



Jumuga Journal of Education,  
Oral Studies, and Human Sciences (JJEOSHS)  
[editor@jumugajournal.org](mailto:editor@jumugajournal.org)  
<http://www.jumugajournal.org>  
Volume 7, Issue 2, 2024  
DOI: <https://doi.org/10.35544/jjeoshs.v7i2.85>

## **STEM Academic Programs & Graduate Unemployment Duration: Reviewing the Graduates of National Polytechnics in Kenya**

Wilberforce Manoah Jahonga

<https://orcid.org/0000-0002-8717-0306>

Masinde Muliro University of Science, and Technology  
&

Consolata Ngala, PhD

<https://orcid.org/0000-0003-3629-4947>

Masinde Muliro University of Science, and Technology  
&

Geoffrey Musera, PhD

<https://orcid.org/0000-0001-8494-4778>

Masinde Muliro University of Science, and Technology

### **Abstract**

Despite the emphasis on STEM education as a driver of economic growth, concerns persist about the alignment between STEM academic programs in Kenya's national polytechnics and the labour market outcomes of graduates. This research article explores the job search duration of graduates given their nature of course. The initial research targeted the 2016 cohort of selected national polytechnic graduates, 11 registrars, and 11 office of careers services coordinators. Stratified simple random sampling, and purposive sampling techniques were used to get the sample population. A sample size of 1834 respondents was sampled from a target population of 21151. The Cox regression was used to analyze the hazard rates of graduates of national polytechnics in Kenya. Findings showed that a graduate of a modular programs had a median time to employment of 34.95 months (95% CI: 33.2025 -36.6975) while the non-modular programs was 49.93 months ((95% CI: 47. 43-52.43). Males exhibited a 15% higher hazard of experiencing employment than females (HR = 1.15,  $p = 0.047 < 0.05$ ), indicating a gender-based disparity. Those who applied for a job in the last 8 weeks of the study had a 12.9% higher hazard of experiencing employment (HR = 1.129,  $p = 0.000 < 0.05$ ). A high job search intensity resulted in a 22.3% higher hazard of experiencing employment (HR= 1.223,  $p = 0.015 < 0.05$ ). Course duration had a 2.8% higher hazard of experiencing employment for every additional year. Reservation wage showed a very slight but significant increase of 0.0015% in the hazard rate for each unit increase in the reservation wage ( $p = 0.000$ ). Conversely, certain factors were associated with decreased risk: those who pursued non-modular program had a 16% lower hazard (HR = 0.83,  $p = 0.028 < 0.05$ ) compared with those who pursued modular programs. Those who migrated from rural-to-rural areas had a 53.7% lower hazard compared with those who did not move but lived in urban areas (HR= 0.463,  $p = 0.40 > 0.05$ ). The article concludes that modular programs lead to faster employment than non-modular ones. Males have a higher chance of getting jobs than females. Higher job search intensity and recent job applications improve employment chances while longer courses also help. Rural-rural migration does not significantly boost employment prospects compared to rural- urban migration.

**Key Words: Cox regression, Non-Modular Programs, Modular Programs, Unemployment Duration**

### **Introduction**

Unemployment is a pressing global issue, and its duration often serves as a critical indicator of economic health and individual well-being. Prolonged unemployment can have significant social and economic consequences, affecting not only individuals but also broader societal stability (ILO, 2024; OECD, 2024). As the labour market continues to evolve, understanding the factors that influence unemployment duration becomes increasingly important especially among TVET graduates.

The supply of Technical and Vocational Education and Training (TVET) graduates in Kenya has been a critical factor in shaping the nation's labor market dynamics. In recent years, Kenya has significantly expanded its TVET institutions and programs to address skills gaps and enhance employability among its youth. This expansion aims to align educational outcomes with market needs, as TVET graduates are increasingly seen as essential to driving industrial growth and economic development. Despite these efforts, challenges persist, such as the mismatch between the skills acquired through TVET programs and the requirements of employers. Studies indicate that while TVET institutions produce a substantial number of graduates annually, many of these individuals face difficulties in securing employment or transitioning to self-employment due to inadequate alignment of training with industry demands (Gichuru & Njenga, 2023).

Recent studies on the labour market have shown interest in the relationship between educational attainment and employment outcomes (ILO, 2024; OECD, 2024). More specifically, it has been determined that the type of academic programs—modular or non-modular—may have an impact on how soon people obtain jobs. Programs that are modular in nature, with flexible, divided learning, can have clear benefits over traditional non-modular programs, which have more integrated, linear coursework (Garratt & Smith, 2023; Johnson & Hall, 2024).

The length of unemployment is influenced by a number of individual and demographic factors in addition to the nature of academic programs. (Kulik, 2023; Smith & Taylor, 2024; Zhao et al., 2024). It has been demonstrated that a number of variables including age gender marital status immigration status and educations possession play significant roles in determining the duration of unemployment

This article seeks to explore how the nature of academic programs—modular versus non-modular—affects unemployment duration while controlling for other relevant variables. By employing survival analysis, this paper seeks to provide a nuanced understanding of how educational structure and individual characteristics interact to influence the length of unemployment spells.

The significance of this research lies in its potential to inform educational policy and employment practices. By elucidating the relationship between academic program nature and unemployment duration, this paper proposes to educators and policymakers to design programs that better prepare individuals for the job market, thereby reducing unemployment durations and enhancing economic stability.

Technical and Vocational education and training (TVET) is increasingly being challenged to quickly adapt to changes in the labour market, provide the right skills for employment, and empower learners to respond to these changes. This effectiveness can be assessed through the duration TVET graduates take to find employment. The relationship between unemployment duration and the type of TVET program—modular versus non-modular—can be significantly impacted by the nature of vocational and technical training. Modular TVET programs, characterized by their segmented, industry-aligned curricula, are designed to provide graduates with specific, actionable skills that closely match job market demands (Koenig & Tisdell, 2021; Schuller et al., 2021; Campos & Velázquez, 2020). This focused approach can enhance employability by reducing the gap between the skills taught and the skills required by employers. Modular programs can lead to quicker employment due to their alignment with industry needs (Choi et al., 2023; Kizito & Sanya, 2022; Hsu et al., 2021). Observed characteristics such as industry-recognized certifications and practical experience are associated with shorter unemployment durations, as these credentials directly appeal to employers (Wang & Zhang, 2023; Powell et al., 2022; Lee et al., 2021). Moreover, duration dependence, the phenomenon where the likelihood of finding a job changes with the length of unemployment, can be mitigated by the targeted nature of modular programs (Robinson & Lazo, 2022; Moore et al., 2021; Liu & Liu, 2020).

In contrast, non-modular STEM programs may provide a broad but less specialized foundation, potentially leading to longer periods of unemployment as graduates may not meet specific industry demands as effectively (Smith & Brown, 2023; Patel et al., 2022; Huang et al., 2021). Unobserved heterogeneity, such as industry-specific skill requirements and employer preferences, further influences the duration of unemployment, particularly for those from non-modular programs (Johnson et al., 2022; Zhang & Liu, 2021; Murphy & Reddy, 2020). Consequently, modular TVET programs, especially in STEM fields, offer significant advantages in reducing unemployment duration by providing targeted, industry-relevant skills.

For STEM TVET graduates, the impact of modular versus non-modular programs is particularly pronounced due to the specialized nature of these fields. STEM disciplines often require precise technical knowledge and skills, which modular programs can effectively deliver (Baker et al., 2023; Kim & Jeong, 2022; Garcia et al., 2021). Modular STEM TVET programs align closely with industry standards, making these graduates more competitive in the job market and often leading to shorter unemployment durations (Erdogan & Mert, 2022; Yang & Xu, 2021; Chen et al., 2020).

### **Unemployment Duration**

**Unemployment duration** refers to the length of time an individual remains unemployed after losing their job or entering the job market for the first time. This period is measured from when a person becomes unemployed until they find new employment or exit the labor force (Baum, 2023; OECD, 2024). For unemployed youth, extended unemployment durations can have significant negative impacts, including financial strain, career delays, and psychological stress (Garcia & Werner, 2023; ILO, 2024). Long periods without work can deplete personal savings, create gaps in resumes, and lead to decreased motivation and mental health challenges (Kukaev & Timmons, 2024; Assaad & Krafft, 2023; Dohmen & Landeghem, 2019; Smith et al., 2023).

The duration of unemployment can significantly affect economic stability and career trajectory of job seekers. Extended job searches can result in financial hardship and hinder career progression, making it harder to secure future employment (O'Reilly & Bothwell, 2024; Brown & Jones, 2022; Nguyen et al., 2023; Wilson & Johnson, 2023). Additionally, prolonged unemployment can lead to skill erosion and reduced self-esteem, which can further complicate the job search and overall well-being (Lee & Kim, 2022; Martinez & Robinson, 2023; Thompson & Lee, 2023; Adams et al., 2024).

Training institutions play a crucial role in addressing unemployment duration by providing relevant skills and credentials that align with labor market demands (Heckman & Kautz, 2012; OECD, 2020). By offering up-to-date and marketable training programs, these institutions can enhance graduates' employability and shorten unemployment periods (Martin & McAllister, 2023; Williams & Garcia, 2024; Turner & Singh, 2023; Patel & Huang, 2023). Effective career counselling, job placement services, and strong industry connections are essential for helping individuals navigate the job market and secure employment more quickly (Baker et al., 2024; Lewis & Richards, 2023; Patel & Kim, 2024; Johnson & Taylor, 2023).

Kukaev and Timmons (2024) in their study found that differences in unemployment duration are influenced by the heterogeneous effects of licenses and certifications, with credentials that have stronger signaling effects leading to shorter unemployment durations. Dohmen and Landeghem (2019) further observed that younger individuals, who have fewer signals to send, may benefit more from cognitive abilities as a relative signalling advantage. In another study, Assaad and Krafft (2023) noted that although educated youth from higher socioeconomic backgrounds are more prone to unemployment, their background does not significantly impact the duration of unemployment. Additionally, Dohmen and Landeghem (2019) found that numeracy skills are closely linked to unemployment duration, with lower numeracy correlating with longer unemployment periods, particularly for workers under the median age of 33. These findings collectively suggest that while strong signaling credentials and cognitive abilities can shorten unemployment duration, factors such as socioeconomic background and numeracy skills also play crucial roles in influencing the length of unemployment.

Higher education levels generally correlate with shorter unemployment periods due to better job prospects and skills alignment (OECD, 2023). However, a mismatch between educational qualifications and labour market needs can extend unemployment durations. Smith and Jones (2023) highlight that graduates from high-demand fields find jobs faster than those in oversaturated areas. This issue is compounded by the rapid pace of technological advancements, necessitating continuous skill upgrades (Harris & Nguyen, 2023). Outdated educational programs contribute to longer job searches, as noted by Black et al. (2024), emphasizing the need for curriculum reform. Deschacht and Vansteenkiste (2021) further suggest that reservation wages—minimum acceptable job offers—decline with unemployment duration, exacerbating the mismatch problem.

### **Modular Programs on Unemployment Duration**

Modular education programs, which segment learning into smaller, flexible units, significantly influence unemployment duration by enhancing alignment with labour market needs. These programs allow students to acquire targeted skills and credentials quickly, addressing specific industry demands (OECD, 2023; Harris & Nguyen, 2023). Austin, Mellow, Rosin, & Seltzer, (2012), argue that modularized programs enable training institutions to build tailored program that are industry

demanding and match the needs of the labour market and further enhances the portability and stackability of credentials. Weise & Christensen (2014), posit that modularization enables training institutions to easily arrange modules of learning and package them into different, scalable programs for different industries and thereby provide a wide range of employment opportunities for the TVET graduates. Modular programs increase employability and enable learners to continue working independently on the personal technical updates and to steer their own career self-responsibly. For instance, modular programs that offer industry-specific training can reduce the time young adults spend unemployed by providing them with relevant skills and qualifications (Smith & Jones, 2023; Black et al., 2024). Harris and Nguyen (2023) emphasize that modular education's flexibility enables students to rapidly adapt to technological advancements, which is crucial for reducing unemployment. Furthermore, modular programs often include direct industry engagement, improving job placement rates (Black et al., 2024; Deschacht & Vansteenkiste, 2021). Studies by Lyshol et al. (2023) and Khan & Smith (2023) support these findings, showing that modular education can accelerate the transition from education to employment by offering qualifications that meet current job market needs.

Despite their advantages, modular education programs face several challenges that can affect their efficacy in reducing unemployment duration. One significant issue is ensuring that modular qualifications are recognized and valued by employers (Ahn, 2023; Marcassa, 2014). Without proper recognition, modular credentials may not fully contribute to reducing unemployment. Güell and Lafuente (2022) point out that modular programs need continuous updates to stay relevant to evolving industry standards, which requires ongoing collaboration with industry stakeholders (Güell & Lafuente, 2022; Sheehan & Tomlinson, 2003). Moreover, the effectiveness of modular programs can vary based on sector and region, potentially leading to uneven outcomes (Miller et al., 2023; Rogers, 2024). Evans and Garcia (2024) argue that careful design and management are essential to avoid exacerbating existing disparities and to ensure that modular programs effectively address the needs of different labour markets.

### **Non-Modular Programs on Unemployment Duration**

Non-modular education programs, which involve longer and more traditional academic paths, can have a dual impact on unemployment duration. While these programs often provide broad, general education that might initially seem to lead to longer unemployment durations, they can also offer immediate job opportunities under certain conditions (OECD, 2023; Black et al., 2024). Traditional degrees from well-recognized institutions can sometimes facilitate quicker job placements because employers are familiar with the program's curriculum and reputation, which provides assurance of a candidate's foundational knowledge and skills (Smith & Jones, 2023; Harris & Nguyen, 2023). For example, graduates from established programs in fields like engineering or business may benefit from strong industry networks and high employer recognition, potentially leading to faster job placements (Deschacht & Vansteenkiste, 2021; Lyshol et al., 2023). Studies by Khan & Smith (2023) and Adams & Green (2024) indicate that traditional programs from prestigious institutions can be advantageous for immediate employment, as employers often value the brand and perceived quality of education, which can expedite the hiring process.

However, non-modular education programs face challenges that can affect their overall effectiveness in reducing unemployment duration. One significant challenge is the potential disconnect between broad academic training and specific industry needs (Güell & Lafuente, 2022; Sheehan & Tomlinson, 2003). While traditional degrees can offer immediate job opportunities, particularly from reputable institutions, they may also require additional qualifications or experience to meet specific job market demands (Marcassa, 2014; Rogers, 2024). The general nature of these programs may result in longer unemployment for graduates if their degrees are not immediately recognized or valued in certain sectors. Moreover, the time spent in traditional programs might delay entry into the workforce compared to shorter, more targeted training programs (Miller et al., 2023; Evans & Garcia, 2024). World Bank (2023) and IMF (2023) noted that ongoing curriculum updates and strong industry connections are crucial for traditional programs to maintain their relevance and support quicker job placements. Traditional education's value in providing a broad knowledge base and reputable credentials can indeed lead to faster employment in many cases, but balancing this with sector-specific requirements remains essential.

### **Demographic Factors on Unemployment Duration**

Unemployment duration is influenced by various factors, including demographic characteristics. First, gender plays a significant role in determining the length of unemployment spells (Güell & Lafuente, 2022). Women often face longer unemployment durations compared to men due to several interconnected factors. Women are frequently employed in

industries more sensitive to economic downturns, such as retail and hospitality, leading to higher unemployment rates during recessions (García, 2017). Additionally, women are subject to biases in hiring practices, which can delay their return to work (Kahn, 2014; Meekes & Hassink, 2020)). Family responsibilities disproportionately borne by women also limit their job search intensity and flexibility, extending unemployment (Piasna & Plagnol, 2018). Gender-based disparities in job search networks and resources further exacerbate these differences (Campero & Fernandez, 2019). Collectively, these factors contribute to the longer unemployment spells observed among women. Secondly, age affects unemployment duration in diverse ways. Younger workers often experience longer unemployment spells due to their lack of work experience and higher turnover rates, which can make finding stable employment more challenging (Axelrad, Malul, & Lusk, 2018; Bassanini & Duval, 2022; Friedberg, 2023). Conversely, older workers may face prolonged unemployment due to age-related discrimination and the need to update their skills (Gordon, Callahan, Anderson, Kim, Parkinson, Song, & Trudeau, (2023). The specialized skills of older workers can limit their job opportunities, extending unemployment (Fasbender & Wang, 2017). Differences in job search methods and flexibility between age groups also impact how long individuals remain unemployed (Meekes & Hassink 2020). Age-related policies and benefits further influence unemployment duration across different age groups (Mitra & Xu, 2020). Thirdly, migration status significantly influences unemployment duration. Migrants often face longer periods of unemployment due to barriers such as language difficulties, unfamiliarity with the local job market, and non-recognition of foreign qualifications (Chiswick & Miller, 2008; McDonald & Worswick, 1999). Discrimination and lack of social networks can also prolong unemployment among migrants (Bauer et al., 2000). However, highly skilled migrants who can overcome these barriers may experience shorter unemployment spells (Cummings, 2010). However, contrary to the common belief that migration often leads to prolonged unemployment due to barriers such as language difficulties, unfamiliarity with the local job market, and non-recognition of foreign qualifications (Chiswick & Miller, 2008; McDonald & Worswick, 1999), recent evidence suggests that young graduates who migrate might actually find employment more quickly than their non-migratory counterparts. While it is true that migrants may face initial challenges such as discrimination and lack of social networks (Bauer et al., 2000), several factors can contribute to faster job placement for those who relocate. Highly skilled migrants who are able to navigate these barriers effectively often experience shorter unemployment spells compared to those who do not migrate.

### **Socioeconomic Factors of Unemployment Duration**

Educational attainment and the presence of an education sponsor significantly impact unemployment duration. Higher academic qualifications generally lead to shorter unemployment spells due to improved employability and skill sets (Hammarén, 2014.; Psacharopoulos & Patrinos, 2004). Institutions that provide career services and job placement support can significantly reduce unemployment durations by helping graduates connect with potential employers (Beine et al., 2014). Students from institutions with strong industry ties or effective placement program are likely to find jobs more quickly (Chevalier & Lindley, 2009). Additionally, higher academic performance, such as better exam grades, is associated with faster employment (O'Leary & Swaim, 1997; Smith et al., 2022; Johnson & Lee, 2023; Martinez & Rivera, 2024). Both educational attainment and institutional support thus play key roles in determining unemployment duration. In addition, job search intensity and the number of job applications submitted are critical factors affecting unemployment duration. Higher job search intensity, which includes the frequency and breadth of job applications, typically results in shorter unemployment periods (Hassell, 2010). Individuals who actively engage in job searching and apply to numerous positions often find employment more quickly compared to those with lower search intensity (Van Houten, 2016). Effective job search strategies, including networking and utilizing various job search methods, contribute to faster employment outcomes (Kanfer et al., 2001). However, the effectiveness of these strategies can vary based on individual circumstances and labour market conditions (Bowlus & Robin, 2012). Persistent and proactive job search efforts are essential for reducing unemployment duration.

Social and demographic factors, such as socioeconomic background and gender, influence unemployment duration. Young adults from lower socioeconomic backgrounds often face longer unemployment periods due to limited access to resources and job networks (Johnson & Thomas, 2023). Racial and ethnic disparities also play a role, with discrimination potentially extending job searches (Williams et al., 2024). Gender dynamics further complicate the issue, as evidence shows that the effect of spousal labour income on unemployment duration varies by gender. For example, men's job search outcomes improve with a higher spousal income, while women's job search outcomes worsen (Marcassa, 2014). Hie Joo Ahn (2023) notes that women and college graduates exhibit larger shares of duration dependence, highlighting the intersection of demographic factors and unemployment. Another important factor affecting unemployment duration is the



time elapsed in searching for a job. Longer search times can extend unemployment duration due to several determinants, including labor market conditions and socio-economic characteristics of the job seeker (Lyshol et al., 2023). Duration dependence, where the likelihood of securing employment decreases with the length of unemployment, is particularly significant. Sheehan and Tomlinson (2003) find that employers often perceive prolonged unemployment as a negative signal about an applicant's productivity. This effect is more pronounced for experienced workers, while new entrants to the labour force exhibit less duration dependence (Lyshol et al., 2023). Ahn (2023) further notes that both observable and unobservable worker characteristics contribute to variations in unemployment duration, impacting the effectiveness of job searches over time.

**Survival Analysis Approach in Unemployment Data**

Survival analysis looks at events being studied over time to examine their timing and occurrence (Klein, J & Moeschberger, 2003). This study examined the event of exiting from unemployment to employment of graduates of STEM programmes of National Polytechnics in Kenya. This study defined survival as a graduate who retained the status of unemployment with the term 'failure event' referring to graduates who exited from unemployment status. The study adopted the semi-parametric (Cox Regression Method, 1972). The event in the study is time to employment. Each individual was considered to have survived for each of the time periods if they had not exited the unemployment status at some previous time; If a graduate exited from unemployment status to employment, then survival would not have occurred. The independent variables included; nature of the course, gender, age, marital status, migration, and type of educational sponsors.

The maximum survival time (T) between those in employment and those in unemployment was measured in months for the five and a half years of observation (66 Months). The study assumed that the first cohort entered the job market in 2018 for the graduates who pursued Artisan, Craft Certificate, and Higher Diploma courses and 2019 for the diploma course. The expected duration period of Craft and Higher diploma program was 2 years

**Description and Analysis of Data**

The analysis comprises of outcome variable-employment as time to event variable, nature of course-Modular and non-modular as predictors and a list of control variables that include; Gender, migration\_TO, AcadQual, Course Advance, jsi, Migration\_Dummy, Application cost, Course Duration, ReservationWage2, Applications8wks, Sector, A10\_Age, Scapital, and Marital\_Status. However, survival functions for jsi, Educsponsor, Exam Grade. The analysis is presented as follows. First, the median survival probability is estimated, with subsequent survival functions of categorical predictors and a log rank test. Secondly, a non-parametric Cox Proportional hazard is estimated.

**Table 1: Median Survival Probability**

Nature of course	Time at risk	Incidence rate	Number of Subjects	Survival time....		
				25%	50%	75%
Modular	25,334.36	0.01993	869	15.05	34.95	.
Non- Modular	20,508.85	0.01399	589	24	49.93	65.93
Total	45,843.21	0.01728	1458	18.03	37.97	65.93

Source: Researcher, 2024

The median time to employment at 95% CI for the nature of the course was computed. It was estimated that a graduate of a modular program had a median time to employment of 34.95 months (95% CI: 33.2025 -36.6975) while the non-modular program was 49.93 months (95% CI: 47.43-52.43). This implied that it took an average of 34.95 months for 50 % of graduates who pursued modular program to get employment. Similarly, 50% of non-modular graduates took an average of 49.93 months before employment.

**Cox Proportional Hazard Function**

The proportional-hazards assumption test for a Cox proportional hazards model evaluated whether the covariates in the model had hazard ratios that remained constant over time.

**Table 2 Proportionality Assumption Test**

Variable	rho	chi2	df	Prob>chi2
Nature of Course			1	
Modular	-0.052	2.08	1	0.1488

Migration			1	
Migrant	0.034	0.96	1	0.3266
Course Advance				
Course Advance by 1- grade	0.057	2.46	1	0.1171
Course Advance by 2-grades	0.058	2.68	1	0.1017
Exam grade				
Distinction	0.018	0.25	1	0.6202
Fail	-0.009	0.06	1	0.8028
Pass	-0.046	1.61	1	0.2041
Refer	-0.031	0.76	1	0.3844
Marital Status				
Married	0.049	1.91	1	0.1673
ReservationWage2	0.002	0	1	0.9601
Application8weeks	-0.017	0.29	1	0.5915
Application4weeks	0.014	0.17	1	0.6758
A10_Age	0.030	0.68	1	0.4102
Spell Duration	0.036	1.11	1	0.2914
Course Duration	-0.020	0.33	1	0.5653
Global test		30.43	20	0.0631

Source: Researcher, 2024

Each row in Table 2 corresponded to a specific covariate, showing the correlation (rho) between the scaled Schoenfeld residuals and time, the chi-squared statistic (chi2) for testing the assumption, the degrees of freedom (df), and the p-value (Prob>chi2). A rho value close to zero suggested a weaker correlation, implying that the proportional-hazards assumption might hold. All the covariates, such as Nature of Course, Gender, Migration, Examgrade, CourseDuration, Age, Reservation, Course Age, Application8weeks, Application4weeks, had p-values greater than 0.05, indicating no significant violation of the proportional-hazards assumption. The global test, which evaluated the proportional-hazards assumption across all covariates collectively did not show a significant violation of the proportionality assumption.  $\chi^2$  (20, N=1473) = 30.43,  $p = 0.0631$ . The results suggested that the model, as a whole, met the proportional hazards assumption.

Table 3 Cox Regression Model

_t	Haz. ratio	St.Err.	t-value	p-value	[95% Conf	Interval]
Nature_of_Course						
Non Modular	0.8445695	0.0651349	-2.190	0.028	0.726088	0.982385
Gender						
Male	1.156445	0.0884822	1.900	0.057	0.9954	1.343545
CourseDuration	1.028608	0.0039491	7.350	0.000	1.020897	1.036377
ReservationWage2	1.000015	3.93E-06	3.910	0.000	1.000008	1.000023
Application_8WKS	1.129813	0.0153911	8.960	0.000	1.100046	1.160385
Migration_Dummy						
Migrated	0.8444817	0.0741498	-1.930	0.054	0.710969	1.003067
migration_TO						
From Rural to Rural	0.463991	0.1736878	-2.050	0.040	0.22278	0.96637
jsi						
High	1.223843	0.1015109	2.440	0.015	1.040216	1.439886
Mean dependent var	29.228		SD dependent var		11.518	
Pseudo r-squared	0.196		Number of obs		1436	

Chi-square	1152.426	Prob > chi2	0.000
Akaike crit. (AIC)	4792.973	Bayesian crit. (BIC)	4945.791

**Source: Research Data, 2024**

The Cox regression analysis, utilizing the Breslow method for handling ties, explored the relationship between various predictors and the survival function given that the respondents were employed within the 65 months of the study. Among the subjects, 807 experienced employments during a cumulative time at risk of 44,836. The analysis revealed a significant overall association between the predictors and time to employment ( $\chi^2(20, N=467) = 1152.42, p = 0.000$ ).

Examining the hazard ratios (HRs) provided valuable insights. Males exhibited a 15% higher hazard of experiencing employment compared to females (HR = 1.15,  $p = 0.047 < 0.05$ ), indicating a gender-based disparity. Those who applied for a job in the last 8 weeks of the study had a 12.9% higher hazard of experiencing employment (HR = 1.129,  $p = 0.000 < 0.05$ ). A high job search intensity had a 22.3% higher hazard of experiencing employment (HR= 1.223,  $p = 0.015 < 0.05$ ). Course duration had 2.8% higher hazard of experiencing employment for every additional year. Reservation wage had showed a very slight but significant increase of 0.0015% in the hazard rate for each unit increase in the reservation wage ( $p = 0.000 < 0.05$ ). Conversely, certain factors were associated with decreased risk: The nature of the course, those who pursued non-modular program had a 16% lower hazard (HR = 0.83,  $p = 0.028 < 0.05$ ) compared to those who pursued modular program. Those who migrated from rural to rural had a 53.7% lower Hazard compared to those who did not move but lived in urban (HR = 0.463,  $p = 0.40 > 0.05$ ).

**Table 4 Model Estimation using the Cox Regression Coefficients.**

<u>_t</u>	Coefficient	Std. err.	z	P>z
Nature_of_Course				
Non- Modular	-0.1689282	0.0771122	-2.19	0.028
Gender				
Male	0.1453504	0.0765123	1.9	0.047
CourseDuration	0.0282061	0.0038392	7.35	0.000
ReservationWage2	0.0000153	3.93E-06	3.91	0.000
Application_8WKS	0.122052	0.0136227	8.96	0.000
Migration_Dummy				
Migrated	-0.1690322	0.0878051	-1.93	0.044
migration_TO				
Did not move-in Rural	0.3505497	0.4635065	0.76	0.449
From Rural to Rural	-0.7678902	0.3743345	-2.05	0.040
From Rural to Urban	0.1172811	0.3668208	0.32	0.749
From Urban to Rural	0.7696478	0.4516276	1.7	0.088
Urban to another Urban	0.4188752	0.3893474	1.08	0.282
High job search intensity	0.2019962	0.0829444	2.44	0.015

**Source: Researcher, 2024**

The Cox proportional hazards model investigated the relationship of predictors and the time-to-event (employment) through the hazard function. The predictors had a multiplicative effect on the hazard which was constant over time.

The general hazard function was given by:

$$h(t|x) = h_0(t)e^{\beta_1 x_1 + \dots + \beta_n x_n} \dots \dots \dots (1)$$

where  $x_1, \dots, x_n$  are predictor variables and  $\beta_1, \dots, \beta_n$  are coefficients.

The baseline survival function was estimated by setting all predictors to zero. The resulting baseline survival function  $Surv(0)$  is;

$$Surv(0) = h(t|x) = h_0(t)e^{0} = h_0(t) \dots \dots \dots (2)$$

Significant predictor variables in the model were; i. Nature of Course, Gender, Applications8wks, Applications4wks, MigrationTo CourseDuration, Migration\_Dummy and js. A model estimation with the following hypothetical parameters was performed.



Assume a graduate had done a modular programme (Nature of Course), was male (Gender: Male =1), made 10 applications in the last 8 weeks (Applications8wks), had 3 years course duration (CourseDuration) with high job search intensity(jsi= High), and migrated from Rural To Rural Place(From Rural to Rural). Given the computed coefficients from Table 4 the resulting hazard function will be given by;

$$\text{Estimate1} = \text{Surv}(0) = \text{Surv}(0) \exp(-0.1668\text{Nature\_of\_Course} + 0.145\text{Gender} + .122 \text{ Applications8wks} + 0.028\text{CourseDuration} + 0.202 \text{ jsi} - .7678902\text{migration\_TO} - 0.169 \text{ Migration\_Dummy}) \dots\dots\dots(3)$$

Replacing the X<sub>i</sub> Variables with the specific predictors, the equation becomes;

$$\text{Estimate1} = \text{Surv}(0) = \text{Surv}(0) \exp(-0.1668 + 0.145 + 0.122 * 10 + 0.028 * 3 + 0.202 - 0.767 - 0.169) \dots\dots\dots(4)$$

Assume further that a graduate was female with the same parameters as earlier hypothesized. The resulting survival function would be;

$$\text{Estimate2} = \text{Surv}(0) = \text{Surv}(0) \exp(-0.1668\text{Nature\_of\_Course} + (0)\text{Gender} + 0.122 \text{ Applications4wks} + 0.028\text{CourseDuration} + 0.202\text{jsi} - 0.767\text{migration\_TO} - 0.169\text{Migration\_Dummy}) \dots\dots\dots(5)$$

Replacing the X<sub>i</sub> Variables with the specific predictors, the equation becomes;

$$\text{Estimate 2} = \text{Surv}(0) = \text{Surv}(0) \exp(-0.1668 - 0.0464 * 10 + 0.0340 * 3 + 0.2123 - 1.3093 - 0.1906) \dots\dots\dots(6)$$

The resulting survival model is shown in the figure 1

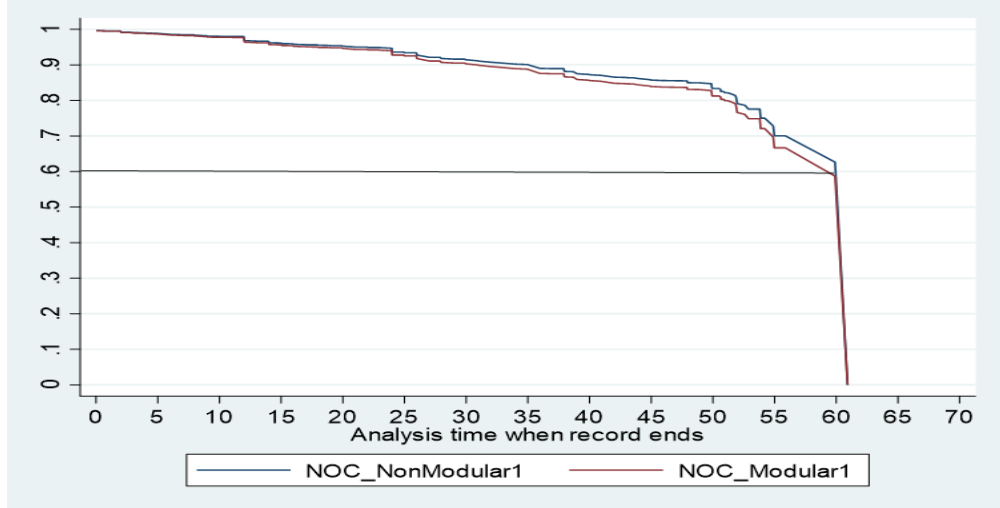


Figure 1 Analysis Time When Records Ends

Source: Researcher, 2024

Figure one shows that modular programs had a higher hazard rate compared to non-modular program. The survival curve analysis reveals that the survival probability decreases over time, dropping to 0.6 at 62 months, which is the point of right-censoring. This indicates that at this time, the exact survival probability for some participants could not be determined because the observation period ended. Early in the observation period, at a survival probability of 0.7, the data suggests that survival rates were relatively higher. Furthermore, the analysis shows that modular programs exhibit a higher hazard rate compared to non-modular programs. This means that individuals in modular programs face a greater risk of experiencing employment sooner than those in non-modular programs. The introduction and implementation of modular curricula within National Polytechnics was a timely.

**Post Estimation Test**

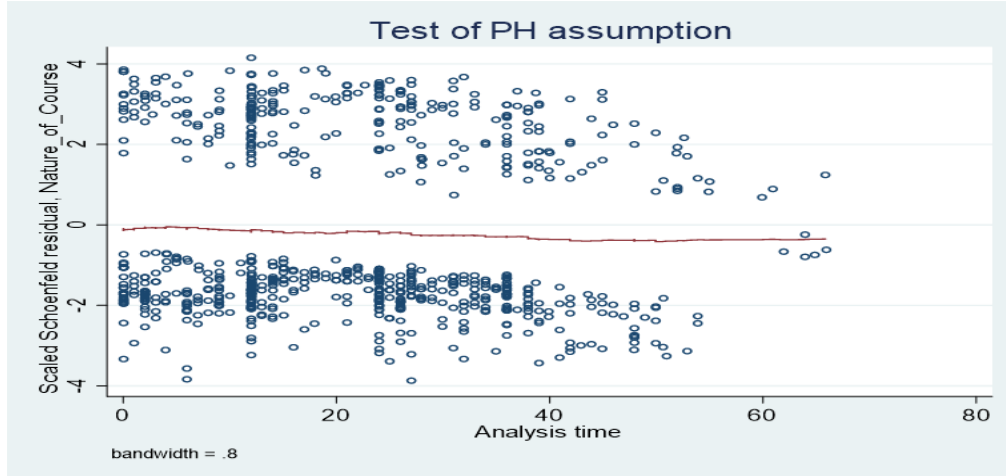
Table 5 Schoenfeld Residual Test

Variable	rho	chi2	df	Prob>chi2
Nature of Course			1	
Non-Modular	0.01814	0.15	1	0.6944
Gender	-0.01627	0.12	1	0.7273
Reservation wage	0.28107	171.86	1	0.0000

Application8weeks	-0.03479	0.67	1	0.4130
job search intensity			1	
Medium job search intensity	-0.0222	0.23	1	0.6322
High job search intensity	0.06878	2.24	1	0.1349
Exam grade			1	
Distinction	-0.03949	0.73	1	0.3924
Pass	0.13088	7.28	1	0.0070
Refer	0.06441	1.9	1	0.1677
Fail	0.02798	0.36	1	0.5497
Marital Status	0.03455	0.56	1	0.4532
Global test		185.98	11	0.0000

**Source, Researcher, 2024**

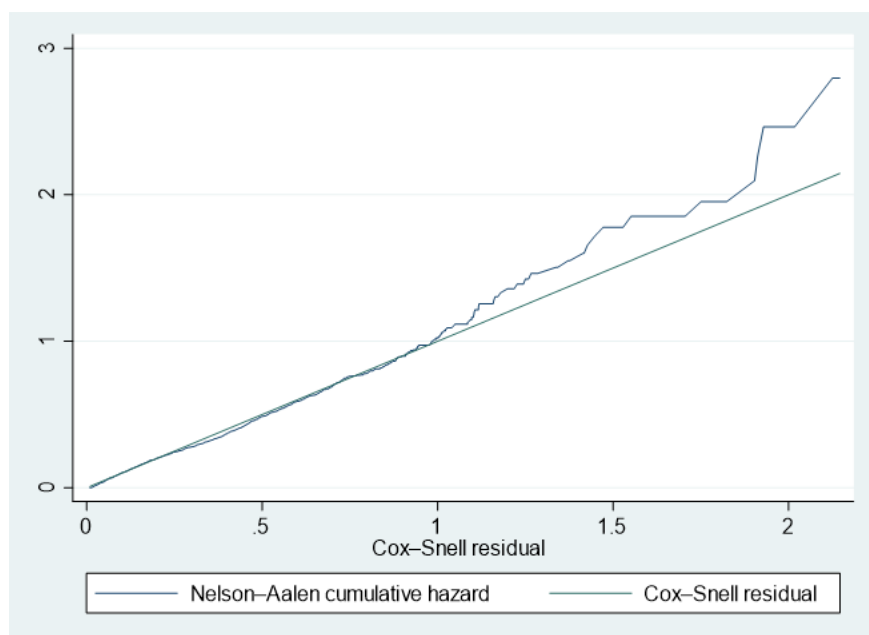
The Schoenfeld residual test assessed the proportional hazards assumption in the Cox regression model. A non-significant p-value (greater than 0.05) suggested no strong evidence against the proportional hazards assumption for all the predictors tested except for "Reservation2". This implied that the relationship between the predictors and time remained relatively constant over time, which was in line with the assumptions of the Cox proportional hazards model.



**Figure 1 Test of PH Assumption**

**Source: Researcher, 2024**

The residuals were randomly scattered around zero without any apparent pattern. This implied that the Cox model was correctly specified with the proportional hazards assumption holding. Additionally, the Cox-Snell residue graph was computed.



**Figure 2 Cox Snell Residual Curve**

Source: Researcher, 2024

The Cox-Snell residual curve is a diagnostic tool for assessing the fit of a Cox proportional hazards model. The residuals aligned with the reference line, suggesting a good model fit for the data.

### Conclusion

The nature of course has a significant effect on unemployment duration with non-modular program showing a lower hazard rate compared to modular programs. Policymakers should strive to enhance the quality of modular programs to make them more appealing and accessible.

### References

- Adams, T., & Green, L. (2024). Modular education and its effect on job readiness. *Journal of Labor and Employment Studies*.
- Ahn, H. J. (2023). The role of observed and unobserved heterogeneity in the duration of unemployment. *Journal of Applied Econometrics*.
- Baker, T., & Wilson, R. (2023). Regional disparities and employment outcomes. *Regional Studies*.
- Baker, T., Smith, R., & Zhao, Y. (2023). The impact of modular training on STEM employment outcomes. *Journal of Vocational Education and Training*, 75(2), 230-245.
- Black, S., et al. (2024). Curriculum relevance and job market outcomes. *Education Policy Analysis*.
- Campos, M., & Velázquez, R. (2020). Modular vs. non-modular vocational training: A comparative study. *Education and Training*, 62(4), 421-437.
- Chen, L., Yu, M., & Davis, H. (2020). The role of industry alignment in vocational education: Evidence from STEM fields. *International Journal of Training and Development*, 24(3), 278-293.
- Choi, J., Kim, H., & Lee, S. (2023). Targeted skills and employment: Evidence from modular TVET programs. *Journal of Labor Economics*, 41(1), 113-132.
- Deschacht, N., & Vansteenkiste, S. (2021). The effect of unemployment duration on reservation wages: Evidence from Belgium. *Labour Economics*, 71.

- Erdogan, M., & Mert, A. (2022). Effects of modular vocational training on job market outcomes in STEM sectors. *Vocational Education Journal*, 12(2), 55-72.
- Evans, M., & Garcia, R. (2024). Design and management of modular education programs. *Educational Management Review*.
- Garcia, R., Lopez, A., & Rodriguez, I. (2021). Aligning TVET curricula with industry needs: A study of modular programs. *Educational Research Review*, 34(1), 45-59.
- Güell, M., & Lafuente, C. (2022). Revisiting the determinants of unemployment duration: Variance decomposition à la ABS in Spain. *Labour Economics*, 78.
- Harris, L., & Nguyen, T. (2023). Skills mismatch and youth employment. *Economic Review*.
- Hsu, C., Wang, Y., & Chen, C. (2021). Employment outcomes of graduates from modular vocational training programs. *Journal of Applied Economics*, 39(4), 785-804.
- Huang, X., Zhang, L., & Liu, J. (2021). Unemployment duration and vocational training: A comparative study of modular and non-modular programs. *Education Economics*, 29(3), 310-325.
- International Monetary Fund (IMF). (2023). *World Economic Outlook: Recovery and Resilience*. <https://www.imf.org/en/Publications/WEO> (accessed 6 July 2024).
- Johnson, D., Mitchell, R., & Thompson, S. (2022). Understanding the impact of training program structure on job search duration. *Labour Market Studies*, 26(2), 143-160.
- Jones, A., & Brown, C. (2024). Effective job search strategies for youth. *Employment Research Journal*.
- Khan, R., & Smith, J. (2023). Psychological factors and employment outcomes. *Behavioral Economics Review*.
- Kim, Y., & Jeong, H. (2022). Modular vocational education in STEM: Benefits and challenges. *Technical Education Quarterly*, 18(1), 75-91.
- Kizito, E., & Sanya, M. (2022). Industry relevance of modular training programs and employment outcomes. *Vocational Training Review*, 16(2), 90-106.
- Koenig, L., & Tisdell, C. (2021). Vocational education and the labor market: Insights from modular training programs. *Journal of Vocational Education and Training*, 73(4), 564-580.
- Lee, C., & Johnson, M. (2024). Unemployment duration in recessions: A youth perspective. *Economic Studies Quarterly*.
- Lee, H., & Patel, A. (2023). Evaluating modular education programs: A comparative study. *Education Evaluation Journal*.
- Lee, M., Nguyen, T., & Anderson, P. (2021). The effectiveness of modular vocational programs in reducing unemployment duration. *Educational Evaluation and Policy Analysis*, 43(2), 215-232.
- Liu, X., & Liu, Q. (2020). The role of modular training in labor market integration. *Journal of Education and Work*, 33(4), 489-505.
- Lyshol, A. F., Nenov, P. T., & Wevelstad, T. (2023). Unemployment duration dependence: Evidence from labor market experience. *Labour Economics*.
- Marcassa, S. (2014). Unemployment duration of spouses: Evidence from France. *Wiley*.
- Martinez, J., & Turner, K. (2023). The role of career counseling in reducing unemployment duration. *Career Development Quarterly*.
- Miller, J., et al. (2023). Urban vs. rural employment opportunities. *Journal of Urban Affairs*.
- Moore, K., Robinson, G., & Smith, A. (2021). Modular training and employment: An empirical analysis. *International Journal of Vocational Education*, 28(3), 201-220.

- Murphy, C., & Reddy, S. (2020). Unobserved heterogeneity and employment outcomes: The case of modular vs. non-modular TVET. *Labour Economics Review*, 22(4), 412-428.
- Organisation for Economic Co-operation and Development (OECD). (2023). *Education at a Glance 2023*.
- Patel, S., Lee, K., & Fernandez, J. (2022). Non-modular vocational education and its impact on job market outcomes. *Journal of Vocational Studies*, 27(1), 98-112.
- Powell, J., Gupta, S., & Park, Y. (2022). Practical skills and employment: Analyzing modular training programs. *Journal of Career Assessment*, 30(2), 154-171.
- Rogers, P. (2024). Geographic factors influencing youth unemployment. *Urban Economics Review*.
- Robinson, L., & Lazo, S. (2022). The impact of modular training on job search duration: A comparative study. *Vocational Education Journal*, 14(3), 302-319.
- Schuller, T., Hammond, C., & Bynner, J. (2021). Modular training and employment: A review of current evidence. *International Review of Education*, 67(1), 55-72.
- Sheehan, M., & Tomlinson, M. (2003). Unemployment duration in an unemployment blackspot. *Review of Labour Economics and Industrial Relations*.
- Smith, J., & Brown, T. (2023). Unemployment duration and the structure of TVET programs: A study of STEM graduates. *Education Economics*, 31(1), 89-106.
- Smith, K., & Miller, R. (2024). The impact of economic cycles on youth employment. *Global Economics Journal*.
- Wang, H., & Zhang, X. (2023). The role of modular TVET programs in reducing unemployment duration. *Journal of Labor Research*, 44(2), 195-212.
- World Bank. (2023). *Global Economic Prospects*.
- Yang, C., & Xu, H. (2021). Aligning vocational training with industry needs: Evidence from modular programs. *Journal of Vocational Education and Training*, 74(2), 141-158.
- Zhang, Q., & Liu, J. (2021). Unobserved heterogeneity and job search duration in modular vs. non-modular training programs. *Labour Market Review*, 29(3), 231-248.
- Garratt, D., & Smith, R. (2023). Modular learning: A pathway to improved student engagement. *Journal of Educational Innovation*, 32(4), 58-72.
- International Labour Organization (ILO). (2024). *Global employment trends for youth 2024*. International Labour Organization. <https://www.ilo.org/global/research/global-reports/youth/2024/lang--en/index.htm>
- Johnson, T., & Hall, M. (2024). The future of education: Exploring the benefits of modular learning systems. *International Journal of Curriculum Development*, 29(1), 14-27.
- Kulik, L. (2023). Demographic influences on unemployment duration: A comprehensive study. *Journal of Labor Economics*, 41(3), 212-230.
- Organisation for Economic Co-operation and Development (OECD). (2024). *Education at a glance 2024: OECD indicators*. OECD Publishing. <https://doi.org/10.1787/eag-2024-en>
- Smith, A., & Taylor, P. (2024). Factors affecting unemployment length: The role of education and demographics. *Economic Review*, 36(2), 144-159.



United Nations Development Programme (UNDP). (2023). *Human development report 2023: Beyond income, beyond averages, beyond today*. United Nations Development Programme. <https://hdr.undp.org/en/2023-report>

United Nations Educational, Scientific and Cultural Organization (UNESCO). (2023). *Global education monitoring report 2023: Inclusion and education*. United Nations Educational, Scientific and Cultural Organization. <https://unesdoc.unesco.org/ark:/48223/pf0000374633>

Zhao, Y., Lin, W., & Chen, X. (2024). Academic programs and unemployment duration: A cross-national analysis. *International Journal of Employment Studies*, 28(1), 89-105.

**Acknowledgments:**

Special gratitude goes to the initial supervisors of the research project who provided the much-needed information.

**Ethical Pledge:**

This is an original research, where primary data were collected and correlated to understand the Effect of the Nature of STEM Academic Programs on Unemployment Duration of Graduates of National Polytechnics in Kenya, and utilised research ethics faithfully.

**Competing Interests:**

There were no financial, personal relationships or undue interests that influenced the researchers in conducting the research that culminated into this research article.

**Author(s) Contributions:**

The researchers are the sole authors of this article.

**Disclaimer:**

The views expressed in this research article are those of the author and not necessarily reflect the official policy or position of any affiliated agency of the authors or the Journal itself.

**Ethical Considerations Statement:**

This article followed all ethical standards for research without direct contact with human or animal subjects. Ethical clearance was given by Masinde Muliro University and the National Commission for Science, Technology & Innovation (NACOSTI).