International Journal of Research in Education

Volume 5, Issue 2, July 2025, pp. 370 – 383

e-ISSN: 2745-3553

DOI: https://doi.org/10.26877/ijre.v5i2.2195

Workability Study for Graduates of the Faculty of Engineering Universitas Negeri Surabaya

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ARTICLE INFO

Received: June 20, 2025

Revised: July 7, 2025

Accepted: July 31, 2025

Keywords:

Tracer Study, Factor Analysis, Competency

ABSTRACT

A successful education provider is one that produces graduates who can apply their knowledge and skills in the real world. This study aims to examine the 2022 graduate profile through a tracer study and identify factors that influence their competencies. Using a descriptive quantitative approach, the study involved 471 graduates from 13 study programs at the Faculty of Engineering. Data collection techniques using questionnaires and analyzed using factor analysis with the help of SPSS. Results show that the average waiting time for graduates to secure their first job is 4.28 months. Most alumni reported that their jobs were very closely (31%) or closely (30%) related to their field of study. The study identified 27 competency-supporting factors, which were grouped into two main components through factor analysis. Combined, these components influence alumni competence by 68.056%. The findings indicate that the curriculum and graduate profile developed by the study programs remain relevant to industry needs. Therefore, universities should adopt a holistic educational approach that balances academic knowledge with character development, ethics, and soft skills. Strengthening collaboration with industry and continuously updating the curriculum are key steps to ensure graduates stay relevant and competitive in the job market.

Introduction

Competitive graduates are shown by being able to compete in getting a job and being ready to build their own business or be an entrepreneur (Maisah et al., 2020). The place and type of work obtained by graduates can show the relationship between education and work (Robst, 2007). Having an educational background, such as material or courses taken, can provide benefits in completing the work. Apart from that, educational relevance can be obtained from stakeholder opinions regarding graduate user satisfaction, graduate competency, and suggestions from graduate users, including the relevance of education.

An educational institution is said to be successful if its graduates can apply the knowledge gained during their education in society (Chodasová et al., 2015). One of the learning objectives is that graduates will be useful in implementing their knowledge and skills according to their field. Preparing professional human resources is one of the goals of higher education in Indonesia. Having professional human resources will be able to help develop and disseminate their areas of expertise to improve the quality of people's lives.

Developments in the world of work are very rapid, therefore it is necessary to search for alumni. By conducting alumni searches , graduate profiles will be known when they have completed their education. The results of this research will be used to support study program policies in improving the quality of education. Tracer think about may be a think about of graduates from higher instruction suppliers (Schomburg H. A., 2014). Another term for tracer ponder is regularly alluded to as graduated class overviews or "follow-up" studies or considers of graduates of higher instruction suppliers. From the data from the tracer ponder comes about, it can give tall input for colleges (Nugraheni.Y, 2018). Tracer study is one of the important activities needed to improve higher education management, quality and relevance of education. Tracer study is a suitable approach for study programs to obtain information and feedback about the advantages and disadvantages presented in the learning and education process. The results of the tracer study can be used as a basic reference for planning activities to improve learning in the future.

A few other definitions of tracer think about were too put forward by a few specialists who contended that the reason of postgraduate tracer consider is to track the advance of graduates after they graduate (Dzomeku et al., 2024; Yizengaw & Weidman, 2024). Typically done to decide the employability of graduates and reflectively survey graduates' fulfillment with the administrations given by the teach where they think about. The benefits of Tracer Ponder are perpetual. This will give encourage data approximately the relationship between higher instruction and the world of commerce and industry. Tracer Ponder can give in-depth and point by point work appropriateness both on a level plane (between different areas of science) and vertically between levels of instruction (Albina & Sumagaysay, 2020; Fenta et al., 2019; Halili et al., 2017; Menez, 2014). Thus, the Tracer Study can help overcome the problem of employment opportunity gaps and efforts to improve them.

The engineering faculty strives to continuously improve the quality of education. To improve the quality of learning, the Engineering Faculty evaluates the condition of study programs, one of which is by conducting a Tracer Study. Tracer Studies are needed to determine the distribution of graduates and the contribution of graduates to society (Hazaymeh, 2015; Ocholla, 2011; Rogan & Reynolds, 2016). Through questionnaire items developed by the Indonesian Ministry of Education and Culture and adapted by Surabaya State University (Unesa), the actual condition of current graduates will be illustrated. The results of the Tracer Study can be used for various needs in the Faculty of Engineering, from filling out accreditation forms, developing curriculum to developing extracurricular activities in the Faculty of Engineering. This research also analyzes the factors that influence Engineering Faculty graduates.

Based on this background, the aim of this research is to find out the results of a tracer study regarding the profile of graduates in 2022, as well as analyze the factors that influence competency. The results of this research can be used as input for evaluating learning, services at the Unesa Faculty of Engineering and determining further policies.

Research Methods

The method in this research uses a survey method with statistical analysis (Stack, 1995). The time for carrying out the research is May – November 2023. Data collection will be carried out using quantitative methods by filling out questionnaires or questionnaires online via the page https://tracerstudy.unesa.ac.id . The population in this research are 2022 graduates of the Faculty of Engineering. Surabaya State University's Faculty of Engineering has 13 study programs. The study program is.

1. Bachelor of Civil Engineering (33 alumni)
2. Bachelor's Degree in Mechanical Engineering (45 alumni)
3. Bachelor's Informatics Engineering (55 alumni)
4. Bachelor's Degree in Electrical Engineering (58 alumni)
5. Bachelor of Information Systems (40 alumni)
6. Bachelor of Information Technology Education (19 alumni)
7. Bachelor's Degree in Mechanical Engineering (61 alumni)
8. Bachelor of Electrical Engineering Education (35 alumni)
9. Bachelor of Education in Building Engineering (26 alumni)
10. Bachelor of Cosmetology Education (28 alumni)
11. Bachelor of Fashion Education (23 alumni)
12. Bachelor's Degree in Culinary Education (40 alumni)
13. Bachelor of Nutrition (8 alumni)

The sample used is a saturated sample considering that this research aims to explore graduate data regarding careers and competencies. Several researchers focus on tracer studies: saturated sampling is a sampling technique where all members of the population are sampled (Rusman, 2012; Syafiq, 2016; ITB Team, 2014) . So the total sample in this study was 471 graduates.

The instrument used in this research was a questionnaire sheet which was distributed with the help of a website/google form application. Giving questionnaires to alumni is used to determine the condition and competency profile of Faculty of Engineering graduates. This questionnaire can later be used as curriculum evaluation material.

This data analysis technique is by reducing data, presenting data and drawing conclusions. The data that has been collected can later be downloaded in Microsoft Excel format. The data obtained will be reduced to data to be selected and sorted according to needs in solving research problems. After reduction, the next step is to present the data so that the data is organized, arranged in a relationship pattern, so that it is easy to understand. Presentation can be in the form of graphs, percentages of graduate absorption, charts, flow diagrams or narrative descriptions. To find out the factors that influence graduate competency, it is analyzed using factor analysis with the help of SPSS 25. Before carrying out factor analysis, it is necessary to carry out a validity test using the Bartlett KMO MSA test and the anti-image correlation test.

Findings

This research conducted a search for Faculty of Engineering alumni. The gender distribution of the alumni is show in Table 1.

Table 1. Gender distribution

Gender	Amount
Man	267
Woman	204
Total	471

The tracer study instrument maps the condition of alumni after completing their education. There are 5 categories contained in the tracer study questionnaire, namely: 1) Working, 2) Not Yet Possible to Work, 3) Self-Employed, 4) Continuing Education, and 5) Not Working but Currently Looking for Work. The distribution of alumni can be seen in the image below.

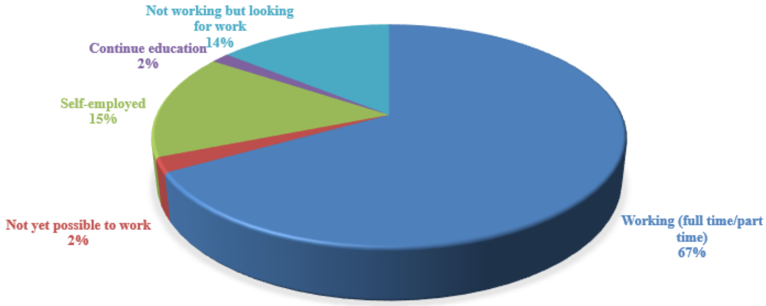

Figure 1. Alumni status

The data from the tracer study reveals that the majority of graduates have successfully transitioned into the workforce, with a dominant proportion engaged in either full-time or part-time employment. This high absorption rate suggests that the educational program is aligned with labor market demands and equips graduates with competencies relevant to their fields. A notable portion of alumni have also chosen entrepreneurial paths, indicating the presence of independent initiative and readiness for self-employment among graduates.

However, a segment of respondents reported being unemployed but actively seeking job opportunities, pointing to the need for continued institutional support in job placement or career guidance. A small percentage of alumni opted to pursue further education, reflecting ongoing academic aspirations or the pursuit of specialized competencies. Meanwhile, the remaining portion of graduates reported being unable to enter the workforce due to personal or contextual limitations.

Figure 2. Waiting time

The data indicate a varied length of time required by graduates to secure employment after completing their studies, reflecting diverse levels of readiness and opportunity in the job market. While a significant portion managed to find work within the first month demonstrating high employability, there remains a considerable percentage who needed more than six months, suggesting challenges such as limited job availability, skill mismatch, or competitive industry demands. The distribution suggests that although many graduates are absorbed quickly into the workforce, sustained efforts are needed to support those who experience longer transition periods through career services, industry linkage, and job-matching initiatives.

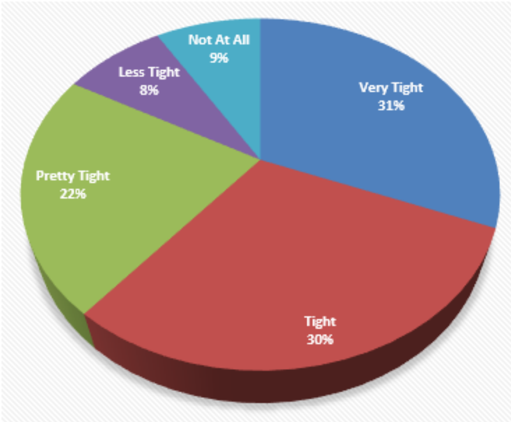

Figure 3. Employment relationship in the scientific field

The illustration reflects graduates' perceptions of the relevance between their field of study and their current jobs. A majority of respondents perceive a strong alignment, indicating that their academic background provides a solid foundation for their professional roles. This is reflected in the high proportion who consider the connection to be either “very tight” or “tight.” Meanwhile, a smaller portion reported only a moderate or minimal correlation, suggesting that while most graduates are working in roles that match their education, there remains a fraction whose jobs may require different skills or knowledge. This finding underscores the importance of continuously adapting academic curricula to align with industry demands and evolving job market trends.

This research analyzes 27 factors that are predicted to support graduates' competence in work. These factors are: 1) Ethics, 2) Expertise based on the field of science, 3) Communication, 4) Self-development, 5) Knowledge in the field of scientific disciplines, 6) Knowledge outside the field of scientific disciplines, 7) critical thinking, 8) Skills research, 9) Learning ability, 10) Working under pressure, 11) Time management, 12) Working independently, 13) Working in a team, 14) Problem solving ability, 15) Negotiation, 16) Analytical skills, 17) Tolerance, 18) Adaptability, 19) Loyalty, 20) Integrity, 21) Leadership, 22) Ability to hold responsibility, 23) Initiative, 24) Project management, 25) Ability to present, 26) Ability to write reports and 27) learning along the way life.

Before carrying out factor analysis, a prerequisite test is carried out. The prerequisite tests that we carry out are the Barlett KMO MSA test and the anti-image correlation test. To find out that the variables that form competence are variables that are correlated with each other, the Bartlett test is used. This test is used to see whether the correlation matrix is not an identity matrix. The purpose of seeing whether the correlation matrix is an identity matrix or not is to reduce the dimensions of the variables used to be simpler and more useful without losing much previous information. The results of Bartlett's Test of Sphericity of competency variables for Faculty of Engineering alumni are presented in the following figure.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.975
Bartlett's Test of Sphericity	Approx. Chi-Square	9688.772
	df	351
	Sig.	.000

Figure 4. KMO MSA test results

Based on the table above, the results show that the KMO MSA (Kaiser Meyer Olikin Measure of Sampling Adequacy) value is 0.975, so the number of samples used in the factor analysis process can be continued, because the KMO results are between 0.9 ≤KMO < 1.0 with the criteria very good data (marvelous) for factor analysis .

After the KMO MSA test has met the requirements, the next stage is to carry out an anti-image correlation test. The anti-image correlation test results data can be seen in the table below.

Table 2. KMO MSA results

No	Variable	MSA
1	Ethics	0.980
2	Expertise based on field of science	0.964
3	Communication	0.967
4	Self-development	0.979
5	Knowledge in the field of scientific disciplines	0.970
6	Knowledge outside the field of scientific discipline	0.974
7	Think critically	0.973
8	Research skills	0.978
9	Learning ability	0.983
10	Work under pressure	0.976
11	Time management	0.967
12	Work independently	0.982
13	Work in a team	0.980
14	Problem solving ability	0.981
15	Negotiation	0.972
16	Analytical capabilities	0.973
17	Tolerance	0.981
18	Adaptability	0.984
19	Loyalty	0.965
20	Integrity	0.969
21	Leadership	0.977
22	Ability to hold responsibility	0.974
23	Initiative	0.977
24	Project management	0.977
25	Ability to present	0.977
26	Ability to write reports, memos and documents	0.975
27	Lifelong learning	0.970

From the table data above and referring to the provisions that variables are suitable for analysis if the MSA value is more than 0.5, thus all existing competency data/variables of Faculty of Engineering alumni are included in the factor analysis.

The prerequisite tests have been met, so the next stage is factor analysis. The Communality Test is the proportion of the diversity of the first original variable that can be explained by general factors, and the remainder that cannot be explained by general factors and is explained by special factors through specific variance. According to J. Supranto, communality is the amount of variance contributed by a variable to all the other variables in the analysis. The results of the Communalities Test for Engineering Faculty Alumni show that there are 2 variables whose values are below 0.5, which means that these variables can be explained by other factors below 50 percent, these variables are: expertise in the field of science with a value of 0.433, English with a value 0.243. The complete Faculty of Engineering Alumni Communalities score can be seen in the following table.

Table 3. Anti-image correlation results

Communalities

	Initial	Extraction
Ethics	1,000	,581
Expertise based on field of science	1,000	,580
Communication	1,000	,638
Self-development	1,000	,640
Knowledge in the field of scientific disciplines	1,000	,630
Knowledge outside the field of scientific discipline	1,000	,596
Think critically	1,000	,693
Research skills	1,000	,720
Learning ability	1,000	,708
Work under pressure	1,000	,658
Time management	1,000	,626
Work independently	1,000	,657
Work in a team	1,000	,699
Problem solving ability	1,000	,741
Negotiation	1,000	,651
Analytical capabilities	1,000	,741
Tolerance	1,000	,656
Adaptability	1,000	,740
Loyalty	1,000	,734
Integrity	1,000	,767
Leadership	1,000	,671
Ability to hold responsibility	1,000	,785
Initiative	1,000	,730
Project management	1,000	,737
Ability to present	1,000	,724
Ability to write reports, memos and documents	1,000	,626
Lifelong learning	1,000	,644

Extraction Method: Principal Component Analysis.

From table 3, in the Extraction column, there are 2 variables whose values are below 0.5, which means that these variables can only be explained by other factors below 50 percent. In the same table "communalities", in the Extraction column there are 10 variables whose values are above 0.5, which means that these variables can explain other factors above 50 percent. Thus it can be concluded that all variables can be used to explain factors.

Table 4. Total variance explained

Components	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	17,281	64,003	64,003

2	1,094	4,053	68,056
3	,753	2,788	70,844
4	,726	2,689	73,533
5	,674	2,495	76,028
6	,601	2,227	78,255
7	,516	1,910	80.164
8	,462	1,709	81,874
9	,420	1,555	83,429
10	,392	1,452	84,882
11	,382	1,415	86,297
12	,351	1,301	87,598
13	,330	1,223	88,821
14	,312	1,155	89,976
15	,291	1,078	91,054
16	,271	1,004	92,058
17	,265	,980	93,038
18	,244	,903	93,941
19	,233	,862	94.803
20	,228	,845	95,647
21	,207	,766	96,414
22	,201	,744	97.158
23	,183	,677	97,835
24	,167	,620	98,455
25	,154	,572	99,027
26	.133	,494	99,522
27	,129	,478	100,000

Extraction Method: Principal Component Analysis.

Variance Expained shows the value of each variable analyzed. In this study there were 27 dance variables with 27 components analyzed. There are two types of analysis to explain a variance, namely initial Eigenvalues and Extraction Sum of Squared Loadings. In the Initial Eigenvalues variant, it shows the factors that are formed. If all factors are added up, it shows the number of variables, namely = 17.28 + 1.09 + 0.75 + 0.73 + 0.67 + 0.60 + 0.52 + 0.46 + 0.42 + 0.39 + 0 .38 + .35 + .33 + .31 + .29 + .27 + .27 + .24 + .23 + .23 + .21 + .20 + .18 + 0.17 + 0.15 + 0.13 + 0.13 = 27 variables. Meanwhile, the Extraction Sums of Square Loadings section shows the number of variations or the number of factors that can be formed. In the output results above there are 2 (two) factor variations, namely 17.28 and 1.09.

The condition for being a factor is that the Eigenvalue must be greater than 1. The Eigenvalue of component 1 is 17.28 or > 1, so it will become factor 1 and be able to explain 64.003 percent of the variation. Meanwhile, the Eigenvalue component 2 of 1.09 or > 1 will become factor 2 and is able to explain 4,053 variations. If factor 1 and factor 2 will be able to explain 68,056 variations.

The image below can be seen at the component point which has an Eigenvalue >1. From this image you can also show that in the scree plot above there are 2 component points that have an Eigenvalue >1, which means that there are 2 factors that can be formed.

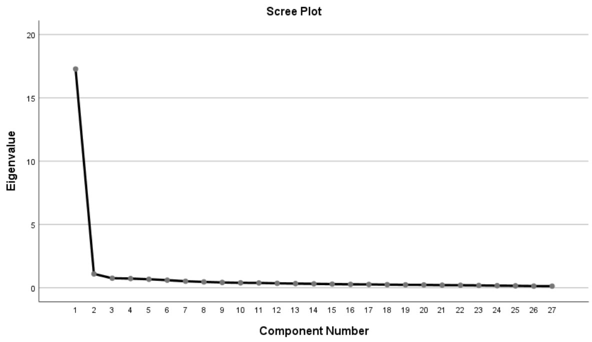

Figure 4. Scree plot

Figure 4 is a screen plot of Eigenvalue as the vertical axis and the number of factors as the horizontal axis, to determine the number of factors that can be drawn (factor extraction). The research results show that the point at which The Scree begins to occur, shows many factors that are true.

Table 5. Rotated component matrix

	Components	
	1	2
Ethics	,678	,349
Expertise based on field of science	.203	,734
Communication	,591	,538
Self-development	,600	,528
Knowledge in the field of scientific disciplines	,353	,711
Knowledge outside the field of scientific discipline	,348	,689
Think critically	,425	,716
Research skills	,395	,751
Learning ability	,582	,608
Work under pressure	,715	,384
Time management	,652	,449
Work independently	,691	,424
Work in a team	,722	,422
Problem solving ability	,561	,653
Negotiation	,429	,683
Analytical capabilities	,479	,716
Tolerance	,741	,327
Adaptability	,756	.411
Loyalty	,799	,310
Integrity	,782	,393
Leadership	,551	,606
Ability to hold responsibility	,801	,380
Initiative	,657	,546
Project management	,580	,633
Ability to present	,534	,663
Ability to write reports, memos and documents	,596	,521
Lifelong learning	,688	,414

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 3 iterations.

The component matrix is a matrix of relationships between variables and factors that are categorizers of the variables in question. Determination of component category 1 or 2 based on the value of the variable in each component is the largest, this is shown in table 5 in yellow. If From the component matrix above, it can be concluded that from 27 variables, 2 factors are obtained. The factor components formed are two factors, namely:

1) Component 1: Ethics, Communication, Self-development, Working under pressure, time management, working independently, teamwork, adaptability, loyalty, integrity, ability to hold responsibility, initiative, ability to write reports, and lifelong learning .
2) Component 2: Expertise based on the field of science, knowledge in the field of scientific discipline, knowledge outside the field of scientific discipline, critical thinking, research skills, learning ability, ability to solve problems, negotiation, analytical skills, leadership, project management, ability to present.

Discussion

The findings of this study provide a compelling insight into the structure of employability competencies among engineering graduates. Through factor analysis, two distinct yet interconnected components emerged, each representing a unique dimension of graduate readiness for the workforce.

Component 1: Personal and Behavioral Competencies

The first component aggregates competencies such as ethics, communication, self-development, working under pressure, time management, independence, teamwork, adaptability, loyalty, integrity, responsibility, initiative, report writing, and lifelong learning. These represent what is commonly referred to in the literature as soft skills, employability skills, or behavioral competencies. According to Andrews & Higson (2008), These attributes are increasingly prioritized by employers, often considered as essential as technical expertise.

Such competencies align with the "emotional intelligence" and "professional behaviour" domains emphasized by Goleman (2006), where qualities like integrity, adaptability, and initiative are linked to long-term workplace success. Jackson (2016) argues that personal attributes like accountability and lifelong learning are foundational in building a pre-professional identity, which is crucial for navigating complex workplace dynamics. Moreover, lifelong learning is increasingly seen as an imperative for continuous adaptation in a rapidly evolving labor market (Canning, 2013).

Importantly, the clustering of these variables confirms that employability is not solely dependent on disciplinary knowledge, but is heavily influenced by an individual's capacity to interact, adapt, and perform under varying professional demands.

Component 2: Cognitive and Technical Competencies

The second component includes domain-specific expertise, interdisciplinary knowledge, critical thinking, research skills, problem solving, negotiation, analytical skills, leadership, project management, and presentation abilities. These represent the cognitive and technical dimensions of employability, which are more traditionally emphasized in engineering education.

This aligns with Finch et al (2013), who highlight that while employers seek well-rounded graduates, they place considerable emphasis on cognitive processing, including analytical thinking and decision-making. The inclusion of critical thinking and problem solving is particularly significant in STEM fields, where graduates are expected to navigate ambiguity and design solutions independently (Litzinger et al., 2011).

Additionally, leadership and project management are competencies often associated with career progression and professional responsibility in engineering roles (Male et al., 2011). Their emergence within this factor reinforces the idea that technical education should be broadened to incorporate leadership development and interdisciplinary collaboration (Crawley et al., 2014).

Interrelation and Educational Implications

The emergence of these two factors suggests that employability is a multidimensional construct, consistent with the T-shaped model of graduate competence Yang & Yang (2014), where deep disciplinary knowledge is supported by broad transversal skills. This duality indicates that engineering graduates need not only to be technically proficient but also socially and behaviorally competent.

Educational institutions must thus adopt integrated learning approaches, combining technical coursework with soft skills development, teamwork, and reflective learning (Luo & Zhang, 2017). Embedding project-based learning, industry mentoring, and experiential tasks into the curriculum can ensure that graduates develop holistically in both dimensions of competence.

Furthermore, the findings underscore the importance of curriculum mapping and employer feedback to ensure continued alignment with workplace demands. As noted by (Finch et al., 2013), employability is not static but evolves in parallel with technological and organizational transformations.

Conclusion

The profile of graduates from the Faculty of Engineering is still in line with current conditions. The relevance of the curriculum that has been created is still relevant to the needs of the field of work. This relevance can be seen from the level of closeness between scientific fields and alumni work. Where the response from alumni stated that the majority was 31% very close and 30% close. Alumni look for jobs that suit their field of science. Therefore they also only need an average of 4.28 months to get their first job. There are even some alumni who get jobs before they graduate. This is because industry or schools are interested when they carry out internship activities. 27 factors support the competency of Faculty of Engineering graduates. The 27 factors can be divided into 2 supporting factor components. Where if these factors are combined, 68.056% are factors that influence alumni competency. The findings indicate that the curriculum and graduate profile developed by the study programs remain relevant to industry needs. Therefore, universities should adopt a holistic educational approach that balances academic knowledge with character development, ethics, and soft skills. Strengthening collaboration with industry and continuously updating the curriculum are key steps to ensure graduates stay relevant and competitive in the job market.

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