leadership structure that can enhance resource utilization and decision-making, positively impacting academic performance. Respondents below the age of 30 (11.1%), between age 31-40 (38.9%), between age 41-50 (44.4%), and 50 years and above (5.6%). The age distribution of respondents indicates a predominance of individuals between 41-50 years, suggesting that the study benefits from the perspectives of more experienced participants. This experience can

enhance the understanding of resource utilization and its impact on academic performance. According to Castro and Isaacowitz (2019), age influences the accuracy of responses as they provide valuable insights. The administrators who have worked for less than 5 years (5.6%), 5-10 years (22.2%), 11-15 years (50%), and 16 years or more (22.2%). The administrators' work experience of 11-15 years of tenure provided valuable institutional knowledge that enhanced resource utilization and decision-making. According to Mummolo and Peterson (2019), the duration of a respondent's employment at a school may not influence the quality or relevance of their input, as their answers are based on personal experience rather than tenure.

4.4.4 Students' Academic Performance

TVET institutions administer national examinations through the Kenya National Examinations Council (KNEC). Upon release to the institutions, the KNEC results are analyzed by each department within the institution and presented in tables and percentages. During data collection, the Heads of Departments (HoDs) in engineering provided data on students' academic performance who passed between 2020 to 2023. The mean percentage pass for each year was calculated and subsequently aggregated to form the overall percentage pass for the period, as illustrated in Table 14.

Table 14

Student's Academic Performance for the Years 2020 to 2023

Year	N	Percentage mean pass	SD
Performance in 2020	10	36.5	6.17
Performance in 2021	10	33.52	9.07
Performance in 2022	10	42.85	11.30
Performance in 2023	10	44.41	6.53
Average performance for the four years	10	38.73	5.84

Table 14 indicates that the performance data from 2020 to 2023 highlights a significant issue with students' academic achievement in engineering courses within TVET institutions in Nakuru County. The average pass rate of 38.73% over the four years, below the Kenya National Examinations Council (KNEC) pass mark of 40%, confirms the high failure rates highlighted in the study's problem of low performance. In 2020 and 2021, the pass rates were particularly low, standing at 36.5% and 33.52%, respectively.

These figures reflect a critical challenge, as most students fail to meet the minimum required standards. This failure contributes to issues such as increased dropout rates, added financial burdens on the government and stakeholders, and an insufficient supply of skilled workers in the engineering field, which threatens the achievement of Kenya's Vision 2030 goals. While there was some improvement in the pass rates in 2022 and 2023, reaching 42.85% and 44.41% respectively, these gains were marginal and insufficient to indicate a resolution of the underlying issue. The slight gains above the 40% pass mark do not represent a significant shift, as nearly 60% of students continue to underperform.

Furthermore, the variability in the data, as shown by the high standard deviations in 2022 (SD = 11.30) and 2023 (SD = 6.53), indicates that the improvement is uneven, with many students still struggling to meet basic academic requirements. Temporary adjustments, rather than a fundamental change in resource utilization, may have contributed to the rise in pass rates in the latter two years. The study's objectives focus on analyzing the relationship between the utilization of selected resources (human, ICT, time, and material) and academic performance. The data indicates that the effective use of these resources to enhance learning outcomes remains a challenge. Even with the slight upward trend in performance, the institutions have not achieved consistent improvements in engineering students' academic success. The continued low average

pass rate over the four years confirms that resource challenges remain a barrier to optimal performance, demonstrating that, despite recent increases, the fundamental issues affecting student achievement are still prevalent.

4.5 Descriptive Statistics

The following information shows data on the utilization of human resources, ICT resources, material resources and time resources provided by the respondents. It includes descriptive statistics from students and technicians and qualitative analysis from administrators (principals, deputy principals, and H.O.Ds).

4.5.1 Students' Descriptive Statistics on Utilization of Human Resources

Data on the utilization of human resources was analyzed using frequencies and percentages from the students. They rated how frequently students responded to the trainer's 10 specified responsibilities based on a scale: Never (NE), Rarely (RA), Sometimes (ST), Frequently (FR), and Always (AL). During data interpretation, the Likert scale categories were combined into high (Always, Frequently) and low (Sometimes, Rarely, Never) engagement levels to simplify data interpretation, enhance statistical power, improve result clarity, and emphasize practical relevance. This combination is critical, as high engagement is essential in engineering practices; low engagement can adversely impact academic performance, underscoring the need for consistent resource utilization. Table 15 presents a summary of their responses.

Table 15*Students' responses to items on the Utilization of Human Resources*

Item	N	AL	FR	ST	RA	NE
Trainers attend lessons	262	49.8	28.7	15.1	5.3	1.1
Trainers assess learners as and when required	262	33.5	20.8	28.7	9.8	7.2
Trainers ensure the workshop is prepared for practical before lessons	262	36.0	11.7	22.7	14.4	15.2
Trainers plan for relevant academic trips	262	11.0	5.7	12.9	17.0	53.4
Trainers provide course outlines	262	55.8	14.0	15.8	5.7	8.7
Trainers give feedback on performance in examinations	262	38.5	15.5	19.6	7.5	18.9
Trainers provide academic advice to support studies	262	34.8	13.3	23.9	14.4	13.6
Training lessons are interactive	262	37.4	18.1	27.9	10.9	5.7
Trainers provide relevant learning materials	262	30.0	14.6	24.0	13.8	17.6
Trainers supervise students' projects	262	43.7	20.5	19.8	5.4	10.6

Table 15 indicates that a portion (21.5%) of the students reported that trainers do not attend lessons regularly. This inconsistency in attendance has significant implications for the learning process. According to Kassarnig et al. (2018), regular attendance by trainers is crucial for maintaining learning continuity and improving academic performance. Inconsistent attendance disrupts the learning process, potentially causing gaps in students' understanding and engagement with the course material. Institutions must ensure that trainers maintain consistent attendance to provide students with a steady learning experience. However, a considerable number (78.5%) of students reported that

trainers always attend lessons, suggesting that some trainers maintain a regular teaching schedule, which positively impacts learning outcomes.

A percentage (45.7%) of the students indicated that trainers do not assess them as required. The lack of regular assessments is detrimental to students' academic progress as it limits their ability to receive timely feedback on their performance. Brown (2019) emphasizes that formative assessments are key in guiding students through personalized learning experiences. Without frequent assessments, students may be unable to identify their areas of strength and weakness, hindering targeted improvement and academic achievement. Nevertheless, 54.3% of the students reported that trainers regularly assess learners as required, indicating that some trainers adhere to effective assessment practices.

The findings show that a large number (52.3%) of the students reported that trainers did not ensure the workshops were prepared for practical lessons. This lack of preparation compromises the effectiveness of practical lessons, which are critical in technical education. Le and Do (2019) highlight the importance of well-prepared practical sessions in developing students' hands-on skills. The absence of workshop preparedness limits students' opportunities to apply theoretical knowledge in real-world scenarios, diminishing the quality of their education. However, a proportion (47.7%) of students reported that trainers consistently ensure workshop preparedness, which facilitates better hands-on learning experiences for those students.

A significant number (83.3%) of students reported that trainers rarely or never plan academic trips. Academic trips provide students with essential experiential learning opportunities, enabling them to apply theoretical knowledge to real-world contexts. According to Carbone et al. (2020), such trips enrich learning experiences and enhance students' comprehension and retention of course material. The lack of academic trips

limits students' exposure to practical learning environments, which negatively impacts their overall learning experience. On the other hand, a small number (16.7%) of the students reported that their trainers plan relevant academic trips, offering some students experiential learning opportunities.

A considerable number (30.2%) of students indicated that they do not receive course outlines consistently. Course outlines are essential for providing students with a clear understanding of course objectives, content, and expectations. Marquis et al. (2017) found that clear course outlines help students plan their studies effectively, manage their time, and stay focused on key concepts. The absence of regular course outlines may lead to confusion and poor time management, negatively impacting academic performance. However, 69.8% of the students reported receiving course outlines regularly, aiding their academic planning and goal setting.

The findings reveal that a considerable proportion (46%) of the students reported not receiving regular feedback on their examination performance. Timely feedback is essential for helping students understand their performance and make necessary improvements. Olave-Encina et al. (2021) highlight that feedback is critical in guiding student learning and enhancing academic achievement. Without regular feedback, students may struggle to identify their weaknesses and improve their learning strategies. Nonetheless, a percentage (54%) of the students indicated that they receive feedback on their examinations consistently, which supports their academic development.

A significant percentage (51.9%) of students reported that they rarely or never receive academic advice from their trainers to support their studies. Academic advising is critical for helping students navigate their educational journey, make informed decisions, and stay motivated. Gogates (2024) asserts that students who receive regular academic advice are better equipped to make decisions that positively impact their academic performance.

The lack of consistent academic advice may lead to poor decision-making, reduced motivation, and lower academic achievement. On the other hand, a proportion (48.1%) of students indicated that they receive academic advice regularly, which supports their educational progression and decision-making.

The findings show that a considerable percentage (44.5%) of students reported that their lessons were only occasionally interactive. Interactive lessons are essential for fostering active learning and critical thinking, which are crucial for academic success. Ullah and Anwar (2020) emphasize that interactive lessons engage students more deeply in learning, leading to better comprehension and academic outcomes. Without interactive teaching, students may become passive learners, which limits their engagement and understanding of course material. In contrast, more than half (55.5%) of the students indicated that their lessons are always interactive, promoting active participation and deeper learning.

A significant number (55.4%) of students reported not receiving relevant learning materials consistently. Access to relevant learning materials is critical for enabling students to engage with course content effectively. This is in line with Miller (2019), who notes that a lack of learning resources can hinder students' understanding of complex concepts, leading to lower academic performance. The inconsistent provision of learning materials places students at a disadvantage, limiting their ability to study effectively and grasp course content. Conversely, a number (44.6%) of the students reported receiving learning materials regularly, which enhances their ability to engage with course material.

The findings reveal that a moderate (35.8%) of students reported inconsistent supervision of their projects which indicated that trainers never supervise students' projects. Adequate supervision is crucial for ensuring that students apply theoretical knowledge

effectively in their projects, as emphasized by (Stevenson et al., 2020). Poor supervision can lead to substandard project outcomes and limit students' ability to develop practical skills. In comparison, a number (64.2%) of students indicated that their trainers consistently supervise their projects, providing valuable guidance and support for their practical work.

4.5.2 Technicians' Descriptive Statistics on Utilization of Human Resources

Technicians in TVET institutions work closely with trainers to conduct practical lessons. Trainers schedule these lessons and instruct technicians to prepare materials and set up equipment. Since trainers lead the practicals, technicians are well positioned to observe and report on trainers' performance. The technicians provided data on human resources utilization, which was also analyzed. They were asked to rate how frequently trainers performed 10 responsibilities as instructors.

The rating was done using the scale Never (NE), Rarely (RA), sometimes (ST), Frequently (FR), and Always (AL). During data interpretation, the Likert scale categories were combined into high (Always, Frequently) and low (Sometimes, Rarely, Never) engagement levels to simplify data interpretation, enhance statistical power, improve result clarity, and emphasize practical relevance. This combination is critical, as high engagement is essential in engineering practices; low engagement can adversely impact academic performance, underscoring the need for consistent resource utilization. Their responses were summarized using frequencies and percentages, as indicated in Table 16.

Table 16*Technicians' Responses to Items on Utilization of Human Resources*

Item	N	AL	FR	ST	RA	NE
Trainers attend lessons	10	33.4	25.6	20.7	10.3	10
Trainers assess learners as and when required	10	45.4	36.4	18.2	-	-
Trainers ensure the workshop is prepared for practicals before lessons	10	36.3	18.2	36.4	-	9.1
Trainers plan for relevant academic trips	10	36.4	27.2	9.1	-	27.3
Trainers provide course outlines	10	60.0	20.0	10.0	-	10.0
Trainers give feedback on performance in examinations	10	54.5	27.3	9.1	-	9.1
Trainers provide academic advice to support studies	10	27.3	45.4	9.1	18.2	-
Trainers' lessons are interactive	10	54.5	36.4	9.1	-	-
Trainers provide relevant learning materials	10	66.7	11.1	11.1	11.1	-
Trainers supervise students' projects	10	54.5	9.1	27.3	9.1	-

Based on Table 16, technicians (41%) reported that trainers do not attend lessons. The findings reveal a lack of consistent attendance by trainers. This inconsistency disrupts the learning process and negatively affects students' academic performance. Werang et al. (2019) emphasize that consistent teacher attendance is essential for enhancing student performance, providing stability and ongoing instructional support. Irregular attendance hinders students from maintaining academic momentum, contributing directly to low performance in engineering courses. Technicians (59%) reported that trainers attend lessons frequently or always.

A significant portion (18.2%) of technicians noted that trainers do not consistently assess learners as and when required. The lack of regular assessments prevents students from receiving timely feedback, essential for their academic progress. Qadir et al. (2020) argue that regular formative assessments are crucial for improving student performance,

especially in engineering education. When assessments are not conducted regularly, students lack critical insights into their performance, which affects their ability to identify areas for improvement. Technicians (81.8%) also reported that trainers assess learners frequently or always.

On workshop preparedness, a considerable (45.5%) of technicians indicated that trainers do not prepare workshops for practicals before lessons. This unpreparedness of workshops negatively impacts the hands-on learning experiences crucial in engineering education. Practical lessons provide opportunities for students to apply theoretical knowledge, and without adequate preparation, these opportunities are missed. Kintu et al. (2019) support this finding, noting that practical readiness is necessary for developing skills critical for industrial training and future employment. However, Technicians (54.5%) indicated that trainers ensure workshop preparedness frequently or always.

Technicians (36.4%) indicated that trainers never plan academic trips, which are essential for providing students with real-world learning experiences. The failure to plan academic trips limits students' exposure to practical applications of engineering concepts, affecting their ability to contextualize theoretical knowledge. Chavan and Carter (2018) highlight the importance of experiential learning in enhancing student performance, noting that such experiences deepen students' understanding and improve academic outcomes. Notably, technicians (63.6%) reported that trainers plan academic trips frequently or always.

Trainers do not provide course outlines, a percentage (20%) of technicians reported that trainers fail to do so. Course outlines are vital for guiding students through the semester, ensuring that they understand the course structure, objectives, and expectations. Without clear outlines, students may struggle to organize their studies effectively, leading to gaps in understanding and poor academic performance. Stephen and Rockinson-Szapkiw

(2021) argue that course outlines enhance students' self-regulation, which is critical for academic success. A significant portion (80%) of Technicians also indicated that trainers provide course outlines frequently or always.

Feedback on examination performance is another area with significant gaps, as a percentage (18.2%) of technicians reported that trainers rarely provide feedback. Without feedback, students cannot accurately assess their progress or identify areas for improvement. The findings agree with Kim and Lee (2019), who concluded that verbal feedback impacts students' self-assessment accuracy, emotional responses, and self-efficacy. It implies that positive feedback leads to higher self-assessment scores, positive emotions, and self-efficacy than negative feedback, though negative feedback improves self-assessment accuracy. In comparison, technicians (81.8%) reported that trainers provide feedback on examination performance frequently or always.

Trainer's provision of academic advice to support studies is inconsistent, with a number (18.2%) of technicians stating that trainers rarely offer academic support, while (9.1%) reported that such advice is only offered occasionally. Regular academic advising is critical for helping students navigate their studies and address challenges, and the absence of this support can negatively impact student performance. Idrus et al. (2018) emphasize that academic advising plays a key role in guiding students toward academic success, particularly in complex and demanding fields like engineering. However, Technicians (72.7%) also reported that trainers provide academic advice frequently or always.

A notable portion (22.2%) of technicians reported that trainers fail to provide relevant learning materials. Learning materials are essential for effective learning, as they help students engage with the course content and reinforce key concepts. Bukoye (2019) highlights that the availability of instructional materials significantly impacts student

performance, and the lack of these resources can hinder students' ability to succeed academically. On the other hand, technicians(77.8%) indicated that trainers provide relevant learning materials frequently or always.

Project supervision is inconsistent, with a considerable number (36.4%) of technicians stating that trainers do not consistently supervise students' projects. Proper supervision is essential for ensuring that students can apply theoretical knowledge in practical projects, which is a key component of engineering education. Rees et al. (2020) argue that active supervision is crucial for enhancing student engagement and improving academic performance. Conversely, technicians(63.6%) reported that trainers supervise student projects frequently or always.

A percentage(9.1%)of technicians indicated that trainers do not consistently conduct interactive lessons. Interactive teaching methods promote active student engagement and improve learning outcomes, making their absence detrimental to academic performance. Tuma (2021)stresses that interactive learning environments foster greater student participation, which is crucial for understanding complex subjects like engineering. On the other hand, Technicians (90.9%) also reported that trainers conduct interactive lessons frequently or always.

4.5.3 Administrators' Qualitative Responses to Utilization of Human Resources

The administrators implemented a variety of strategies to guarantee class attendance, although they continue to encounter issues with trainers missing lessons. Among the strategies is the use of monitoring tools such as random checks, impromptu visits, attendance registers, class representative reports, and records of work (83.3%). The other strategies that were implemented included the timely preparation of the timetable (11.1%) and the availability of instructional materials (22.2%). One of the principals from Institution R stated, *"We occasionally carry out random checks and use attendance*

registers to confirm that trainers are in class as scheduled; however, we believe that trainers take responsibility for attendance as per the timetable.” Although administrators assume trainers meet this responsibility, quantitative data reveals a gap, with 21.5% of students and 41% of technicians reporting inconsistent trainer attendance. This inconsistency may reduce student's motivation and engagement which is crucial for academic success. These findings align with Hejji Alanazi (2019) who highlights how obstacles like unclear monitoring hinder pre-service teachers' lesson planning, ultimately impacting academic performance.

On the assessment of students and the entry of all marks into the system for students to monitor their progress, the administrators observed that despite employing various strategies, scores and classes remain unassessed. They informed the researcher that the strategies involved verifying the assessment process by reviewing examination attendance and marks sheets, class representative reports, and conducting impromptu visits to classes during the assessment (50.0%). It also involved the implementation of academic policy by preparing assessment timetables, setting, moderating, and submitting examinations; validating results (33.3%); and building the assessment capacity of trainers through training (16.7%). The deputy principal from Institution T noted, *"We sometimes check exam attendance and conduct spot checks during assessments to ensure everything is running smoothly."* The quantitative data reveals that students (45.7%) and technicians (18.2%) reported incomplete assessments. This suggests a need for clearer communication and expectations around assessment practices. Avcı and Ergün (2022) assert that students must be accustomed to navigating complex processes to obtain and share reliable information. The lack of consistent assessments could hinder students' ability to gauge their understanding and progress, negatively impacting their academic outcomes.

Ensuring timely preparation of workshop practical is among the responsibilities of institution administrators because of the key role of hands-on experiences in imparting skills to trainees. An analysis of the administrators revealed that they ensured this by planning, including the practical sessions in the timetable, setting the objectives and outcomes (33.3%), providing resources (50.0%), and conducting inspections to confirm everything was in place (27.8%). They observed that the timely preparation of workshops before classes commence is hindered by the release of government capitation, procurement processes, and monitoring of workshop preparedness. *"We strive to obtain the necessary materials for the workshops during the practical lessons, but the procurement process is tedious, and we only receive training materials after classes have commenced,"* said a department head from Institution R.

These findings agree with students (52.3%) who noted that trainers do not ensure workshop preparedness consistently, and technicians (45.5%) confirm that trainers do not prepare workshops before practical lessons. Mohzana et al. (2023) underscore the impact of resource availability on practical activities, suggesting that improper resource management could impede the learning process. Inadequate workshop preparedness can result in ineffective learning experiences, reducing students' engagement and their ability to apply theoretical knowledge to practical situations and thus affecting their overall performance.

Overseeing planning for academic trips is among the duties of institution administrators. They carried out this oversight function by interacting with trainers, coordinators, Heads of Departments, and industry (50.0%), ensuring that the trip aligned with the curriculum, learning objectives, and outcomes, and specifically targeted learning areas that needed reinforcement (50%). Several administrators reported receiving complaints from students who felt that the industries they visited did not align with the courses they were

taking. This indicates a deficiency in the administrators' ability to oversee the entire process. A deputy principal from institution S highlighted this: *"The trip coordinator is responsible for organizing academic trips. We sometimes strive to have collaborations with industry that align with the curriculum objectives."* The quantitative data indicates that a significant number of students (83.3%) reported that trainers rarely plan such trips, highlighting the importance of experiential learning opportunities, whereas a significant proportion (34.4%) of technicians stated that they hardly or never planned trips.

Nawi and Azmi (2018) affirm that effective educational field trips should follow a structured strategy, suggesting that they enhance students' engagement and learning outcomes. The lack of academic trips could diminish students' exposure to real-world applications of their studies, which can limit their practical understanding and reduce the overall effectiveness of their education.

During the interview, the administrators also deliberated on the importance of timely preparation of course outlines. They reported achieving this by delegating responsibilities to HoDs (11.1%), providing resources to trainers (22.2%), setting deadlines for submission (38.9%), and monitoring to ascertain that these directives were adhered to (44.4%). During the internal quality audit and quality assurance, it became evident that some classes were missing these crucial documents from their records. A principal from institution R said, *"We often give deadlines for submitting course outlines; however, mechanisms need to be put in place to ensure these deadlines are adhered to and records of documents submitted to students and HoDs are available."*

The students (30.2%) and technicians (20.0%) indicated they do not receive course outlines regularly. According to Farrell and Ashcraft (2024), course outlines help students anticipate their term expectations, emphasizing the importance of communication in ensuring students are well-prepared. The inconsistent availability of course outlines can

lead to confusion and lack of direction for students, potentially resulting in lower academic performance due to inadequate preparation for assessments and projects.

The administrators occasionally verified whether trainers were providing students with feedback on their examination performance to aid in their learning. The strategies used by the administrators to ensure this included encouraging trainers to return marked scripts and upload marks in the students' portal (55.6%), using monitoring tools (complaints, examination audits, class conferences) (16.7%), holding staff examination analysis meetings (16.7%), and giving guidelines on how to provide feedback to learners (16.7%). During the interview, it was highlighted that feedback was done, though not to satisfactory levels. There was a need to monitor these activities to enhance student confidence and, in the long run, improve student performance.

The head of a department from Institution U stated, *"We monitor how trainers provide feedback through examination audits, though there are still non-conformities of trainers not giving feedback to students. The issue of missing marks is still a concern."* The qualitative data supported the findings, revealing that students (46%) and technicians (81.8%) reported inconsistent feedback. Armson et al. (2019) discussed the importance of effective feedback that blends process and content skills, suggesting that relationship-building and communication techniques could enhance the feedback provided to students. The absence of timely and constructive feedback can hinder students' ability to identify areas for improvement, ultimately impacting their academic progress and overall performance.

The administrators reported that learners had limited access to guidance and counseling services (72.2%). Strategies put in place for students to access the services included organized forums for discussing academic issues (50.0%) and inviting motivational speakers and experts (22.2%) to speak to students on academic advice for

their studies. Some administrators mentioned that they occasionally organize support forums within their institutions, however, they have a challenge of resource-intensive nature and the challenge of reaching out to the entire population. As noted by the deputy principal from Institution T, "*We once in a while organize forums where students can discuss their academic issues; however, a small proportion of students attend these forums.*" According to the quantitative data, 51.9% of students and 36.4% of technicians reported that they rarely receive such advice. Xerri et al. (2018) affirm that teacher-student relationships are crucial for academic engagement, suggesting that enhancing these relationships could lead to improved support for students. The limited availability of academic advice can prevent students from receiving guidance on their studies, which may lead to confusion and a lack of focus on their academic goals and thus affect their performance.

The administrators also played a role in encouraging interactive learning during lessons by promoting the adoption of student-centered teaching methods such as practical, group work, question and answer, and role play (94.4%), integration of ICT in instruction (11.1%), and creating a conducive environment where all students can participate in learning (11.1%). Administrators mention they remain unimplemented due to limited resources, an intensive curriculum, and exam-focused training. "*We occasionally encourage the use of group work, practicals, and role-playing to make learning more engaging, but we never practice it due to a lack of resources and congested programs that do not give learners and trainers adequate time to prepare,*" said one of the principals from institution R. The quantitative data supports these findings, as a significant number of students (44.5%) and a portion of technicians (9.1%) reported that trainers rarely used interactive techniques. Tuma et al. (2021) propose that enhancing engagement through active learning can significantly improve educational outcomes,

indicating that further emphasis on interactive methods is necessary. The lack of interactive learning strategies can lead to decreased student motivation and engagement, potentially resulting in poorer academic outcomes.

The administrators participated in ensuring learning materials were available for students. The mechanisms they implemented to ensure this included budgeting and timely purchasing (61.1%), encouraging innovation, borrowing, and sharing, when necessary (11.1%), writing correct specifications of required items (38.9%), and using ICT to enhance procurement processes (16.7%). There is still a challenge in budgeting, correct specifications, and procurement of training materials on time. A department head from Institution R expressed, *"We strive to secure resources by closely collaborating with the procurement department to guarantee timely delivery and availability of learning materials."*

The quantitative data supports this finding; 55.4% of students reported unavailability of materials, and 22.2% of technicians indicated that there are challenges faced in accessing necessary training materials. (Milligan et al., 2019) highlight the importance of learning materials in effective teaching, suggesting that addressing material availability could enhance the overall educational experience. Inadequate access to learning materials can severely limit the quality of instruction and learning, negatively impacting students' ability to perform academically.

Data from administrators' interviews revealed that they supervised class projects through the trainers to ensure they were aligned with objectives. They accomplished this by supervising project design and planning (27.2%), guaranteeing the presence of competent trainers (27.2%), and keeping track of project progress and milestones (22.2%). The implementation of these strategies remains a concern, as the quality and completeness of projects suffer due to inadequate supervision. There should be a

monitoring policy and guidelines in place to guarantee effective supervision of all students working on projects. A deputy principal from Institution U reported, "*We still struggle with the implementation of strategies of supervising projects, and we periodically ensure that student projects are aligned with course objectives and that progress is monitored by trainers regularly.*" The quantitative findings corroborate these findings, revealing that 35.8% of students reported insufficient supervision of their projects, while 36.4% of technicians reported a negative impact on project quality due to inconsistent oversight.

Lau et al. (2018) argue that improving project supervision can foster better learning outcomes. Honig and Rainey (2019) also emphasized that effective mentoring is crucial for self-directed learning, suggesting that administrators should enhance their mentoring practices to support students better. Poor supervision of projects can lead to subpar student outcomes; insufficient guidance may prevent students from fully understanding project objectives and standards, adversely affecting their overall academic performance.

4.5.4 Students' Descriptive Statistics on Utilization of ICT Resources

The second objective examined the relationship between ICT utilization and academic performance. ICT utilization was determined using data provided by the technicians and students and qualitative analysis from administrators (Principals, Deputy principals, H.O. Ds).

The trainers were asked to indicate how much ICT was used in teaching trainees using a 4-point scale: 4 = All, 3 = Many, 2 = Few, and 1 = None. A set of 10 closed-ended items was used to collect this data. During data interpretation, the Likert scale categories were combined into more (All, Many) and less (Few, None) engagement levels to simplify data interpretation, enhance statistical power, improve result clarity, and emphasize practical relevance. This combination is critical, as high engagement is essential in

engineering practices; low engagement can adversely impact academic performance, underscoring the need for consistent resource utilization. The trainers' responses to the items were scored, and their means were calculated and transformed into the utilization of ICT. Table 17 shows findings in percentage.

Table 17

Students' Responses to Items on Utilization of ICT Resources

Item	N	All	Many	Few	None
Students use ICT to access information for learning activities	262	23.8	20.0	31.3	24.9
Students use simulations to understand complex engineering concepts	262	13.1	20.8	41.5	24.6
Students communicate with peers using ICT platforms	262	12.9	15.2	29.7	42.2
Students communicate with instructors using ICT platforms	262	13.7	18.8	24.4	43.1
Students use ICT tools to discuss coursework	262	14.1	20.7	28.1	37.1
Students use e-libraries when studying	262	14.7	23.0	26.1	36.2
Students use mobile learning applications to supplement what is learned in the classroom	262	33.8	31.2	18.1	16.9
Students access academic performance reports using ICT tools	262	22.2	18.3	22.5	37.0
Students use ICT conferencing tools to attend institutional meetings	262	10.7	13.6	27.2	48.5
Students use relevant engineering software in the learning process	262	19.2	23.1	30.2	27.5

As indicated in Table 17, the data reveal significantly low levels of ICT utilization among students for learning, which could have important implications for their academic

performance and professional readiness in engineering. A significant number (56.2%) of students reported that they do not use ICT to access information for learning activities, suggesting that many students are missing out on valuable digital resources. This finding aligns with Lavrentieva et al. (2019), who assert that students can utilize modern ICT tools, including digital textbooks and simulations, to develop comprehensive self-directed learning materials. The low response indicates that students may not be adequately trained or encouraged to use these tools. Factors such as limited access to technology, lack of awareness about available resources, or insufficient training in digital literacy could contribute to this low performance. Conversely, a number (43.8%) of students do use ICT to access information for learning activities, reflecting some engagement with digital resources.

Similarly, a majority (66.1%) of students indicated that they do not use simulations to understand complex engineering concepts, suggesting a gap in the use of technology to enhance their understanding of challenging topics. This finding agrees with Kiv et al. (2019), who state that simulations serve as effective alternatives to physical experiments, particularly when natural laboratories are inaccessible. The low engagement with simulations could be due to a lack of familiarity with these tools, insufficient curricular integration, or inadequate resources to support their use. Nevertheless, a percentage (33.9%) of students reported using simulations to understand complex concepts, indicating some level of utilization of these resources.

Regarding peer communication, a large proportion (71.9%) of students indicated do not utilize ICT platforms to communicate with their peers, which indicates missed opportunities for collaboration and shared learning. This aligns with Dyantyi (2023) findings in South Africa, highlighting the positive impact of ICT integration in education on student communication and collaboration. The low response suggests that

students may lack the motivation to engage with digital tools for peer interactions. However, a proportion of students (28.1%) indicated that they communicate with peers using ICT platforms, showcasing positive engagement.

A significant percentage (67.5%) of students reported not using ICT platforms to communicate with instructors, highlighting a critical gap in student-teacher interactions. This finding corresponds with Fedock et al. (2019), who argue that ICT platforms facilitate better communication and collaboration between instructors and students. The low engagement may stem from a lack of awareness about the advantages of using these platforms or confidence in initiating communication through digital channels. On the other hand, some students (32.5%) reported using ICT for communication with instructors, indicating some beneficial engagement with digital communication tools.

The data show that a considerable number (65.2%) of students do not use ICT tools for coursework discussions, highlighting a lack of engagement in collaborative learning through digital platforms. This is in collaboration with Alahmari (2019), who emphasizes that ICT tools can foster virtual learning communities for collaboration and shared knowledge building. The low response suggests that students may not feel comfortable or knowledgeable about using ICT for academic conversations or may perceive traditional methods as more effective. However, some students (34.8%) reported using ICT for coursework discussions, reflecting some level of positive engagement.

A large percentage (62.3%) of students reported not using e-libraries for studying, implying that many students are not leveraging valuable academic resources. This aligns with Okyere-Kwakye and Md Nor (2020), who state that accessibility, user-friendliness, and perceived benefits of e-libraries significantly influence students' attitudes toward utilizing these resources. The low response indicates that students may lack the skills or

motivation to navigate e-libraries effectively. Nevertheless, a proportion of students (37.7%) reported using e-libraries, showing that some actively engage with this resource.

Regarding mobile learning applications, a number (35%) of students indicated that they use these applications to supplement classroom learning, reflecting a growing acceptance of technology for educational purposes. While a significant percentage (65%) do not utilize mobile applications, most engagement aligns with Burke et al. (2022), who affirm that personalized mobile learning activities enhance perceived learning outcomes. This suggests that mobile applications are beneficial tools for reinforcing classroom learning.

Regarding access to academic performance reports using ICT tools, more than half (59.5%) of students reported not using these tools, indicating that some students miss out on the benefits of easy access to performance data. This finding corresponds with Gaftandzhieva et al. (2023), who emphasize that ICT tools foster transparency and help students take ownership of their learning. The low response may indicate apathy toward monitoring academic performance or a lack of understanding of accessing reports. Nonetheless, some students (40.5%) reported using ICT to access academic performance reports, suggesting that most benefit from this technology.

When considering the use of ICT conferencing tools for attending institutional meetings, a majority (75.7%) of students reported that they do not use these tools, which reflects a significant gap in technology utilization for communication and collaboration within the institution. This aligns with Owo and Isaac (2021), who note that ICT facilitates timely meetings and promotes the transition from traditional interactions to online platforms. The low response may be attributed to a lack of awareness regarding these tools or resistance to change from conventional methods. However, a percentage (24.3%) of students reported that they use ICT conferencing tools, indicating some engagement in virtual meetings.

A significant percentage (57.7%) of students indicated that they do not use relevant engineering software in their learning process, which may impede the development of essential skills for their engineering careers. This corresponds with (Chen et al., 2020), who highlight the importance of multimedia tools in addressing educational needs and enhancing student engagement with technical content. The low engagement with relevant software may be due to insufficient training, limited access to technology, or a lack of curricular integration. Still, a number (42.3%) of students reported using relevant engineering software, showing some level of incorporation of these critical tools into their studies.

4.5.5 Technicians' Descriptive Statistics on Utilization of ICT Resources

In TVET institutions, technicians collaborate closely with instructors to deliver hands-on instruction. The workshops are planned by trainers, who also give technicians setup instructions and material preparation instructions. Technicians are in a good position to monitor and evaluate trainer performance because trainers conduct the practicals (Lewis, 2016). The technicians provided data on ICT resource utilization, which was also analyzed. The data was gathered using a set of 10 closed-ended items based on the extent to which the respondents agreed with them (All=1, Many =2, Few = 3, None =4). During data interpretation, the Likert scale categories were combined into more (All, Many) and less (Few, None) engagement levels to simplify data interpretation, enhance statistical power, improve result clarity, and emphasize practical relevance. This combination is critical, as high engagement is essential in engineering practices; low engagement can adversely impact academic performance, underscoring the need for consistent resource utilization. The descriptive statistics of the Utilization of ICT were calculated from the technicians' responses. Table 18 shows findings in percentage.

Table 18*Technicians' Responses to Items on The Utilization of ICT Resources*

Item	N	All	Many	Few	None
Students use ICT to access learning materials	10	18.2	63.6	18.2	-
Students use ICT-based simulators to understand complex engineering concepts	10	18.3	18.2	45.5	18
Students communicate with peers using ICT platforms	10	30.0	30.0	30.0	10.0
Students communicate with instructors using ICT platforms	10	18.2	36.4	36.4	9
Students use ICT tools to discuss coursework	10	30.0	30.0	30.0	10.0
Students use e-libraries when studying	10	20.0	50.0	-	30.0
Students use mobile learning applications to supplement what is learned in the classroom	10	50.0	20.0	30.0	-
Students access academic performance reports using ICT tools	10	50.0	10.0	20.0	20.0
Students use ICT conferencing tools to attend institutional meetings	10	44.4	22.3	11.1	22.2
Students use various engineering software to learn	10	44.4	22.2	22.2	11.2

Table 18 shows that technicians (18.2%) indicated that students rarely use ICT to access learning materials. This significant lack of utilization suggests that students may miss essential learning opportunities, limiting their access to crucial information and resources that could enhance their academic performance. Barbosa Granados and Amariles Jaramillo (2019) concur that a positive attitude towards ICT can significantly improve learning, and this underutilization could hinder student outcomes. On the other hand, a smaller proportion of technicians (81.8%) reported that students frequently use ICT to access learning materials.

A considerable percentage of technicians (63.5%) reported that students do not use ICT-based simulators to understand complex engineering courses. The limited use of these

simulators indicates a significant gap in students' ability to visualize and comprehend intricate engineering topics, which may negatively impact their grasp of essential course content. Paul et al. (2019) agree that simulations are critical for visualizing complex systems, and this underuse might hinder student success in engineering studies. In comparison, a number (36.5%) of technicians indicated that students frequently utilize these simulators.

A proportion (40%) of students who rarely use ICT platforms for communication with peers may face challenges such as limited access, digital literacy, or a preference for face-to-face interactions. This aligns with Cacheiro-gonzalez et al. (2019), who noted that while online forums offer diverse viewpoints, factors like technology access and engagement can limit participation. The implication is that educators should address these barriers by providing support and resources to enhance online engagement. On the other hand, a percentage of 60% of students either often or occasionally use these platforms, indicating a strong willingness to engage in peer-to-peer online communication, highlighting the potential for further leveraging these tools for collaborative learning.

According to technicians (40%), students rarely use ICT platforms to communicate with their instructors. This lack of communication may reduce students' access to guidance and feedback, which are crucial for their academic growth. The absence of effective interaction could also demotivate students and weaken their connection to the learning process. (Fedock et al., 2019) affirm that effective communication between students and instructors is essential for academic success. Meanwhile, a large proportion (60%) of the technicians noted that students frequently engage with instructors via ICT platforms.

Half (50%) of technicians reported that students seldom use ICT tools to discuss coursework. This limited engagement suggests that students may not capitalize on

collaborative learning opportunities that could deepen their understanding of course materials, leading to isolated learning experiences. Trespalacios and Lowenthal (2019) emphasize the role of active discussions in creating knowledge-building communities, and the lack of such engagement could hinder students' academic development. In contrast, the other half (50%) of technicians stated that students frequently use ICT tools for coursework discussions.

A number (30%) of technicians indicated that students rarely use e-libraries when studying. The limited use of these digital resources suggests that students may not fully utilize the extensive range of academic materials available, which could negatively impact their research skills and academic performance. Fichten et al. (2018) affirm that accessibility and awareness could explain the limited engagement with e-libraries. Conversely, a higher percentage (70%) of technicians noted that students frequently access e-libraries for their studies.

A significant proportion(40%) of technicians observed that students do not frequently use mobile learning applications to supplement classroom learning. This underutilization implies that students may not take full advantage of mobile apps to reinforce their learning, potentially affecting their ability to explore additional educational resources outside the classroom. Griffith et al. (2020) agree that mobile applications offer crucial support for continuous learning, and students' limited use of these tools may hinder self-directed learning. However,(60%) of technicians indicated that students often use mobile learning apps.

A notable percentage(40%) of technicians reported that students rarely access their academic performance reports using ICT tools. This lack of engagement with performance data may prevent students from monitoring their progress effectively, reducing their accountability and awareness of academic standing. Abbas et al. (2019)

concur that access to digital performance reports is essential for fostering engagement and timely academic intervention. On the other hand, a considerable (60%) of technicians observed that students frequently use ICT tools to access performance reports.

A percentage (33.3%) of technicians reported that students seldom use ICT conferencing tools to attend institutional meetings. The limited use of these tools may hinder students' participation in important discussions and collaborations, which are essential for their academic and professional development. The absence of engagement in these meetings could also make students feel disconnected from their academic community. Lowenthal et al. (2020) agree that using conferencing tools can significantly enhance the online learning experience. Conversely, (66.7%) of technicians indicated that students frequently use ICT conferencing tools.

A proportion (33.4%) of technicians noted that students rarely utilize various engineering software for learning. This limited engagement with essential technical software suggests that students may not develop the necessary practical skills for their field, which could hinder their readiness for the workforce. Abdulrahman et al. (2020) affirm that using specialized software is essential for providing practical knowledge, and students' underuse of these tools may impede their ability to excel in their studies. However, (66.6%) of technicians observed that students frequently use engineering software for learning.

4.5.6 Administrators' Qualitative Responses Utilization of ICT Resources

The results revealed that administrators used several strategies to ensure students effectively utilize ICT resources for accessing learning materials. These included the provision of ICT facilities (55.6%), running computer literacy classes (27.8%), allocating time for such exercises (16.7%), and giving students assignments (research, one-line

writing) (38.9%) that require the use of such resources. Low internet connectivity, resistance to ICT adoption in training, and the lack of ICT tools to keep pace with the growing staff and student populations hinder these strategies. A principal from Institution R emphasized, *"We offer computer literacy classes to help students gain basic ICT skills and encourage them to use the digital library; however, there is a challenge of internet connectivity and a negative attitude toward ICT adoption."* From the quantitative, students (56.2%) reported insufficient use of ICT tools to access materials, suggesting that many students are not fully utilizing the available resources. Meanwhile, technicians (18.2%) noted that students rarely use ICT to access learning materials, underscoring the need for additional encouragement and training to bridge the gap between resource provision and actual usage. Paudel (2021) emphasizes the need for clear ICT policies and skills development to enhance educational outcomes.

When asked how they integrated simulation into the curriculum to help students understand complex engineering concepts, the administrators listed several practices. The practices included identifying objectives that necessitate simulation (11.1%), obtaining necessary software (16.7%), and incorporating simulation-intensive tasks into lessons (50.0%). However, over a fifth (23.5%) reported that they do not engage in teaching-learning activities that involve simulation. One deputy principal from Institution S stated, *"Although we have simulation software, many instructors have not yet incorporated it into their teaching."* Students (66.1%) echoed this sentiment, indicating minimal use of simulations for understanding engineering concepts. This is supported by Chernikova et al. (2020), which found that structured support within simulations enhances learning outcomes. Technicians further underscored this gap, with 45.5% noting that students rarely engage with simulators, emphasizing the need for

greater hands-on integration and encouragement from faculty to enhance learning through simulations.

Regarding how they facilitated communication among students using ICT platforms, the administrators reported that they assisted in setting up social media platforms (72.2%), availed internet (38.9%), conferencing applications (11.1%), bulk SMS (16.7%), and gave students leaders money for airtime (11.1%). Despite these strategies, some students to cannot access WhatsApp, and others lack smartphones. Given the large number of students residing outside the institutions, accessing the Internet for timely communication remains a challenge challenging. The head of the department from Institution T stated, *"We created WhatsApp groups for each class so that students can easily share ideas and collaborate on projects; however, students who do not have smartphones and access to the internet as a result of their place of residence are disadvantaged by this mode of communications."*

The quantitative data concurs with these findings; students (40.0%) do not use ICT for peer discussions, and (40.0%) reported minimal communication with instructors via digital platforms. This indicates that while administrators are creating avenues for communication, actual student engagement remains low, suggesting a need for more proactive outreach and motivation. The work of Annamalai and Kumar (2020) echoes this, highlighting the transformative role of smartphones in fostering student-centered learning through enhanced communication.

The administrators indicated that they facilitated ICT-based instructor communication by implementing a paperless office policy (11.1%), availing internet connectivity (emails) (66.7%), and setting up social media (55.6%) and SMS (11.1%) platforms. Some trainers still embrace the traditional mode of instruction and communication. The authenticity of the information has tainted their attitude toward the effectiveness of ICT tools, leading

them to resist change and continue to rely on paper-based communications and meetings. A principal from Institution R stated, *"We hold workshops to train our instructors on the latest ICT tools and teaching methodologies and encourage them to adapt to new technologies."* From the quantitative data, students (61.2%) felt their instructors were not effectively using ICT in lessons. This suggests that while efforts to train faculty are in place, the impact on teaching practices may not translate into improved student experiences and academic performance. This finding resonates with Goh and Sigala (2020), who pointed out that ICT is instrumental in ensuring consistent teaching quality among different instructors.

On the integration of e-libraries and digital resources into the learning processes, The administrators indicated that the integration involved providing the resources (44.4%), having trainers give students online assignments (16.7%), and training learners to use e-learning resources (27.8%). A few (16.7%) respondents indicated they had integrated digitization into their learning processes. Despite the efforts made by the administrators, digitization is low in TVET institutions. During COVID-19, institutions remained closed due to poor ICT learning and training integration. Low internet connectivity and acceptance of change pose a challenge (Paudel, 2021). Institution T's head of department stated, *"We have digital resources available, but staff and students need more training to use them effectively."* The quantitative data confirmed these findings, revealing that 62.3% of students and 50.0% of technicians reported minimal use of e-libraries and digital resources.

This feedback underscores the necessity for improved training and motivation to encourage staff and students to take advantage of the e-library offerings and digital resources. The use of these resources enhances self-paced learning and the accessibility of these resources anytime and anywhere whenever the staff and students need them.

This will enhance restrictions and hence improve academic performance. This is in line with Vtyurina (2019), who discussed the implementation of digital library systems that enhance access to resources.

Administrators (50%) reported that they sometimes use ICT tools, such as video conferencing, when having meetings, but in most cases, they hold physical meetings (50%). As the principal of Institution R noted, *"We use video conferencing to hold meetings, which has improved communication across departments, though some staff and students still prefer face-to-face meetings."* The quantitative data from students (75.7%) and technicians (33.3%) reported very few uses of ICT conferencing tools for institutional meetings. This suggests that while administrative processes have improved, a significant opportunity remains to involve students and staff more actively in these digital interactions. This perspective resonates with Hacker et al. (2020), who noted that online meeting platforms became crucial for maintaining social interactions during the pandemic.

The administrators were asked whether students access their academic performance results using ICT facilities. Most administrators reported that learners use the institution's website (portal) to access examination results (61.1%). The other channels used were SMS (11.1%) and printed copies (38.9%). Although the student portal uploads the results, students often visit the office to request them. Students have reported experiencing difficulties in accessing the portal and frequently forgetting their passwords. Emphasizing training on the use of ICT tools is crucial. The head of the department from institution S shared, *"We upload marks in the student portal, but we still receive cases of students not being able to access it due to internet connectivity and the availability of gadgets to access at home."* Students (55.5%) and technicians (33.4%) reported challenges accessing these facilities, suggesting that, despite upgrades, issues

related to availability and accessibility still pose significant barriers to practical ICT usage in their studies. Annamalai and Kumar (2020) revealed that the transition to personalized learning has revolutionized the educational process.

When asked to describe how mobile learning applications supplement learning outside the classroom, the administrators cited that trainers share learning materials with learners through social media (16.6%). Other strategies mentioned included students evaluating learning materials (72.2%), trainers assigning assignments (22.2%), students conducting discussions or conferencing (16.7%), and assessments (16.7%). Despite some administrators acknowledging the need for more to facilitate student and staff interaction beyond classrooms, these strategies were effective. Internet connectivity and a willingness to embrace new technologies posed significant challenges.

The head of a department at Institution T stated, *"We occasionally integrate ICT into our engineering courses to prepare students for the quantitative data results, which indicate a discrepancy between administrative intentions and student experiences."* This underscores the necessity for a more strategic approach that prioritizes and effectively implements ICT within the curriculum. Bergman (2021) emphasizes the importance of consistent communication in educational success, emphasizing the need for effective integration. Very few learning institutions have integrated ICT into their curriculum. Those who have integrated ICT into the curriculum have witnessed a tremendous increase in students' performance.

Regarding student support, (66.7%) of administrators reported they periodically dedicate staff to assist students with ICT-related inquiries. Technical know-how presents challenges for staff and students in accessing ICT tools, particularly the learning management system and ICT tools for meetings. Students and staff still face a training gap in the integration of ICT. One head of department from institution T noted, *"Our ICT*

support team is overstretched with the number of inquiries, and they are sometimes available to help students navigate various software and resources." The findings showed that students (54.5%) and technicians (33.4%) rarely use ICT tools. This suggests that even with the availability of support, many students might not be aware of the resources at their disposal. This finding aligns with Kumar and Bervell (2019), who noted that students are more likely to adopt new technologies when they perceive them to align with their academic goals.

The administrators described the steps they took to ensure students could access engineering software for learning. The steps included providing the software (83.3%) and training the students on using the applications (11.1%). A number (11.1%) of respondents indicated they had not taken any steps due to the unavailability of ICT resources. There was also a concern about training staff (trainees and technicians) in the use of software. Deputy Principal from Institution S remarked, *"We have a challenge with the availability of software for engineering courses, and for the software available, there are still gaps in staff and student training."* Quantitative data support these findings.

A significant number (57.7%) of students indicated that they do not use relevant engineering software in their learning process, and a proportion of technicians (33.4%) noted that students rarely utilize various engineering software for learning purposes. This indicates a gap between providing software resources and their practical application. It suggests that targeted training and integration into the curriculum could enhance student proficiency and usage of these essential tools. Striuk and Semerikov (2019) also support this need for effective training, emphasizing the importance of equipping students with skills to utilize engineering software effectively.

4.5.7 Students' Descriptive Statistics on Utilization of Material Resources

The following information shows data on the utilization of material resources provided by the respondents. It includes descriptive statistics provided by the students and Technicians and Qualitative analysis provided by administrators.

The students provided quantitative data on the Utilization of Material Resources. It was gathered using a set of 10 closed-ended items. The items were based on the extent to which the respondents agreed with them (Never=1, Rarely =2, Sometimes = 3, Frequently =4, Always=5). During data interpretation, the Likert scale categories were combined into high (Always, Frequently) and low (Sometimes, Rarely, Never) engagement levels to simplify data interpretation, enhance statistical power, improve result clarity, and emphasize practical relevance. This combination is critical, as high engagement is essential in engineering practices; low engagement can adversely impact academic performance, underscoring the need for consistent resource utilization. The descriptive statistics of the Utilization of material resources were calculated from the students' responses. Table 19 shows findings in percentage.

Table 19*Students' Responses to Items on Utilization of Material Resources*

Item	n	AL	FR	ST	RA	NE
Students use workshop tools and equipment for practical exercises	262	48.3	16.1	17.6	8.6	9.4
Students access workshop tools and equipment easily	262	30.3	18.1	26.2	12.7	12.7
Students engage in hands-on activities in workshops and laboratories	262	29.7	16.9	21.1	16.5	15.8
Students refer to textbooks as part of learning materials	262	21.1	15.0	14.3	13.5	36.1
Students use the resources available in the library	262	28.7	12.5	15.5	12.4	30.9
Safety equipment is used during practical lessons	262	40.6	15.0	11.3	13.5	19.6
Students used computers for learning activities	262	16.0	18.3	24.3	16.3	25.1
All classrooms are used during lessons	262	60.7	12.5	9.1	9.1	8.6
Institute vehicles are used during academic trips	262	25.3	11.7	10.9	6.8	45.3
Lecture chairs are adequate in classrooms	262	20.2	7.6	11.8	17.2	43.1

Based on Table 19, A percentage (35.6%) of students reported that they sometimes, rarely, or never used workshop tools and equipment for practical exercises. This low engagement in hands-on activities limits students' practical learning opportunities, which are crucial in technical education. The implication is that students may not acquire the necessary skills and competencies for their field, leading to inadequate preparation for the job market. Beako et al. (2018) affirm that accessibility to workshop tools is crucial to active learning. However, their hands-on skills development is compromised when students cannot fully engage with them. Despite several (64.4%) students stating they

frequently or consistently used these tools, the remaining gap suggests a need for improved accessibility.

Slightly above half (51.6%) of students indicated that they could only sometimes, rarely, or never easily access workshop tools and equipment. This underutilization of workshop tools and equipment concurs with Hernández-de-Menéndez et al. (2019), who also identified issues related to active learning and the effective use of educational tools. If students do not have regular access to these materials, their practical experience may be significantly limited, impeding the learning process. The implication is that students may delay acquiring practical skills, leading to potential frustration and demotivation. However, less than half (48.4%) of students reported frequently or consistently having access, highlighting room for improvement.

A notable percentage (53.4%) of students mentioned that they only sometimes, rarely, or never engaged in hands-on activities in workshops and laboratories. This low participation level significantly undermines the development of technical skills central to engineering courses. Therefore, students may lack the experiential learning necessary for mastering technical subjects, affecting their ability to apply knowledge in real-world situations. Erickson et al. (2020) agree that engaging students in hands-on tasks increases motivation and interest. Although some (46.6%) of the students reported frequent participation, the large percentage of students not fully utilizing this learning method points to a critical gap in experiential learning.

A significant percentage (63.9%) of students reported using textbooks sometimes, rarely, or never. This highlights a severe underutilization of textbooks, a critical theoretical learning component. The implication is that students may miss out on building a solid theoretical foundation, which is crucial for technical fields that require both practical and theoretical expertise. Clinton and Khan (2019) concur that textbooks are widely used in

higher education for integrating knowledge. When students are not referring to them, it could result in a lack of depth in their understanding of the curriculum. On the other hand, a small portion (36.1%) of the students indicated frequent or consistent use, which suggests the need to reinforce the importance of textbooks in learning.

Similarly, a significant number (58.8%) of students stated they used the library only sometimes, rarely, or never, showing a concerning level of underutilization of library resources. Clinton and Khan (2019) affirm that access to a range of resources, such as those found in libraries, enhances learning outcomes. Hence, the students may not maximize the knowledge and support available through library resources, potentially limiting their research capabilities and understanding of subjects. With only a number (41.2%) of students using the library frequently or always, efforts to promote the use of the library as a learning resource are needed to bridge this gap.

A significant percentage (44.4%) of students reported using it only sometimes, rarely, or never. The inconsistent use of safety equipment raises concerns about safety protocols during practical lessons. Therefore, students may be at a higher risk of accidents and injuries due to poor safety practices, which could lead to liability issues for institutions. Nath et al. (2020) align with the importance of consistent safety equipment usage to prevent accidents. The lack of adherence to safety measures among many students underscores the need for stricter enforcement of safety regulations. In contrast, a number (55.6%) of students used safety equipment frequently or consistently.

Most (65.7%) of students reported using computers for learning activities only sometimes, rarely, or never. Tuma (2021) concurs that integrating digital tools in education is vital for developing essential 21st-century skills. This implies that students may be ill-prepared for the increasingly digital workplace, where technological competence is crucial. The low frequency of computer usage indicates that many

students are not gaining the necessary technological skills to succeed in the modern workforce. Only a percentage (34.3%) of students frequently or consistently used computers, suggesting a significant gap in digital literacy that must be addressed.

A significant number (63.0%) of the students reported using institute vehicles for academic trips sometimes, rarely, or never. This limited access to vehicles for academic purposes curtails opportunities for experiential learning outside the classroom. Hence, students may miss meaningful fieldwork experiences essential for linking theoretical knowledge to real-world applications. Lee et al. (2020) agree that academic trips enhance learning when students are exposed to real-world environments. However, some (37.0%) of the students indicated frequent or always having access to institute vehicles, showing that more resources could be allocated to support these educational experiences.

A significant percentage (72.1%) of students expressed that lecture chairs were only sometimes, rarely, or never adequate in classrooms. Poor seating conditions may lead to discomfort, which could negatively affect students' concentration and learning outcomes. Sam-Kalagbor (2021) affirms the importance of adequate physical resources, including seating, as they directly influence students' academic achievement. The fact that only 27.8% of students felt the chairs were always or frequently adequate suggests that poor infrastructure could negatively impact learning experiences, necessitating urgent improvements.

A percentage (26.8%) of students reported that classrooms were only sometimes, rarely, or never used during lessons, highlighting an area for improvement in ensuring consistent classroom availability. This inconsistency could disrupt the learning experience and reduce student engagement and motivation. Burden (2020) states that a well-organized and consistently available learning space fosters a positive learning atmosphere and can enhance academic performance. These findings imply that while

there are benefits to the current classroom usage, addressing gaps in availability could further optimize the environment for all students. In contrast, a large proportion (73.2%) of students indicated that classrooms were always or frequently in use, demonstrating effective space utilization and alignment with Burden's emphasis on structured, conducive learning environments.

4.5.8 Technicians' Descriptive Statistics on Utilization of Material Resources

In TVET institutions, technicians and trainers collaborate closely to deliver hands-on instruction. Technicians are instructed by trainers to set up equipment and prepare materials, who also schedule these classes. Because trainers conduct the practicals, technicians are in a good position to observe and report trainer performance (Lewis, 2016). The technicians provided quantitative data on the utilization of material resources. The data was gathered using a set of 10 closed-ended items, based on the extent to which the respondents agreed with them (Never=1, Rarely =2, Sometimes =3, Frequently =4, Always=5). During data interpretation, the Likert scale categories were combined into high (Always, Frequently) and low (Sometimes, Rarely, Never) engagement levels to simplify data interpretation, enhance statistical power, improve result clarity, and emphasize practical relevance. This combination is critical, as high engagement is essential in engineering practices; low engagement can adversely impact academic performance, underscoring the need for consistent resource utilization. The descriptive statistics of the utilization of material resources were calculated from the trainer's responses. Table 20 shows findings in percentage.

Table 20*Technicians' Responses to Items on Utilization of Material Resources*

Item	N	AL	F R	ST	RA	NE
Students use workshop tools and equipment for practical exercises	10	56.6	27.3	9.1	7	-
Students access workshop tools and equipment easily	10	45.5	35.5	15	4	-
Students engage in hands-on activities in workshops and laboratories	10	90.9	-	9.1	-	-
Students refer to textbooks as part of learning materials	10	30.0	20.0	40.0	-	10.0
Students use the resources available in the library	10	45.5	36.4	9.1	9.0	-
Safety equipment is used during practical lessons	10	72.7	18.2	9.1	-	-
Students use computers for learning activities	10	18.2	54.5	18.2	9.1	-
All classrooms are used during lessons	10	54.5	18.2	27.3	-	-
Institute vehicles are used during academic trips	10	60.0	20.0	-	-	20.0
Lecture chairs are adequate in classrooms	10	54.5	18.2	18.2	-	9.1

Table 20 reveals that a notable (19%) of technicians reported that students sometimes, rarely, or never have easy access to workshop tools. This limited access indicates organizational inefficiencies that may obstruct practical learning experiences. Mohzana et al. (2023) confirm that inadequate planning and outdated frameworks can hinder students' access to essential tools, emphasizing that strategic improvements in resource allocation are necessary to facilitate more effective hands-on learning opportunities. To improve access to practical learning resources, it is critical to address these inefficiencies. However, a significant number (81%) of technicians affirmed that students frequently or always have access to these resources.

The data indicates that a considerable number (16.1%) of technicians reported that students use workshop tools and equipment sometimes, rarely, or never. This suggests

potential barriers such as insufficient training or a lack of confidence among students in utilizing these resources effectively. Catena and Carbonneau (2019) affirm that hands-on experiences are crucial for developing technical competencies, highlighting the significant positive impact that experiential learning has on student performance and understanding of technical subjects. Addressing these barriers through enhanced training and encouragement is essential to foster a more robust learning environment. In contrast, (83.9%) of technicians noted that students frequently or always utilize these resources.

A number (9.1%) of technicians indicated low engagement in hands-on activities in the workshop. This finding may suggest that some students lack interest or confidence in actively participating in practical exercises. Yechkalo et al. (2019) agree on the importance of hands-on experiences in competency development, asserting that students who engage in practical learning are more likely to demonstrate improved skills and knowledge retention. Fostering engagement through structured activities and supportive environments is vital for enhancing students' practical skills. Despite this, a significant (90.9%) of technicians reported that students frequently or always engage in these activities.

According to the findings, half (50%) of technicians indicated that students use textbooks sometimes, rarely, or never. This discrepancy suggests a gap in students' theoretical knowledge, which is essential for understanding technical concepts. Ayu (2020) aligns with this by underscoring the vital role of textbooks as structured learning tools, indicating that consistent engagement with textbooks significantly enhances students' comprehension and mastery of course content. Enhancing students' engagement with textbooks through guided reading and assignments could significantly improve their academic performance. Nevertheless, the other half (50%) of technicians reported that students frequently or consistently use textbooks.

The data shows that a notable (9.1%) of technicians indicated that students sometimes, rarely, or never use library resources. This low engagement infers that students may not be taking advantage of valuable learning materials that could enhance their academic performance. Amarasekara and Marasinghe (2020) affirm the critical role of libraries in meeting user information needs, highlighting that effective library services and resources can significantly influence students' satisfaction and academic success. Promoting library resources could enrich students' educational experiences and help them access critical information for their studies. However, a pronounced (90.9%) of technicians reported frequent or always usage of library resources.

A percentage (9.1%) of technicians reported that safety equipment is used sometimes, rarely, or never, this raises concerns about student safety during practical exercises. Verbeek et al. (2020) emphasize the importance of adhering to safety protocols, agreeing that ensuring the proper use of personal protective equipment is essential for minimizing risks and safeguarding students during hands-on activities. Compliance with safety measures is crucial to maintain a safe learning environment. Nevertheless, many (90.9%) of technicians confirmed frequent or always usage of safety equipment.

The data indicates that a significant number (27.3%) of technicians reported that students use computers sometimes, rarely, or never for learning activities. This low engagement raises questions about the barriers to technology integration in learning environments. Shatri (2020) agrees that students generally exhibit proficiency in using computers, emphasizing the necessity of incorporating technology into curricula to enhance digital literacy and access to educational resources. Improving access to and integration of technology in the curriculum could enhance students' digital skills. However, a percentage (72.7%) of technicians reported frequent or always usage of computers for learning activities.

The findings reveal that a considerable (27.3%) of technicians indicated that classrooms are used only sometimes or rarely. This suggests inefficiencies in space utilization. Blatchford and Russell (2019) confirm that ineffective use of space can negatively impact student outcomes, underscoring that thoughtful management of classroom environments is essential for optimizing learning experiences and fostering student engagement. A strategic approach to classroom management is essential to optimize learning environments for student engagement. Nonetheless, a large proportion (72.7%) of technicians stated that classrooms are frequently or always utilized.

A notable (20%) of technicians reported that institute vehicles are sometimes, rarely, or never used for academic trips. This raises concerns about accessibility to experiential learning opportunities. Lee et al. (2020) affirm the importance of transportation logistics in enhancing student learning experiences, arguing that effective planning and execution of field trips are vital for maximizing the educational benefits of outdoor learning experiences. Improved logistics and planning could increase the effectiveness of field trips in hands-on teaching. However, the majority (60%) of technicians noted frequent or always usage of institute vehicles.

The findings indicate that a considerable percentage (27.3%) of technicians reported that lecture chairs are sometimes, rarely, or never adequate. This suggests discomfort for some students, which can hinder their attention and participation during lectures. Sam-Kalagbor (2021) aligns with this by emphasizing the influence of physical resources on academic achievement, indicating that adequate seating is crucial for maintaining student engagement and facilitating effective learning. Enhancing classroom comfort could lead to improved student engagement. In contrast, most (72.7%) of technicians stated that lecture chairs are frequently or always adequate.

4.5.9 Administrators ' Qualitative Responses to Utilization of Material Resources

Administrators were asked to explain how they ensured that workshop tools and equipment were effectively utilized for practical exercises by students. The administrators explained that they ensured this by providing students with an adequate number of tools and equipment (27.8%), maintaining and caring for the facilities (50.0%), and including practical sessions in the timetable (27.8%). They also involve technicians in supporting learners (22.2%) and training students in workshop practice and procedures (11.1%). However, the tools and equipment are not equivalent to the number of students in the institutions. Technicians also need training on the latest tools and how to maintain them. A principal from institution R explained, “*We occasionally avail students’ tools and equipment for practical lessons, but we also face challenges with keeping the facilities in good condition, and at times the number of pieces of equipment does not match the number of learners.*”.

A study by Mtshali and Msimango (2023) affirms that the majority of construction technology educators lack critical workplace competencies and have difficulties in delivering effective instruction during simulations. Inadequate planning and insufficient use of instruments impede effective lessons. It advises educators to engage in training, explore industrial environments, and seek ongoing professional development to enhance their practical and pedagogical skills. Quantitative data from students (35.6%) and technicians (19.0%) who reported not using workshop tools despite their availability supports these findings. There is a need for an organized way for students to access tools and equipment in the workshop even during their free time.

The administrators also outlined the steps they had taken to guarantee that trainers and students could access the workshop tools and equipment. The measures included setting rules/regulations and procedures for accessing the facilities (61.1%), providing

technicians/storekeepers to support teaching-learning (44.4%), addressing the inadequacy of facilities (22.2%), and ensuring regular maintenance and repairs (11.1%). Large enrolment limits the use of workshops for other classes, thereby limiting their accessibility to staff and students seeking practice. The workshop's limited resources prevent staff and students from accessing it outside of scheduled lessons. The head of a department from institution T emphasized the weak establishment of protocols, stating, *"We've set up rules and procedures for accessing workshop facilities that are most times not effective; therefore, we occasionally assign technicians and storekeepers to assist both trainers and students, but materials are meant for specific lessons and not for other practices and research."*

Additionally, a principal from Institution R stated, *"We strive to maintain and repair the tools to guarantee their functionality for practical lessons, but occasionally, we receive late reports for repair."* Mohzana et al. (2023) found that inadequate planning, outdated organizational frameworks, and constrained resources obstruct initiatives to guarantee access to workshop tools and equipment. These limitations hinder the execution of practical tasks. The quantitative data supports these findings, as technicians (16.1%) and students (51.6%) reported not having access, indicating significant gaps in accessibility.

The administrators reported that the institutions used several strategies to encourage students to engage in hands-on activities in workshops and laboratory lessons. These included trainers giving trainees individual and group practical assignments, such as projects (55.6%), attaching them to technicians (16.7%), and ensuring all the required facilities were available (11.1%). The other strategies were sensitizing learners about the importance of hands-on skills in the world of work (11.1%) and encouraging trainers to adopt teaching approaches that expose learners to practical work (22.2%). Despite these strategies, the inconsistent attendance of trainers to lessons, late procurement of

materials, and the large number of students in class negatively impact the one-on-one interaction between learners and trainers, which in turn affects individual projects. The head of a department at institution S explained, *"Trainers' absence from lessons and late material procurement negatively impact the individual and group projects in which students participate in practical work."* DeBoer et al. (2019) concur with these findings, stating that encouraging students to engage in hands-on activities improves student experiences and employability. The quantitative data showed that students (53.4%) do not participate in hands-on activities, revealing a significant gap in student involvement due to the late start of practicals and lecturers missing classes. Despite efforts to encourage practical engagement, the data suggests that a significant portion of students may not benefit from these initiatives, with 19.1% of technicians noting frequent student absences from hands-on activities.

The administrators were asked to explain how they ensured that textbooks are effectively utilized as learning materials. The administrators reported that their institutions ensured this by making the materials available in libraries and digital form (77.8%), encouraging trainers to assign tasks and assignments (research, projects) that utilize these resources (33.3%), and providing reliable internet services to enable access to e-materials (11.1%). Some respondents (16.7%) expressed difficulties in effectively utilizing textbooks due to the absence of physical libraries. Most students currently use ICT and applications for research instead of physical textbooks, thanks to the advent of technology. The principal from Institution R stated, *"We strive to provide textbooks in both library and digital formats to enable students to access learning materials at any time, yet our on-site inspections reveal that libraries remain underutilized. Since many of us lack access to a physical library, we must rely on digital textbooks, which require subscriptions. It is a challenge to access."* Adeniran (2020) concurs with the findings,

observing that teachers' lack of skills led to the inadequate and ineffective use of instructional materials. It advocated for increased governmental support for resources, the recruitment of skilled trainers, and the establishment of regular seminars for skill enhancement. According to the quantitative data, 63.9% of students and 50.0% of technicians, respectively, stated that they don't have textbooks for their assignments, a sign of restricted access and underutilized library resources.

An analysis of the data provided by the administrators revealed that they encouraged trainees to assign learning tasks that require the use of library resources, with the aim of encouraging students to utilize these facilities for academic purposes (27.8%). Other strategies used to maximize utilization of the facilities were simplifying the process (e.g., easy to register) of accessing the resources (33.3%) and sensitizing/making learners aware of facilities available in institutions (11.1%). The analysis also revealed that some institutions, specifically those without physical libraries, did not encourage students to use these facilities. The use of technology also contributed to the low library use.

Bureaucratic procedures for registering and a poor reading culture prevent most students from going to the library. The head of a department at Institution T clarified, *"We aim to streamline the library's access process to enable students to utilize its resources for academic purposes. However, most students choose not to register, as they can complete most assignments using their mobile phones."* The flexibility of the library materials to be used away from the library facilities discourages students from using the library. The quantitative data reveals that 58.8% of students and 9.1% of technicians reported not using the library, indicating a significant gap in resource utilization. Kizilaslan et al. (2021) emphasized the need for efficient collaboration among educators, learners, and specialists in creating educational resources. This relationship is vital for augmenting

students' awareness and utilization of accessible library resources, which is imperative for raising their academic achievement.

When asked to explain the integration of computers into training and learning activities, the administrators noted that the integration of digital literacy into institutional curricula remains a challenge (38.9%). They further pointed out that ICT is used for administration/ communication, though not many staff and students have embraced it (27.8%), accessing teaching/learning materials (11.1%), and ICT integration in instruction is low (77.8%). The head of a department at Institution T stated, *"We use ICT integration and computers in a few lessons, indicating that staff and students familiarize themselves with emerging technologies, particularly in TVET institutions."* It was clear from one of the deputy principals from institution S that *"We sometimes use computers for accessing learning materials and for administrative tasks."*

Huang (2019) affirms that students must effectively utilize and adapt to current and emerging technologies. However, 65.7% of students reported that they do not use computers for learning, suggesting challenges in either access or training that hinder full participation in digital learning initiatives. Technicians indicated that 27.3% of students also underutilize computer resources, which further complicates digital literacy efforts.

The administrators reported that the use of specialized tools and equipment in training has led to the retirement or departure of some teachers from work (38.9%). They also reported that institutions promoted the simulation of situations that cannot be done experimentally (33.3%) through meetings, though software and specialized tools are not available. 11.1% of these respondents stated that only specialists had access to these facilities. Specialized facilities were off-limits to students due to their lack of skills.

A principal from institution R explained, *"We sometimes offer training to both the trainers and students on how to use specialized tools and equipment safely; however, the specialized tools are expensive and couldn't be allowed for students to practice."*

However, the deputy principal from Institution S pointed *"only specialists possess the necessary skills to handle some highly specialized tools."* Gupta and Chandna (2020) concur with this finding, stating that comprehensive training on specialized tools and equipment is essential for effective everyday operations. Access to certain tools suggests a potential limitation in the depth of students' practical training, particularly with more advanced technologies, as 65.7 % of students frequently report not engaging with specialized equipment such as computers.

The administrator indicated that they assigned rooms using software (50.0%) and formed teams and committees (44.4%) to ensure that all timetabled lessons had a designated classroom. Administrators employ these strategies, but most institutions struggle with a shortage of chairs and fewer classes. The head of the department at institution T stated, *"We sometimes use software to assign classrooms for timetabled lessons to ensure everything runs smoothly. Some intakes experience high enrollment, which strains the facilities."* This aligns with the findings from a Mexican institution where student cohorts developed an intuitive scheduling application using 0-1 integer programming and Open-Solve (Ma & Rod, 2020). Quantitative data (73.3%) students and technicians (27.3%) reported that students often miss class due to poor classroom management, indicating that classroom assignment strategies need further improvement.

The administrators stated that they adopted a raft of measures to ensure that there was adequate transport available for academic trips. The administrators prioritize early planning (booking and providing accurate data) at 44.4%, budgeting for the trips at 22.2%, hiring large buses, and collaborating with neighbouring institutions on

transportation (22.2%). Despite these various measures, challenges arise when other activities, such as bus hire, industry delays, vehicle breakdowns, and the processing of legal documents, impede the smooth operation of student transportation. Some institutions lack buses and rely on hiring for their transportation needs. The deputy principal of institution S shared, *"Sometimes we plan ahead and ensure we book buses large enough to accommodate everyone, but sometimes the buses are not available."* Ribeiro et al. (2020) underscore the necessity for enhanced transportation alternatives for academic excursions. However, 63.3% and 20.0% of students and technicians, respectively, indicated that students do not have adequate transport for academic trips, revealing another area where students may face challenges.

4.5.10 Students' Descriptive Statistics on Utilization of Time Resources

The following information shows data on the utilization of ICT as provided by the respondents. It includes descriptive statistics provided by the students, trainers, and technicians and qualitative analysis provided by administrators (Principals, Deputy principals, H.O. Ds).

The students provided quantitative data on the utilization of time resources. It was gathered using a set of 10 closed-ended items. The items were based on the extent to which the respondents agreed with them (Never=1, Rarely =2, Sometimes= 3, Frequently =4, Always=5). During data interpretation, the Likert scale categories were combined into high (Always, Frequently) and low (Sometimes, Rarely, Never) engagement levels to simplify data interpretation, enhance statistical power, improve result clarity, and emphasize practical relevance. This combination is critical, as high engagement is essential in engineering practices; low engagement can adversely impact academic performance, underscoring the need for consistent resource utilization. The descriptive

statistics of utilization of time resources were calculated from the student's responses.

Table 21 shows findings in percentage.

Table 21

Students' Responses to Items on Utilization of Time Resources

Item	N	AL	FR	ST	RA	NE
Trainers attend lessons on time	262	28.1	22.1	26.2	18.4	5.2
I attend all the lessons	262	70.4	16.3	9.5	2.7	1.1
Training timetable is prepared on time	262	37.4	15.6	23.7	13.4	9.9
Examination timetable is prepared on time	262	47.9	11.7	14.8	13.5	12.1
The syllabus content coverage is completed on time	262	21.2	15.3	22.3	20.8	20.4
Trainers adhere to the timetable schedule	262	29.2	20.8	25.4	15.9	8.7
Training starts immediately on reporting	262	19.6	10.9	16.6	22.7	30.2
Feedback is given on time	262	19.5	15.8	27.2	17.6	19.9
Orientation is done well to minimize time wastage	262	29.7	17.1	20.9	16.3	16
Communications are done on time	262	26.5	19.3	18.2	16.3	19.7

Table 21 shows that a considerable number (50.2%) of students indicated that trainers do not attend lessons on time. This lack of punctuality may disrupt learning and negatively affect students' engagement and academic performance. This finding aligns with Marika et al. (2021), who emphasize the importance of effective time management in enhancing teachers' service delivery. The implications are significant, as consistent trainer attendance is crucial for establishing a disciplined learning environment. Conversely, a portion (49.8%) of students reported that trainers attend lessons on time.

A significant number (13.3%) of students indicated that they do not attend lessons regularly. This inconsistency in attendance may be influenced by factors such as trainer punctuality or lesson relevance, which can adversely affect academic outcomes. Büchele (2021) states that regular attendance is positively correlated with improved exam scores, indicating that institutions should work to maintain high attendance levels. On the positive side, a majority (86.7%) of students reported total attendance.

A significant percentage (47%) of students believe the training timetable is not prepared on time. Delays in preparing the timetable can lead to confusion and inefficient use of time resources within the institution. Ahmed et al. (2019) state that timely preparation of timetables is crucial for meeting scheduling constraints and optimizing resource use. The implication is that institutions may struggle with logistical challenges, impacting overall educational effectiveness. Conversely, a percentage (53%) of students felt the training timetable was prepared on time.

A significant proportion (40.4%) of students agreed that the examination timetable is not prepared on time. This discrepancy can lead to inadequate exam preparation and increased anxiety among students. Institutions should streamline their processes to avoid such delays, as timely exam scheduling is essential for student success. Nweke and Osakwe (2024) also noted that prompt exam timetable formulation enhances student preparedness and alleviates exam-related stress. On a positive note, more than half (59.6%) of students confirmed that the examination timetable is managed effectively.

A significant percentage (63.5%) of students agreed that the syllabus content coverage is not completed on time, raising concerns about the potential disadvantage this creates for students during assessments. Bett (2020) supports this, asserting that timely completion of the syllabus is vital for students' exam success. The implications of incomplete

syllabus coverage can severely hinder students' readiness for examinations. In contrast, some (36.5%) of students indicated that the syllabus was covered on time.

Notably, half (50%) of students reported that trainers do not adhere to the timetable schedule. This lack of adherence can disrupt the learning process, leading to missed lessons. This observation concurs with Lorimom et al. (2023), who suggest that a structured approach to timetable adherence enhances the learning environment. The implications of non-adherence include reduced instructional time and a fragmented learning experience. Conversely, the other half (50%) of students felt that the timetable schedule was adhered to.

A large proportion (69.5%) of students indicated that training does not start immediately upon reporting. This delay can reduce overall contact time and hinder learning outcomes. Nweke and Osakwe (2024) affirm that effective time management skills are essential for maximizing educational productivity. The implications here suggest that any delay in starting training can detract from the overall learning experience. However, a number (30.5%) reported that training starts promptly.

A significant number (64.9%) of students noted that feedback is not provided on time, which can impede their academic improvement. This aligns with Nweke and Osakwe (2024), who state that timely feedback is critical for enhancing student learning outcomes. The implications are that students may struggle to make necessary adjustments in their studies without prompt feedback. However, a considerable percentage (35.3%) of the students reported that they receive timely feedback.

More than half (53.2%) of students felt that orientation is not conducted well to minimize time wastage. This deficiency can lead to confusion and inefficiency in students' adaptation to the academic environment. Al Karim (2019) concurs that effective

orientation programs are vital for improving performance and satisfaction. The implications suggest that poor orientation can negatively affect students' initial experiences and ability to engage fully with the curriculum. Conversely, a portion (46.8%) of students felt that orientation was well-executed.

A large number (54.2%) of students expressed that communications are not handled promptly, which can negatively affect their academic progress. This finding affirms Dhillon and Kaur (2021), who indicate that effective communication is essential for optimizing student performance. The implications of ineffective communication can lead to misunderstandings and a lack of clarity in academic expectations. On the positive side, a percentage (45.8%) of students reported that communications are done on time.

4.5.11 Technicians' Descriptive Statistics on Utilization of Time Resources

When conducting hands-on classes, technicians and trainers collaborate closely in TVET institutions. Technicians are instructed by trainers to set up equipment and prepare materials for these classes. The practicals are led by trainers and therefore, technicians are in an ideal position to observe and report trainer performance (Lewis, 2016). The technicians provided quantitative data on the utilization of time resources. The data was gathered using a set of 10 closed-ended items, based on the extent to which the respondents agreed with them (Never=1, Rarely =2, Sometimes =3, Frequently =4, Always=5). During data interpretation, the Likert scale categories were combined into high (Always, Frequently) and low (Sometimes, Rarely, Never) engagement levels to simplify data interpretation, enhance statistical power, improve result clarity, and emphasize practical relevance. This combination is critical, as high engagement is essential in engineering practices; low engagement can adversely impact academic performance, underscoring the need for consistent resource utilization. The technicians'

responses calculated the descriptive statistics of Time resource utilization. Table 22 shows findings in percentage.

Table 22

Technicians' Responses to Items on Utilization of Time Resources

Item	N	AL	FR	ST	RA	NE
Trainers attend practical lessons	10	63.6	27.3	9.1	-	-
Students attend all practical lessons	10	45.5	45.5	9.1	-	-
Practical lessons timetable is prepared on time	10	45.5	36.4	9	-	9.1
Practical examination timetable is prepared on time	10	36.4	27.3	27.3	9.1	-
All practical content in the curriculum is covered on	10	6.6	9.1	27.3	-	-
The timetable schedule is adhered to	10	50.	20.0	30.0	-	-
Practical lessons start immediately students report	10	36.4	9.1	36.4	9.0	9.1
Feedback to students is timely and constructive	10	30.	30.0	40.0	-	-
Orientation is organized for students to minimize waste of time	10	45.5	36.4	-	18.2	-
Communication with students is clear and done on time	10	63.6	9.1	18.2	-	9.1

In Table 22, Technicians (9.1%) reported that trainers sometimes, rarely, or never attend practical lessons. This indicates potential issues with trainer commitment and reliability, which could impact the quality of the training provided. This aligns with Játiva et al. (2022), who affirm that commitment from trainers significantly influences the quality of practical instruction. The implications of this finding suggest that inconsistent trainer attendance may lead to gaps in knowledge and skills development for students, ultimately affecting their overall academic performance. However, a majority (90.9%) of technicians indicated that trainers consistently attend practical lessons, highlighting their dedication to delivering effective training sessions.

Technicians (9.1%) noted that students sometimes, rarely, or never attend all practical lessons. This inconsistency in attendance may hinder students' ability to grasp essential practical skills fully. This aligns with Nordmann et al. (2019), who found that first-year students who attend lessons positively impact their performance, while the effects were less clear for later years. The implications suggest that irregular attendance could lead to skill acquisition gaps, adversely impacting students' performance and assessment preparedness. In contrast, a significant percentage (90.9%) of technicians confirmed that students regularly participate in practical lessons, emphasizing the importance of hands-on learning in their educational experience.

A percentage (18.2%) of technicians indicated that the timetable for practical lessons is not prepared on time, which can lead to disorganization and disrupt students' learning processes. This resonates with Olivo (2021), who states that teachers who allocate more time and resources for classroom instruction and preparation demonstrate strong time management skills. The implications of this finding highlight that delayed timetable preparation could result in missed learning opportunities for students, ultimately leading to a decline in academic performance due to insufficient practice and revision time. On the other hand, (81.9%) of technicians reported that the timetable is prepared on time, suggesting that some effective planning is in place.

A considerable portion (36.4%) of technicians noted that the practical examination timetable was not prepared on time. This delay could cause stress for students as they may struggle to manage their study time effectively. This concurs with Borsheim et al. (2020), who argue that due to unknown test dates and study schedules, students are likely to feel emotionally exhausted, resulting in higher burnout. The implications of this finding suggest that a lack of timely examination schedules can lead to increased anxiety and decreased performance during practical assessments. Conversely, a significant

percentage (63.6%) of technicians acknowledged that the examination timetable is prepared on time, indicating effective scheduling practices in some areas.

A percentage (28.5%) of technicians indicated that not all practical content in the curriculum is covered on time, which could lead to gaps in students' education and preparation for future employment. Brockhaus et al. (2023) affirm the need for improvement in curriculum coverage, as emphasized by industry stakeholders concerned about workforce readiness. The implications of this finding suggest that inadequate coverage of practical content could severely limit students' competencies and employability, negatively impacting their overall academic performance. In contrast, a significant percentage (71.5%) felt that the curriculum was completed on time, highlighting a significant need for improvement in curriculum delivery.

A notable number (30%) of technicians felt that the timetable is not consistently adhered to, which may result in inefficient use of time and resources in practical lessons. This aligns with Umar et al. (2024), who assert that effective schedule management is essential for successful project completion. The implications of this finding suggest that a lack of adherence to the timetable can disrupt learning and hinder students' ability to keep pace with the curriculum, ultimately affecting their academic success. However, a large portion (70%) of technicians reported that the timetable is generally followed, indicating that adherence often occurs.

A significant percentage (54.6%) of technicians indicated that practical lessons do not start immediately upon students' arrival. This delay could waste valuable learning time and diminish students' engagement. This aligns with Gill et al. (2023), who support the introduction of academic and professional staff to commence teaching immediately after students report. The implications of this finding suggest that delayed starts to lessons could lead to a loss of motivation among students, adversely affecting their academic

engagement and performance. In contrast, a number (45.4%) reported that lessons start promptly, suggesting that timely commencement does occur in some instances.

A notable proportion (40%) of technicians felt that student feedback is not timely or constructive, which can hinder student progress and development. This aligns with Bahtilla (2024), who indicates that students submit their work late due to a lack of engagement with supervisory comments. Implications of this finding suggest that the absence of timely feedback can prevent students from understanding their strengths and weaknesses, ultimately hindering their academic growth and performance. However, more than half (60%) of the technicians indicated that feedback provided to students is timely and constructive, highlighting areas where positive engagement does exist.

A small percentage (18.2%) believed that the orientation was not well-organized, which could lead to confusion and inefficiencies at the beginning of the program. This resonates with Damianidou (2024), who found that effective in-service training should be well-organized to encourage communication and discussions. The implications of this finding indicate that disorganized orientations may result in students feeling unprepared and overwhelmed, which can adversely affect their academic performance early in their studies. Conversely, a significant percentage (81.8%) of technicians reported that orientation was effectively organized, facilitating a smoother transition for students into their practical training.

A notable percentage (27.3%) of technicians indicated that communication with students is unclear and timely, leading to misunderstandings and a lack of engagement. This concurs with Brockhaus et al. (2023), who identified various reasons why students may submit their work late. The implications of this finding suggest that poor communication can create confusion among students, leading to missed deadlines and decreased

academic performance. However, 72.7% of the technicians affirmed that communication is effective, indicating that most students receive necessary information on time.

In analyzing these data, emphasis on lower-response items was crucial, as they highlight specific gaps that, though affecting a minority, could significantly impact student outcomes if left unaddressed. While the majority of responses indicate generally effective practices, the lower responses point to potential inconsistencies in trainer attendance, timeliness of practical lessons, and scheduling. Addressing these minority areas ensures a more robust system, where all students benefit equally from reliable, well-organized training. By proactively targeting these lower-response gaps, this study aims to enhance the overall quality and consistency of educational practices in engineering courses.

4.5.12 Administrators' Qualitative Responses to Utilization of Time Resources

The analysis of the qualitative data revealed that technical institutions employed various strategies to promote punctuality among students. The strategies were educating trainers and trainees on the essence of punctuality and related rules and regulations (50.0%), using attendance registers and sheets (33.3%), and preparing and distributing timetables on time (22.2%). The other strategies adopted were disciplining latecomers (22.2%) and making learning attractive, enjoyable, and interesting using appropriate teaching methods and resources (11.1%). These strategies are emphasized, but occasionally, trainers and students arrive late for lessons. Timetables are produced as late as the second week of the opening of the term. Registers are used, though they are not analyzed to improve attendance, hence performance. The principal from institution R stated, *“We at times use strict attendance policies to ensure that students understand the importance of punctuality, though still some trainers attend lessons late. Our data shows that those who attend regularly tend to perform better academically.”* This recognition emphasizes the

direct correlation between punctuality and academic performance. Bok et al. (2024) agree that a student's self-assessment of task initiation, which measures self-discipline, is associated with lower average performance alone. However, self-discipline was associated with higher performance when combined with better punctuality. Students (50.2%) and technicians (9.1%) reported trainers do not attend lessons on time, indicating a perception of inconsistency that may hinder engagement and academic performance.

The findings showed that the administrators implemented an academic policy requiring students to attend 70% of lectures on time to sit for examinations (27.8%). Other techniques employed by institution administrators included penalizing irregular and late attendance (33.3%), promoting time-keeping habits among trainers and trainees (11.1%), and encouraging trainers to adopt teaching methods that make learning enjoyable, interesting, and attractive. Despite these strategies, moving from one classroom to the other during changeover causes delays in joining the class. Occasionally, classrooms may be devoid of chairs, forcing students to search for them, or a trainer's tardiness may result from exceeding the designated time. Most of the students operate from residential areas far away from school, and they may encounter transport challenges.

A principal from institution R stated, *"To promote punctuality, we often sensitize both trainers and trainees about the rules regarding attendance,"* affirmed by the department head from institution S. *"Students have to change classes or be late due to transportation issues, personal issues may cause late attendance.* Another department head from Institution T stated, *"We occasionally integrated the use of attendance registers into our daily routines without conducting any analysis, and we promptly addressed late students or trainers."* This proactive measure reinforces attendance requirements. Bartanen (2020) concluded that research frequently ignores the role of school leaders, despite the

growing recognition of student attendance as a crucial indicator of educational success. Some students admitted to irregular attendance, with 13.3% indicating trainers attended classes late. Technicians (9.1) expressed concerns about the impact of inconsistent attendance on practical sessions, as low student attendance can lead to underutilization of equipment and facilities.

The administrators reported that some allocated subjects at the end of the current term to prepare training timetables before the new one began (94.4%). They further reported that guidelines on timetable preparation with timelines and dates were always given to trainers and HoDs (22.2%). The head of a department from Institution T stated, *“We, at times, try to have the timetable ready on time with clear deadlines and guidelines to ensure everything is ready before the term begins. This challenge highlights the importance of establishing a structure in educational settings to ensure timely preparation of timetables.”* This implies that if the timetable is not ready by the beginning of the term, syllabus coverage will be low, thus affecting the students’ performance. This finding aligns with the quantitative data, indicating that 47.0% of students and 18.2% of technicians perceive a lack of prompt preparation of timetables. The findings by Nweke and Osakwe (2024) affirm that teachers' prompt use of time in their job roles would lead to teaching effectiveness.

The administrators stated that departmental committees set the dates for examinations and tests then transmitted the information to the timetabling office, which then prepared the timetables (50.0%). Some institutions prepare the timetables in the fourth week of the term, which department committees then review (16.7%). Other institutions base the preparation of examination timetables on the methods of setting, moderating, printing, and packaging examinations (11.1%) or using an assessment guide for each intake/cohort (22.2%). There are delays in the examination timetable, ranging from a week

to a day before the exam, which can significantly impact students' preparation and performance. The deputy principal of institution R stated, *"We regularly communicate with students through various channels regarding the preparation of the timetable. However, the departments involved often delay the timetable's release due to corrections and incomplete information."*

This underscores the difficulties in communicating the timetable, potentially delaying exam preparations and consequently impacting students' performance. This finding aligns with the quantitative data, revealing that a significant (52.1%) of students expressed disagreement with the timely preparation of exam timetables, citing delays that impede exam preparation. Proper timetable scheduling is vital for ensuring all necessary equipment and facilities are available and functional for a practical assessment. Salem (2023) aligns with this finding that there is a problem most institutions have to overcome each semester that makes scheduling difficult.

Administrators (72.2%) indicated that institutions occasionally monitor syllabus content coverage using reports from class representatives and heads of departments, along with feedback from students. Additional strategies to ensure syllabus coverage included developing pacing guides and adhering to timetables. A head of department from Institution S stated, *"Despite our efforts, I still observe that some trainers do not adhere to the timetable as expected, which affects students' perceptions of the importance of punctuality."* This response reflects ongoing challenges in ensuring compliance with the established syllabus. According to Nweke and Osakwe (2024), there is a prevailing concern that teachers in public secondary schools in Rivers State may not complete the curriculum before major internal or external exams, potentially leading to a negative impact on student's performance. A notable (78.8%) of students believed that syllabus coverage is often incomplete, affecting their readiness for assessments. Technicians

stressed that timely syllabus coverage is critical for scheduling practical sessions, as delays can lead to insufficient hands-on training.

The administrators used class representatives' and HoDs' reports, trainer schemes, and work records, among other methods, to ensure adherence to the timetable schedules (66.7%). Other techniques employed included the preparation and timely distribution of timetables to all stakeholders (16.7%), the avoidance of timetable changes without prior communication to all stakeholders (11.1%), and the use of sign-in/attendance registers (16.7%). A head of department from Institution T noted, *“We do not have a well-structured timetable; there are still instances where lessons do not start on time, which creates confusion among students.”* Tan et al. (2021) highlighted that high timetabling issues can be attributed to factors such as the availability of instructors and classrooms, the number of lessons teachers must deliver to specific groups or pupils, and constraints. Students felt that 50.0% of trainers did not follow the timetable, disrupting the learning process. Technicians (30.0%) corroborated these findings, noting that schedule adherence is vital for equipment setup and maintenance.

Data analysis from the interviews indicated that administrators employed several methods of ensuring that training starts promptly upon reporting. These methods included adequate planning, which involved preparing lesson plans, schemes of work, and mobilizing instructional materials before the commencement of the term (72.2%), as well as developing a time-keeping culture among trainers and trainees, which involved registering on time and adhering to a timetable (22.2%). The other methods used by the administrators were signing attendance sheets/registers (11.1%) and scheduling examinations a few days after opening (16.6%). Establishing a culture and lacking clear policies regarding starting classes hinder the promptness of learning and training immediately upon student arrival. There is a need to break the culture and be strict about

the consequences if lessons do not start on time. A principal from institution T stated, *"We emphasize the need for effective communication within the institution, as it significantly impacts student performance and overall satisfaction. Despite clear communication, students and trainers still fail to start classes on time, often due to a lack of a schedule, a lack of consequences, or a lack of a ready timetable."* This underscores the importance of proper planning for a smooth academic experience. A notable 30.2% of students reported delays in class commencement, which can reduce contact time. Technicians stressed the importance of timely class starts to guarantee the completion of all technical setups before lessons. Bailey and Hess (2020) affirm that reopened schools will require adjustments in line with guidance from national, state, and local health officials.

The findings show that to provide timely assessment feedback, various communication channels were utilized (83.3%), and examination processing deadlines were communicated to students (16.7%). Feedback enables students to plan the next action. The delays in arrival to institutions, preparations for exams, and adjusting to the new environment result from poor feedback to the students. Institutions should try to provide feedback to customers as needed. The deputy principal of institution R stated, *"Institution communication requires a significant overhaul, akin to a private organization, where timely release of information and feedback enables students to schedule their attendance, prepare for exams, and strategize their activities."* The quantitative data supports these findings, revealing that 47.4% of students perceive frequent delays in feedback, while technicians underscore the importance of timely feedback in resolving technical issues in teaching materials. Bahtilla (2024) agrees with the findings, emphasizing the importance of providing prompt feedback during the supervisory procedure.

With regard to ensuring that communication within the institution is clear and timely, the administrators reported that they use a variety of channels (social media, internet, SMS, noticeboards) (55.6%) to relay messages and release them early (22.2%). Additionally, they reported adhering to the institution's communication protocols and policies (33.3%) and utilizing language and vocabulary that everyone can understand (22.2%). The principal from Institution T emphasized, “*Timely communication is key in preventing misunderstandings among students and staff.*” The quantitative data supports these findings, as 45.8% of students reported communication delays that can confuse them. Technicians agreed that clear and timely communication is crucial for coordinating the maintenance and preparation of learning environments. The findings concur with Garfinkel et al. (2023), who concluded that a well-thought-out framework for enhancing communication and information sharing between institutions and journals could lead to stronger working relationships, increased trust, greater transparency, and, most importantly, quicker resolution of data integrity issues, particularly in published literature.

The results showed that effective orientation sessions in organizations involved several steps, such as scheduling the event in the second week after registration closure (38.9%), conducting it immediately after freshers' reports (11.1%), preparing a list of events for orientation day (44.4%), and choosing a day with the fewest lessons to minimize disruptions (11.1%). Orientations make trainees adjust to the institution very quickly. Most of these activities occur towards the end of the term, during which numerous instances of self-direction and misdirection have occurred. Students must register before the opening date and undergo immediate orientation to prevent confusion and facilitate easy adjustment, particularly in large institutions. A head of department from Institution U echoed these findings, stating, “*Orientation always starts late, but it enhances*

accessibility and eliminates barriers to participation.” This indicates efforts to ensure all students have the necessary resources and information for success. The quantitative data reveal that 70.3% of students felt the orientation provided was insufficient, leading to confusion in school activities. Confusion at the start of a new student's journey can significantly impact their performance if not addressed promptly. Being misguided can have a significant impact on some TVET students who lack self-drive. Technicians (18.2%) have highlighted the importance of well-organized orientations to help familiarize students with technical equipment and resources. Brahmana and Kontesa (2024) align with the findings that orientation enhances accessibility and eliminates barriers to participation. It also creates equal opportunities for all students and their families by ensuring equal access to crucial information and resources for their success.

4.6 Inferential Statistics

This sections illustrates the relationship between utilization of selected resources and academic performance, and also testing of hypotheses.

4.6.1 Relationship between Utilization of Human Resources and Academic Performance in Engineering Courses

The simple linear regression technique was used to determine whether the relationship between human resources and academic performance in engineering courses was statistically significant. The results of the regression test are presented in Table 23

Table 23*Regression Test on Utilization of Human Resources and Academic Performance*

Scale	Unstandardized Coefficients		Standardized Coefficients	t-value	p-value
	B	Std. Error	Beta		
Constant	71.587	1.404		50.984	.000
Utilization of human resources index	1.939	.392	.291	4.944	.000

R = .291, R² = .084, F (1, 265) = 24.440, p = .000

From Table 23, the results show that the relationship between utilization of human resources and academic performance was positive ($r = 0.291$). This factor accounted for 8.4 % ($R^2 = 0.084$) in academic performance. The results further indicate that human resources utilization is a key predictor of engineering students' academic performance. The constant is 71.587, indicating that when human resources utilization is zero, performance measures 48.522 units. The coefficient for the human resources index is 1.939, signifying that for every unit increase in human resources usage, academic performance rises by 1.939 units.

The regression equation is:

$$Y = 71.587 + 1.939X_1 \dots \dots \dots (2)$$

Let Y represent academic performance and X_1 denote the utilization of human resources.

The results imply that the utilization of human resources is a meaningful contributor to academic performance, explaining 8.4% of the variance. This highlights that while human resource utilization positively impacts academic outcomes, additional factors also influence performance. Institutions should focus on optimizing the deployment of human resources, as each unit increase in effective utilization corresponds to a measurable improvement in student achievement, enhancing the academic success of engineering

students. The findings align with Francis (2018), emphasizing that strategic human resource utilization through effective employment, training, and development supports institutional goals and reduces wastage. Kuswati (2020) highlights motivation's role in retention and productivity. Thus, optimizing human resource practices can enhance academic performance and align with educational objectives.

4.6.2 Hypothesis One Testing

From Table 23, the regression analysis was used to test the null hypothesis which stated that:

H₀₁: There is no statistically significant relationship between the utilization of human resources and academic performance in engineering courses in technical and vocational institutions.

According to Dul et al. (2020), the null hypothesis can be accepted or rejected. The author further said at 95 % confidence level ($\alpha = 0.05$), the null hypothesis is rejected when the calculated value (P) is less than the critical value (α), $P < 0.05$, and it is accepted when the calculated value (P) is greater than the critical value, $P > 0.05$. From the findings, the calculated value ($P = 0.000$) is less than the critical value ($\alpha = 0.05$) meaning that the null hypothesis was rejected and does not support the first hypothesis, which stated that there is no statistically significant relationship between utilization of human resources and academic performance. It, therefore, implies that there is a statistically significant relationship between the utilization of human resources and academic performance in engineering courses in technical and vocational institutions in Nakuru county, Kenya. The findings align with Darmawan et al. (2020), who assert that the quality of human resources significantly influences academic outcomes. Training, empowerment, and regular performance appraisals improve HR skills, productivity, and

motivation. This fosters a committed workforce, ultimately contributing to a more effective academic environment and improved performance.

The regression analysis suggests that improved management and utilization of human resources could substantially enhance student performance. This aligns with the study's objective to assess how resource utilization impacts academic achievement. Thus, the findings offer a pathway to mitigating the broader issue of high failure rates.

4.6.3 Relationship between Utilization of ICT Resources and Academic Performance in Engineering Courses

The simple linear regression technique determined whether the relationship between the utilization of ICT resources and academic performance in engineering courses was statistically significant. The results of the regression test are presented in Table 24.

Table 24

Regression Test on Utilization of ICT Resources and Academic Performance

Scale	Unstandardized		Standardized	t-	p-
	Coefficients		Coefficients		
	B	Std. Error	Beta	value	value
Constant	68.068	1.139		59.744	.000
Utilization of ICT Resources	1.469	.496	.179	2.963	.003

$r = .179, R^2 = .032, F(1, 265) = .8.780, p = .003$

Table 24 shows that using ICT resources is a significant predictor of students' academic performance ($r=0.179$). The constant is 68.068, meaning that when ICT resource utilization is zero, academic performance is 68.068 units. The coefficient for the utilization of ICT facilities is 1.469, suggesting that for each unit increase in ICT resource utilization, academic performance increases by only 1.469 units. The R^2 value

of 0.032 shows that only 3.2% of the variation in academic performance is explained by ICT resource utilization.

The regression equation is:

$$Y = 68.068 + 1.469X_2 \dots\dots\dots (3)$$

Where Y = Academic performance, and X_2 = Utilization of ICT.

The findings imply that while ICT resource utilization positively influences academic performance, its impact is minimal, accounting for only 3.2% of performance variation. This highlights the need for a multifaceted approach integrating ICT with other educational strategies, such as improving teaching methods and student support systems. Institutions should strategically allocate resources, recognizing that ICT alone is insufficient for substantial academic performance enhancement. This aligns with Ishaq et al. (2020), who emphasized that ICT has a significant contribution to enhanced academic performance and suggests comprehensive integration measures, including improved infrastructure and faculty training.

4.6.4 Hypothesis Two Testing

From Table 24, the regression analysis was used to test the null hypothesis, which stated that:

H₀: There is no statistically significant relationship between the utilization of ICT resources and academic performance in engineering courses in technical and vocational institutions.

When testing the null hypothesis, based on 95 % confidence level ($\alpha = 0.05$), the null hypothesis is rejected when the calculated value (P) is less than the critical value (α), $P < 0.05$, and it is accepted when the calculated value (P) is greater than the critical value, $P < 0.05$ (Dul et al., 2020). According to the findings, the calculated value (P)

was 0.003 is less than the critical value, $\alpha = 0.05$ meaning that the second hypothesis was rejected, which stated that there is no statistically significant relationship between the utilization of ICT resources and academic performance. It, therefore, implies that utilization of ICT resources has a statistically significant relationship on academic performance in engineering courses in technical and vocational institutions in Nakuru county, Kenya. This finding is aligned with Liwanag (2019), who said that educators' use of ICT in instruction can significantly predict students' academic success in Mathematics, Science, and English. A low correlation was found between ICT usage and academic outcomes, indicating that the findings may be attributed to chance or other external influences.

4.6.5 Relationship between Utilization of Material Resources and Academic Performance in Engineering Courses

The simple linear regression technique determined whether the relationship between Material Resources and academic performance in engineering courses was statistically significant. The results of regression on the utilization of material resources are shown in Table 25.

Table 25

Regression Test on Utilization of Material Resources and Academic Performance

Scale	Unstandardized Coefficients		Standardized Coefficients	t-value	p-value
	B	Std. Error	Beta		
Constant	71.251	1.200		59.358	.000
Utilization material resources index	2.030	.365	.323	5.557	.000

$r = .323, R^2 = .103, F(1, 265) = 30.879, p = .000$

Table 25 shows that the utilization of material resources significantly predicts students' academic performance ($r=0.323$). The constant is 71.251, indicating that when the utilization of material resources is zero, academic performance is 71.251 units. The coefficient for the utilization of material resources is 2.030, implying that for each unit increase in physical facility utilization, academic performance increases by 0.984 units. The R^2 value of 0.103 shows that only (10.3%) of the variation in academic performance is explained by utilizing material resources.

The regression equation is:

$$Y = 71.151 + 2.030X_3 \dots\dots\dots(4)$$

Where Y = Academic performance, and X_3 = Utilization of physical facilities.

The findings imply that in TVET engineering courses, the utilization of material resources significantly influences academic performance, contributing 10.3% to performance variation. Although this highlights the importance of effectively using physical facilities, it also suggests that other factors, such as teaching quality and practical training, must be prioritized. Improving material resource management alongside holistic educational practices can enhance academic outcomes in engineering courses within TVET institutions. The findings align with Mbatha (2021), who noted resource inadequacies in Nigeria's TVET programs. This highlights that the utilization of materials is key to enhancing academic performance. His recommendation for stakeholder collaboration to secure funding is essential, as improved resource availability and strategic partnerships can significantly benefit engineering courses within TVET institutions.

4.6.6 Hypothesis Three Testing

From Table 25, the regression analysis was used to test the null hypothesis, which stated that:

H0₃: There is no statistically significant relationship between the utilization of material resources and academic performance in engineering courses in technical and vocational institutions.

When testing the null hypothesis, based on 95 % confidence level ($\alpha = 0.05$), the null hypothesis is rejected when the calculated value (P) is less than the critical value (α), $P < 0.05$, and it is accepted when the calculated value (P) is greater than the critical value, $P < 0.05$ (Dul et al., 2020). According to the findings, the calculated value (P) was 0.000, which is less than the critical value, alpha equals, 0.05 meaning that the null hypothesis was rejected, which stated that there is no statistically significant relationship between utilization of material resources and academic performance. These findings align with Aggrey et al. (2022), who said that when students and teachers maximize resources like labs, libraries, and textbooks, they positively influence academic performance. However, challenges such as lack of skills, inadequate storage, limited resources, large class sizes, poor internet connectivity, insufficient time for practical lessons, heavy teaching loads, and poor maintenance hinder optimal resource use, negatively impacting academic performance.

4.6.7 Relationship between Utilization of Time Resources and Academic Performance in Engineering Courses

The simple linear regression technique was used to determine whether the relationship between the Utilization of Time Resources and academic performance in engineering courses was statistically significant. The results of the regression test are presented in Table 26.

Table 26

Regression Test on Utilization of Time Resources and Academic Performance

Scale	Unstandardized Coefficients		Standardized Coefficients	t-value	p-value
	B	Std. Error			
Constant	68.682	1.199		57.262	.000
Utilization of time	1.141	.342	.201	3.335	.001

$r = .201, R^2 = .040, F(1, 265) = 11.121, p = .001$

Table 26 shows that using time resources significantly predicts students' academic performance ($r=0.201$). The constant is 68.682, meaning that when time resource utilization is zero, academic performance is 68.682 units. The coefficient for time resource utilization is 1.141, indicating that for each unit increase in time resource utilization, academic performance increases by 1.141 units. The R^2 value of 0.040 shows that 4.0% of the variation in academic performance is explained by time resource utilization.

The regression equation is:

$$Y = 68.682 + 1.141X_4 \dots\dots\dots(5)$$

Where Y = Academic performance, and X_4 = Utilization of time.

These results imply that while time resource utilization contributes to academic performance, its impact is limited, indicating that other factors must also be considered. Institutions should encourage better time management practices among students. However, they should also explore additional strategies to enhance performance, as other factors influence the majority of the performance variation. The findings indicate that while time resource utilization contributes to academic performance, its limited impact

(4.0% variation) suggests other factors are also significant. Effective time management is essential, as noted by Taghani and Razavi (2022), but additional support and engagement strategies for optimal outcomes must complement it.

4.6.8 Hypothesis Four Testing

From Table 26, the regression analysis was used to test the null hypothesis, which stated that:

H₀₁: There is no statistically significant relationship between the utilization of time resources and academic performance in engineering courses in technical and vocational institutions.

Dul et al. (2020) state that the null hypothesis can be accepted or rejected. The author further said that at 95 % confidence level ($\alpha = 0.05$), the null hypothesis is rejected when the calculated value (P) is less than the critical value (α), $P < 0.05$, and it is accepted when the calculated value (P) is greater than the critical value, $P > 0.05$. From the findings, the calculated value ($P = 0.001$) is less than the critical value ($\alpha = 0.05$) meaning that the null hypothesis was rejected and does not support the first hypothesis, which stated that there is no statistically significant relationship between utilization of time resources and academic performance. These results suggest that efficient time management is critical to improving academic achievement. Educational institutions and teachers should prioritize time management techniques because they have a favourable impact on students' academic performance. An organized approach to time management within the curriculum must be implemented to ensure that students and teachers maximize their engagement and productivity. These findings align with Cyril (2015), who states that effective utilization of time as a resource enhances academic performance. By addressing challenges and creating actionable plans, teachers and

parents can collaborate to ensure that time is well-managed for academic growth, ensuring that students remain on track and focus on their areas of need, ultimately improving their academic performance. This timely intervention best uses the limited time available for learning and development.

4.6.9 Relationship between the Human, ICT, Material and Time Resources and Academic Performance

The study analyzed the relationship between selected resources (Human, ICT, Material, and Time) and academic performance in engineering courses in technical and vocational institutions in Nakuru County, Kenya. Table 27 shows the overall relationship of the selected resources.

Table 27

Regression Test on Utilization of Selected Resources and Academic Performance

Scale	Unstandardized		Standardized	t-	p-
	Coefficients		Coefficients		
	B	Std. Error	Beta	value	value
Constant	72.868	1.506		48.380	.000
utilization human resource mean score	1.269	.510	.190	2.487	.014
Utilization of ICT Resource mean score	.223	.575	.027	.388	.698
Utilization of material resource mean score	1.747	.520	.278	3.357	.001
utilization Time resource mean score	.421	.452	.074	.931	.353

$r = .354, R^2 = .125, F(4, 262) = 9.390, p = .000$

Table 27 reveals a positive correlation ($r = 0.354$) between the utilization of four factors—human resources, material resources, ICT resources, and time resources—and academic performance, explaining 12.5% of the variance. Among these, human resources ($\beta = 0.190$, $p = .014$) and material resources ($\beta = 0.278$, $p = 0.001$) significantly contributed to academic success, indicating that effective engagement of trainers and provision of adequate materials are crucial. Conversely, ICT resources ($\beta = 0.027$, $p = 0.0698$) and time resources ($\beta = 0.074$, $p = 0.353$) did not show significant predictive power, suggesting that their mere presence may not enhance academic performance.

These findings imply that educational institutions should prioritize enhancing human and material resources to improve student outcomes, potentially through professional development and better material provision. Additionally, the lack of significant impact from ICT and time resources indicates a need to reevaluate their application in learning contexts. The overall statistical significance of the model ($F(4,262) = 9.390$, $p = .000$) underscores the importance of resource utilization in influencing academic performance, while further research could explore additional variables to gain a comprehensive understanding of factors affecting performance in engineering courses.

Based on the combined results for all four predictors, the overall regression equation would be:

$$Y = 72.868 + 1.269X_1 + 0.223X_2 + 1.747X_3 + 0.421X_4 \dots \dots \dots (6)$$

Where:

$Y =$ Academic performance

$X_1 =$ Utilization of human resources

$X_2 =$ Utilization of ICT resources

X_3 = Utilization of material resources

X_4 = Utilization of time resources

The regression equations show that academic performance (Y) is positively influenced by human resources utilization (X_1) and materials resources utilization (X_3). Human resources (1.269) and material resources utilization (1.747) have the strongest impact, while ICT (0.223) and time (0.421) show weaker, non-significant effects. The constant (72.868) reflects baseline performance without these factors. This suggests that prioritizing improvements in human resources and time resources strategies can significantly boost academic performance, whereas investments in ICT and time may yield limited returns.

4.6.10 Summary of Hypothesis Testing

The summary of the Hypothesis is given in Table 28.

Table 28*Summary of Hypothesis Testing*

Hypothesis	P-Value	Decision rule
		Reject H ₀ : $\beta_x = 0$; if $p < 0.05$, Otherwise, accept the H ₀ : $\beta_x = 0$
H ₀₁ : There is no statistically significant relationship between the utilization of human resources and academic performance in engineering courses in technical and vocational institutions in Nakuru County, Kenya.	Correlation coefficient $r = 0.291$ $p = 0.000$	$p = 0.000 \leq p = 0.05$ The null hypothesis was rejected
H ₀₂ : There is no statistically significant relationship between the utilization of ICT resources and academic performance in engineering courses in technical and vocational institutions in Nakuru County, Kenya.	Correlation $r = 0.179$ $p = 0.003$	$p = 0.003 < p = 0.05$ The null hypothesis was rejected
H ₀₃ : There is no statistically significant relationship between the utilization of material resources and academic performance in engineering courses in technical and vocational institutions in Nakuru County, Kenya.	Correlation $r = 0.323$ $p = 0.000$	$p = 0.000 < p = 0.05$ The null hypothesis was rejected
H ₀₄ : There is no statistically significant relationship between time resource utilization and academic performance in engineering courses in technical and vocational institutions in Nakuru County, Kenya.	Correlation $r = 0.201$ $p = 0.001$	$p = 0.001 < p = 0.05$ The null hypothesis was rejected

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1. Introduction

This chapter provides a synopsis of the significant findings, conclusions, and recommendations made throughout the study.

5.2 Summary of Findings

The following section provides an overview of the key findings. It highlights the findings based on the data collected, analyzed, and presented in the previous chapter, which was based on the objectives.

5.2.1 Utilization of Human Resources and Academic Performance in Engineering Courses

This study aimed to analyze the relationship between the utilization of human resources and academic performance in engineering courses in technical and vocational institutions in Nakuru County, Kenya. The findings revealed a statistically significant positive relationship between human resource utilization and academic performance, with a correlation coefficient (r) of 0.291 and a p -value less than 0.05. The model explained 8.4% ($R^2 = 0.084$) of the variance in academic performance.

The null hypothesis, which stated no statistically significant relationship between human resource utilization and academic performance, was rejected. These findings underscore the importance of effective human resources. Institutions that strategically manage and deploy their human resources can create a supportive academic environment conducive to improved performance.

The study highlighted challenges faced by administrators in addressing inconsistencies in trainer attendance, incomplete assessments, and inadequate workshop preparation. These

issues disrupted learning continuity and practical skill acquisition. Furthermore, delayed academic trips, insufficient course outlines, and inadequate feedback hindered real-world application and motivation among students.

These findings have significant implications. Institutions should prioritize reforms that ensure the timely allocation of resources, effective monitoring of trainer practices, and consistent use of interactive teaching methods. Providing comprehensive support through academic advising and fostering better teacher-student relationships can also enhance learning experiences. Addressing these issues holistically will contribute to improved academic outcomes and ensure that technical education equips students with both theoretical knowledge and practical competencies.

5.2.2 Utilization of ICT Resources and Academic Performance in Engineering Courses

The study determined the relationship between the utilization of ICT resources and academic performance in engineering courses in technical and vocational institutions in Nakuru County, Kenya. The regression analysis revealed that while ICT resource utilization is a significant predictor of academic performance, the impact is minimal, with only 3.2% of the variation in academic performance explained by ICT usage. This suggests that ICT alone cannot substantially enhance academic outcomes, highlighting the need for a more integrated approach that combines ICT with improved teaching methods and student support systems.

The study also tested the hypothesis regarding the relationship between ICT utilization and academic performance. The null hypothesis was rejected ($P = 0.003$, $\alpha = 0.05$), confirming that ICT utilization significantly affects academic performance. However, the study uncovers significant underuse of ICT tools among students and technicians. Many students reported not using ICT tools such as simulations, e-libraries, and engineering

software, limiting their access to resources that could enhance their understanding of engineering concepts. Furthermore, students often fail to utilize ICT platforms for communication with instructors and peers, limiting collaboration and feedback essential for academic growth.

Technicians noted that while some students engage with ICT tools like engineering software, many others do not. There is also limited use of mobile learning applications and performance monitoring tools, suggesting a gap in digital engagement among students. The barriers to ICT utilization include inadequate training, lack of access to technology, and insufficient integration of ICT tools into the curriculum. Administrators employ strategies such as providing ICT facilities, running computer literacy classes, and allocating time for ICT exercises to encourage usage. Despite these efforts, challenges like low internet connectivity and resistance to ICT adoption hinder the effectiveness of these initiatives.

The study suggests that institutions need to invest in better ICT infrastructure, enhance digital literacy among students and staff, and better integrate ICT tools into the curriculum. Promoting collaboration through ICT tools, improving access to learning resources, and ensuring adequate training can enhance academic performance and workforce readiness, addressing the current gaps in ICT utilization.

5.2.3 Utilization of Material Resources and Academic Performance in Engineering Courses

The study found out a significant relationship between the utilization of material resources and student academic performance, explaining 10.3% of the variation in performance. The regression analysis shows that each unit increase in resource utilization leads to a 0.984unit improvement in performance, with the null hypothesis of no relationship being rejected ($P=0.000$). However, challenges such as limited resources,

poor planning, and inconsistent access to tools hinder optimal practical learning. While administrators have implemented strategies for resource management, issues like inadequate access, insufficient tools, and high costs persist.

Students' engagement with textbooks and libraries was also low, with many preferring digital platforms due to limited physical access. Practical learning was further constrained by a lack of specialized training and resources, while safety concerns arose from inconsistent use of protective equipment. Technology integration faces challenges, with computers underused for learning activities. Inadequate classroom infrastructure, such as uncomfortable seating, also affects student concentration and learning outcomes.

These findings underscore the need for improved resource accessibility, better infrastructure, and greater use of technology in training. Institutions should enhance access to practical tools, textbooks, and digital resources while addressing safety protocols and classroom conditions. Strengthening the management of resources and fostering better engagement with learning materials will improve both practical skills and theoretical knowledge, better-preparing students for the workforce. By addressing these gaps, educational institutions can enhance students' readiness for real-world applications, improving academic outcomes and ensuring a more effective learning experience.

5.2.4 Utilization of Time Resources and Academic Performance in Engineering Courses

This study assessed the relationship between the utilization of time resources and academic performance in technical and vocational institutions, with a focus on the challenges related to punctuality, timetabling, and communication. The analysis found a statistically significant, moderate positive correlation ($r=0.201$) between the utilization of time and academic performance, suggesting that better time management is associated with improved performance. However, the explained variation in academic performance

due to time resource utilization was relatively low (4.0%), indicating that other factors also contribute significantly to academic success.

The hypothesis testing rejected the null hypothesis, which posited no significant relationship between time resource utilization and academic performance. The findings highlighted the importance of time management in enhancing academic outcomes, though the effect was not overwhelming. Therefore, while time management strategies are crucial, they must be complemented by other institutional interventions to improve overall student performance.

Qualitative data revealed that technical institutions adopted various strategies to improve punctuality, such as educating staff and students on the importance of time management and utilizing attendance registers. However, challenges such as delayed timetables, transport issues, and inconsistent trainer attendance persisted, which hindered effective time utilization. Administrators noted that communication problems, including delayed feedback and orientation sessions, further complicated the implementation of timely academic activities.

The study emphasized the need for improved institutional planning, timely syllabus coverage, and consistent adherence to timetables to enhance learning outcomes. Addressing gaps in trainer punctuality, feedback timeliness, and communication could significantly improve the academic environment, fostering better student performance and readiness for exams. These findings contribute to understanding how time resource utilization can impact academic performance in technical education settings.

5.3 Conclusions

The study explored the relationship between utilizing resources human, ICT, material, and time and academic performance in engineering courses within technical and

vocational institutions. The findings indicate a pressing issue of low academic performance among students, mainly attributable to the ineffective utilization of these essential resources. In examining human resources, it was found that inconsistent trainer attendance and a lack of regular assessments severely hindered student engagement and learning experiences. The regression analysis highlighted a statistically significant relationship between human resource utilization and academic performance ($r = 0.291$, $p = 0.00$), suggesting that ineffective human resource practices contribute to the observed low performance in engineering courses.

Similarly, the investigation into ICT resource utilization revealed a significant relationship between access and engagement among students, with minimal active use of ICT tools leading to a significant relationship with academic performance ($r = 0.179$, $p = 0.003$). The assessment of material resources further confirmed disparities in student engagement, as many students reported lacking access to necessary tools, resulting in significant prediction of academic performance ($r = 0.323$, $p = 0.00$). Time resource utilization analysis demonstrated a significant correlation with academic performance ($r = 0.201$, $p = 0.001$), underscoring the importance of structured time management practices. Overall, the study illustrates that the low academic performance in engineering courses at technical and vocational institutions is linked to the inadequate utilization of human, ICT, material, and time resources. Addressing these issues is crucial for improving educational outcomes and equipping students to meet future challenges in their fields.

5.4 Recommendations

Given the research findings on the analysis between utilization of selected resources and academic performance in engineering courses in technical and vocational institutions, the following recommendations were preferred.

Administrators should introduce strategic ways to deploy qualified human resources, ensure consistent trainer attendance, and timely provide assessments and feedback. This would foster a conducive academic environment that supports student learning and practical skill acquisition.

The study also recommends the government should allocate specific funding to support the procurement and maintenance of ICT resources in technical and vocational institutions. This could include grants or subsidies for institutions to purchase necessary digital tools, software, and hardware, particularly in public institutions that face financial constraints. Additionally, the government should facilitate the expansion of digital learning platforms and resources, especially in regions with limited access to physical textbooks and libraries. This could include subsidizing internet access for students, providing e-books and online resources, and developing mobile apps to enhance learning engagement. Finally, stakeholders, including administrators, trainers, and students, should be provided with regular workshops and training sessions on effective time management. These initiatives could include prioritizing tasks, avoiding procrastination, and using tools like planners or digital calendars to track academic schedules. This will help improve students' time management skills and improve academic performance.

5.4.1 Recommendation for Policy

- i. According to the study, the government should introduce policies that foster partnerships between educational institutions and industry partners to improve the timeliness and efficiency of practical training.
- ii. The Ministry of Education should introduce policies that mandate the integration of digital learning tools and platforms in the TVET institutions, ensuring that ICT is used effectively to supplement traditional learning methods.

- iii. The study recommends that school administrators implement policies that mandate timely completion of syllabus and curriculum delivery and regular monitoring to ensure institutions adhere to their academic schedules.
- iv. Institutions should implement strict accountability measures for punctuality for both staff and students. These measures should include penalties for repeated tardiness and rewards for good punctuality. Regular audits of attendance and punctuality records should be mandatory to ensure compliance.

5.4.2 Recommendations for Further Research

The study recommends that scholars, educationists, researchers, and policymakers can:

- i. Comparative studies could be conducted to analyze how different technical and vocational institutions manage human, material, time, and ICT resources.
- ii. Longitudinal studies could be conducted to explore the relationship between trainer engagement levels (attendance, participation, and preparation) and student academic performance.
- iii. A study be carried out on the influence of peer support systems on student engagement and performance in practical learning environments.
- iv. Research be conducted on the institutional culture within TVET institutions and its impact on student motivation and academic performance.

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APPENDICES

Appendix I: Letter of Introduction

Komen K. Paul,
Kabarak University,
P.O. Private Bag 20157,
Nakuru.

Dear Sir/Madam,

Ref: Permission To Collect Data

I would like your cooperation in conducting a research study as part of my postgraduate degree program in Education (Leadership and Management) at Kabarak University. The focus of my research is to analyze the relationship between the utilization of selected resources and academic performance in engineering in TVET institutions in Nakuru County, Kenya.

As part of the study, I would like to request permission from your office to allow the sampled respondents within your institution to participate. Your institution's participation in this research would greatly contribute to the understanding of the factors influencing academic performance in engineering within TVET institutions.

I assure you that all information gathered was treated with strict confidentiality and used solely for academic purposes. Additionally, I am more than willing to discuss any concerns or questions you may have regarding the study.

I would greatly appreciate your support in this matter, and I am open to discussing and scheduling a suitable date for the data collection process.

Thank you for considering my request, and I look forward to your positive response.

Yours sincerely,

Komen K. Paul

Appendix II: Informed Consent

STUDY TITLE: Relationships Between Utilization of Selected Resources and Academic Performance in Engineering in Technical and Vocational Institutions in Nakuru County, Kenya

PI KOMENK.PAUL Affiliated Institution: **KABARAKUNIVERSITY**

Co-investigator(s) Prof. Fredirick Ngala, & Prof. Henry Kiplangat Affiliated Institution(s): **KABARAK**

Introduction

The above-listed investigators invite you to participate in this research study. This form will help you gather information about the study to decide whether you want to participate voluntarily. You are encouraged to ask any question regarding the research process and any benefit or risk you may accrue by participating. After adequately informing you about the study, you will be requested to either agree or decline to participate. Upon agreeing to participate in the study, you will be further requested to affirm that by appending your signature /thumbprint on this form. Accepting or declining to participate in this study does not in anyway waive the following rights which you are entitled to:

- a) Voluntary participation in the study;
- b) Withdrawing from the study at any Time Resources without the obligation of having to explain and;
- c) Access to services to which you are entitled to

A copy of this form will be provided for your records. Should I continue YES/NO

This study has been reviewed and approved by Kabarak University Research Ethics Committee (KUREC).

Who can Take Part in the Study?

The study participants will include engineering students who are currently enrolled on Technical and Vocational institutions in Nakuru County, Principals, Deputy Principals, Heads of Departments, Trainers, and Technicians who are actively involved in engineering programs. The participants must be willing to engage in filling the

questionnaire and taking part in interview related to resource utilization and academic performance.

Participating in the Study

Once you agree to participate, you'll spend approximately 10-15 minutes completing questionnaires and 20-30 minutes in the interview. Questions will cover human, ICT, material, and time resource utilization and academic performance. After data collection, questionnaires and interview records will be securely stored for one month before being shredded to ensure confidentiality. Only official institutional contacts will be used for any necessary follow-up, maintaining participant anonymity and confidentiality throughout the study process.

Potential Risks

No risks involved

Privacy & Confidentiality

Participants will remain anonymous, with no names on the questionnaires. Data will be coded, kept confidential, and securely stored. After analysis, data will be shredded. The study poses no risks and ensures privacy.

Benefits

Government decision-makers will gain insights for informed budgetary decisions, optimize resource use in TVET institutions, enhance academic performance, better prepare students for the workforce, and contribute to industry growth.

Cost

The participants will not incur any cost by participating in the study. They will be informed that there is no monetary obligation attached to this study, only their responses are required, which are also voluntary. The study will take place within their reach, which is within the institutions.

Expenditure

There is no money they will be refunded in case of any expenses

Further Questions/Concerns in Future

If you need further clarification or have questions regarding your continued participation

in the study, feel free to contact the PI (Komen K Paul -0721762497). In case of concerns regarding your rights and/or obligations as a research participant, do not hesitate to contact the secretary, KUREC (Dr. Mirriam Muga -0710360700)

Voluntary Participations

The decision to participate or not is absolutely voluntary. You can withdraw from the study at any point without providing any explanation.

Communication

If you have any questions or need clarification, do not hesitate to contact the researcher through the university.

Statement of Consent

I have comprehensively read the consent form, and/the information has been comprehensively read to me by the researcher. I have understood what the study is about and all the questions and concerns that I had have been responded to in a clear and concise. The study benefits and foreseeable risks have been explained to me. I totally understand that my decision to participate in this study is voluntary and I have the right to withdraw at any point during the study.

I freely consent to participate in this study

Signing this form does not in any way imply that I have given up the rights am entitled to as a participant

I agree to participate in this research, YES_____NO_____

I agree to provide my contact details for follow-up, YES_____NO_____

Participant's Name _____

Participant's Signature/Thumb print:_____Date _____

Appendix III: Questionnaires for Students

This study aims to understand the utilization of resources in TVET institutions.

Kindly do not include your name or the name of your institution on the questionnaire.

Fill in the blanks with the appropriate answer by putting a tick (✓) inside the bracket.

You have been identified as a key stakeholder, and we request that you support by filling out this study questionnaire.

NB: The information provided will be solely utilized for research purposes.

Section A: Background Information

1. Program of Study

Electrical Engineering ()

Mechanical Engineering ()

Civil Engineering ()

Other (Specify): _____

2. Year of Study:

Module 1 ()

Module 2 ()

Module 3 ()

TEP ()

3. Extracurricular Activities (if applicable):

Yes ()

No ()

4. Age:

Under 20 ()

20-22 ()

23-25 ()

Over 25 ()

Section B: Utilization of Human Resources

Kindly indicate your frequency of the following statements by placing a tick (✓) in the appropriate column

Key: 1. Never 2. Rarely 3. Sometimes 4. Frequently 5. Always

No	Statements	1	2	3	4	5
1.	Trainers attend lessons					
2.	Trainers assess learners as and when required.					
3.	Trainers ensure that the workshop is prepared for practical before the lessons.					
4.	Trainers plan for relevant academic trips.					
5.	The trainers provide course outlines.					
6.	I receive feedback on exam performance.					
7.	Trainers provide academic advice to support studies.					
8.	The training lessons are interactive.					
9.	The trainer provides relevant learning materials.					
10.	Trainers supervise the projects.					

Section C: Utilization of ICT Resources

Kindly indicate your frequency of the following statements by placing a tick (✓) in the appropriate column.

Key: 1. None 2. Few 3. Many 4. All

No	Statements	1	2	3	4
1.	Students use ICT to access information for learning activities.				
2.	Students use simulations to understand complex engineering concepts.				
3.	Students communicate with peers using ICT platforms.				
4.	Students communicate with instructors using ICT platforms.				
5.	Students use ICT tools to discuss coursework.				

6.	Students use e-libraries for studies.				
7.	Students use mobile learning apps to supplement learning outside the classroom.				
8.	Students access academic performance reports using ICT tools.				
9.	Students use ICT conferencing tools to attend institutional meetings.				
10.	Students use relevant engineering software in the learning process.				

Section D: Utilization of Material Resources

Kindly indicate your frequency of the following statements by placing a tick (✓) in the appropriate column.

Key: 1. Never 2. Rarely 3. Sometimes 4. Frequently 5. Always

No	Statements	1	2	3	4	5
1.	Students use workshop tools and equipment for practical exercises.					
2.	Students access workshop tools and equipment easily.					
3.	Students engage in hands-on activities in workshops and laboratory lessons.					
4.	Students refer to textbooks as part of learning materials.					
5.	Students use the resources available in the library.					
6.	Safety equipment is consistently used during practical sessions.					
7.	Students use computers for learning activities.					
8.	All classrooms are used for lessons.					
9.	Institute vehicles are used for academic trips.					
10.	Lecture chairs are adequate in classrooms.					

Section E: Utilization of Time Resources

Kindly indicate your frequency of the following statements by placing a tick (✓) in the appropriate column.

Key: 1. Never 2. Rarely 3. Sometimes 4. Frequently 5. Always

No	Statements	1	2	3	4	5
1.	Trainers attend lessons on time.					
2.	I attend all the lessons.					
3.	The training timetable is prepared on time.					
4.	The exam timetable is prepared on time.					
5.	The syllabus content coverage is completed on time.					
6.	Trainers adhere to the timetable schedule.					
7.	Training starts immediately on reporting.					
8.	Feedback is given on time.					
9.	Orientations are done well to minimize Time Resources wastage.					
10.	Communications are done on time.					
11.	The minimum Time Resources is used during admission.					

Appendix IV: Questionnaires for Technicians

This study aims to understand the utilization of resources in TVET institutions. Kindly do not include your name or the name of your institution on the questionnaire. Fill in the blanks with the appropriate answer by putting a tick (✓) inside the bracket.

You have been identified as a key stakeholder, and we request that you support by filling out this study questionnaire.

NB: The information provided will be solely utilized for research purposes.

SECTION A: Background Information:

1. Gender: Male () Female ()

2. Age: 20-29 () 30-39 () 40-49 () 50 and above ()

3. Years of Service:

Less than five years () 5-10 years () 11-15 years () 16 years and above ()

4. Department:

Mechanical Engineering ()

Automotive Engineering ()

Electrical Engineering ()

Building and Civil Engineering ()

Other (Specify: _____)

Section B: Utilization of Human Resources

Kindly indicate your frequency of the following statements by placing a tick (✓) in the appropriate column.

Key: 1. Never 2. Rarely 3. Sometimes 4. Frequently 5. Always

No	Statements	1	2	3	4	5
1.	Trainers attend lessons					
2.	Trainers assess learners as and when required.					
3.	Trainers ensure that the workshop is prepared for practical before the lessons.					
4.	Trainers plan for relevant academic trips.					
5.	The trainers provide course outlines.					
6.	Trainers give feedback on exam performance.					
7.	Trainers provide academic advice to support studies.					
8.	The training lessons are interactive.					
9.	The trainer provides relevant learning materials.					
10.	Trainers supervise the projects.					

Section C: Utilization of ICT Resources

Kindly indicate your frequency of the following statements by placing a tick (✓) in the appropriate column.

Key: 1. None 2. Few 3. Many 4. All

No	Statements	1	2	3	4
1.	Students use ICT to access information for learning activities.				
2.	Students use simulations to understand complex engineering concepts.				
3.	Students communicate with peers using ICT platforms.				
4.	Students communicate with instructors using ICT platforms.				
5.	Students use ICT tools to discuss coursework.				

6.	Students use e-libraries for studies.				
7.	Students use mobile learning apps to supplement learning outside the classroom.				
8.	Students access academic performance reports using ICT tools.				
9.	Students use ICT conferencing tools to attend institutional meetings.				
10.	Students use relevant engineering software in the learning process.				

Section D: Utilization of Material Resources

Kindly indicate your frequency of the following statements by placing a tick (✓) in the appropriate column.

Key: 1. Never 2. Rarely 3. Sometimes 4. Frequently 5. Always

No	Statements	1	2	3	4	5
1.	Students use workshop tools and equipment for practical exercises.					
2.	Students access workshop tools and equipment easily.					
3.	Students engage in hands-on activities in workshops and laboratory lessons.					
4.	Students refer to textbooks as part of learning materials.					
5.	Students use the resources available in the library.					
6.	Safety equipment is used during practical sessions.					
7.	Students use computers for learning activities.					
8.	All classrooms are used for lessons.					
9.	Institute vehicles are used for academic trips.					
10.	Lecture chairs are adequate in classrooms.					

Section E: Utilization of Time Resources

Kindly indicate your frequency of the following statements by placing a tick (✓) in the appropriate column.

Key: 1. Never 2. Rarely 3. Sometimes 4. Frequently 5. Always

No	Statements	1	2	3	4	5
1.	Trainers attend practical lessons on time.					
2.	Students attend practical lessons.					
3.	The practical timetable is prepared on time.					
4.	A practical exam timetable is prepared on time.					
5.	All practical content is covered on time.					
6.	The timetable schedule is adhered to					
7.	Practical starts immediately on reporting					
8.	Provide timely and constructive feedback.					
9.	Organize orientation for students to minimize Time Resources wastage.					
10.	Communications are clear and done on time.					

Appendix V: Interview schedules for Administrators

This study aims to understand the utilization of resources in TVET institutions. Kindly do not include your name or the name of your institution on the questionnaire. Fill in the blanks with the appropriate answer by putting a tick (✓) inside the bracket.

You have been identified as a key stakeholder, and we request that you support by filling out this study questionnaire.

NB: The information provided will be solely utilized for research purposes.

Section A: Background Information:

- (a) Gender: Male () Female ()
- (b) Age: Under 30 () 31-40 () 41-50 () 51 and above ()
- (c) Years of Service in the Institution as a leader:
- Less than five years () 5-10 years () 11-15 years () 16 years and above ()
- (d) Number of students registered for exams in the last six years

Year	2018	2019	2020	2021	2022	2023
Number of Students						

- (e) Percentage pass of engineering students who passed exams in the last six years

Year	2018	2019	2020	2021	2022	2023
Average Percentage Pass						

Section B: Utilization of Human resources

1. How do you ensure that the trainers attend lessons as per the timetable?
2. What approach do you use to ensure the trainers assess learners when required?
3. How do you oversee the preparation of workshops practicals to ensure they are well-prepared?

4. What strategies do you employ to plan academic trips relevant to the course content?
5. How do you ensure that course outlines are prepared?
6. How do you ensure that trainers give feedback on exam performance to help students improve their understanding?
7. What measures are implemented to ensure students get academic advice to support their studies?
8. How do you encourage interactive learning experiences in training lessons to engage students?
9. How do you ensure that relevant learning materials are available to support the curriculum?
10. Can you elaborate on your supervision process for class projects to ensure they align with learning objectives and are completed successfully?

Section C: Utilization of ICT Resources

1. What strategies have you implemented to ensure students effectively use ICT to access information for their learning activities?
2. How are simulations integrated into the curriculum to help students understand complex engineering concepts?
3. How do you facilitate communication between students using ICT platforms?
4. How do you facilitate communication between instructors using ICT platforms?
5. In what ways do students utilize ICT tools for discussing coursework?
6. How have e-libraries and digital resources been integrated into the learning process?
7. Could you share some examples of how mobile learning apps supplement learning outside the classroom?
8. How do students access their academic performance reports using ICT tools?
9. How have ICT conferencing tools facilitated institutional meetings and collaboration among staff members?

10. What steps have been taken to ensure students can access relevant engineering software for their learning process?

Section D: Utilization of Material Resources

1. How do you ensure that workshop tools and equipment are effectively utilized for practical exercises?
2. What measures have been implemented to ensure trainers and students access workshop tools and equipment?
3. How are students encouraged to engage in hands-on activities in workshops and laboratory lessons?
4. How do you ensure that textbooks are effectively utilized as learning materials?
5. How do you encourage students to utilize the resources available in the institution's library for academic purposes?
6. How are computers integrated into training and learning activities?
7. Can you elaborate on how specialized tools and equipment are used in training?
8. How do you ensure all timetabled lessons are appropriately assigned to classrooms?
9. What measures are taken to ensure adequate transport for academic trips?
10. How do you assess that lecture chairs are adequate in classrooms?

Section E: Time Resources

1. Can you provide specific strategies you employ to promote punctuality among students?
2. How do you ensure that students attend all classes on time?
3. Could you elaborate on how the training timetable is prepared on time?
4. Discuss your approach to preparing exam timetables on time.
5. How do you ensure syllabus content is covered within the allocated Time Resources frame?
6. In what ways do you ensure adherence to the timetable schedule?

7. Describe your methods for ensuring that training starts promptly upon reporting.
8. How do you provide timely feedback to students?
9. What steps do you take to organize student orientation sessions to minimize Time Resources wastage?
10. How do you ensure that communications within the institution are clear and timely?

Appendix VI: Table for Determining Sample Size

<i>N</i>	<i>S</i>	<i>N</i>	<i>S</i>	<i>N</i>	<i>S</i>
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	100000	384

Note.—*N* is population size. *S* is sample size.

Source: Krejcie & Morgan, 1970

Appendix VII: Geographical Locations (Maps)

NAKURU COUNTY: SUB -COUNTIES



Appendix VIII: KUREC Approval Letter



KABARAK UNIVERSITY RESEARCH ETHICS COMMITTEE

Private Bag - 20157
KABARAK, KENYA
Email: kurec@kabarak.ac.ke

Tel: 254-51-343234/5
Fax: 254-051-343529
www.kabarak.ac.ke

OUR REF: KABU01/KUREC/001/18/07/24

Date: 18th July, 2024

Paul Komen
Reg No: GMEML/M/3261/12/19
Kabarak University,

Dear Paul,

RE: RELATIONSHIPS BETWEEN UTILIZATION OF SELECTED RESOURCES AND ACADEMIC PERFORMANCE IN ENGINEERING IN TECHNICAL AND VOCATIONAL INSTITUTIONS IN NAKURU COUNTY, KENYA

This is to inform you that **KUREC** has reviewed and approved your above research proposal. Your application approval number is **KUREC-180724**. The approval period is **18/07/2024 – 18/07/2025**.

This approval is subject to compliance with the following requirements:

- i. All researchers shall obtain an introduction letter to NACOSTI from the relevant head of institutions (Institute of postgraduate, School dean or Directorate of research)
- ii. The researcher shall further obtain a RESEARCH PERMIT from NACOSTI before commencement of data collection & submit a copy of the permit to **KUREC**.
- iii. Only approved documents including (informed consents, study instruments, MTA Material Transfer Agreement) will be used
- iv. All changes including (amendments, deviations, and violations) are submitted for review and approval by **KUREC**.
- v. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to **KUREC** within 72 hours of notification;
- vi. Any changes, anticipated or otherwise that may increase the risk(s) or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to **KUREC** within 72 hours;
- vii. Clearance for export of biological specimens must be obtained from relevant institutions and submit a copy of the permit to **KUREC**;
- viii. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal and;
- ix. Submission of an executive summary report within 90 days upon completion of the study to **KUREC**

Sincerely,

Prof. Jackson Kiteu, Ph.D.
KUREC-Chairman

Cc Vice Chancellor
DVC-Academic & Research
Registrar-Academic & Research
Director-Research Innovation & Outreach
Institute of Post Graduate Studies

As members of Kabarak University family, we purpose at all times and in all places, to set apart in one's heart, Jesus as Lord.

(1 Peter 3:15)

Kabarak University is ISO 9001:2015 Certified



Appendix X: Evidence of Conference Participation



KABARAK UNIVERSITY

Certificate of Participation

Awarded to

KOMEN K. PAUL

For successfully participating in the 14th Annual Kabarak University International Research Conference held on 14th October 2024 and presented a paper entitled *“Relationship Between Utilization of Selected Resources and Academic Performance in Engineering in Technical and Vocational Institutions in Nakuru County, Kenya.”*

Conference Theme

Emerging Trends in Education and Learning: Unlocking opportunities For All

Prof. Frederick B.J.A Ngala
Dean, School of Education
& Director Music
Performance

Dr. Phillip Nyawere
Ag. Director - Research,
Innovation and Outreach

Kabarak University Moral Code

As members of Kabarak University family, we purpose at all times and in all places, to set apart in one's heart, Jesus as Lord.

(1 Peter 3:15)



Kabarak University is ISO 9001:2015 Certified




Appendix XI: List of Publication

Editon Consortium Journal of Educational Management and Leadership [ISSN: 2709 - 1414]



Issue no: 1 | Vol no: 5 | November 2024: 9-31

Relationships between utilisation of human resources and academic performance in engineering in Technical and Vocational Institutions in Nakuru County, Kenya

Komen K. Paul ⁽¹⁾ 
Frederick Ngala ⁽²⁾ 
Henry Kiplangat ⁽³⁾ 

Article History
Received: 2024.09.10
Accepted: 2024.10.11
Published: 2024.11.12

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Cite this article in APA

Komen, K. P., Ngala, F., & Kiplangat, H. (2024). Relationships between utilisation of human resources and academic performance in engineering in Technical and Vocational Institutions in Nakuru County, Kenya. *Editon consortium journal of educational management and leadership*, 5(1), 9-31. <https://doi.org/10.51317/ecjempl.v5i1.546>

Abstract

The purpose of this article was to analyse the relationships between the utilisation of human resources and academic performance in engineering at technical and vocational institutions in Nakuru County, Kenya. The problem that the study addressed was the high failure rate of students in engineering. The study used a descriptive survey design utilising closed-ended questionnaires and interview schedules. The sample consisted of 331 students, 11 technicians, and 22 Administrators (11 Heads of Departments, 7 Deputy Principals, and 4 Principals). A proportionate sampling technique was used to obtain student samples per institution. Participants were selected through simple random sampling. The hypothesis was tested and established that there was a positive and statistically significant relationship between utilisation of human resources and academic performance in engineering ($p=0.000 < p=0.05$), concluding that ineffective utilisation of human resources in the TVET institutions contributes to the observed low performance in engineering programs. The study recommended that institutions implement a trainer monitoring system, prioritise data-driven assessment of teaching methods, provide ongoing professional development, and establish formative assessments with clear metrics to enhance training quality and student performance in engineering.

Key words: Academic performance, human resources, technical and vocational training, utilisation.



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