Impact of Higher Secondary Level ICT Education on the Performance of Tertiary Level STEM Students: Bangladesh Perspective.

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APPROVAL

This thesis titled on "**Impact of Higher Secondary Level ICT Education on the Performance of Tertiary Level STEM Students: Bangladesh Perspective.**", submitted by **Most. Nahida Sultana (ID: 201-35-522)** to the Department of Software Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of Bachelor of Science in Software Engineering and approval as to its style and contents.

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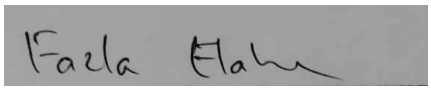

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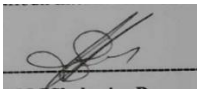

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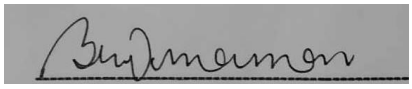

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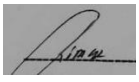

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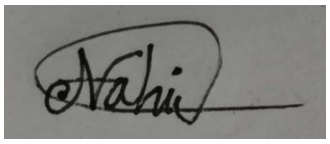
DECLARATION

It hereby declares that this thesis has been done by me under the supervision of Mr. Khalid Been Badruzzaman Biplob, Lecturer (Senior Scale), Department of Software Engineering, Daffodil International University. It also declares that neither this thesis nor any part of this has been submitted anywhere else for award of any degree.



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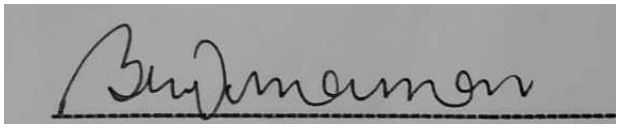

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ACKNOWLEDGEMENT

First, I express my heartiest thanks and gratefulness to almighty God for His divine blessing makes it possible to complete the final year Thesis successfully.

I am really grateful and wish profound indebtedness to **Mr. Khalid Been Badruzzaman Biplob Lecturer (Senior Scale)**, Department of SWE Daffodil International University, Dhaka. Deep Knowledge & keen interest of our supervisor in this field carry out this thesis. His endless patience, scholarly guidance, continual encouragement, constant and energetic supervision, constructive criticism, valuable advice, reading many inferior drafts and correcting them at all stages have made it possible to complete this project.

I would like to express my heartfelt gratitude to the Head of the Department of SWE, along with my supervising teachers and seniors, for their invaluable assistance in completing our thesis. I extend my appreciation to all the faculty members and staff of the SWE department at Daffodil International University for their support and guidance.

I would like to thank my entire course mate in Daffodil International University, who took part in this discussion while completing the course work.

Finally, I must acknowledge with due respect the constant support and patients of my parents.

ABSTRACT

This study investigates the significant impact of ICT education from the Higher Secondary Certificate (HSC) has on Bangladeshi students' progress in tertiary STEM fields. Through utilizing a comprehensive examination of demographic profiles, proficiency assessments, facility rating systems, and satisfaction measures, this study determines the complex relationships between HSC level ICT education as well as success in STEM areas at the university level. Data were collected through an online survey from 244 students enrolled in Computer Science and Engineering (CSE), Software Engineering (SWE), and Information Technology Management (ITM) departments. The results highlight how many different factors have significant effects on students' first-semester SGPA. A number of variables, including prior ICT knowledge on data handling from college, quality of instruction provided by college ICT Teacher, and HSC level ICT course grade, have strong relationships with student performance in university level. This study illustrates the positive impact of improved instructional materials and teacher-led projects on strong skill development, a phenomenon that will increase overall satisfaction among learners. Although geographical location, gender, and college type have been explored, it does not appear such they have significantly affected ICT course grades directly. Instead, instructional components and techniques for improving skills become important factors in determining students' academic performance. The study not only finds significant relationships but also promotes curriculum improvements on a focus towards ICT education technique optimization. With an aim of improving instructional methods and curriculum design, these observations provide governments and other individuals within education with suggestions that are applicable. The study highlights how important it is to effectively utilize ICT education in order that encourage overall STEM development in Bangladesh's educational system.

Keyword: ICT, HSC, Tertiary, STME, Demographic, SGPA, Geographic location.

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CHAPTER 1: INTRODUCTION

1.1. Introduction:

The rapid expansion of the economy has led people to recognize undeniably that technology plays a crucial role in promoting higher education and economic development [3]. ICT play a pivotal role in improving education access and awareness in developing nations. They greatly aid in acquiring and sharing knowledge, offering remarkable chances for underprivileged countries to enhance education, policy-making, and economic prospects. Every facet of human existence is being impacted by Information and Communication Technologies (ICT). The adept use of ICT in developed countries has already demonstrated a significant role in their economic and societal advancement. The use of information technologies in several sectors—including the education sector, one of the key sectors determines the economic success of a nation [2]. The Bangladeshi government recognizes the significance of ICT education in the contemporary global context [1]. So, in recent times, the Government of Bangladesh has embraced the integration of ICT within both domestic and international educational institutions, underscoring the significance of this initiative [4]. In this regard, the government introduced ICT education, which was integrated into the curriculum of secondary school certificate (SSC) and higher secondary school certificate (HSC) levels in 2013 [1]. At the HSC level, Bangladesh is currently in the initial phases of embracing ICT adoption with the intention of improving students' understanding and stimulating their interest in this field. This is done to aid students in understanding the significance of ICT in our rapidly transforming world. Students get an opportunity to educate themselves on the fundamentals of computers through this Inter level ICT educational program. This includes understanding computer basics, hardware components like input and output devices, processing units, and storage devices. Additionally, students will learn about the operational principles of hardware, the functioning of operating systems, basics of networking, communication devices, the Internet, programming fundamentals, and more [1]. This study assists students in attaining higher levels of education. It additionally assists them to make career choices; for instance, there has been an enormous rise in choice for the IT sectors at the university level in the past few years.

The impact of prior ICT education at the Higher Secondary Certificate (HSC) level on students' success in STEM (Science, Technology, Engineering, and Mathematics) subjects at universities is enormous. Students' journey into tertiary STEM professions is enhanced by this foundational education, providing them the information and skills they need. Many courses require the use of specialized software, data analysis tools, and programming languages. Higher Secondary-

level ICT education can provide a head start in understanding these tools, making it easier for students to engage with complex course content. As students make their way into university STEM performance, the benefits of a strong ICT education at the HSC level become visible, giving them a strong basis in technology and problem-solving abilities. This prior education helps students integrate more easily and enables them the confidence and adaptability to face the challenges that come along entering the STEM fields. Higher education has been significant in adopting modern technology and driving innovation in a variety of sectors, including education, knowledge dissemination, instructional delivery, healthcare services, artistic performances, and public administration, across others. This prepares students for university-level studies, where a significant amount of research, coursework, and communication is conducted using digital platforms. Many universities in Bangladesh have successfully integrated ICT into their curricula, employing it in effective and suitable ways to enhance teaching and learning across various academic areas. By efficiently incorporating ICT into their educational programs, these universities have harnessed its potential to significantly elevate the quality of education and benefit a diverse range of academic participants. This shift has enabled students to online learning platforms, digital libraries, and e-learning resources. They can engage with multimedia content, participate in online discussions, and access a variety of educational materials that enrich their learning experience. Proficiency in ICT allows students to collaborate with peers and professors through digital platforms, facilitating group projects, discussions, and information sharing regardless of physical distances. This prepares them to adapt to different modes of instruction, especially important during unforeseen circumstances like the COVID-19 pandemic.

1.2. Objectives

The study aims to investigate how ICT education affects university-level studies. Determine the students' comprehension level following their Higher Secondary -level ICT course, assess how ICT education affects their choice of university department and career plans, and identify areas in the ICT sector that require improvement. Overall, our study seeks to advance knowledge of the impact of Higher Secondary ICT education on universities in Bangladesh, based on the following factors.

I. Impact Assessment of Higher Secondary ICT Education: Investigate the influence and impact of higher secondary ICT education on students' performance in university IT departments.

II. Evaluation of Higher Secondary Educational Environment: Assess the overall quality, facilities, and student satisfaction regarding higher secondary education, particularly in ICT, to identify areas for improvement and enhancement.

1.3. Problem Statements

A structured questionnaire was developed to collect different kinds of information in order to establish an in-depth evaluation of ICT education impact on tertiary STME performance and HSC education environment. This data included student satisfaction levels, teacher contributions, first-semester SGPA, college categories and locations, student skill assessments, and grades from HSC level ICT courses. To facilitate succeed in the subsequent study aims, we have established the following parameters:

I. Participants demographic profile
II. Prior ICT knowledge and skills
III. Resources and facilities provided from college
IV. Student satisfaction and motivation
V. Student performance in university IT departments

A breakdown of the participants' demographic profiles is given in Section I. Section II evaluates the knowledge that was learned at the HSC level, and Section III specifies the facilities & resources that students can access within their colleges. The IV section explores the student satisfaction levels of overall systems. while the last section evaluates student performance in their first semester of university.

CHAPTER 2: LITERATURE REVIEW

2.1. Literature Review

Digital technology has played a pivotal role in the economic development of societies by significantly influencing higher education and its modernization [3]. ICT contributes significantly to the economic, political, social, and cultural advancement of emerging countries [13]. Development allocates significant investment to education [8]. & education plays a pivotal role in the development of a nation [10] both are connected. RAHMAN et al. [2] Over the past twenty years, numerous nations have made substantial investments in the comprehensive development of information and communication technology (ICT). Bangladeshi government has undertaken various initiatives to incorporate information and communication technology (ICT) in education. The government has initiated the "ICT for Education" project, aiming to integrate ICT tools in schools and colleges by supplying computers, internet access, and digital content to enhance interactive and modern learning. This education empowers students to embrace technology-driven career paths, aligning with Bangladesh's vision of a digital economy.

The World Bank, the UN, and other donor organizations are implementing large-scale projects or programs in developing countries that cost millions of dollars and are supported either directly or indirectly by information and communication technologies (ICT) [11]. ICT has the power to substantially change lifestyles, prepare students for careers, improve educational systems, and completely transform how we access and use information [8]. Amid tech revolution, education must integrate ICT for enriched experiences, especially in universities [10]. Worldwide, educational institutions have embraced ICT for teaching and providing academic programs focused on ICT [9]. Several educational institutions in Bangladesh have used ICT into their strategies of teaching [9]. Almost all public and private universities offer study in ICT-related subjects such as Computer Science & Engineering (CSE) and some provides Software Engineering (SWE) as well. The field of information and communication technology (ICT) focuses on using software and computers & CSE concentrates on fundamental ideas about the building blocks of computers and networks (hardware), as well as fundamental ideas about programming (formal languages, programming, and software development) [7]. While the relationship between ICT use and student achievement in higher education is yet unknown [9]. However, Higher Secondary ICT provides ideas and influences students towards IT-centered subjects in university.

2.2. Comparative Analysis and Summary

According to Rahman et al. [3] it shows that digital technology (internet users) and GDP stimulate higher education, with 3.26% increase for a 1% rise in digital technology and 18.93% increase for a 1% rise in GDP. This research underscores the importance of effectively integrating digital technology in higher education for sustainable economic growth in Bangladesh, emphasizing collaboration among educators, institutions, and policymakers. Huda et al. [10] Approximately 35% of private universities in Bangladesh utilize ICT to a significant degree for teaching purposes. The utilization of ICT in education, particularly in Bangladesh, Nepal, and Sri Lanka, was examined by the Asian Development Bank (ADB) [6]. This study offers comprehensive insights into ICT in education initiatives in Bangladesh, along with an assessment of their strengths, weaknesses, opportunities, and threats [6]. Roughly 1,367,377 students were registered for higher secondary examinations in Bangladesh in the year 2020 [1] most of them are studied from rural area. The majority of trained teachers work in urban areas with advanced facilities [1]. A wide range of teachers struggle to provide adequate guidance, and there is a shortage of laboratory facilities in rural areas in contrast to urban areas [1]. The main findings of Rahman et al [2] include infrastructural problems in using ICT, higher student interest in ICT integration, and recommendations for providing ICT facilities in classrooms and developing an ICT-based service system. The study also emphasized the importance of teachers and focused on ICT training for them. Limitations of the study include the lack of ICT equipment, manpower, and training in institutions, as well as the need for further development and practice of ICT facilities. The study also suggests further research on the development and practice of ICT facilities [2]. Chowdhury et al [21] The study highlights ineffective ICT integration in higher education, citing obstacles like teachers' limited skills, inadequate equipment, and lack of technical support. Addressing these challenges is crucial for improving ICT utilization in higher education teaching-learning. The study's limitations include teachers' insufficient knowledge and skills, limited time, inadequate equipment, and a lack of technical support. Notably, the absence of self-reported issues and specific suggestions for further research is a noteworthy limitation. Additionally, there is a crucial need for comprehensive teacher training in ICT integration [21].

Al – Rahmi et al [23]. The study underscores the significant impact of PEU, PU, and ACU on students' ICT intentions and satisfaction, affirming the TAM model's robustness. It emphasizes the importance of systematic research for model validation in education sustainability. However, limitations, such as the unexplored CSE-PU relationship, call for future studies using

interview techniques, cross-cultural validation, and consideration of cultural dimensions [23]. Islam et al [9] The study reveals minimal impact of ICT on academic performance, as most students are unaware of its potential for academic enhancement, viewing ICT access primarily as a source of recreation. Limitations include a small sample size, potential bias from self-reported data, and limited generalizability to other academic programs, alongside a lack of detailed analysis on specific ICT tools. Suggestions for improvement lack empirical testing, necessitating careful interpretation and validation through further research [9]. The paper Youssef et al [16] explores the link between ICT use and student performance in higher education, noting conflicting literature results. It emphasizes that strategic implementation of digital technologies can significantly impact students' attitudes and academic achievements. The Haque et al [17] paper's key findings highlight subpar education quality in non-government universities, factors shaping perceptions of higher education quality, and recommendations for improving its quality. Study limitations encompass a small sample size, restricted generalizability, potential data collection bias, absence of external validation, and a narrow scope of variables [17]. The main findings of the paper Punie et al [25] include the potential impacts of ICT on education, such as improved student outcomes, closing the gender gap, assisting students with special needs, and enhancing teacher and classroom outcomes. The paper Das et al [5] underscores the potency of ICT as a tool for broadening educational opportunities, with the potential to enhance access, relevance, and quality of education. It emphasizes ICT's role in facilitating teaching and learning, fostering a conducive environment, and nurturing learners' creative thinking and self-confidence.

CHAPTER 3: MATERIALS AND METHODS

3. Materials and Methods

3.1.Data Source

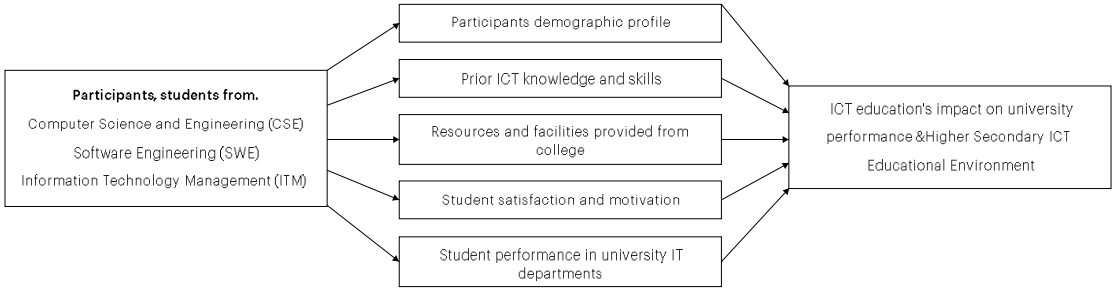

Figure 3.1: Data collection process

We developed a semi structured questionary which consists 38 questions for this study based on particular criteria, and we placed these questions in a Google Form. A total of 244 responses were gathered from students in Computer Science and Engineering (CSE), Software Engineering (SWE), and Information Technology Management (ITM) departments across various universities in Bangladesh.

3.2. Statistical Methods

We have analyzed our dataset with considering a number of parameters, which will be outlined in the following sections, in order to determine the condition of Higher Secondary ICT education in university STEM performance & Higher Secondary Educational Environment in Bangladesh.

3.2.A. Reliability Test

The internal consistency of survey questions is checked using Cronbach's alpha reliability testing in SPSS. A high alpha value (preferably more than 0.7) implies strong correlation between elements, proving the reliability and consistency of the data. This testing ensures that survey correctly measures the desired concepts or variables, hence increasing the certainty of results.

3.2.B. Frequency Analysis

a statistical method, i used for categorical data in my survey. Showcasing the distribution or occurrence of different categories or values. This analysis aids in understanding patterns or frequencies within specific variables, offering insights into data structure and prevalence.

3.2.C. Factor Analysis

Factor analysis is a statistical technique used to identify underlying relationships between observed variables, aiming to condense them into a smaller set of unobserved variables called factors. It helps uncover the hidden structure in datasets, revealing patterns and associations among variables, simplifying complex data, and aiding in the interpretation of relationships among multiple variables.

3.2.D. Linear Regression Analysis

Linear regression analysis is a statistical method used to model and analyze the relationship between a dependent variable and one or more independent variables. It examines how changes in the independent variables are associated with changes in the dependent variable. This analysis calculates a linear equation that best predicts the value of the dependent variable based on the independent variables, providing insights into the strength and direction of the relationships between variables.

3.2.E. Correlation Analysis

This is a statistical technique used to evaluate the strength and direction of the relationship between two continuous variables. It assesses how changes in one variable correspond to changes in another. The result of a correlation analysis is expressed as a correlation coefficient, which ranges from -1 to +1. A coefficient close to +1 indicates a strong positive correlation, while a value close to -1 suggests a strong negative correlation. A coefficient near zero signifies a weak or no relationship between the variables. This analysis helps to understand how variables move in relation to each other, aiding in predictive modeling and understanding associations within data.

CHAPTER 4: ANALYSIS & RESULT

4. Analysis & result

After gathering survey responses, we structured our data in MS-Excel. Using the SPSS tool and MS-Excel functions, we performed mathematical operations to achieve the required results.

4.1. Demographic Profile of Participants

Table 4.1.1: Test result of Demographic Profile

Variable	Categories	Frequency	Percent
Gender	Male	201	82.4
	Female	43	17.6
College category	Private	105	43.0
	Semi-Government	55	22.5
	Government	84	34.4
College location	Urban	167	84.4
	Semi-Urban	57	23.4
	Rural	20	8.2
HSC passing year	2015	14	5.7
	2016	25	10.2
	2017	21	8.6
	2018	59	24.2
	2019	125	51.2

Table 4.1.1: shows that, the survey included 244 people from the departments of Computer Science and Engineering (CSE), Software Engineering (SWE), and Information Technology Management (ITM), the most of them were men (82.4%) with a small percentage of females (17.6%). Their educational backgrounds differed according to the type of college they attended: 34.4% were associated with government-affiliated colleges, 22.5% were enrolled in semi-government schools, and 43.0% attended colleges that were private. Geographically, most of respondents (84.4%) were from urban areas, followed by those from semi-urban areas (23.4%) and rural areas (8.2%). Significantly, the distribution of Higher Secondary Certificate (HSC) passing

years showed that a larger percentage finished in 2019 (51.2%), compared to smaller percentages in 2018 (24.2%), 2017 (8.6%), 2016 (10.2%), and 2015 (5.7%).

4.2. Effects of HSC education on first semester SGPA

Table 4.2.1: Regression analysis result

	Unstandardized Coefficients	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
	B		Lower Bound	Upper Bound	Tolerance	VIF
First Semester SGPA	3.712	.000	3.546	3.879		
ICT_grade	-.106	.008	-.184	-.028	.990	1.011
Prior_Knowledge_ Data Handling	.010	.026	.007	.102	.490	2.040
Quality_Instruction_ College_ICT_Teacher	.016	.044	.002	.124	.455	2.195
Prior ICT Skills	-.041	.218	-.106	.024	.214	4.667
Student Satisfaction	-.001	.904	-.021	.018	.249	4.016
Teacher effort	.012	.495	-.023	.048	.403	2.480

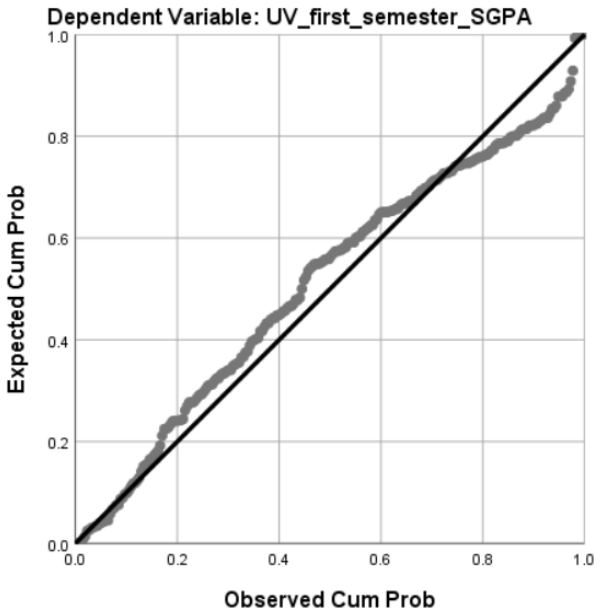

Figure 4.2.1: Regression analysis Chart

The findings suggest that the HSC grade has a significant impact, as indicated by the negative coefficient for HCL level ICT course grade (-0.106, p = 0.008, 95% CI [-0.184, -0.028]), implying that a higher HSC grade correlates with a lower first semester SGPA.

Moreover, prior knowledge in Data Handling displays a positive effect on SGPA (Coefficient = 0.010, p = 0.026, 95% CI [0.007, 0.102]), suggesting that students with more background knowledge in this area tend to perform slightly better in their first semester at the university.

Additionally, the quality of instruction provided by College ICT Teachers also exhibits a positive influence (Coefficient = 0.016, p = 0.044, 95% CI [0.002, 0.124]). Students who perceive higher quality instruction from their ICT teachers tend to have a slightly higher first semester SGPA.

Other shows non-significant impact on Students first semester SGPA.

4.3. ICT Proficiency Levels received from HSC Studying

Table 4.3.1: Frequency of ICT Proficiency Levels

	Not at all (Valid Percent)	Rarely (Valid Percent)	Neutral (Valid Percent)	Moderate (Valid Percent)	Very Strong (Valid Percent)
Computer Hardware	8 (3.3)	18 (7.4)	74 (30.3)	99 (40.6)	45 (18.4)
Computer Software	9 (3.7)	20 (8.2)	71 (29.1)	95 (38.9)	49 (20.1)
Networking	7 (2.9)	30 (12.3)	86 (35.2)	80 (32.8)	41 (16.8)
Internet using	3 (1.2)	3 (1.2)	40 (16.4)	96 (39.3)	102 (41.8)
Data handling	21 (8.6)	36 (14.8)	81 (33.2)	65 (26.6)	41 (16.8)
Programming	9 (3.7)	17 (7.0)	66 (27.0)	112 (45.9)	40 (16.4)
Practical skills	6 (2.5)	28 (11.5)	74 (30.3)	102 (41.8)	34 (13.9)

The Table 4.3.1 shows students' self-perceived understanding levels in a wide range of capacity acquired during their Higher Secondary Certificate (HSC) education. Students indicated measure levels of competency across several skills. Notably, a significant number of students demonstrated Moderate to Very Strong understanding of computer hardware (40.6% Very Strong), computer software (38.9% Very Strong), and programming (45.9% Very Strong). Meanwhile, Internet Usage rated first, with 39.3% indicate Very Strong knowledge, followed by Data Handling, with 26.6% reporting Moderate understanding. While networking received

more Moderate ratings (32.8%), it also had a balanced distribution across other understanding levels. A significant proportion of students (41.8%) claimed Very Strong understanding in Practical Skills. These self-reported perceptions provide insight into students' confidence and performance in specific HSC knowledge and skills, showing.

4.4. ICT Course Content at the Higher Secondary Certificate (HSC) Level

Table 4.4.1: ICT Course Content

	Yes (Valid Percent)	No (Valid Percent)
Programming languages	165 (67.6)	79 (32.4)
Database management	95 (38.9)	149 (61.1)
Web development	98 (40.2)	146 (59.8)
Networking	105 (43.0)	139 (57.0)
Cybersecurity	39 (16.0)	205 (84.0)
Artificial Intelligence	42 (17.2)	202 (82.8)
Digital devise logic gate	132 (54.1)	112 (45.9)

Table 4.4.1 shows, while in the Higher Secondary Certificate (HSC) courses, students demonstrated a variety of knowledge with various ICT disciplines. While the majority (67.6%) reported comprehending programming languages and digital device logic gates (54.1%), areas such as cybersecurity (84.0%) and Artificial Intelligence (82.8%) demonstrated lower levels of understanding. This reveals diverse capacity across HSC-level ICT topics, revealing potential curriculum areas for development.

4.5. Facilities available to students during higher secondary college education

Table 4.5.1: Frequency test result

	Not at all (Valid Percent)	Rarely (Valid Percent)	Neutral (Valid Percent)	Moderate (Valid Percent)	Very Strong (Valid Percent)
Prac_exercise	11 (4.5)	24 (9.8)	17 (7.0)	152 (62.3)	40 (16.4)
HandOn skill	6 (2.5)	28 (11.5)	74 (30.3)	102 (41.8)	34 (13.9)
Multimedia	4 (1.6)	36 (14.8)	45 (18.4)	108 (44.3)	51 (20.9)
Com_resources	4 (1.6)	28 (11.5)	78 (32.0)	99 (40.6)	35 (14.3)
Internet access	6 (2.5)	37 (15.2)	64 (26.2)	94 (38.5)	43 (17.6)

Labs-upto-date	10 (4.1)	39 (16.0)	71 (29.1)	81 (33.2)	43 (17.6)
Lab functional	6 (2.5)	30 (12.3)	60 (24.6)	99 (40.6)	49 (20.1)

The Table 4.5.1 shows how students rate the college's ICT course facilities. Practical activities (62.3%) and hands-on skills (41.8%) received the highest scores. Positive feedback was also obtained for multimedia (44.3%) and computer resources (40.6%). However, satisfaction with labs—both functionality and up-to-date infrastructure—was relatively poor, ranging from 33.2% to 29.1%. Overall, students reported moderate to strong familiarity in most areas, however they emphasized significant improvement opportunities in the college's lab facilities for the ICT course.

4.6: Impact of College Facilities on Student Skills

Table 4.6.1: Linier regression analysis

	Unstandardized Coefficients	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
	B		Lower Bound	Upper Bound	Tolerance	VIF
Student Skill (Constant)	4.326	.000	3.160	5.492		
Prac_exercise	.124	.515	-.251	.500	.749	1.335
HandOn skill	.874	.000	.469	1.278	.697	1.434
Multimedia	.390	.056	-.010	-.010	.627	1.594
Com_resources	.248	.000	-.193	.689	.615	1.625
Internet access	.043	.036	-.361	.448	.599	1.670
Labs-upto-date	.114	.611	-.326	.553	.459	2.180
Lab functional	.097	.685	-.376	.570	.450	2.225

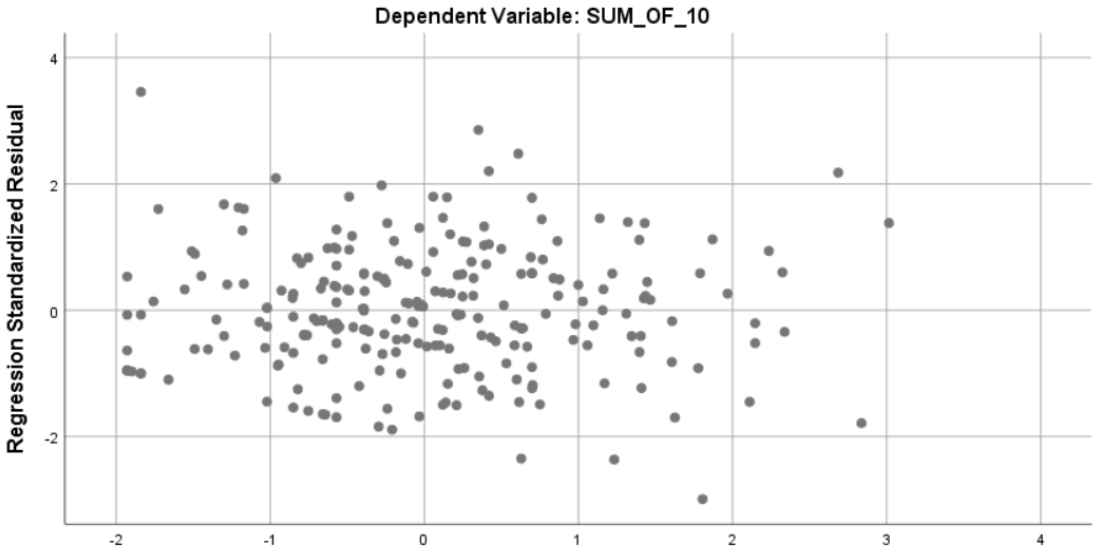

Figure 4.5.1: Regression analysis chart

In this analysis, three items revealed statistically significant impacts ($p \leq 0.05$) on student skills. Enhanced Hand On skill resources demonstrated a substantial effect (coefficient = .874, p = 0.000), indicating considerable advancements in student skills. Improved access to Computer Resources exhibited a significant positive influence (coefficient = .248, p = 0.000), correlating with enhanced student skills. Additionally, Multimedia displayed a coefficient of .390 (p = 0.056). Meanwhile, there was no statistically significant effect ($p > 0.05$) of Practical exercise, Internet availability, Labs-updated, and Lab functioning variables on student skills.

4.7. Student Satisfaction Levels in Higher Secondary College

Table 4.7.1: Kaiser-Meyer-Olkin Measure

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.882
Bartlett's Test of Sphericity	Approx. Chi-Square	812.683
	df	28
	Sig.	.000

Table 4.7.2: Component Matrix from Factor analysis

Component Matrix	
	Component 1
Quality_ICT_Teaching_Methods_HS	.793
Sufficiency_ICT_Facilities_College	.768
quality_ ICT_curriculum	.744
Quality_Instruction_College_ICT_Teacher	.734
Support_Instructors_Peers_ICT_Studies	.726
Computer_Labs_Availability_College	.724
Alignment_ICT_Curriculum_Interests_Needs	.690
Effectiveness_Assessment_Methods	.678

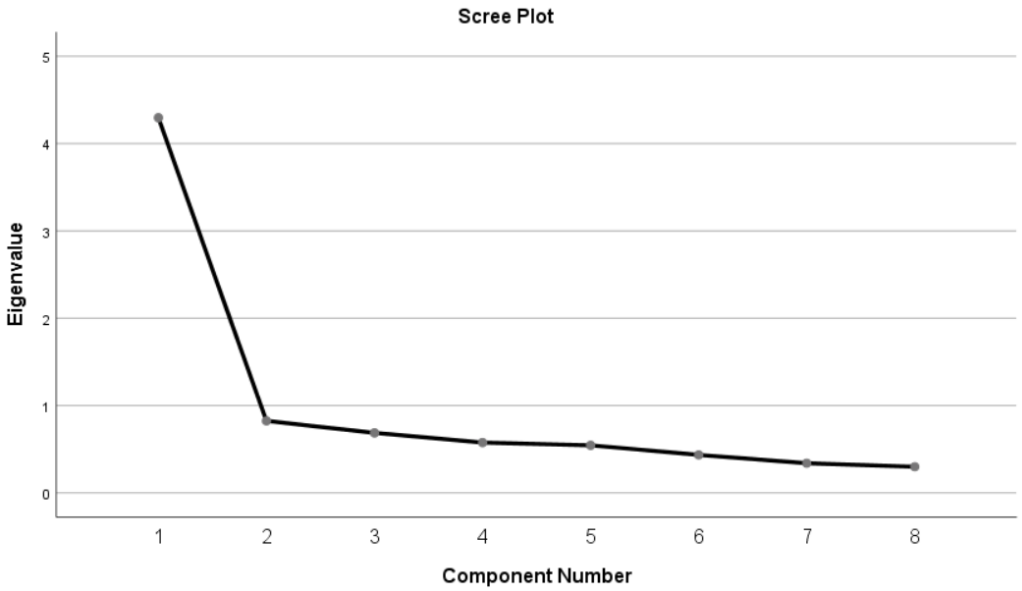

Figure 4.7.1: Total variance chart

In Table 4.7.1: The factor analysis results show that the dataset is consistently suitable for analysis, as seen by a low Bartlett's Test of Sphericity ($p < 0.001$) and a high Kaiser-Meyer-Olkin Measure (0.882).

In Table 4.7.2: Component 1 shows significant correlations and represents elements that are important for student satisfaction in Higher Secondary College (HSC) ICT environments. Notable variables include curriculum quality (0.744), instructor support (0.734), the availability of ICT facilities (0.768), and the quality of teaching methods (0.793). In order to improve overall satisfaction levels at the HSC level, it is critical to improve teaching strategies,

facilities, and curriculum alignment with student needs. These findings highlight the critical role that ICT-related components have in affecting student satisfaction.

4.8: Impact of College Facilities on Student Satisfaction

Table 4.8.1: Regression analysis result

	Unstandardized Coefficients	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
	B		Lower Bound	Upper Bound	Tolerance	VIF
Student Satisfaction (Constant)	2.019	.000	.904	3.135		
Frequency_Practical_ Exercises	.260	.155	-.099	.620	.749	1.335
Emphasis_Practical_ Skills_HS	1.013	.000	.626	1.400	.697	1.434
Use_Multimedia_ Resources_College	.529	.007	.146	.912	.627	1.594
Computer_Resources_ Availability_HS	1.064	.000	.642	1.486	.615	1.625
Internet_Access_ Availability_HS	.632	.001	.245	1.020	.599	1.670
UpToDate_Computer Systems_Software	.724	.001	.303	1.144	.459	2.180
Functional_Computer Systems_Software	.611	.008	.159	1.064	.450	2.225

The table 4.8.1: shows the relationship between various college facilities and student satisfaction, emphasizing statistically significant factors. The emphasis on practical skills at the Higher Secondary level (HSC) ($B = 1.013$, $p < 0.001$), the availability of computer resources at HSC ($B = 1.064$, $p < 0.001$), and the use of modern computer systems and software ($B = 0.724$, $p = 0.001$) all significantly positively influence student satisfaction. Notably, although their effects are less apparent than those of other significant factors, the utilization of multimedia resources at college ($p = 0.007$) and effective computer systems/software ($p =$

0.008) are statistically significant, revealing significant effects on the satisfaction of students. On the other hand, the frequency of practical exercises shows no significant effect on student satisfaction (p = 0.155). Even though these variables don't reach the standard criteria for statistical significance, they still might have small but noticeable effects.

4.9: Impact of Students Skills on Student Satisfaction

Table 4.9.1: linier regression analysis result

	Unstandardized Coefficients	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
	B		Lower Bound	Upper Bound	Tolerance	VIF
Student Satisfaction (Constant)	3.683	.000	1.897	5.469		
Prior_ICT_ Knowledge_Hardware	.361	.192	-.183	.905	.564	1.773
Prior_ICT_ Knowledge_Software	-.319	.264	-.880	.243	.491	2.037
Prior_ICT_ Knowledge_Networking	.022	.937	-.525	.569	.526	1.902
Prior_ICT_ Knowledge_Internet	.770	.009	.193	1.348	.670	1.492
Prior_ICT_Knowledge _DataHandling	.137	.549	-.311	.585	.582	1.719
Introduction_Coding _Programming_HS	1.544	.000	1.027	2.060	.644	1.554
Emphasis_Practical _Skills_HS	1.671	.000	1.164	2.178	.677	1.477
Covered_Programming _Languages	.627	.203	-.341	1.594	.770	1.299
Covered_Database _Management	.375	.415	-.529	1.279	.811	1.232
Covered_Web_ Development	.072	.873	-.806	.950	.851	1.175

Covered_Networking	-.208	.656	-1.129	.713	.758	1.319
Covered_Cybersecurity	-.986	.096	-2.147	.175	.871	1.148
Covered_Artificial_ Intelligence	-1.051	.092	-2.274	.173	.739	1.353
Covered_Digital_ Device_Logic_Gate	.482	.290	-.414	1.379	.790	1.266

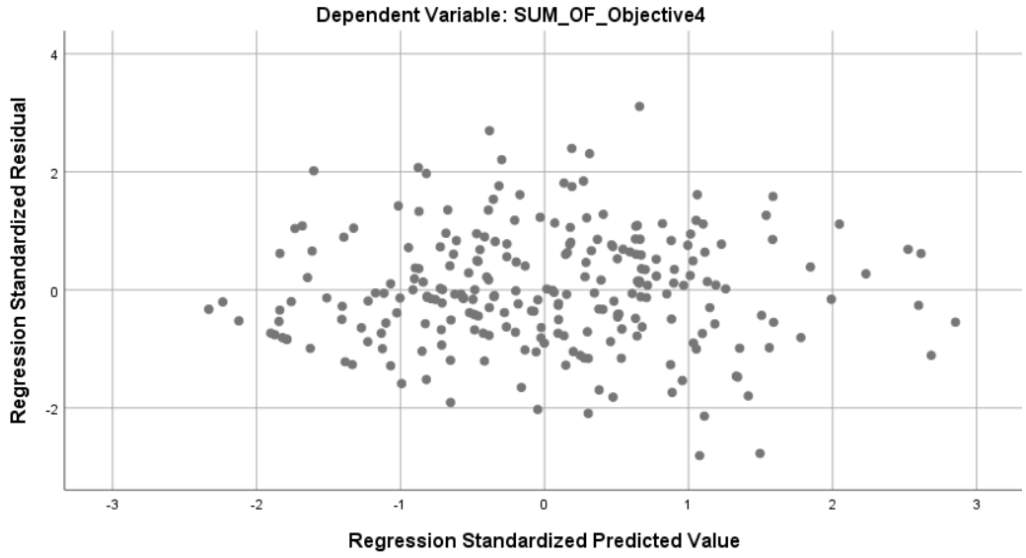

Figure 4.9.1: Regression Analysis chart

Table 4.9.1: shows the impact of students' covered topics and prior knowledge of ICT on their level of satisfaction in their education is displayed in the table. Two prominent elements that have a major positive effect on student satisfaction are the Emphasis on Practical Skills at HS ($B = 1.671$, $p < 0.001$) and Introduction to Coding/Programming at the Higher Secondary level ($B = 1.544$, $p < 0.001$). Additionally, there is a significant positive correlation between students' prior Internet knowledge ($B = 0.770$, $p = 0.009$) and satisfaction levels. However, a number of covered topics such database management, cybersecurity, artificial intelligence, and networking, as well as prior ICT knowledge in hardware, software, networking, and data handling, have non-significant effects on student satisfaction ($p > 0.05$). These areas do not satisfy the statistical significance level, although.

4.10: Impact of Teacher Effort on Student Satisfaction

Table 4.10.1: Impact of Teacher Effort on Student Satisfaction

	Unstandardized Coefficients	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
	B		Lower Bound	Upper Bound	Tolerance	VIF
Student satisfaction (Constant)	5.790	.000	4.792	6.788		
Encouraged_Creative _ProblemSolving	1.445	.000	.971	1.918	.498	2.007
Encouraged_Critical _Thinking	1.755	.000	1.257	2.254	.498	2.007

The data shows that teacher-led activities have significant effects on student satisfaction. Encouraging Critical Thinking ($B = 1.755$, $p < 0.001$) and Creative Problem-Solving ($B = 1.445$, $p < 0.001$) show significant positive effects. Teachers are the driving force behind these activities, which are essential to improving students' overall satisfaction in their educational environment. The significant coefficients and corresponding the significance levels support the report's accuracy and highlight how crucial these efforts are in creating a positive learning environment.

4.11. Impact of Teacher Effort on Student Prior ICT Skill

Table 4.11.1: Linier regression Result

	Unstandardized Coefficients	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
	B		Lower Bound	Upper Bound	Tolerance	VIF
Prior ICT Skill (C.Hardware, C.Software, Networking Internet using, Data handeling) (Constant)	6.103	.000	5.183	7.023		
Encouraged_Creative	.273	.220	-.164	.709	.498	2.007

_ProblemSolving						
Encouraged_Critical _Thinking	.848	.000	.389	1.308	.498	2.007

In this Table 4.11.1: shows the basic ICT sector, teacher-led efforts have a significant effect on Critical Thinking ($p < 0.001$). These activities, despite this, do not significantly affect the development of specific ICT skills ($p = 0.220$), suggesting that they have a notable impact on critical analytical abilities but not on the improvement of specific ICT skills.

Table 4.11.2: Analysis result

	Unstandardized Coefficients	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
	B		Lower Bound	Upper Bound	Tolerance	VIF
Prior ICT Skill (Programming language, Practical hand on project) (Constant)	2.058	.000	1.675	2.441		
Encouraged_Creative _ProblemSolving	.472	.000	.291	.654	.498	2.007
Encouraged_Critical _Thinking	.330	.001	.139	.521	.498	2.007

In Table 4.11.2: shows, students' prior ICT skills are highly influenced by instructor support ($B = 2.058$, $p < 0.001$). Additionally, these initiatives greatly promote Critical Thinking ($p = 0.001$) and Creative Problem-Solving ($p < 0.001$), demonstrating their significant influence on students' capacities of solving ICT problems critically and creatively.

Table 4.11.3: Test result

	Unstandardized Coefficients	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
	B		Lower Bound	Upper Bound	Tolerance	VIF
Prior ICT Skill (Programming language, Database, Web development, Networking, Cybersecurity, AI, Logic Gate) (Constant)	1.589	.000	1.252	1.926		
Encouraged_Creative _ProblemSolving	-.096	.239	-.256	.064	.498	2.007
Encouraged_Critical _Thinking	.088	.303	-.080	.257	.498	2.007

In Table 4.11.3: shows Teacher-led efforts had a significant effect on students' skills across this substantial area (B = 1.589, $p < 0.001$). But efforts within this large area focusing on Critical Thinking ($p = 0.303$) and Creative Problem-Solving ($p = 0.239$) are identified as non-significant depending on the established criteria. These findings indicate non-significant effects in areas related to critical thinking and problem-solving within this wide range of ICT skills, but they show significant effects on skill development within specific areas.

4.12: Impact of Teacher Effort, Student skills, College facilities & Student satisfaction on HSC level ICT course grade.

Table 4.12.1: Linier regression Analysis result

	Unstandardized Coefficients	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
	B		Lower Bound	Upper Bound	Tolerance	VIF
ICT course grade (Constant)	4.642	.000	4.375	4.908		

Student Skills	-.001	.304	-.019	.024	.742	1.348
Student Satisfaction	-.010	.475	-.038	.018	.249	4.016
Teachers Effort	.005	.847	-.046	.056	.403	2.480
Emphasis_Practical _Skills_HS	.184	.004	.061	.307	.252	3.964
College Facilities	-0.004	0.552	-.104	.050	.555	2.340

The Table 4.12.1: shows the variables that affect grades in ICT courses and shows statistics on collinearity, significance, coefficients, and confidence intervals. Only the college emphasis on practical skills has a significant impact on ICT grades ($p = 0.004$) among variables like student skills and satisfaction. Some have smaller correlations. Moderate to low levels of collinearity suggest that the relationships between the predictors are acceptable. Overall, it is clear that a major factor positively impacting college students' performance in ICT courses is the emphasis placed on practical skills.

4.13: Impact of Demographic things on HSC level ICT course grade.

Table 4.13.1: Demographic impact on HSC grade

	Unstandardized Coefficients	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
	B		Lower Bound	Upper Bound	Tolerance	VIF
ICT course grade (Constant)	-1.564	.975	-100.284	97.156		
Gender	.018	.821	-.139	.175	.998	1.002
HSC passing year	.003	.899	-.046	.052	.986	1.014
College category	.002	.966	-.068	.071	.978	1.023
College location	-.045	.350	-.140	.050	.991	1.009

The provided Table 4.13.1: presents unstandardized coefficients, significance levels, 95% confidence intervals, and collinearity statistics for factors affecting ICT course grades. The constant term, representing the baseline value for ICT grades, appears negligible with a non-

significant p-value (p = 0.975). Among the variables—Gender, HSC passing year, College category, and College location—none significantly impact ICT grades, as their p-values exceed the 0.05 threshold. Additionally, collinearity statistics reveal no concerning multicollinearity issues, with tolerance values between 0.978 and 0.998 and VIF values close to 1, indicating independence among predictors. In summary, this model suggests that gender, HSC passing year, college category, and location do not significantly influence ICT course grades, implying a lack of association between these factors and academic performance in this context.

CHAPTER 5: DISCUSSION

4.2.Result Interpretation

The study's comprehensive analysis of demographic profiles, academic performance characteristics, ICT proficiency levels, and the impact of college facilities provided significant conclusions. The findings revealed a negative correlation between HSC grades and first semester university performance, although prior ICT knowledge in Data Handling and quality instruction influenced University performance positively. The levels of proficiency varied across ICT skills indicating areas for curriculum improvement. Furthermore, the emphasis on practical skills, resource availability, and teaching quality all had a substantial impact on student satisfaction and skills. The study emphasizes the critical significance of practical skill development, teaching quality, and resource adequacy in shaping academic success and satisfaction in ICT education, with implications for curriculum enhancement and teaching methodologies proposed.

4.3. Theoretical contribution

The data acquired provides unique insights into the various factors that shape student performance in ICT education. It investigates the multidimensional impact of prior knowledge, instructional quality, and skill emphasis on first semester performance in university, release clarity on the critical relationship between foundational education and tertiary performance in Computer Science & Engineering (CSE), Software Engineering (SWE) & Information Technology Management (ITM). Furthermore, the study's investigation of ICT skills and curricular alignment emphasizes the essential role of curriculum design to fostering important competencies. In addition, the impact of college facilities and teaching efforts on student satisfaction and skill development emphasizes the importance of an appropriate educational setting and effective teaching in encouraging engagement and knowledge development. These findings collectively make a substantial contribution to the field of ICT education, providing information that can guide teaching strategies and curriculum design for improved educational outcomes.

4.4.Summary

This study investigated the multifaceted relationship between students' educational backgrounds, ICT skill development, academic performance, and satisfaction levels in the context of higher secondary education. The findings revealed that prior knowledge in specific ICT domains, quality of instruction, college facilities, and teaching techniques all had a significant impact on students' initial academic performance and satisfaction in university settings. Notably, the emphasis on practical skills and instructor efforts appeared as important elements in molding students' capacities and levels of satisfaction. The study also revealed significant differences in knowledge of ICT across fields and suggested critical areas for educational improvement, particularly in refining teaching approaches, curriculum design, and facility infrastructure.

CHAPTER 6: CONCLUSION

6.1 Conclusion

The study's findings show a fundamental link between Higher Secondary Certificate (HSC) level ICT education and its impact on students' STEM studies at the university. This study emphasizes the considerable impact on students' academic performance and satisfaction in higher education by a detailed investigation of prior ICT knowledge, instructional approaches, and available facilities. These findings highlight the crucial significance of foundational ICT education in development students' careers within the university STEM field, emphasizing the importance of a strong ICT basis in HSC education to boost achievement and satisfaction in university STEM studies.

6.2 Limitations

Certainly. The study's principal limitations is that it depends on self-reported data, which increases the possibility of response bias and incorrect data. Using subjective reports from participants may be influenced by memory gaps, social desirability biases, or misunderstandings of the questions provided, which could compromise the data's reliability and validity. This could manipulate the data, leading to misinterpretations or an inadequate understanding of the observed students' actual actions or experiences.

Another major limitation is the study's regional or institutional priority, which may limit the research's data' universality. Limiting the inquiry to specific geographic areas or a small number of institutions could fail to sufficiently represent the different contexts in which ICT education takes place. Differences in teaching methods, curricular structures, or resources between areas or institutions may have significant effects on students' experiences and performance. As a result, the findings may not be generally applicable to different educational contexts or regions, limiting the research's more significance.

6.3. Future work

Future exploration opportunities look excellent. One possible direction is to perform ongoing investigations to track students' ICT skill development over time and the implications for their academic progression and post-graduation professional aspirations. Comparative investigations across educational institutions or regions would shed light on the impact of different educational systems on ICT learning results. Furthermore, researching the influence of educational adjustments or facility upgrades on students' skill acquisition and satisfaction

levels would be extremely beneficial to educational institutions. The addition of qualitative narratives from interviews or case studies to quantitative data could result in a more complete knowledge of students' educational experiences.

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