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Graduate Employability in Malaysia: Analysing Students' Level of Study and Fields of Study in Relation to their Employability

[1]Muhammad Fithri Ibrahim, [2]Anees Janee Ali, [3]Bi Fangling, [4]Mass Hareeza Ali, [5]Zubair Ahmed, [6]Ndagi Abdullahi, [7]Sufaid Ali

[1,2,3,5,6,7]School of Management, Universiti Sains Malaysia, [4]School of Business and Economics, Universiti Putra Malaysia

Email: mass@upm.my

Corresponding Author Email: aneesali@usm.my

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Abstract

This study analyzes the employability trends of graduates from Malaysian higher education institutions, with a focus on bachelor's, master's, and doctoral degree holders. Using data from the Ministry of Higher Education (MOHE), the study examines graduate employability across different types of education and fields of study by using the Python analysis. The findings reveal that while bachelor's degree graduates exhibit lower employability rates, averaging around 30%, master's and PhD graduates show significantly higher employability, with PhD programs achieving a 100% employment rate. The study also highlights that fields such as Applied Arts, including accountancy and business-related disciplines, demonstrate the highest graduate employability. The Kernel Density Estimation (KDE) analysis confirms a positive relationship between institutional type, level of education, and field of study, with an R^2 score of 0.83. Despite overall high employability rates, certain variables negatively influence graduate outcomes, signaling areas for further investigation. This research provides valuable insights for stakeholders to address graduate unemployment and improve alignment between tertiary education and labor market demands.

Keywords: Graduate Employability, Malaysian Higher Education Institutions, Python, Graduate Unemployment

Introduction

Datuk Seri Ahmad Maslan, Deputy Finance Minister, stated in a report by Berita Harian (Noh, 29 May 2023) that approximately 60% of SPM students do not pursue further studies each year and instead engage in the gig economy. Out of 500,000 candidates for the Malaysian Certificate of Education, only 200,000 have pursued tertiary education or Technical and Vocational Education and Training (TVET). From an economic perspective, this scenario poses a significant risk to the Malaysian industry as it threatens to diminish the nation's talent pool. In the next 10 or 20 years, Malaysia may face the necessity of importing skilled labour to

sustain the economy. At that point, the nation could be in a precarious situation, with both unskilled and skilled labour dependent on foreign workers. This issue was further emphasised by Nesaratnam et al (2018), in their research. They reported that 23% of youth unemployment is attributed to graduates. One of the reasons that has been identified is that the Malaysian tertiary education curriculum lacks the competence to equip students with the skills, attributes, and professional qualities demanded by employers (Samkin & Stainbank, 2016). Nevertheless, the authors can only conclude that the level of tertiary education in Malaysia does not match industrial requirements and needs when the increase in the number of graduates does not match the available job opportunities (Yusof & Jamaluddin, 2015)

According to Yusof and Jamaluddin (2015), the government has invested significantly in public universities to develop higher tertiary education in Malaysia. The authors also emphasised that the government's efforts to enhance education standards should not be solely measured by the monetary grants allocated to universities. Nevertheless, they should also consider the establishment of new public universities. A notable example of such development is Universiti Sultan Zainal Abidin (UNISZA), Terengganu. Initially established as a state-level college, UNISZA underwent significant growth with adequate state and federal funding, ultimately evolving into one of Malaysia's public universities.

Table 1
Graduate Employability of Higher Education in Malaysia in 2022

	GE Rate	TVET	Male	Female
Percentage (%)	90.2	92.5	91.1	89.5

*Note. GE – Graduate Employability / TVET - Technical and Vocational Education and Training

Table 2
Graduate Employability Within the Workforce from 2018 To 2022

Year	2018	2019	2020	2021	2022
Graduates	326 500	330 557	305 301	318 034	324 504
Respondents	290 282	298 551	260 701	286 299	295 962
Response Rate (%)	88.9	90.3	85.4	90.0	91.2
GE Rate (%)	80.2	86.2	84.4	85.5	90.2

*Note. GE – Graduate Employability

The statistics in Tables 1 and 2 were derived from a report published by the Ministry of Higher Education (MOHE). As indicated in both tables, the researchers of the present study observed a consistent upward trend in graduate employability within the workforce. The only setback occurred in 2020, during the global COVID-19 pandemic that impeded economic growth in most countries, including Malaysia. The effects of the COVID-19 pandemic were not only observed in Malaysia but also other countries. The graduate unemployment rate increased from 47% to 58% in 2020, with an expected annual loss estimated at $53 million. The primary reason behind this drastic increase in unemployment is a low demand for manpower and a high supply of available manpower in the workforce (Shahriar et al., 2021). The MOHE (2022) further emphasised this issue by highlighting that among all the employed graduates, 95% are working as skilled or semi-skilled workers.

The present study underscores the role of university graduates as key contributors to Malaysia's workforce and economy. Disruptions in graduate output could impact labor supply, especially in operational roles. A steady stream of skilled workers attracts foreign investment and boosts economic capacity. Graduate employability also reflects effective human capital utilization, while tertiary education helps address Malaysia's skill shortage.

Problem Statement

In order to achieve the status of a developed nation, prioritising education for its citizens is vital to develop a civil society. Education is believed to promote racial peace, social equality, and economic progress in particular. By offering equal educational opportunities to all citizens, education serves as a force for social equality, advancing social consciousness and social justice (Lee, 1999).

Despite the consistent emphasis on the graduate employability rate in every report by the MOHE, no paper or study has been conducted to analyse this data to forecast the graduate employability rate. Thus, this paper aims to highlight and analyse the trend of employability among graduates from 2018 to 2022. The objective is to provide researchers with insights into the overall employability trend over this five-year period. Researchers can classify graduates according to their respective institutions through a detailed data analysis. This classification will enable researchers to identify courses and institutions requiring improvement, enhancement, and development.

Research Objectives

The objective of this study is to analyze the trends in employability among graduates from both public and private tertiary institutions in Malaysia, encompassing all fields of study. The authors aim to predict the current level of postgraduate employability by evaluating employment rates, job placements, and career trajectories of recent graduates. This approach enables a comprehensive examination of the supply-demand dynamics within the job market.

Literature Review

Researchers can analyse numerous frameworks constructed to analyse factors impacting and affecting student development. Some of the theoretical frameworks for student employability in Malaysia are discussed below. The first framework was adapted from Yusof and Jamaluddin (2015), while the second framework was developed by (Nesaratnam et al., 2018).

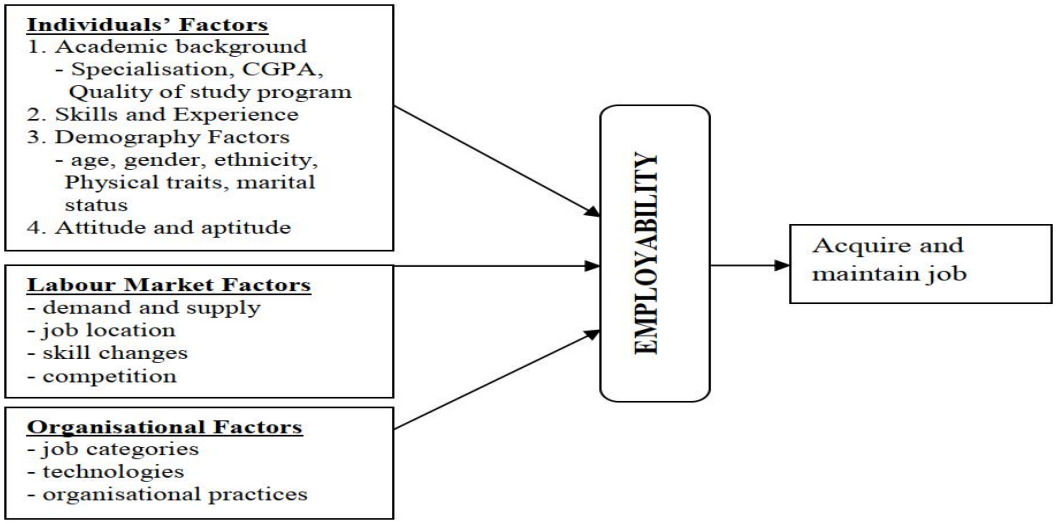

Figure 1: Framework by Yusof and Jamaluddin (2015)

In their research, Yusof and Jamaluddin (2015), successfully examined three pillars of graduate employability: individual factors, labour market factors, and organisational factors. Under individual factors, students must not only meet but exceed certain thresholds to secure a place in job interviews. Simultaneously, they must possess expertise that can contribute to the company during the hiring process. The subsequent pillar, labour market factors, are predominantly external and beyond the control of both students and employees. Employers may have the ability to influence the effects of these factors, but eliminating them is impossible. The final pillar is organisational factors, which lie more on the employer's side. This factor is contingent on the economic readiness of the country.

Nesaratnam and Prabha (2018), focused on the first factor identified by (Yusof and Jamaluddin, 2015). They emphasised the significance of individual factors in determining graduate employability, which comprises four key aspects: Communication, Leadership, Problem-Solving, and Teamwork.

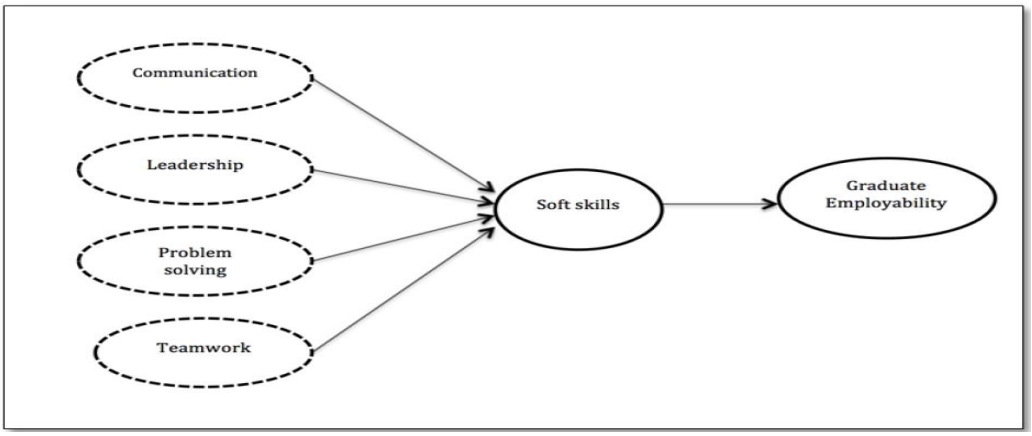

Figure 2: Framework by Nesaratnam et al (2018).

In this framework, the researchers can observe the approach used to tackle the soft skills development in students throughout their academic journey. This study employs an idealist approach where the solution and action taken to address the issue are subjective and

not versatile. The outcomes of these actions may vary, and reactions are based on individual students. Consequently, it poses a challenge for academic institutions to formulate solutions that effectively mitigate the employability issues among graduates.

Graduate Employability

During the fourth quarter of 2022, the job market in Malaysia featured 8.75 million vacancies. These vacancies were categorised as 24.9% skilled jobs, 62.3% semi-skilled jobs, and 12.8% low-skilled jobs (Pfordten, 2023). According to a report written by Pfordten (2023), the Malaysia Employers Federation (MEF) has stated that the vacancies in the market cater to the needs of undergraduates but do not cater to postgraduates. In reality, many postgraduates tend to apply for jobs that may not align with their qualifications, often accepting positions below their educational level due to market offerings. Besides, MEF clarifies that this situation arises as Malaysia is still not widely recognised as a research-oriented country, and many postgraduates emerge from research disciplines. Consequently, their expertise may not align with market demands, reflecting the market's immaturity in supporting skilled workers, including those with master's and PhD qualifications.

Many postgraduates primarily engage in the academic field. According to interviews with postgraduates reported by The Star (2023), these individuals express dissatisfaction with the industry's failure to meet their salary expectations and perceived undervaluation of their qualifications. Consequently, a significant number of postgraduates transition into academia, even if they initially come from industrial backgrounds. The undervaluation issue, as highlighted in The Star's interviews, is particularly alarming for postgraduates, with instances cited where the industry offers salaries as low as RM 1,800. Such remuneration is considered insultingly low for individuals with postgraduate qualifications.

According to Suleman (2016), the key determinant towards candidate employment is the skills the individual offers to the table. The determinants span across all educational levels, from undergraduate to postgraduate degrees. Nevertheless, this principle is only applicable in countries where the job market has matured across all industries, including the research sector, which is not the case in Malaysia. In the Malaysian context, six major issues related to graduate employability have been identified (MOHE, 2012):

(1) Unknown market size and the need for a high-income economy
(2) Unknown intake and exit attributes except for a few professional courses
(3) Poor intake attributes
(4) The notion that the industry prefers ready-made instead of fundamentals
(5) Stop-gap measures vs immersion at the higher education level
(6) Not obtaining the right choice of courses

These issues pose challenges to Malaysian employyers, particularly in hiring fresh graduates. Some challenges include the lack of essential employability skills, mismatches between expected and offered salaries and inadequacies in graduates from specialised programmes (Hanapi & Nordin, 2013).

Research Gap

Previous literature on the explored topic indicates that most studies commonly approach the same aspect, emphasising student development during tertiary education. The focus is on highlighting how successful universities have groomed students into desirable and competent manpower ready to enter the workforce.

Method

Data Set

The data for this study were obtained from official statistics provided by the MOHE and collected directly from students six months after they completed their studies. In the survey, students had the option to choose between working, continuing their studies (for example, Master's or PhD), enhancing and upgrading their skills (professional papers or short courses) or awaiting placement for work. The official statistics website can be accessed through https://ge.mohe.gov.my/. The dataset from MOHE was originally in Malay language, which has been translated into English, and the variables are presented in the table 3 below. The variables collected from the survey will be analysed as outlined in the table below.

Figure 1 illustrates that a bachelor's degree constitutes the largest portion of tertiary education compared to a master's degree and PhD. The total number of all courses registered from 2018 to 2022 is 21,199, with bachelor's degrees accounting for 11,977 (56%), followed by master's at 7,183 and PhDs at 2,039. One reason for the decline in enrolment from bachelor's degrees to PhDs is the association of PhDs with academic careers. Individuals not interested in pursuing an academic career may pursue professional qualifications or licenses instead, as these are perceived to offer more tangible benefits.

Table 3
Variables Collected from The Survey

VARIABLES	DATA TYPE	DESCRIPTION
IPTA	Categorical	IPTA = *Institut Pengajian Tinggi Awam*
IPTS	Categorical	IPTS = *Institut Pengajian Tinggi Swasta*
DEGREE	Categorical	DEGREE = Bachelor's Degree
MASTER	Categorical	MASTER = Master's Degree
PHD	Categorical	PHD = Doctor of Philosophy
SAINS TULEN	Categorical	SAINS TULEN = Pure Science (Biology, Physics and Chemistry)
SAINS GUNAAN	Categorical	SAINS GUNAAN = Applied Science (Engineering, Medical Doctor, and Computer Science)
SASTERA TULEN	Categorical	SASTERA TULEN = Pure Art (English, Music and Theatre Arts)
SASTERA GUNAAN	Categorical	SASTERA GUNAAN = Applied Art (Finance, Law, and Mass Communication)
KEBOLEHPASARAN	Integer	KEBOLEHPASARAN = Graduate Employability (GE%)
TAHUN	Integer	TAHUN = Year (From 2018 to 2022)

Tertiary Education Differences among Graduates in Malaysia

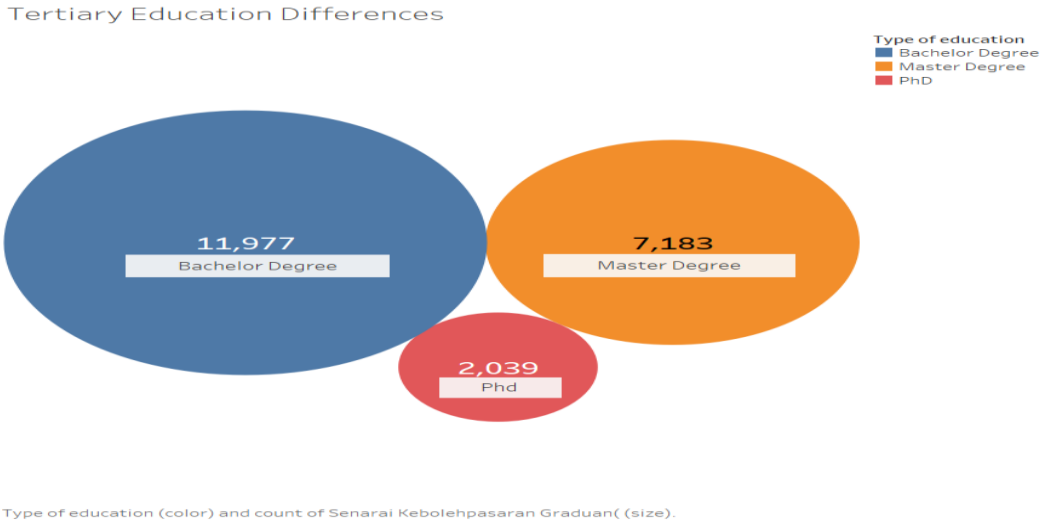

Figure 1: Packed Bubble for Tertiary Education Differences

Tertiary Education Differences over the Years

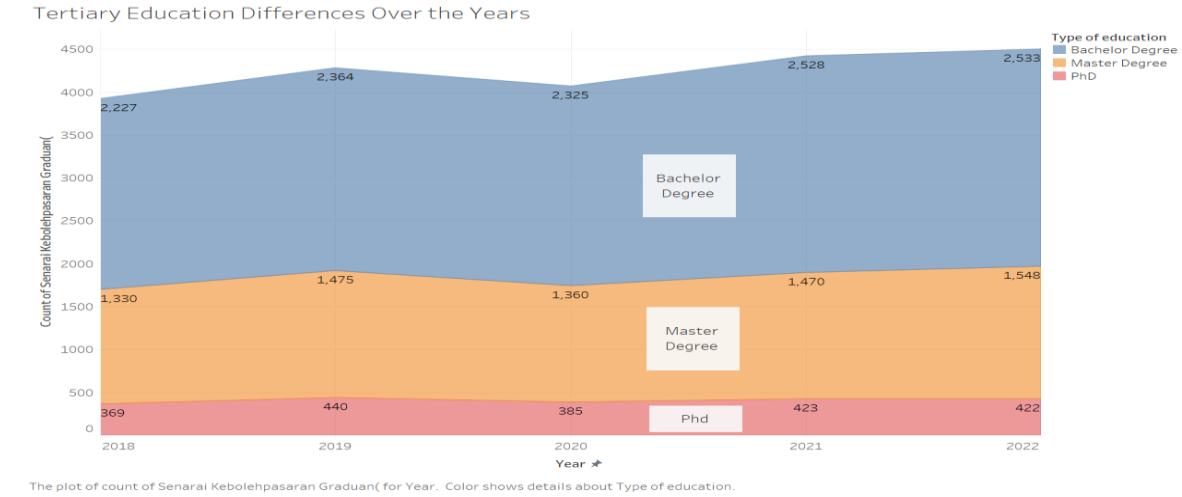

Figure 2: Area Map for Tertiary Education Differences over the Years

In Figure 2, researchers can observe a consistent trend within tertiary education from 2018 to 2022. A continuous increase in the number of courses registered indicates an increase in Malaysia's education level. Such a trend typically occurs when the demand and supply align effectively. Unfortunately, as anticipated by researchers, there was a decline in the number of registered degrees, master's, and PhD programmes during the peak of the COVID-19 pandemic in 2020. Nevertheless, in 2021, the number of tertiary studies stabilised and resumed the upward trend, reflecting a recovery and continuation of the increasing trend.

Field of Study

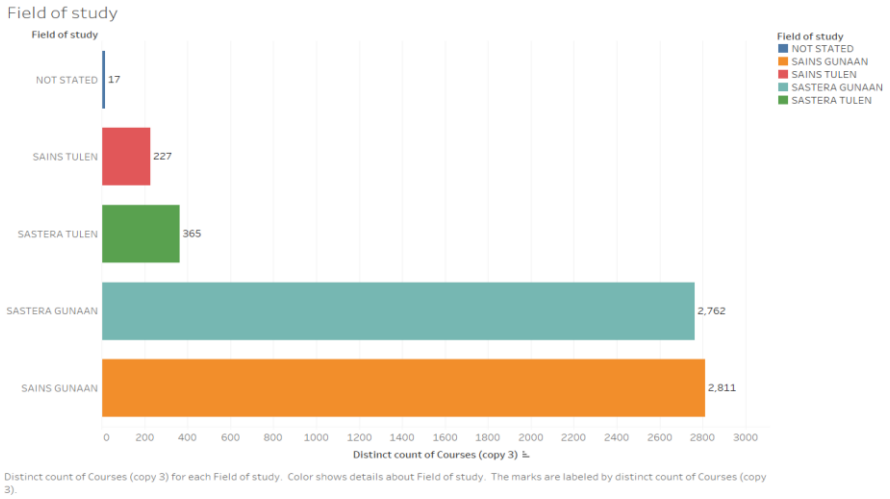

Figure 3: Bar Chart for Field of Study

As shown in figure 3, courses classified as Pure Science and Pure Art have the lowest offerings within the field of study. Pure Science courses include Pure Biology, Pure Physics, and Pure Chemistry, while Pure Art courses encompass Language, Theatre Art, and Fine Art. Although these courses are fundamental for other branches of applied courses, they are less favoured in the workforce. Thus, pure courses are offered less compared to applied courses due to their practicality of use. For example, Applied Sciences such as Medicine and Engineering play a significant role in universities. In fact, many large universities have developed focused or specialised campuses dedicated to these courses due to the high demand from industries for graduates with qualifications in these courses.

Data Splitting and Transformation

One of the challenges researchers encountered during data upload into the Jupyter Notebook was the abundance of string values in the dataset. In the 'Program Pengajian' and 'IPT' columns, each row had a unique value, and, in some cases, punctuation marks were present. When the Excel file was converted to a CSV file, all the punctuation marks produced wrong data interpretation in the Jupyter Notebook. The wrong data interpretation emerged as CSV delimits values using commas. When additional punctuation marks are present in the data, Jupyter struggles to interpret the mixed integer and string content within a single column. Consequently, the researchers encountered this error when uploading the data file.

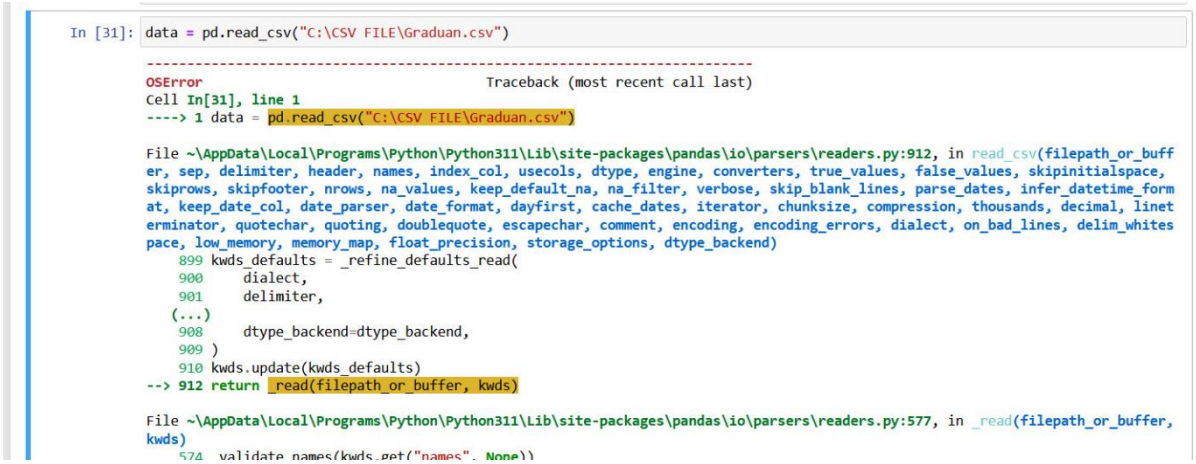

Figure 4: Error in Uploading the Data File

After encountering multiple errors due to the presence of unique values, the researchers decided to exclude the 'Program Pengajian' and 'IPT' columns. The initial table from Excel is displayed below, followed by the transformed CSV file used for Exploratory Data Analysis (EDA), Kernel Density Estimation (KDE), and linear regression.

Table 4
The Original Dataset from Excel

Bil.	Program Pengajian	Peringkat Pengajian	IPT	Tahun	GE (%)	Type of Institution	Field of Study
1	ACCA QUALIFICATION	Ijazah Pertama	CRESCENDO INTERNATIONAL COLLEGE	2019	100	IPTS	SASTERA GUNAAN
2	ACCA QUALIFICATION	Ijazah Pertama	KOLEJ ANTARABANGSA YES	2019	100	IPTS	SASTERA GUNAAN
3	AMERICAN DEGREE TRANSFER PROGRAMME	Ijazah Pertama	INTEC EDUCATION COLLEGE	2018	100	IPTS	SASTERA GUNAAN
4	AMERICAN DEGREE TRANSFER PROGRAMME	Ijazah Pertama	INTEC EDUCATION COLLEGE	2021	100	IPTS	SASTERA GUNAAN
5	ASSOCIATION OF CHARTERED CERTIFIED ACCOUNTANT QUALIFICATIONS	Ijazah Pertama	INTEC EDUCATION COLLEGE	2018	100	IPTS	SASTERA GUNAAN

Bil.	Program Pengajian	Peringkat Pengajian	IPT	Tahun	GE (%)	Type of Institution	Field of Study
6	B. ENG (HONS) CIVIL ENGINEERING	Ijazah Pertama	UCSI UNIVERSITY	2020	100	IPTS	SAINS GUNAAN
7	B. ENG (HONS) CIVIL ENGINEERING	Ijazah Pertama	UCSI UNIVERSITY	2021	100	IPTS	SAINS GUNAAN

*Note. GE – Graduate Employability

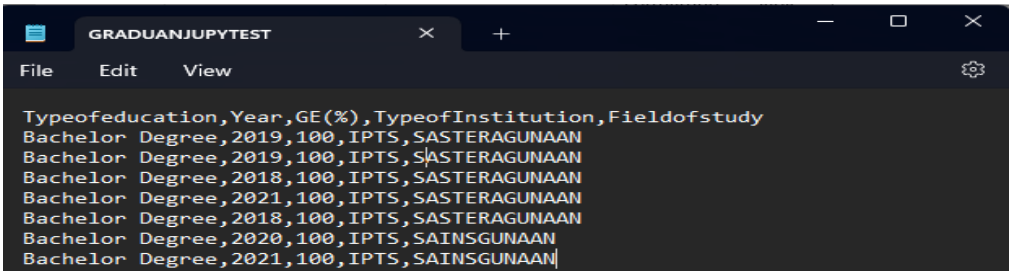

Figure 5: CSV file for EDA and KDE

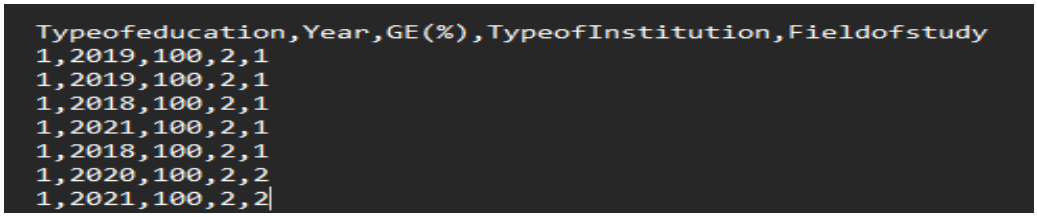

Figure 6: CSV File for Linear Regression

The authors undertook additional data transformation in the linear regression process to convert string data into a fully numerical format. Specifically, the 'IPT' (Type of Institution) and 'Field of Study' columns were converted to numerical format to enable their inclusion in the linear regression analysis and assessment, as the module cannot understand categorical data. The variables that have been changed are outlined below:

Table 5
List of Type of Education

TYPE OF EDUCATION	VALUE
BACHELOR DEGREE	1
MASTER DEGREE	2
PHD	3

Table 6
List of Types of Institutions

TYPE OF INSTITUTION	VALUE
IPTA	1
IPTS	2

Table 7
List of Fields of Study

FIELD OF STUDY	VALUE
SASTERA GUNAAN	1
SAINS GUNAAN	2
SASTERA TULEN	3
SAINS TULEN	4
NOT STATED	5

Data Analysis

In this study, Python-based machine learning tools are used for efficient programming, web development, and data analysis. By employing these tools, the authors aimed to forecast the trend of graduate employability through a thorough analysis. For the analytical model, linear regression was chosen over other machine learning models.

Data Cleaning

The data from the MOHE website was converted to Excel format, allowing for easier cleaning using Excel tools. Additional columns, such as 'Type of Institution' and 'Field of Study,' were added for analysis.

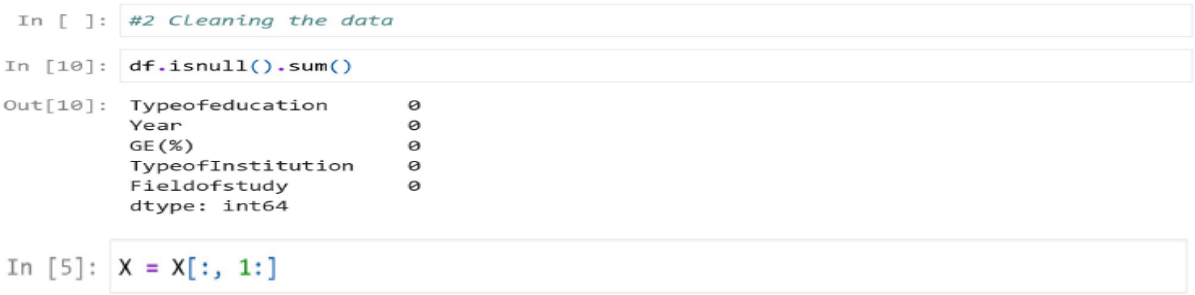

Figure 5: Data Cleaning in Jupyter Notebook

During the data analysis in Jupyter Notebook, the authors executed specific commands to clean the data further. As depicted in Figure 5, the authors attempted to identify and address any rows with missing values (null). The authors proceeded with the analysis after all variables indicated 0 null values.

Importing Python Modules

For the Python processing, researchers chose Jupyter Notebook as the tool due to its capability to run the system on an individual cell basis rather than a whole cell. Therefore, the user can easily track which specific line of command that needs to be amended if any error occurs. The Python modules chosen in this analysis were pandas, NumPy, seaborn and matplotlib. Each library serves its own unique function in the analysis.

Pandas has effectively addressed the statistical data aspect, while NumPy serves as the tool researchers use to perform mathematical computations and extract information from the dataset. As Van Der Walt et al (2011), highlighted, NumPy provides a high level of abstraction for numerical computation without compromising performance.

Lastly, both seaborn and matplotlib are libraries that can generate graphical information to convey the findings obtained from the dataset. Nevertheless, in most cases, to effectively use seaborn and matplotlib, they must be complemented with using NumPy. Without NumPy, matplotlib and seaborn cannot create any graphical data due to a lack of information (Ari & Ustazhanov, 2014).

```
In [1]: import pandas as pd
        import numpy as np
        import seaborn as sns
        from matplotlib import pyplot as plt
```

Figure 6: EDA and KDE Analysis Python Module

```
In [2]: # Importing the libraries
        import numpy as np
        import matplotlib.pyplot as plt
        import pandas as pd
        import seaborn as sns
        %matplotlib inline
```

Figure 7: Linear Regression Python Module

```
In [2]: df = pd.read_csv('GRADUANJUPYTEST.csv')
```

Figure 8: EDA and KDE Analysis Data Import

```
In [3]: # Importing the dataset and Extracting the Independent and Dependent variables

        df = pd.read_csv('GRADUANLR.csv')
        X = df.iloc[:, ].values
        y = df.iloc[:, ].values

        df.head()
```

Figure 9: Linear Regression Data Import

Exploratory Data Analysis (EDA)

Before delving into a comprehensive analysis based on various variables, the researchers tested the EDA analysis in Python using the 'Year' and 'GE' (%) variables. The result aligned with the authors' expectations, confirming that the code utilised accurately analysed the tested variables. In the graph, researchers observed that all the data for graduate employability were distributed densely at around 50% and above, with the highest concentration at 100%.

```
In [17]: sns.pairplot(df)

Out[17]: <seaborn.axisgrid.PairGrid at 0x220eeca7820>
```

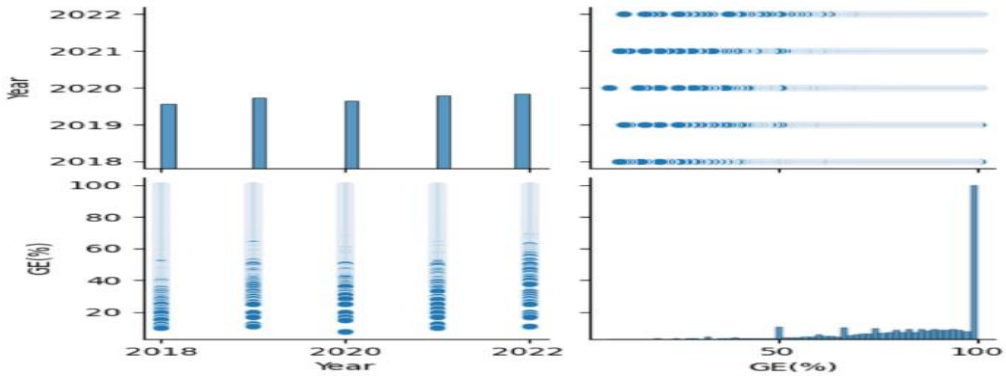

Figure 10: EDA Sample

```
In [20]: sns.catplot(
             data=df, x="Year", y="GE(%)", hue="TypeofInstitution",
             native_scale=True, zorder=1
         )
         sns.regplot(
             data=df, x="Year", y="GE(%)",
             scatter=False, truncate=False, order=2, color=".2",
         )

Out[20]: <Axes: xlabel='Year', ylabel='GE(%)'>
```

Figure 11: EDA Code for Type of Institution

Kernel Density Estimation (KDE)

```
In [ ]: # KERNEL DENSITY ESTIMATION
In [23]: sns.kdeplot(df['GE(%)'], fill=True);
```

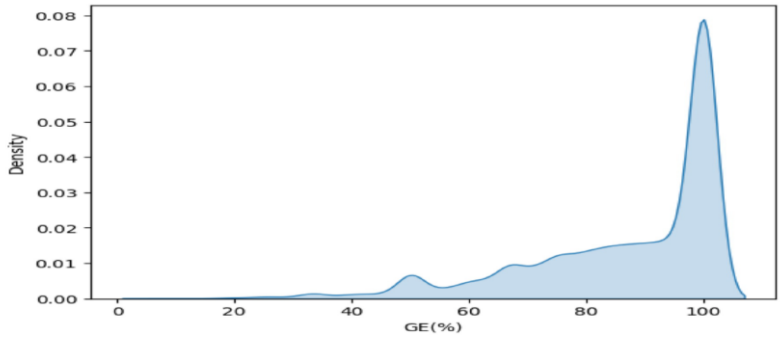

Figure 12: KDE

```
In [17]: sns.kdeplot(data=df,
                     x="GE(%)",
                     hue="TypeofInstitution", multiple="stack")
         plt.show()

In [18]: sns.kdeplot(data=df, x="GE(%)", y="Year", hue="TypeofInstitution")
         plt.show()
```

Figure 13: KDE Code for Type of Institution

The KDE is a valuable tool employed for measuring the probability density function. In other words, it represents a smoothed-out version of a histogram for the continuous variable

under investigation. In this study, graduate employability (%) serves as the constant variable, while the manipulated variables include the type of education, type of institution, and field of study.

Building Machine Learning Models

Transitioning to the machine learning phase, the researchers opted for multiple linear regression by employing a supervised learning approach with a test size of 20%. By using multiple linear regression, the researchers will be able to understand the impact of collective variables on the outcome. This module establishes the undetermined result through the application of a mathematical formula, utilising the slope concept. In this context, the focus of the researchers' observation is graduate employability (%). The variables collectively analysed include the type of education, type of institution, and field of study.

```
In [5]: X = X[:, 1:]

In [6]: # Splitting the dataset into the Training set and Test set

        from sklearn.model_selection import train_test_split
        X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.2, rando

In [7]: # Fitting Multiple Linear Regression to the Training set

        from sklearn.linear_model import LinearRegression
        regressor = LinearRegression()
        regressor.fit(X_train, y_train)

Out[7]: ▾ LinearRegression

        LinearRegression()
```

Figure 14: A Fraction of Linear Regression Code

Results and Discussion

EDA Results

After the execution of the command in Jupyter, a graph was generated using the Seaborn Module. As stated earlier, graduate employability (%) is the dependent factor, while the type of institution, type of education, and field of study are independent variables. The data was measured based on the year, enabling researchers to analyse trends over the years.

EDA of Type of Institutions

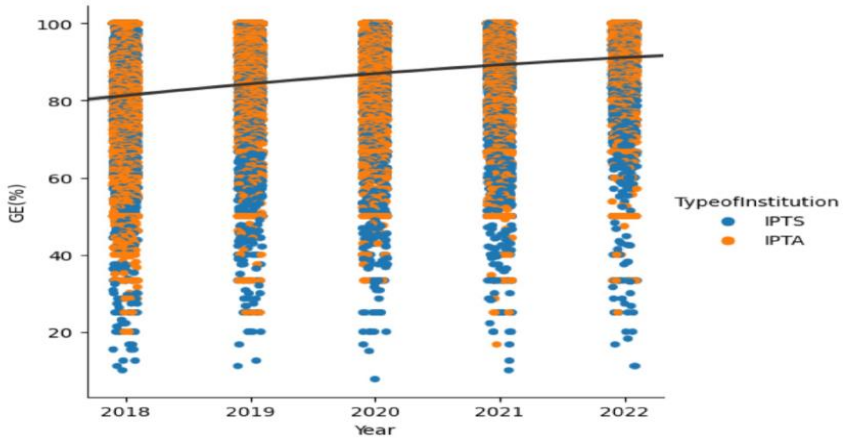

Figure 15: Type of Institutions

As displayed in Figure 15, EDA for each type of institution comprises IPTA and IPTS. Public universities are represented by IPTA, while IPTS represents private universities. The graph displays that the graduate employability bar threshold increased from 2018 to 2022. The density of graduate employability has steadily decreased from below 60% from 2018 to 2022. The graph also reveals that, despite the cumulative number of IPTS being significantly higher than IPTA, the output generated by IPTA remains notably higher. In 2018, the scatter plot indicates a majority dominance by IPTA, and by 2022, it is evident that the number of products from IPTS has approached that of IPTA.

EDA of Type of Education

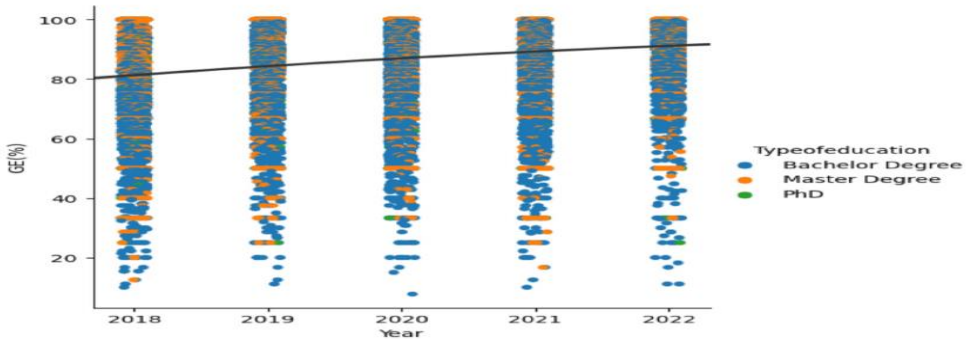

Figure 16: Type of Education

The type of education is an independent variable with three values, which are bachelor's degree, master's degree, and PhD. The dataset indicates that most students have bachelor's degrees from 2018 to 2022. This observation is reinforced by the graphical representation, where the prevalence of blue dots representing bachelor's degree holders is evident. The decline in enrolment at the higher levels of education can be attributed to the common perception that master's and PhD degrees are often associated with pursuing an academic career.

Individuals uninterested in pursuing a career as a lecturer may perceive obtaining advanced degrees, such as a PhD, as lacking significant value for their career growth. Therefore, they rather choose professional certifications or licenses. Since Malaysia is not considered a research country, the graph reveals that the PhD courses with graduate

employability (%) range only from 20 to 40. Unfortunately, this percentage may be considered very low for skilled workers.

EDA of Field of Study

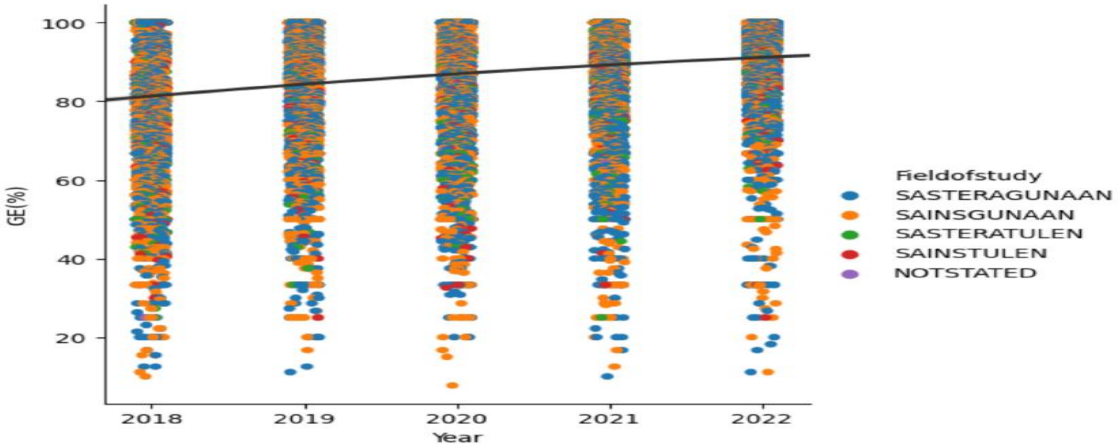

Figure 17: Field of Study

The final analysis for EDA focuses on the field of study, which comprises five values: Sastera Gunaan (Applied Art), Sains Gunaan (Applied Science), Sastera Tulen (Pure Art), Sains Tulen (Pure Science), and Not Stated. These classifications were introduced as additional columns in the original data to classify the categorisation of courses further. As most universities assign different names to similar courses with almost identical syllabi, the authors chose to classify them into five categories. The authors were unable to utilise the names of the courses directly as it would create an unreadable graph due to too many unique values. As shown in the graph, all the classes from each year were distributed equally.

Additionally, graduate employability exhibits an increasing trend as the threshold has been raised annually. The density of graduate employability has decreased significantly from 2018 to 2022. A concern for researchers is the presence of the colour orange, particularly in the lower range of graduate employability, which indicates a considerable number of Applied Science courses with lower graduate employability percentages. In the lower tier of graduate employability, a minor presence of green is associated with Pure Art. Since the presence of green is subtle, researchers can conclude that it represents only a minority within the dataset. Nevertheless, the presence of Applied Science courses in the bottom tier is more concerning. Thus, university management should carefully investigate and address this issue. As Applied Science courses are directly related to industries, the prevalence of low graduate employability suggests a potential challenge in the job market for graduates in this category.

KDE Results

In the KDE result, the researchers aim to examine the probability density function for each variable. The analysis will adhere to the same methodology as employed in the EDA.

In the KDE graph for the type of institutions, the graduate employability (100%) has the highest density, with IPTS having a higher density compared to IPTA. The graph indicates a spike at 100% graduate employability, suggesting that the majority of courses claimed to have 100% graduate employability from 2018 to 2022.

KDE of Type of Institutions

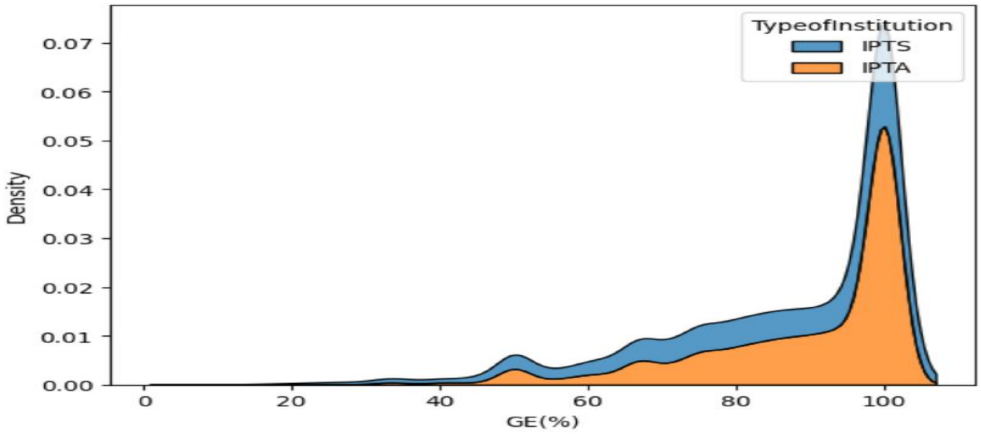

Figure 18: Type of Institutions

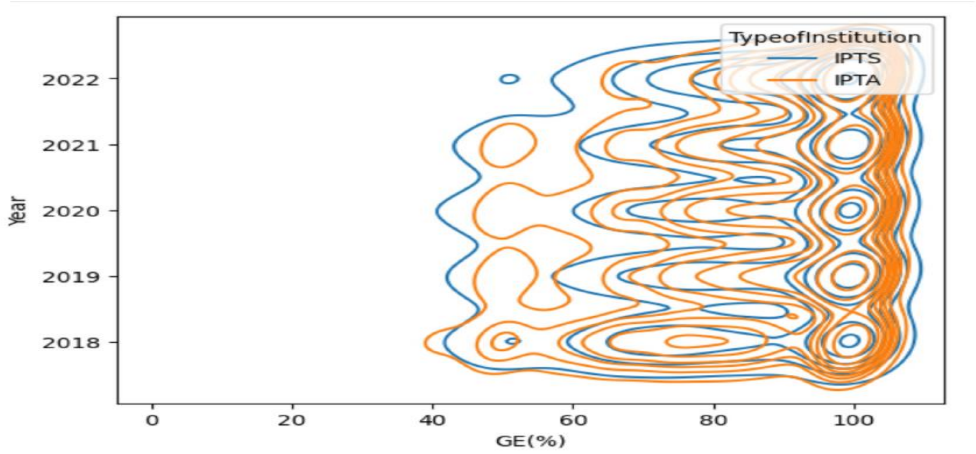

Figure 19: Type of Institutions

In the subsequent graph for institutions, there is an improvement in the quality of education. As the graph contracts towards 2022, the value becomes concentrated around 60% of graduate employability.

In the KDE analysis for type of education, researchers observed that the population of bachelor's degrees is the highest but does not score high in graduate employability. Specifically, in the graph, bachelor's degree courses exhibit a score of around 30% of graduate employability, implying that for every 100 students enrolled, only 30 secure employment. This trend is concerning and requires monitoring by relevant stakeholders. Nevertheless, the majority of bachelor’s degree courses still maintain graduate employability scores in the range of 60% to 90%.

KDE Type of Education

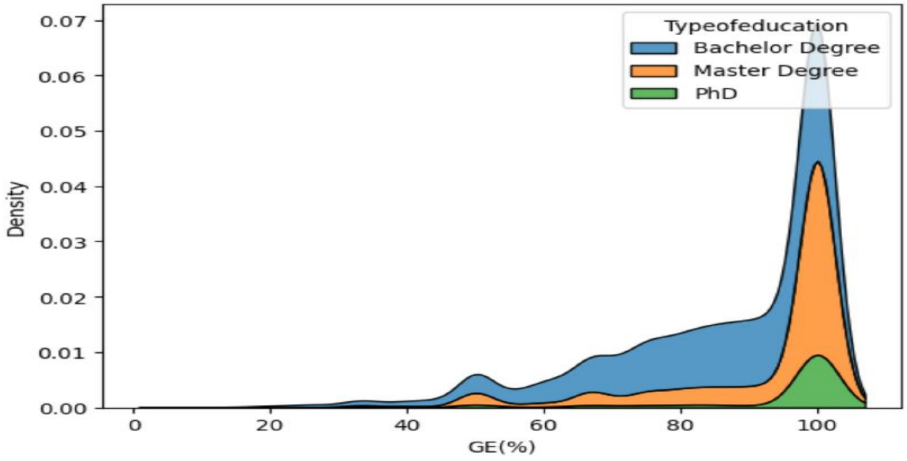

Figure 20: Type of Education

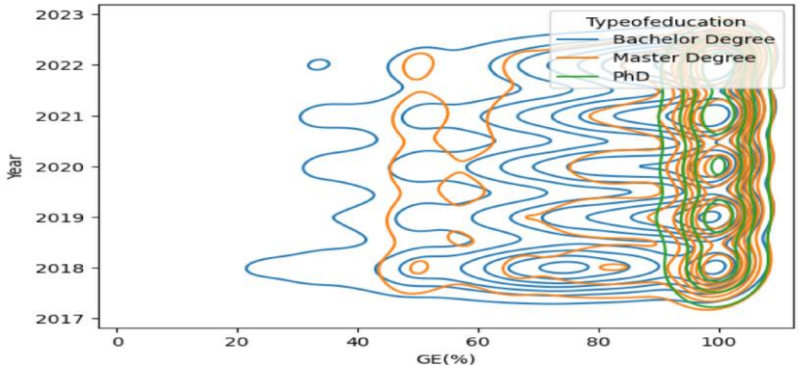

Figure 21: Type of Education

In this graph, an interesting point emerges at the higher level of education, where graduate employability becomes more concentrated at the top tier. A bachelor's degree exhibits its lowest graduate employability score at 20%, while a master's degree has a minimum of 40%. Remarkably, PhD programmes achieve an outstanding graduate employability score, with concentration exclusively at 100%.

KDE of Field of Study

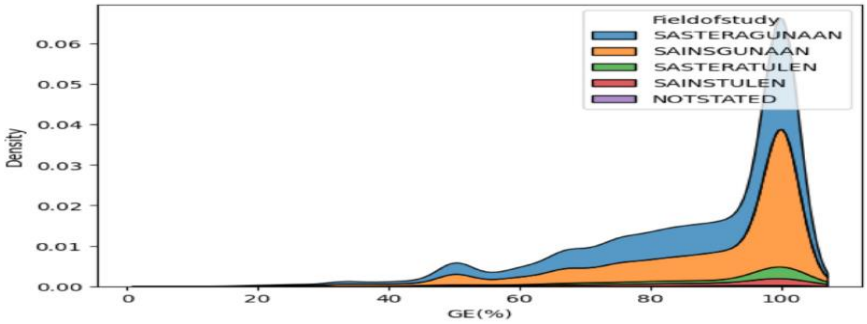

Figure 22: Field of Study

The final variable for KDE is the field of study, and among all classes, Applied Art exhibits the highest density at 100% for graduate employability. Applied Arts courses

encompass disciplines such as accountancy, finance, and business-related subjects, which explains the highest density of 100% graduate employability observed in Applied Art.

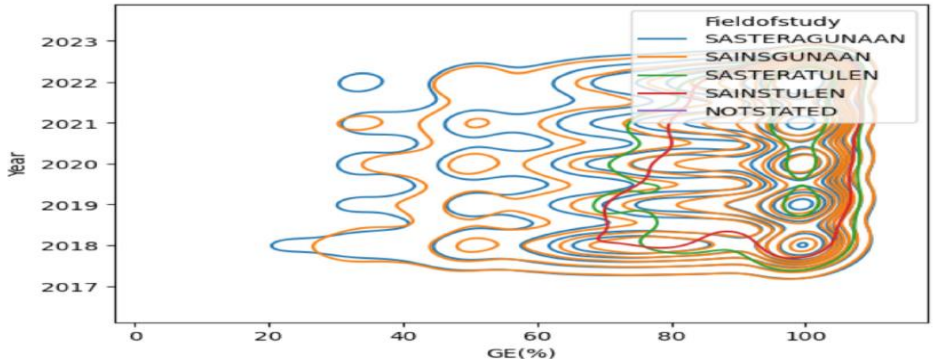

Figure 23: Field of Study

In conclusion, the KDE discussion resulted in a surprising finding for Pure Art, as indicated in the above graph. There is a misconception that Pure Art has limited job opportunities, posing a risk to job security. Nevertheless, graduate employability for Pure Art is surprisingly favourable. The lowest graduate employability score for Pure Art is 60%, in contrast to Applied Art, which has a lower graduate employability score of 20%.

Linear Regression Results

```
In [9]: # Calculating the Coefficients

        print(regressor.coef_)
```

```
[[-1.94906600e-02  8.49313087e-03 -3.39777290e-01  6.78520612e-02]
 [ 1.00000000e+00  1.24391144e-16  2.76683779e-15  1.47544404e-15]
 [-1.00737280e-14  1.00000000e+00 -9.19403442e-16  2.43294968e-16]
 [-1.07598224e-15  3.12250226e-17  1.00000000e+00  1.41958487e-16]
 [ 6.21516782e-15 -1.06685494e-16  2.58407475e-15  1.00000000e+00]]
```

```
In [ ]: # Calculating the Intercept

        print(regressor.intercept_)
```

```
In [10]: # Calculating the R squared value

         from sklearn.metrics import r2_score
         r2_score(y_test, y_pred)
```

```
Out[10]: 0.8307661050014316
```

Figure 24: Linear Regression Results

The final R^2 score of 0.83 indicates that the authors have successfully trained the dataset, revealing an 83% positive relationship to institution, education, and field of study that will influence the percentage of graduate employability. Nevertheless, when the authors investigate all the coefficients, it becomes evident that some variables have negative values, signifying a negative impact on graduate employability.

Table 8
Malaysia Graduate Employability Percentage based on Tertiary Level of Study

Educational Qualification	2021 (%)	2022 (%)
PhD	91.2	94.7
Masters	92.9	95.4
Postgraduate Diploma	89.1	92.4
Postgraduate Certificate	91.3	97.2
First Degree	84.5	89.8
Graduate Diploma	-	97.6
Graduate Certificate	-	50.0
Advanced Diploma	85.0	93.2
Diploma	85.4	89.2
Advanced Certificate	-	97.6
Certificate	85.3	92.0
Professional courses	93.1	96.2

Source: MOHE 2022

The statistics presented in table 8 indicate that Malaysian graduates have high employability rate. In 2021, the employability rate ranges from the lowest, 84.5% (from the first degree students) to the highest, 93.1% (from the Professional courses students). In 2022, the employability rate range from the lowest, 89.2% (from the diploma students) to the highest, 97.6% (from the Advanced certificate students). The analysis conducted in the present study on tertiary education institutions reveals a high employability rate, with only a fraction of students failing to secure employment post-graduation. This finding suggests that tertiary institutions are effectively producing candidates who meet the needs and expectations of employers. In the analysis of the field of study, Applied Science and Art emerge as the highest categories. This trend can be attributed to the fact that applied courses hold higher economic value, particularly in terms of workplace compensation (Wilkinson & Yussof, 2005)

From the statistics provided by MOHE, the authors can deduce that there is no distinction in the quality of education between private and public institutions. Contrary to the belief that private institutions offer higher quality education to students, Wilkinson and Yussof (2005), debunked this notion by finding that public universities boast better teaching infrastructure and maintain a lower student-to-teacher ratio. Furthermore, private universities also tend to hire more retired, part-timers and underqualified workers, particularly in teaching roles (Tilak, 1991).

Conclusion

In conclusion, the graduate employability analysis reveals a profound impact on the independent variables. The observed variation in graduate employability scores across courses indicates that certain courses are in high demand in the workforce. Nevertheless, courses that have low graduate employability are not less important. Every course offered in Malaysian tertiary education has been monitored and supervised by the Malaysian Qualifications Agency (MQA). Therefore, each course uniquely serves the Malaysian economic environment and the nation's development.

Recommendations

Enhancing collaborations between the academic world and industries is one of the many ways to increase graduate employability. When academia and industry professionals collaborate, knowledge is exchanged between theoretical education and practical applications. This collaboration will greatly affect the students and create better-prepared candidates to enter the workforce.

Universities should reassess their teaching syllabus periodically and ensure that the curriculum aligns with the needs of current industries. For example, in teaching software usage in syllabi, university management should evaluate whether industries are currently utilising that specific software. One harmonised and enhanced recommendation at the university level is to incorporate entrepreneurship subjects in the syllabus. By fostering entrepreneurship values in students, they can become job creators instead of job seekers. The increase in the number of job creators will also raise graduate employability (%).

Limitations

Throughout the article, the authors identified two primary limitations in the dataset. The first limitation is the lack of integer values in the data. Although the dataset has 21,199 rows, the authors have only one integer value, which is the graduate employability. Consequently, challenges arose when plotting graphs in Python due to insufficient data. If the dataset included three or more integer values, the authors would be able to conduct and have the flexibility to choose appropriate graphing methods to explore the dataset.

The second limitation is the authors' suspicion that some of the graduate employability values in the dataset may not accurately reflect the true situation but rather represent sugar-coated values. This suspicion arises from the perplexing finding that certain courses, predominantly from the private universities, reported graduate employability of only 10%. The value of 10% of graduate employability implies that out of 100 people registered in the courses, only ten people secured employment. The authors hypothesised that the limitation may be attributed to the lack of student cooperation in completing the employability survey, prompting institutions to input the data independently.

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