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Original Research Article

Structural equation modeling: A path analysis on the tracer study factors influencing graduates' ability to work and competencies

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This study investigates how effectively Arusha Technical College's curriculum equips graduates for labor market demands. It evaluates graduates' ability to perform daily tasks and their job market competencies across various skills, including Information and Communication Technology (ICT), technical skills, soft skills, behavioral skills, and work ethics. Using Smart PLS software, Structural Equation Modeling (SEM) was applied to data from 568 graduates in a quantitative approach. Findings shows the significant role of ICT and technical skills in enhancing workplace performance and employability, while soft and behavioral skills showed relatively weaker associations. Although the important role of these skills, direct impact on job performance and alignment with employer expectations appear more complex. This study contributes to the discourse on higher education and industry needs, suggesting a re-evaluation of curriculum components to provide a well-rounded skill set among graduates. Recommendations provided in this study includes: enhancing the curriculum, strengthening industry-academia collaboration, and continuing graduate tracer studies to refine educational practices. This research addresses a gap in understanding the relationship between educational preparation and labor market integration in a technical context, offering a framework for future studies on changing labor market requirements.

Keywords: Graduate employability, technical education, skills gap analysis, curriculum development, structural equation modeling (SEM)

INTRODUCTION

Tracer studies became to be one of the fundamental tool in evaluating program effectiveness in higher education in preparing graduates for their professional careers (Cruz, 2022). These studies use the Alumni and employers feedback to monitor graduates' success and career paths after completing their studies (Bacani et al., 2023). There are several existing literatures which have highlighted the need of employability skills for graduates, but there is scarce of studies which provides the comprehensive approach. For instance, the study done by (Nabil et al., 2011) discusses the distinction between technical and non-technical skills, but emphasizing the need of both skills in the modern labor market and failed to integrate them as a unified framework. Similarly, the research done by (Robles,

2012) focuses on key soft skills considered as essential by most of the executives, but the study does not provide their interaction with other set of skills such as technical skills or ICT skills. Additionally, the study done by (Asefer and Abidin, 2021) on employer perspective regarding soft skills and graduates' employability is limited in scope, primarily focusing on behavioral and soft skills without considering the role of technical skills or work ethics. Furthermore, the study of (Suarta et al., 2017) provided a comprehensive literature review on the employability skills needed in the 21st century labor market, though the study does not give empirical validation and does not provide a holistic analytical framework. These studies, although they provide valuable contributions in addressing employability factors, they leave a gap by discussing the factors in isolation and thus call for a more comprehensive and integrative approach to examine the relationship of these factors in influencing graduates' ability to work and competencies.

This study focuses on comprehensive examination of the factors influencing graduates' ability to work and develop competencies by using tracer study survey conducted by Arusha Technical College in the year 2023. Different from the previous research, which mostly focused on individual employability factors in isolation, this study adopts a holistic approach by integrating multiple factors including, technical skills, soft skills, behavioral skills, ICT skills, and Work ethics within a unified framework. Furthermore, the study employed a Structural Equation Modelling and path analysis, to examine the relationship among these factors and their collective influence towards graduates ability to work and competencies. Focusing on the specific context and cohort of graduates the study provides a valuable insights that can be used to inform curriculum design, educational practices, and policy interventions in the need of improving technical and vocational education programs.

Technical Skills

Are specialized knowledge, abilities, and competencies required to perform specific tasks or function within a particular field or industry. The need of technical skills in graduates' employability has been extensively studied, emphasizing their important role in technical and vocational education. For instance the study conducted by (Bakar et al., 2013) assessed the workplace skills acquired by students in vocational and technical education institutions, highlighting that proficiency in technical tasks and industry specific competencies are essential for graduates' employability and performance in their respective fields. Similarly, the study done by (Robles, 2012) show the need of converging the technical and soft skills as fundamental for shaping 21st - century graduates to meet the demand of the labor market. Moreover, (Brine and Feather, 2002) supported the development of information professionals, emphasizing that continuous enhancement of technical skills is necessary to stay relevant and competitive in the evolving job market. Collectively, these studies highlights the integral role of technical skills in bridging the gap between education and employment.

Soft skills

Are the personal attributes, interpersonal abilities and communication skills that facilitate effective interaction, collaboration and performance in professional environment. The study conducted by (Abdullah et al., 2019) evaluated the role of soft skills in business students employability, revealing that soft skills are important in bridging the gap between academic knowledge and career success. The study insisting that employers are highly value graduates with soft skills. The study done by (Andrews and Higson, 2008) conducted a comparative study across Europe, showing that while technical skills are important but soft skills outweigh hard knowledge in determining graduates' employability. Furthermore, the study by (Succi and Canovi 2020) compared the perception of students and employers on soft skills, revealing that these skills are necessary for career readiness and professional growth.

Behavioral skills

Are the interpersonal abilities, attitudes, and characteristics that influence how individuals interact and collaborate with others in professional setting. Behavioral skills plays important role in graduates' employability as evidenced by the following studies. The study conducted by (Hassan et al., 2011) discusses the competencies, skills, and knowledge of quantity survey of graduates in Malaysia encouraging the role of behavioral skills in consultancy activities. The findings from these study shows that graduates equipped with strong interpersonal and leadership abilities were better demanded by the labor market. Similarly, the study done by (Yusof et al., 2013) examined the importance of behavioral skills in educational setting revealing that behavioral skills is significant in enhancing graduates' readiness in the labor market. Collectively, these studies show that the behavioral skills plays important role in today's dynamics of the labor market.

ICT skills

Are the competencies and proficiencies required to effectively utilize digital technologies for communication, information management, and problem solving. ICT skills has emerged as one of the important determinant of graduates' employability in the modern labor market. The study conducted by (Arregui et al., 2019) provides the changing nature of work and the increasing need of non-technical competencies in the digital age, pin-pointing that ICT skills are essential skills to navigate towards the dynamics of labor market. This was further supported by (Audrin et al., 2024), the study developed and empirically validated a measurement scale for digital skills at work, explaining the dual nature of soft skills and digital literacy. Thus collectively, these insights suggest that soft skills are increasingly recognized as important factor in the labor

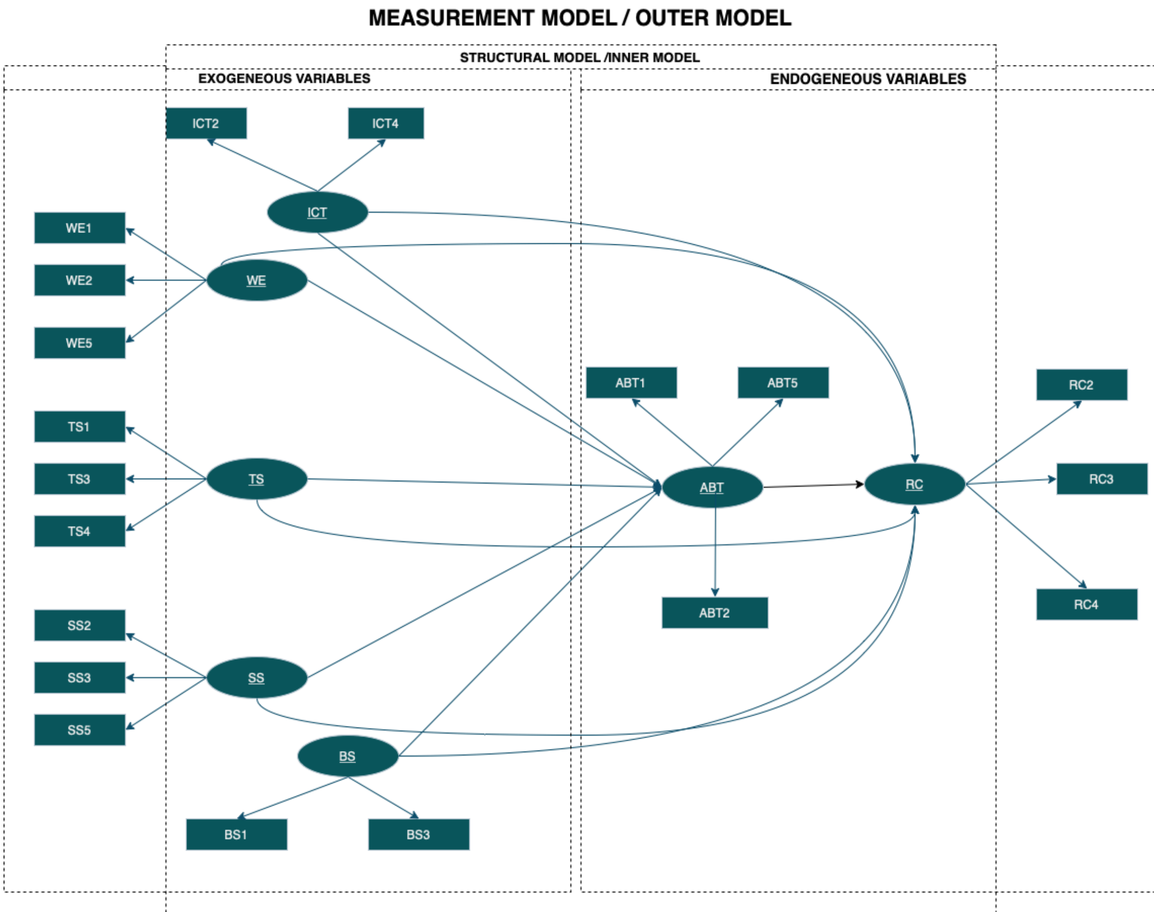

Figure 1: Conceptual Framework

market.

Work ethics

Are the set of principles, values, and moral standards that guide an individual's behavior and actions in the workplace. Work ethics plays an important role in facilitating graduates employability as pointed out by several studies. The study conducted by (Gamer et al. 2018) provided a review of literatures on employers perceptions regarding the graduates' employability revealing that work ethics are highly valued. Similarly, the study conducted by (Ngah et al. 2021) studied the impact of work ethics, soft skills and values on employers' intention to employ graduates for the Universiti Malaysia Terennggan (UMT), the findings revealed work ethics significantly influence hiring decision. Additionally, the research conducted by (Pheko and Molefhe 2016) proposed a framework for improving graduates employability in Botswana, suggesting work ethics as important factor employers seek. Moreover, the study done by (Shivoro et al., 2017) stress the view on their study on management sciences graduates, by pin-pointing that employers are interested to graduates who demonstrate strong ethical standards in professional conducts.

Conceptual Frame Work

The conceptual model presented in Figure 1, adopts a reflective structural framework to examine the relationships between various constructs. The model comprises exogenous constructs, including ICT skills, Technical Skills, Behavioral Skills, Soft Skills, and Work Ethics, which are postulated to influence the endogenous variables, namely Ability to Perform Daily Activities and Relevance Competencies. Exogenous variables are those constructs that are considered external to the system being studied and has no predecessor (Gefen et al., 2000). These variables represent the foundational elements influencing graduates' readiness and abilities as they enter the workforce. On the other hand, Endogenous variables are those that are influenced or determined by other variables within the system (Gefen et al., 2000). These variables represent the outcomes or consequences of graduates' engagement with the exogenous factors within the workplace environment.

Table 1. Operational Variables of Work Ethics

Construct	Definition	Indicator	Code	Measurement Scale
Work Ethics (WE) Exogeneous	Are the set of principles, values, and moral standards that guide an individual's behavior and actions in the workplace	Accountability	WE1	Likert
		Integrity	WE2	Likert
		Honesty	WE3	Likert
		Confidentiality	WE4	Likert
		Obedience	WE5	Likert

We empirically test this model using statistical methodologies applied to the tracer study survey data. This approach allows us to address the following research questions:

- What are the direct effect of ICT skills, Technical skills, Soft skills, Behavioral skills, and Work ethics on graduates' ability to perform daily activities?
- What are the direct effect of ICT skills, Technical skills, Soft skills, Behavioral skills, and Work ethics on graduates' Competencies
- Does graduates' ability to perform daily activities influence graduates' Relevance Competencies?

MATERIALS AND METHODS

Study Design, Population, and Period.

This study used a crossectional design. The population surveyed included all students from Arusha Technical College who graduated in 2022. In total, 768 graduates completed their studies in 15 regular Diploma programmes and bachelor's degree programs during the 2022 academic year at Arusha Technical College. The survey was conducted between January and March of 2023.

Data Collection Tools and Procedures

In this study, a semi structured questionnaire was used. The questionnaire was prepared by the Arusha Technical College, which was drafted in English. Graduates were contacted on their phones using baseline information recorded before leaving the college. Team of trained staff on data collection from different department were sent to different regions where graduates were located for data collection. On the other hand, Online google forms were used to collect graduate data. An e-mail invitation to participate in the study were sent to all graduates of 2021-2022 academic year. Among other things the invitation included: Information about the project and a secured link to the online study. To ensure adequate participation of graduates in this study, phone calls and e-mail reminders were used. The data collection process ended with 568 respondent out of 768, meaning a response rate of 73.9% which is satisfactory. The data were entered into excel before they were further transferred to SMART PLS software.

Data Quality Control

Pre-testing of the questionnaire was done as part of the 2022 tracer study. Before data collection, training was provided to the data collection team. This training covered the study's objectives, procedures, data collection techniques, a detailed review of the questionnaires, interviewing techniques, data collection methods, data entry, questionnaire coding, and clarifications. Additionally, during the data collection phase, team leaders (including EASTRIP manager and quality assurance coordinators from the college) monitored the data collection process and validated a random sample of the data. Prior to data entry, the team leader reviewed every questionnaire. Data collection team then entered the data into Excel for analysis and interpretation.

Variables

The study used mainly two variables the exogeneous and endogenous variables to examine tracer study factors influencing the graduates' ability to work and competencies. The exogeneous variable includes, work ethics, technical skills, behavioral skills, soft skills, and ICT skills while the endogenous variable includes the graduates' ability to work and Relevance competencies. The definition of variables, indicators, codes, and scale of measurement of each variable are presented from Table 1 to Table 7.

Operational Definition of Variables

This section indicates the operational definition of each construct along with its indicators and corresponding codes, providing a clear and standardized framework for measuring and interpreting the variables of interest.

Data analysis

This study used Structural Equation Modeling (SEM) to examine the influence of various research variables on graduates' performance abilities. A total of 568 graduates responses was analyzed, the data was analyzed using Structural Equation Modeling (SEM) through Smart PLS.

Table 2. Operational Variables of Technical Skills

Construct	Definition	Indicator	Code	Measurement Scale
Technical Skills (TS) Exogeneous	Are the specialized knowledge, abilities, and competencies required to perform specific tasks or functions within a particular field or industry	Technical knowledge	TS1	Likert
		Technical Documentation	TS2	Likert
		Practical Job-related skills	TS3	Likert
		Occupational knowledge	TS4	Likert
		Quality of Work	TS5	Likert

Table 3. Operational Variables of Behavioral Skills

Construct	Definition	Indicator	Code	Measurement Scale
Behavioral Skills (BS) Exogeneous	Are the interpersonal abilities, attitudes, and characteristics that influence how individuals interact and collaborate with others in professional setting	Entrepreneurship Skills	BS1	Likert
		Leadership Skills	BS2	Likert
		Team Work Skills	BS3	Likert

Table 4. Operational Variables of Soft Skills

Construct	Definition	Indicator	Code	Measurement Scale
Soft Skills (SS) Exogeneous	Are the personal attributes, interpersonal abilities and communication skills that facilitate effective interaction, collaboration and performance in professional environment	Problem solving skills	SS1	Likert
		Time management skills	SS2	Likert
		Managerial Skills	SS3	Likert
		Customer Service Skills	SS4	Likert
		Negotiation Skills	SS5	Likert

Table 5. Operational Variables of ICT Skills

Construct	Definition	Indicator	Code	Measurement Scale
ICT Skills (ICT) Exogeneous	Are the competencies and proficiencies required to effectively utilize digital technologies for communication, information management, and problem solving	Proficiency in Using Software	ICT1	Likert
		Ability to use Operating Systems	ICT2	Likert
		Internet Usage	ICT3	Likert
		Coding and Programming	ICT4	Likert
		Cybersecurity and Practices	ICT5	Likert

Table 6. Operational Variables of Ability to Perform Daily Activities

Construct	Definition	Indicator	Code	Measurement Scale
Ability to Perform Daily Activities (ABT) Endogeneous	Refers to an individual's ability to effectively carry out routine tasks and responsibilities inherent to their job role within the organizational setting	Task Excution	ABT1	Likert
		Time Management	ABT2	Likert
		Adaptability	ABT3	Likert
		Collaborations	ABT4	Likert
		Decision Making	ABT5	Likert

Table 7: Operational Variables of Relevance Competencies

Construct	Definition	Indicator	Code	Measurement Scale
Relevance Competencies (RC) Endogeneous	Refers to the specific skills, knowledge, and capability that are directly applicable and pertinent to an individual's job role, tasks, and responsibilities within a particular organizational context	Industry Knowledge	RC1	Likert
		Job-Specific skills	RC2	Likert
		Problem Solving ability	RC3	Likert
		Adaptability and Flexibility	RC4	Likert
		Customer Focus	RC5	Likert

Table 8. Respondents Characteristics

Characteristics	Categories	Employment Status		
		Unemployed N(%)	**Employed N (%)**	**Total**
Gender	Female	63 (52.5%)	57 (47.5%)	120
	Male	259 (57.8%)	189 (42.2%)	448
Age Interval	15-24	155(51.5%)	146(48.5%)	301
	24-35	96(36.5%)	167(63.5%)	263
	35 and above	1(25.0%)	03(75.0%)	04
Program of Study	Electrical Engineering	35(37.2%)	59(62.8%)	94
	Electronics and Telecommunication Engineering	21(67.7%)	10(32.3%)	31
	Electrical and Biomedical Engineering	15(24.6%)	46(75.4%)	61
	Electrical and Automation Engineering	03(15%)	17(85%)	20
	Electrical and Hydropower Engineering	11(52.4%)	10(47.6%)	21
	Auto-electric Engineering	12(50.0%)	12(50.0%)	24
	Auto-motive Engineering	13(72.3%)	05(27.7%)	18
	Civil Engineering	12(60.0%)	08(40.0%)	20
	Civil and Irrigation Engineering	24(77.4%)	07(22.6%)	31
	Civil and Highway Engineering	15(36.6%)	26(63.4%)	41
	Computer Science	13(34.2%)	25(65.8%)	38
	Information and Communication Technology	12(37.5%)	20(62.5%)	32
	Mechanical Engineering	27(50.0%)	27(50.0%)	54
	Pipeworks Oil and Gas Engineering	14(58.4%)	10(41.6%)	24
	Laboratory Science and Technology	25(42.4%)	34(57.6%)	59

This tool was chosen because of its ability to analyze complex relationships efficiently.

RESULTS

Demographic Characteristics of the Respondents

The demographic characteristics of the respondents in this study include a diverse representation of gender, age, and academic background as presented in Table 8.

Measurement Model Assessment

Measurement model is the outer model of the conceptual framework, before going to structural model (inner model) there is a need to perform the outer model assessment. This helps in validating the measurement instruments used in operationalizing the constructs of the model. In this paper the validity and realibity of the outer model were tested, allowing the subsequent analysis to be conducted.

Determination of Appropriate Indicators

The strength and validity of the research findings relies on the appropriate indicators selected for each construct of the model. Loading factors of the indicators were used as the criterion to identify appropriate indicators. Each indicator with the loading factor value greater than or equal to 0.708 was considered as strong indicator (Hair et al., 2012). Indicators whose values were less than 0.40 were automatically excluded for consideration in the analysis, indicators whose value were between 0.40 and 0.708 they were further analyzed to see their effect on Average Variance Extracted (AVE) and Composite reliability before deletion of the indicator. If the deletion of the indicator results in increasing AVE and CR above the specified threshold, the indicator was retained. Otherwise, if the

Table 9. Outer Loadings-Matrix

	ABT	BS	ICT	RC	SS	TS	WE
ABT1	0.873	0	0	0	0	0	0
ABT2	0.822	0	0	0	0	0	0
ABT5	0.857	0	0	0	0	0	0
BS1	0	0.925	0	0	0	0	0
BS3	0	0.917	0	0	0	0	0
ICT2	0	0	0.841	0	0	0	0
ICT4	0	0	0.898	0	0	0	0
RC2	0	0	0	0.888	0	0	0
RC3	0	0	0	0.815	0	0	0
RC4	0	0	0	0.781	0	0	0
SS2	0	0	0	0	0.799	0	0
SS3	0	0	0	0	0.851	0	0
SS5	0	0	0	0	0.762	0	0
TS1	0	0	0	0	0	0.825	0
TS3	0	0	0	0	0	0.883	0
TS4	0	0	0	0	0	0.836	0
WE1	0	0	0	0	0	0	0.778
WE2	0	0	0	0	0	0	0.836
WE5	0	0	0	0	0	0	0.862

Table 10. Construct Reliability and Validity

	Cronbach's Alpha	Composite Reliability Rh_a	Average Variance Extracted AVE
ABT	0.810	0.812	0.724
BS	0.821	0.822	0.848
ICT	0.683	0.702	0.757
RC	0.774	0.805	0.688
SS	0.729	0.744	0.648
TS	0.805	0.808	0.720
WE	0.766	0.765	0.682

deleted indicator did not improve these measures, it was removed from consideration (Sarstedt et al., 2022). Indicators which met the requirements under this process (indicating strong and significant relationship with their constructs) are presented in Table 9.

Reliability and Validity of the Model

To ensure the constructs of the model accurately reflect the data observed and support the inferences of this paper, the reliability and validity of the model was tested using the three tests: internal consistency reliability, convergent validity and discriminant validity.

a)**Internal Consistency Reliability**: This test assess how well the indicators of the construct consistently measures the concept. The test was performed by evaluating the values of the Cronbach's alpha and Composite reliability score (Rho_a), indicators whose value is above 0.7 was generally considered as acceptable (Hair et al., 2020). As shown in Table 10, most of the indicators exceeded the acceptable value for both Cronbach's alpha and Rho_a suggesting a high level of reliability (Hair et al. 2020). However, the ICT construct fell short of the required value, the lower value of the ICT indicates that the indicators may not measure the concept as intended. A number of factor such as diverse nature of the skills or phrasing and interpretation of the construct could be associated for the construct to have the lower values as explained by (Hair et al. 2010).

b)**Convergent Validity:** This test was used to find out how closely the indicators of the specific construct relates to one another. The test was performed by examining the Average Variance Extracted (AVE). A construct with AVE value greater than or equal to 0.5 indicates that it explains its indicators more than half (Hair et al., 2020). The findings presented in Table 10, indicates that all the constructs under this study exceeded the required minimum value, suggesting that each construct effectively presented by its indicators, and thus support the validity of the model (Hair et al., 2014).

c)**Discriminant Validity**: This test was performed to ensure that each construct of the model is different from the other constructs. The Fornell-Larcker Criterion (FLC) is one of the techniques used to test the discriminant validity. In this criterion, the diagonal elements which are the square roots of the AVE of each construct must be the maximum value in both row and column (Fornell and

Table 11. Discriminant Validity-Fornell-Larcker Criterion

	ABT	BS	ICT	RC	SS	TS	WE
ABT	0.851						
BS	0.606	0.921					
ICT	0.725	0.590	0.870				
RC	0.785	0.652	0.740	0.829			
SS	0.584	0.768	0.571	0.646	0.805		
TS	0.716	0.610	0.679	0.824	0.617	0.848	
WE	0.618	0.498	0.560	0.786	0.494	0.726	0.826

Table 12. Collinearity Statistics (VIF) Outer Model and Inner Model

Collinearity Statistics Outer Model	VIF	Collinearity Statistics Outer Model	VIF	Collinearity Statistics Inner Model	VIF
RC2	1.776	WE1	1.334	ABT->RC	2.799
RC3	1.580	WE2	1.826	BS->ABT	2.725
RC4	1.511	WE5	1.950	BS->RC	2.765
SS2	1.392	ABT1	1.964	ICT->ABT	2.087
SS3	1.542	ABT2	1.648	ICT->RC	2.476
SS5	1.420	ABT5	1.783	SS->ABT	2.689
BS2	1.939	ICT2	1.367	SS->RC	2.697
BS3	1.939	ICT4	1.367	TS->ABT	3.039

Larcker, 1981) to ensures that a construct is distinctly different from other constructs within the model, both in terms of how it is measured and what it represents. However, if FLC is used in combination with results of variance based structural equation modeling such as traditional partial least squares path modeling and generalized structural component analysis the Fornell Larcker criterion lacks sensitivity (Rönkkö and Evermann 2013), and if used in combination with consistent estimates, it lack specificity (Voorhees et al., 2016).The results presented in Table 11, comply with the Fornell-Larcker Criterion, indicating a strong discriminant validity among the constructs. This ensures that the constructs are empirically distinct and measure discrete concepts within the model (Fornell and Larcker, 1981).

Structural Model Assessment

Is the inner model assessment, normally performed after the measurement model assessment being examined. It shows the relationship existing between the latent variables in the structural model which are generally called path coefficients. In this paper the test performed to assess the structural model includes: Collinearity test, Size and significance of the path coefficients, coefficient of determinations R^2, effect f^2 and the predictive relevance Q^2.

Structural Model Collinearity

Collinearity test helps to assess the multicollinearity among the constructs. Multicollinearity occurs when predictor variables are highly correlated, which can lead to unreliable parameter estimates (Hair et al., 2020). In the context of PLS-SEM a tolerance value of 0.2 or lower and VIF value of 5 and higher respectively indicates a potential collinearity problem (Hair et al. 2012). As presented in Table 12, the constructs met the requirements evidenced by the VIF values.

Size and Significance of Path Coefficients

This test is important in the sense that it is used to identify not only the significant path coefficients in the structural model but also the significant and relevant effects. To test the path coefficient a bootstrapping with 5000 resamples and bias-corrected accelerated (BCa) method were employed to evaluate the size and significance of path coefficients within the structural model. The path coefficients have the standardized values (coefficients) between -1 and +1 for every relationship in the structural model and the measurement model (Hair et al., 2012). The results presented in Table 13, shows that most of the constructs met the requirements except relationship involving Behavioral skills and Soft skills.

Coefficient of Determination R^2

It is the commonly used measure to evaluate the structural model. It represents the exogeneous variables' combined effect on the endogenous variables. It also represents the amount of variance in the endogenous constructs explained by all of the exogeneous constructs. The minimum value of R^{2} is 0 but it would never be that much low and the maximum value is 1 but values this high very seldom occur (Hair et al., 2020). As presented in Table 14, for ABT, the R^2 value was 0.643, indicating that approximately 64.3% of

Table 13. Path Coefficients p-values, and Confidence Intervals

	Original Sample (O)	p-value	2.5%	97.5%
ABT->RC	0.205	0.000	0.122	0.295
BS->ABT	0.121	0.093	-0.021	0.257
BS->RC	0.060	0.210	-0.035	0.149
ICT->ABT	0.373	0.000	0.272	0.477
ICT->RC	0.147	0.000	0.069	0.226
SS->ABT	0.052	0.402	-0.069	0.174
SS->RC	0.062	0.120	-0.016	0.143
TS->ABT	0.257	0.000	0.136	0.371
TS->RC	0.307	0.000	0.222	0.387
WE->ABT	0.137	0.017	0.026	0.250
WE->RC	0.294	0.000	0.225	0.363

Table 14. R-Square Overview Results

	R-Squared Overview	Adjusted R^2
ABT	0.643	0.637
RC	0.838	0.835

Table 15a. f-Square List

Path	f-Square	Path	f-Square
ABT->RC	0.093	SS->RC	0.009
BS->ABT	0.015	TS->ABT	0.061
BS->RC	0.008	TS->RC	0.180
ICT->ABT	0.187	WE->ABT	0.024
ICT->RC	0.054	WE->RC	0.242
SS->ABT	0.003		

Table 15b. Blindfolding and Predictive Relevance Q^2

Endogenous Indicator	Q-Square Predict
ABT1	0.0472
ABT2	0.393
ABT5	0.493
RC2	0.817
RC3	0.461
RC4	0.362

the variance in ABT is explained by the model. The adjusted R^2, which accounts for the number of predictors in the model, was slightly lower at 0.637, showing a good fit while adjusting for model complexity. For RC, the R^2 value reached 0.838, with an adjusted R^2 of 0.835, meaning that 83.8% of the variance in RC could be explained by the predictors in the model.

Effect of f^2

The change in the R^2 value when a specified exogeneous construct is omitted from the model can be used to evaluate whether the omitted construct has a substantive impact on the endogenous constructs, this measure is referred to as Effect size f^2. It can be calculated as;

$$f^2 = \frac{R^2_{included} - R^2_{excluded}}{1 - R^2_{included}}$$

The f^2 value is categorized into small, medium, and large magnitudes. Magnitudes ranging from 0.02 to 0.15 are classified as small effects, while those falling between 0.15 and 0.35 are considered medium effects, and large effects are characterized by values of 0.35 and above (Cohen, 2013). The Effect size f^2 results are presented in Table 15a.

Blindfolding and Predictive Relevance Q^2

The Q^2 of the blindfolding procedure represents a measurement on how well the path model can predict the

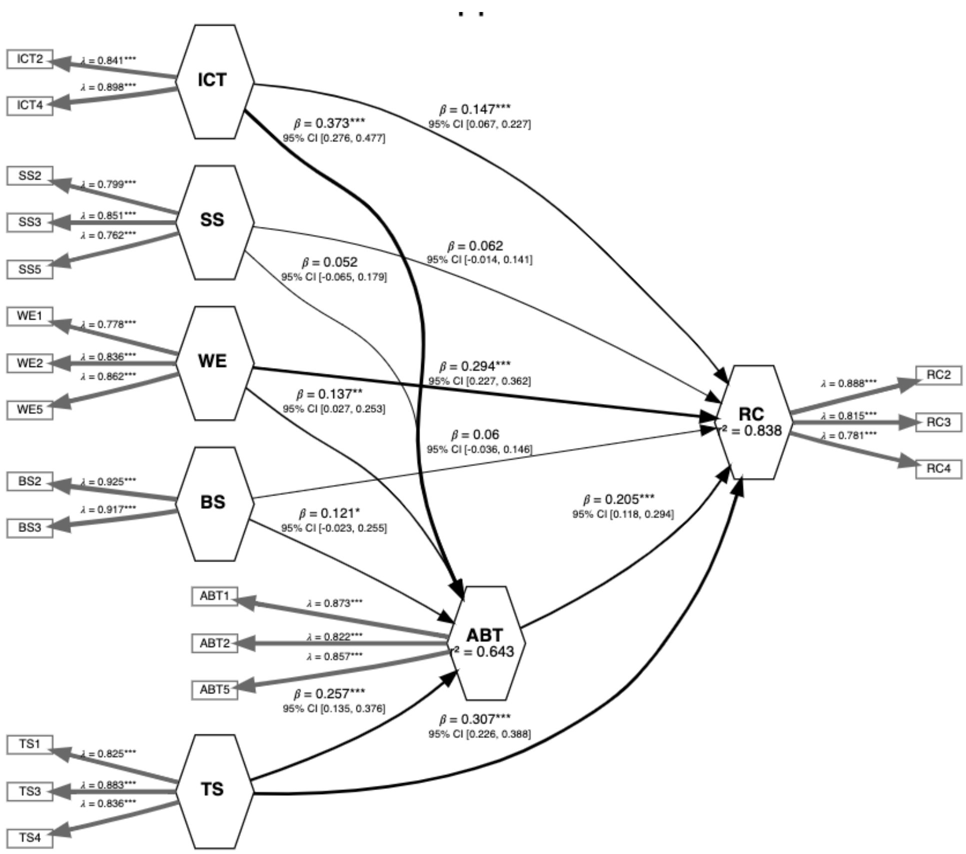

Figure 2: Structural Model Equation Results

originally observed values. The relative impact of the predictive relevance can be compared by means of the measure to the q^2 effect size, formally defined as;

$$q^2 = \frac{Q^2_{included} - Q^2_{excluded}}{1 - Q^2_{included}}$$

This value is only generated for the non-formative endogenous construct. When assessing Q-square, positive values are indicative of meaningful predictive relevance, whereas negative values suggest a lack of predictive accuracy. Furthermore, Q-square values exceeding 0.25 and 0.50 signify medium and large levels of predictive relevance within the model, respectively (Hair et al., 2020). In this paper the blindfolding results are presented Table 15b.

Structural Equation Modeling

The results from the structural equation model (SEM) analysis provided significant insights into the relationships between various skills and competencies of graduates from Arusha Technical College. The model shown in Figure 2, assessed the influence of technical skills, behavioral skills, work ethics, soft skills, and ICT skills on the ability to perform daily activities and relevance competencies. The loading factors λ for indicators to their respective constructs were notably high, demonstrating strong measurement reliability. Specifically, ICT skills indicators ICT2 and ICT4 had loadings of 0.841 and 0.898, respectively, indicating a strong representation of ICT skills in the construct. Similarly, indicators for SS, WE, BS, ABT, TS, and RC showed high loading factors, confirming the strength of the constructs.

The Beta coefficients and their 95% confidence intervals (CI) revealed the strength and significance of the relationships between constructs. Notably, ICT skills to ABT had a Beta of 0.373 with a 95% CI of [0.276, 0.477], suggesting a strong and positive influence of ICT skills on the ability to perform daily activities. This was the highest Beta value among the relationships analyzed, indicating the critical role of ICT skills in workplace effectiveness.

Technical skills (TS) also showed a significant positive effect on both ABT (β=0.257, 95% CI=[0.135,0.376]) and RC (β=0.307, 95% CI=[0.226,0.388]), reinforcing the importance of technical knowledge and abilities in contributing to graduates' competencies and daily performance. Work ethics (WE) to ABT and RC were positively related, with Beta value of 0.137 and 0.294, respectively, highlighting the value of ethical considerations in professional success.

Conversely, soft skills (SS) and behavioral skills (BS) had less pronounced effects on ABT and RC, with SS to ABT and RC and BS to ABT and RC showing lower Beta values and wider confidence intervals, some of which crossed zero, indicating less certainty in these relationships.

The relationship between ABT and RC (β=0.205, 95% CI=[0.118,0.294]) signifies the positive impact of daily activities performance on relevant competencies, suggesting that effectiveness in daily tasks contributes to the broader competencies required in the professional domain.

DISCUSSION

The results from the structural equation model (SEM) analysis provided a valuable insights into the relationships which exists between exogeneous constructs and endogenous constructs among graduates from Arusha Technical College. These findings provides implications for both academic institutions and the workforce, by identifying the factors that contribute to graduates' abilities to perform daily tasks and develop relevant competencies.

The strong and positive influence of ICT skills on the ability to perform daily activities (ABT) shows the important role of technology proficiency in today's workplace. As technology continues to advance rapidly across industries, graduates with strong ICT skills are better equipped to use digital tools and platforms, enhancing their efficiency and effectiveness in completing tasks. This finding aligns with previous research highlighting the growing importance of ICT skills in the modern labor market (Arregui et al., 2019; Audrin et al., 2024; Gallardo-Echenique et al., 2015; Pérez and Vázquez, 2021). Thus, there is a need for educational institutions to prioritize the integration of ICT training into curricula to ensure that graduates possess the technical competencies as demanded by employers.

The positive effects of technical skills on both daily activities performance (ABT) and relevant competencies (RC) emphasize the significance of field specific knowledge and expertise. Technical proficiency enables graduates to perform specialized tasks with precision and accuracy, contributing to their overall job performance and competence in their respective fields. These findings are in line with the existing literature highlighting the important role of technical skills in enhancing graduates' employability and career success (Bakar et al., 2013; Brine and Feather, 2002; Deng et al., 2014). Academic programs in technical institutions should provide students with opportunities to acquire hands on experience and practical skills relevant to their chosen professions, and thus, enhancing their readiness for the dynamics of the labor market.

The positive relationships between work ethics (WE) and both daily activities performance (ABT) and relevant competencies (RC) shows the importance of ethical behavior in the workplace. Graduates who demonstrate integrity, accountability, and professionalism are more likely to earn the trust and respect of their colleagues and supervisors, enhancing a conducive work environment to productivity and innovation. These findings aligns well with previous research highlighting the ethical dimensions of professional success (Hussey, 2011; Stam et al., 2014). Educational institutions should emphasize the cultivation of ethical values and principles alongside technical and ICT skills to produce well rounded graduates capable of ethical decision making in various professional contexts.

The less effects of soft skills (SS) and behavioral skills (BS) on both daily activities performance (ABT) and relevant competencies (RC), shows a potential challenges in these areas. While soft skills such as communication, teamwork, and problem solving are widely recognized as essential for workplace success, their development may require more targeted interventions and support mechanisms. Similarly, behavioral skills encompassing traits such as entrepreneurship, leadership, and adaptability may require more training programs to enhance graduates' proficiency in these areas. Future studies could explore innovative approaches to soft and behavioral skills development, such as experiential learning opportunities, mentorship programs, and interdisciplinary collaborations, to address these challenges effectively.

The positive relationship between daily activities performance (ABT) and relevant competencies (RC) shows the interconnectedness between task execution and broader professional capabilities. Graduates who perform well in daily tasks are better positioned to acquire and refine the competencies necessary for long term career success . This finding shows the importance of providing graduates with opportunities to engage in real world projects, internships, and professional development activities that bridge the gap between academic knowledge and practical skills. By fostering a culture of continuous learning and skill enhancement, educational institutions can empower graduates to adapt to evolving job demands and industry trends effectively.

Conclusions

In conclusion, the findings of this study showing the multidimensional nature of graduates' abilities to work and develop competencies, with ICT skills, technical skills, and work ethics emerging as key determinants of success, provides valuable inputs for policymakers, academic institutions, and industry stakeholders seeking to enhance graduates' employability and career readiness. By addressing the challenges identified in soft and behavioral skills development and promoting ethical leadership and technological literacy, educational programs can better prepare graduates for the demands of the 21st-century workforce. Future studies may focus on exploring innovative pedagogical approaches, evaluating the effectiveness of skills training initiatives, and investigating the long term outcomes of graduates in various professional domains. Through collaborative efforts and evidence based interventions, stakeholders can contribute to the continued advancement of graduate employability and workforce development initiatives.

Availability of data

The data that support the findings of this study are available upon reasonable request from the Directorate of Academics, Research, and Consultancy at Arusha Technical College

Authors' contributions

Conceptualization, O.M. and E.E.; methodology, O.M and E.E.; software, O.M and E.E.; formal analysis, O.M and E.E.; data curation, O.M. and E.E; writing---original draft preparation, O.M and E.E.; writing---review and editing, O.M and E.E.; supervision, O.M and E.E.; project administration, O.M and E.E.; All authors have read and agreed to the published version of the manuscript.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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