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Assessing Learners' Perceptions of Graduate Employability

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Abstract: The rapid advancement of technology, including the internet of things (IoT), industry 4.0, and smart cities, revealed an excess need for career-ready graduates. It is expected that a career-ready graduate is technically competent and possess professional skills acquired via the experiential learning incorporated into the curriculum. But the gap exists with the learners understanding of requirements and opportunities associated with graduate employability. In this research, we focus on evaluating the learners' experiences, expectations, and perceptions of graduate employability in an engineering curriculum. In this research, the interpretations of students on the graduate employability and the extent of influence that exists based on the learning outcomes of the graduate course are examined. The gaps between the academic environment and graduate employability awareness are highlighted. Later, a national language processing-based sentiment analyzer is used to evaluate the student's perceptions. Results from the analysis portrayed that the different levels of expectation and experiences that prevailed in the graduate course based on the conceptual idea of graduate employability need substantial focus in future curriculum development.

Keywords: engineering education; national language processing; graduate learning outcomes; sentiment analysis; student perception

1. Introduction

In the past decade, a huge concern of graduate employability is considered into the process of redefining the course learning outcomes of engineering graduates. This clearly stands in line with the instability and randomness that exists in the Australian labor market. The importance of maintaining employability based on the following traits such as finding jobs, networking, unpaid laboring, and training draws a new economic dimension on the concept of employability [1]. Besides graduate employability, the importance of the higher education system's considered the rapid advancements in the modern era of globalization and technological development [2]. The factor of graduate employability explores the association of skills obtained from undergraduate engineering programs and the subsequent use of the skills needed for acquiring employment [3].

The 2013 Graduate Career Australia survey states that the rate of graduate employability in the year 2013 is the lowest from the past two decades, which was a significant concern for future engineering graduates [4]. In 2014, "The Sydney Morning Herald" revealed a remarkable fact that most number of recruitment in the Australian Public service commission has dropped by a quarter [5]. Considering sudden declines in the level of graduate employability and continuing increase in the number of graduates, there is a significant threat that the skill sets of the graduates acquired from the higher education institutions are struggling to fulfil the demand and expectations of the employers. In order to investigate the gap between the major stakeholders and academia, many researches have

been conducted in and around Australia [6]. The Australian government, in accordance with the bond university, highlighted the group of twelve components that needs to be implemented in the graduate employability framework [7]. The focus of this paper is to evaluate engineering learners' experiences and expectations of graduate employability in an engineering curriculum and give recommendations on how to improve the focus on graduate employability in the engineering curriculum to make employable engineers.

2. Graduate Employability

A difference of opinion exists within the higher education society that the state of the economy and the personal traits substantially influences the individual graduates' possibilities on acquiring a professional career. Yorke et al. state that "the skills, understandings and personal attributes which make students more likely to secure employment and be successful in their chosen occupations for the benefit of themselves, the workforce, the community and the economy" [8]. There is a substantial fact that the prevailing settlement of the changes that have to be incorporated in the higher education system plays a vital role in increasing the graduate employability [9]. Alongside, the main expectations of the employers on hiring additional employees are centered on the three main criteria, namely "Quality, Work experience and skill of the applicant" [10]. A research study analyzed the factors influencing the employability of graduates, which illustrates a clear view of employers perceptions on recruiting new graduates who have more competent soft-skills than an academic standing [11]. Higher education institutions are mainly criticized for the lack of those soft skills, a deficiency that prevails in graduates looking for jobs. It is a forbidden fact that the industry-relevant competencies expected from the employers stay as a broad skill gap in the graduates, and this is existing worldwide [11]. There exists a contradictory opinion in the cohort of researchers around the world that the driving force behind the decline in graduate employability is the misalliance in between the skills obtained in graduate education and the expectation in the work [3,12,13] and the methodologies that are used to teach the targeted learning outcomes, along with the different methods used for assessing the level of achievement of students [8,9,14–16].

There exists a regularity in low graduate employment and lack of a solution to enhance the graduate employability, which is evident from the critical literature review conducted. It drives fellow researchers to investigate the significant issue of the stakeholders in higher education. The perspectives on employability are classified as (a) 'possessive', which focuses on the conception of skills and attributes that add dominance to the theoretical aspects, (b) 'positioning', which shows more solidarity in the social positioning theory that enhances the employment outcomes, and (c) 'processual', an approach that highlights the concept of graduate identity [17]. Furthermore, it is an essential aspect of considering an academic institution's and employer's role in supporting the graduates to obtain the skills, attributes, and individual identity which is required to meet out the demands of the work expectations [8,16–19].

However, there is clear evidence of an urge for the educational institutions on embedding the activities that give a personal and professional development that enhances the leadership and self-identity in the curriculum to obtain the graduate outcomes. A study on participation of sports [20] shows that volunteering and self-analysis contribute to the probability of increasing graduate employment [9,21]. By reflecting on the above studies, the high level of expectation on the graduate from the employability market proves that there should be a considerable change in the strategies followed on graduate readiness for employability [16,22–27]. This research focuses on developing a set of guidelines or employability strategy which helps graduates' awareness on employability and gradually reduces the existing gap between the expectations of employers and reality in an academic environment.

In order to satisfy the requirement needed in the labor market, it is clear that there should be a better way of collaboration between academic and employers to derive a strategy and framework to enhance employability [22,27]. The pathway of investigating the learning outcomes of the education system in Australia, from early childhood to the graduate level, will also close the gap in the employer's skill set expectation. This research is focused on identifying the gap between student's course curriculum and

graduate employability, which will enhance the graduate employability awareness. The following subsection critically reviews the different aspect of graduate employability and how it is incorporated into the academic curriculum.

2.1. Work Integrated Learning

Work experience, internships, temporary jobs, and placements are programs intended to give students formal, upheld viable open doors in the working environment. Such formal encounters help students to nurture themselves in knowing both the limits based on their aptitude and graduate traits like a representative identity [28]. Work-integrated learning acts as a strong aid in a well-managed transition of a student from study to work environment with the practical opportunities that are given to the students during the course [29]. Even the employers treat these internships as a positive inclusion in the curriculum, as it provides them with an opportunity to effectively evaluate the work of a fresh graduate in an industrial environment and contribute to a betterment of the company [30]. It adds an attribute to the profile of the students that it may help them secure a job in the same company they do their internship, if the employer is satisfied with the quality of work, and whether the individual is able to deliver to the company requirements proactively. Finally, another factor that has to be considered as an attribute to increase graduate employability is the industrial tie-up that the university gives extensive opportunities to carry out industrial projects and industry-based research.

2.2. Graduate Career Training

The modifications made in the education and labor market has significantly increased the pressure of producing employable graduates in the recent past. Whereas career management or employability skill development is considered as one of the key contributors to employability, which is enhanced by addressing the desirable graduate attributes and recognizing the importance of self-management in the process of building a career [31]. This is incorporated in the curriculum by the inclusion of employability assistance strategies like assistance in preparing a resume, mock interviews, engaging network opportunities, and mentoring for self-realization, etc., which would directly contribute to the employability of students [32,33]. Thus, the relationship of graduates' learning outcome and the career management services is extensively reviewed by Bridgstock [30], and Harvey and Shahjahan (2013) [22], which reinforced insights for the approaches that are incorporated in the curriculum to enhance employability outcomes.

2.3. Social Responsibility and Extra-Curricular Activities

Preliminary involvement of the students in the social and extra-curricular volunteering activities enhances the student's responsibility in a wider angle with respect to the social aspect. One of the most important goals of education is employability, but there is a dissimilarity in expectation and reality in the bridge between the educational programs that emphasize the importance of skill development and employers who value the performance [34]. This led to the inclusion of the Graduate learning outcomes on the role of citizenship, which is also considered to be a skill that has to be incorporated into the curriculum, which highlights the voluntary participation in events that would enhance the role of social responsibility of the citizen [35]. It is supported by the strategy of giving awards to the students who effectively contribute and involve themselves in extra-curricular activities like community service, voluntary service, etc., [36].

2.4. Career Advancement and Industrial Networking

In career counselling, professional mentoring, industrial tie-up, and involvement in voluntary or community services, the network that the educational hubs provide to the students plays a big hand in the transition of the student to a graduate. It also gives an opportunity to directly interact with the employers and get their insights on the expectation of the employable graduates [37]. One such approach that has been incorporated in the many educational curricula is to have alumni and industry

personalities to regularly interact with the students with some social gathering and some professional club meetings to continuously learn through the shared knowledge [12].

2.5. Learning through Capstone Projects

The process of preparing undergraduate students for engineering practices that expand the professional skill of the personnel is attributed to the quality of teaching and learning. There exists considerable scrutiny that there is an existing gap in the engineering design aspects of the graduates, and in order to enrich this skill set, team-based learning activities are embedded in the curriculum. One such aspect in design education is the capstone design practice. The opportunity is given to students to undertake independent research on a question or problem of their choice and work on it for two semesters. The capstone project demonstrates the following traits like originality, independence, realistic scope, orderly and objective process in compiling, communicating and providing a solution to the identified problem, along with the intellectual stretch obtained during the course [38]. It also adds an attribute in ensuring the integrity of students by accumulating the knowledge and expertise of the students [39,40]. It gives students an opportunity to work in an interdisciplinary project, which will enhance the knowledge of the project in all dimensions as illustrated by Lee [41].

2.6. Professional Memberships

The increase in recognition for the importance of the professional association membership that allows the students to effectively take part in professional conferences, workshops and other events conducted by these professional bodies gives a chance to the students to interact with the employers and technical scholars from different part of the world. It helps in regularly updating the knowledge in the advancement of technologies that are developed around the world [42,43].

2.7. International Exchange

Experience in a global context will enhance the qualities that are required to meet out the expectation on employability in the global aspect; the international exchange program is incorporated into the curriculum [43]. However, there exists another side of the opinion that the students consider this opportunity as a break from the highly stacked study [44]. Academics believe that this opportunity included in the curriculum will broaden cultural bonding and boost the mobility of the students, which will give them exposure to the international work culture and help them adapt to the global competency.

2.8. Part-Time Employability

It is a general opinion that the students' interest in low-maintenance or part-time jobs during the course of the study is turning out to be more intense [44]. The increase in the propensity of part-time employment during the study period has contributed a lot to the social and economic condition of the person individually. It has a negative impact that the level of interest in studies is gradually decreasing because of lack of time due to commitments that superimposed over the study pressure. In other aspects, it also proves that the possibility of landing in a job is easy for a student who is doing part-time than to a person who is fully spending time for studies. It is because of the fact that the part-time opportunities provide a real work environment to work and also enhances the soft skillset of the individual, which adds an attribute to his profile [45].

2.9. Social Media Networks

Social media has become a part of the life that is mandatorily used by every individual. Tackling the rise of the online social interactions gives another aspect of interacting with professionals and has been underused, as illustrated in the following research that proposes a system that graduates entering the outer universe of the work culture should enhance their employability traits by setting focus on their long-range informal communication that is considered to be termed as digital literacy [46].

Considering the fact that the employers feel that the most important trait for an individual is to be digitally literate and also have the interpersonal skill to come out the barrier and express his/her opinion in the general public contributes a lot to give a positive impression in the online vehicle for employability networks like LinkedIn [47].

Therefore, from the above sub-section, we get a clear idea of how the different aspects of graduate employability are incorporated into the current engineering curriculum. It is equally important for the graduates to secure the above-mentioned experiences, along with the academic expertise, and attain the soft skills which make the graduate employable ready. Despite the significant measure taken from the academic side, there still exists the gap between the expectation of the stakeholders and the reality of skillsets trained from the academic institutions. In this research, in order to understand the reason for the existence of this gap and obtain real feedback from the learner about the effective implementation of the above-mentioned aspects of graduate employability in the curriculum. Additionally, to understand whether these traits really play a vital role in securing employment, we conducted an online study and later analyzed the results using an NLP-sentiment analyzer in order to evaluate the learner's perspective on graduate employability.

3. Design/Research Methodology

An online survey was piloted towards undergraduate students of engineering discipline at Deakin University to understand their perspective on graduate employability. The survey had an underpinning objective of understanding the gap that existed between the expectation of skillsets that supports a graduate to secure professional employment and the contribution of the learning outcomes of graduate courses that are focused on enhancing graduate employability. Deakin University has a range of resources and events to assist in nurturing and preparing students for graduate employability. The range of resources, includes career success workshops to access hands-on support for planning their future career opportunities, career coaching to access personalized career guidance with experts, talent development programs to engage in professional development programs to enhance student's marketability. The other resource is Deakin Talent team, who offer students opportunities to attend employer events and interact with employers. It also provides services for students to connect with experienced recruitment services.

The survey was structured in a way that it would consume about five to ten minutes' time maximum to complete, and it was available as an open-ended online survey, which was created using an online survey development cloud-based software called Survey Monkey. The participation of the survey was not focused on any particular course or year of study in order to understand the different levels of expectations that existed within the student community, and the participation was completely out of voluntary interest. It also helped the researchers understand the level of interest that exists in the students to explore stuff related to graduate employment. The survey also contained an explanatory statement and a consent form to maintain ethical conduct. The first part of the survey dealt with the information like personal demographics and the understanding of the learning outcomes of the course, and the second part was focused on the graduate employability and how it is incorporated in the curriculum to improve the skillsets that are needed for graduate employability.

The interpretations of students on graduate employability and the extent of influence that exists based on the learning outcomes of graduate courses were examined based on the quantitative and qualitative analysis of the data obtained from the survey, which was anonymous and non-identifiable. The results of the survey portrayed the different level of expectation and experiences that prevailed in the graduate course based on the conceptual idea of graduate employability. The research survey questions are listed in Appendix A. There was a final question which provided an option to give their personal perspective, and responses received was analyzed using an NLP-sentiment analyzer to detect whether the respondents were positive, negative, or objective. The results of the survey are highlighted below in the following sections.

4. Learners' Perspectives on Graduate Employability

In order to better understand the impact of the learning outcomes incorporated into the course structure of graduate programs that are centered towards enhancing the graduate employability, it was essential for us to conduct initial research by centering our focus on carefully evaluating the learning outcomes of different levels of education that exist within Australia. Mainly, targeting the Graduate Learning Outcomes (GLO's) that intensively emphasize on personally improving the student's individual skill set to land in a professional career. The research emphasizes reducing the gap that exists between the expectation of skillset of a graduate in the professional market and the structure of graduate courses that focus on molding the expected skillset in the graduate courses.

The study conducted a survey to evaluate the gap that exists between the learning outcomes and the expected employability traits of graduates graduated. In order to examine this gap, the students were asked to answer a questionnaire with ten questions that focused on identifying the gap between the GLO's and the expectation from the employers about the graduate. A copy of the questionnaire is attached in the Appendix A, which will give us a better understanding of how influential the GLO's of a course is for making a graduate an employable graduate. It compares the learning outcomes of the different levels of education in Australia to identify the gap that prevails in the existing system. The survey is voluntary participation, where the focus group was targeted over engineering graduates from Deakin Engineering irrespective of their department or year of study. This resulted in the participation of about 52 individuals who volunteered to participate in this survey. The age group of the participants was distributed in the range of 18 to 27 and more, with a 63% of total students belonging to the age group of 21–23, followed by 25% in 18–20 age group, 8% in 24–26 age group, and 4% of students in the age group of 27 and more, which is clearly illustrated in Table 1.

Table 1. Demographics of the participants.

Category		Percentage
Age of participants	18–20	25
	21–23	63
	24–26	8
	27 or more	4
Native of participants	International	58
	National	42
Discipline of study	Software Engineering	4
	Civil Engineering	8
	Electrical and Electronics Engineering	25
	Mechanical Engineering	42
	Mechatronics Engineering	17
	Others	4
Year of study	First Year	9
	Second Year	9
	Third Year	25
	Fourth Year	57

The perspective of international students was a pivotal point to be noted in the survey. 58% of the participants were international students, and only about 42% were native students of Australia, as shown in Table 1. It is also clear that a number of international students pursuing the graduate-level courses are comparatively high. This helped to understand what the students from different background feel about

the graduate employability, and how effective the skillsets are transformed into the curriculum through the targeted learning outcomes of the course. The student's participation was equally distributed across the various departments across the engineering domain. From the cohort of students, mechanical engineering topped the list with 42% of participation, followed by electrical and electronics engineering and mechatronics stream, which counted about 25% and 17% of the total participants. Finally, it is also essential to share that there was an equal amount of participation of about 4% from software and other streams as well, as shown in Table 1.

To have a better understanding of how students from different years of engineering look into the traits that are required for graduate employability, and also examine whether the expectations of the students are fulfilled in the curriculum structure, it was important for this research study to look at the perceptive of the students in a broader aspect, which encouraged to make this survey open to students from all the years. Table 1 shows how the participation of the students was distributed across the year of study. From which, it is clearly identified that the interest of the people about employability was more intensified in the final years of the study, as the last two years topped the response rate with 57% and 25% for the fourth and third year. Whereas the second- and first-year students' participation was comparatively less, and that accounted for a number of 9% of the total participants, as shown in Table 1.

Despite the fact, the response was well centered towards the participation of final and pre-final year students. There exists a dominant issue within the cohort of students that there was no student who has secured a job related to the field of his/her study at the current time. About 89% of people responded "No", and 11% answered "Not Sure", which clearly indicated that there exists a gap between the expectation in the global market to treat a graduate as an employable graduate. The questionnaire was structured in a way that it included a question that examined during which point of time in the course the student realized the importance of the skill sets that are required to land up in a professional job. The responses state that the realization of the skillset that is required for landing up in a job was mainly during the first three years, which accounted for a number of 28% in the first year, followed by 22% in second, and about 44% of the participants stated that they realized the importance in the third year. Finally, there was about 6% of the participants who responded that they realized it during their final year, as shown in Table 2.

This clearly emphasizes a point that there is a gap in the structure of the course, as the realization of the importance of the skills that are required to make yourself employable is mainly focusing on the third year, which is a bit late for the expected market. The later part of the survey included a question that evaluated the course structure of the participants during which students were asked to tick the strategies that are incorporated into their curriculum from the given list of strategies. This list was compiled based on evaluating the past researchers around the world, which proved that when these strategies were interrogated into the course curriculum, it contributed a lot to enhancing the graduate employability of the students.

The responses clearly depicted that the Internship/Placement Opportunities topped the list, as 89% of the participants responded that this strategy was part of the graduate course that they are undertaking. It is closely followed by Capstone/Final year project and Career Counselling that stood with a standing number of 67% and 61% of participants accepting that their course incorporates these strategies. Also, it was clear that 56% of participants felt that the Professional membership like IEEE, SAE, etc., was part of their course, which is followed by involvement in extra-curricular activities, industrial networking events, and influence of social media/ networks which was accepted by 50% of the participants as they had ticked in their responses.

The industrial tie-up, international exchange, and part-time employability within the organization that helped students in improving the skills that are required for securing a job after graduation. Only 39% of the participants responded that these vital strategies are incorporated into their curriculum. Finally, the least implemented strategy in the course was the career enhancement program from external sources, which was standing in the least implemented strategies in the course structure to improve graduate employability. From the above analysis, it is clear that there exists a gap in

the curriculum that the above strategies are not adequately incorporated into the structure of the course. Followed by this the survey, the research study has been conducted multiple years, and it was structured in a way that the following questions were to be interpreted based on the experience and response for every year whether the expectation and the experience were on the same pace of learning. Following Figures 1 and 2 clearly illustrates how the response was distributed across the year of study. The list of questions 1–8, which are considered for the analysis, is highlighted under question 9 in the Appendix A attached.

Table 2. Responses from the survey.

Category		Percentage
Participants who secure graduate employment	Yes	0
	No	89
	Not Sure	11
Students realize the importance of skills required for employability	First Year	28
	Second Year	22
	Third Year	44
	Fourth Year	6
Strategies imposed to improve graduate employability	Internship/Placement Opportunities	89
	Career Counselling	61
	Industrial tie-up	39
	Involvement in extra-curricular activities	50
	Help in developing portfolios and records of achievement	33
	Industrial networking events	50
	Career enhancement programs from external sources	22
	Capstone/Final year projects	67
	Professional membership (IEEE, SAE, etc.)	56
	International Exchange	39
	Part-time employability within the organization	39
	Social Media/networks	50

Figures show that around 83.32% of first-year students claimed that they expected and experienced the discipline-specific knowledge and capabilities associated with the degree (course), 72.22% have course engagement with professional activities to enhance oral, written communication, 61.11% experienced the use of digital technologies, engineering techniques, tools, and resources, which enhances their research, 55.56% admits that the course gives a chance to improve critical thinking by in-depth analysis of the problem and helps using engineering methods to solve complex problems. When students are questioned about whether their course has a learning process that adapts to change and incorporates new perspectives, about 50% of students mentioned the course made them be creative, innovative, and pro-active in incorporating new ideas to solve a problem. About 61.11% acknowledge that the course involves phases of the study, which allows them to work and learn independently to manage and maintain their professional conduct at times. Whereas, 73.68% believed to work in teams collaboratively to enhance their team membership and team leadership. Only 44.44% claimed that the course supports them to engage ethically in the professional context to collaborate with diversified

communities and culture. There are other students, around 5% to 16%, who say that they didn't expect and experienced the above-mentioned activities, skills, or attributes.

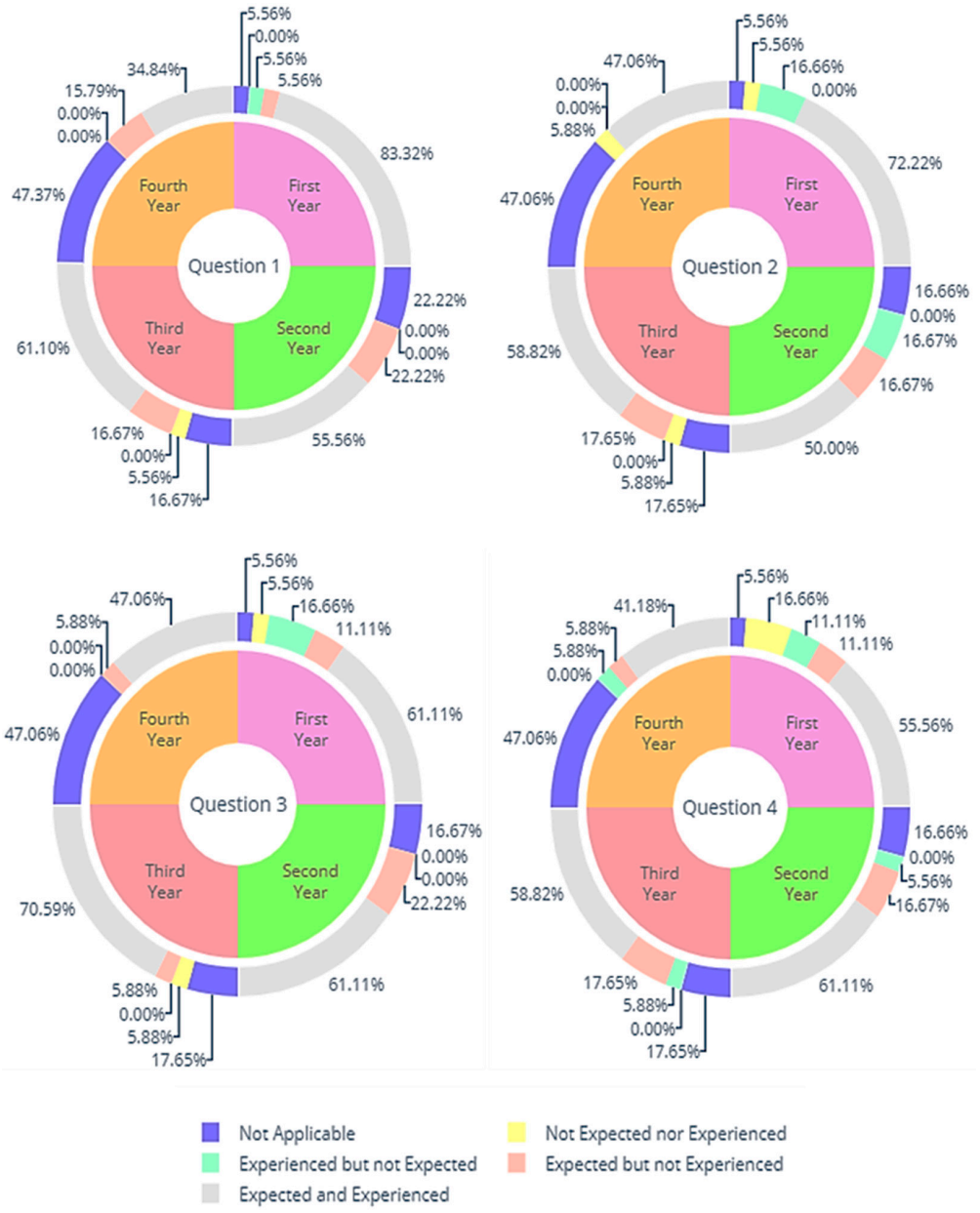

Figure 1. Responses for Question 1, 2, 3, and 4.

When the research study analyzed second-year students, it is more interesting to visualize the difference in the expected and experienced level, where discipline-specific knowledge and capabilities associated with the degree (course) have reduced by 28% compared to the first year. The engagement with professional activities to enhance oral and written communication also reduced percentage by 22%, whereas there is a slight rise of 6% that the course improves critical thinking by in-depth analysis of the problem and helps students using engineering methods to solve complex problems. With a 17% decrease in students' perceptions with the course didn't have enough chance to adapt change and incorporate new perspectives and to be creative, innovative, and pro-active in incorporating new ideas to solve the problem. Again, a fall in the course phase in second-year students expected and experienced less to work and learn independently to manage and maintain their professional conduct

at times. When we analyze the number of students in the expected but not experienced level, there is an increase in numbers from 11% to 16% compared to the first year. It clearly shows that the curriculum needs more attention on student transition from the first year to second year. In Australia, most first-year engineering courses are common for all students, and students will choose their preferred discipline in the second year of the course.

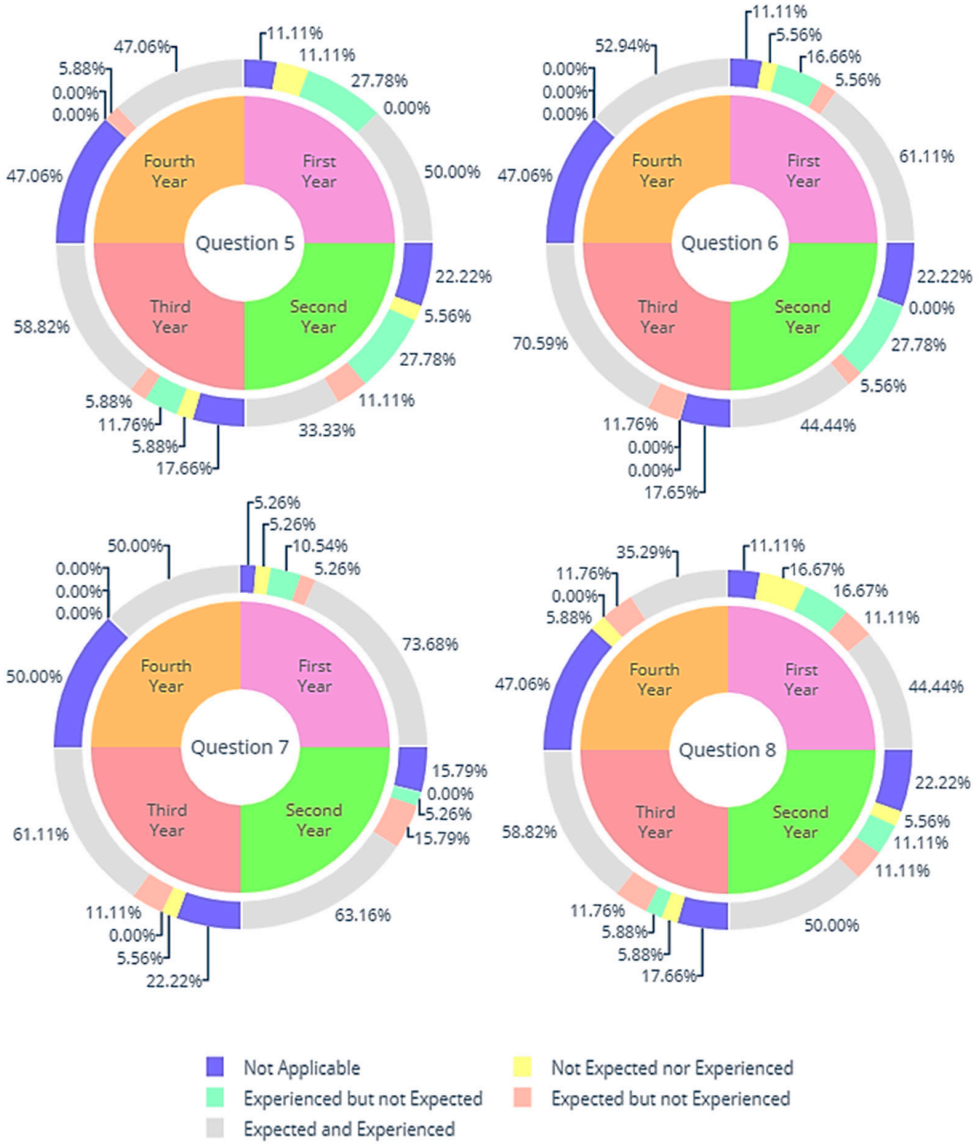

Figure 2. Responses for Questions 5, 6, 7, and 8.

It is meaningful when we investigate the third-year students, the first three questions, specific knowledge and capabilities, effective oral and written communication in professional activities, and use of digital technologies, engineering techniques, and tools have increased in percentage of students expected and experienced level. Even other aspects, such as improving critical thinking, using engineering methods to solve complex problems, adapt to change and incorporate new perspectives, work and learn independently, working in teams, and work with ethical conduct and professional accountability are in the percentage of student's level of expectation and experienced through the course. The third-year engineering students' views on their experiences prove the novelty of the course structure, which specializes in in-depth knowledge in particular discipline areas.

In Fourth-year, students' views on various aspects through the course are very surprising. It is clearly showing that half of the students expected and experienced those aspects mentioned above in Figures 1 and 2. Almost 47% of students say not applicable to all aspects in the phases of their course. All students in the final year were expected to undergo a final year project, which is a massive project that starts with an initial phase of exploring the problem/project in semester 1 and working on design/prototyping in semester 2. Students who are not competent enough with their grades equal to the level of Distinction/High Distinction in the first three years may not be eligible to undertake industry projects. This particular rule makes some students not be satisfied or not experienced any of those aspects mentioned above.

5. Discussion

Australian Qualification Framework (AQF), is a heterotypic structure that defines the different learning levels of education based on predefined learning outcomes. The structure of the AQF framework is designed in order to create consistency and clarity in the way the different levels of qualification are described. Exploring the difference and relationship between the level of learning throughout the four years of engineering education helps us understand the benefits of the AQF in a better manner. The AQF defines the learning outcomes corresponding to the level of graduate study based on what the student is expected to know, understand, and be able to do as a result of learning.

AQF standards are influenced by the dimensions of knowledge, skills, and the application of both in real-time applications. The range of generic and the specialized depth and breadth of knowledge obtained at the graduate level is described as knowledge, and the use of intuitive, logical, and critical thinking is described as cognitive and creative skills. As mentioned earlier, in the process of examining the learning outcomes highlighted by AQF, graduate employment is considered as a benchmark to be evaluated. This is one of the main reasons why the highlighted study evaluates the importance of graduate employability in the perspective of student awareness and curriculum development.

In the online survey conducted in the study, the participants were given a chance to record their personal perspective/opinion on graduate employability, along with the other survey questions highlighted in the previous section. The responses received for this question on the opinion were collected, and initially, a word cloud of the most repeated words of the responses was created to understand the collective perspective of the participants as shown in Figure 3. The word cloud highlighted a few negative words in relation to graduate employability. The lack of clarity on whether the student's perception from the comments and the word cloud encouraged the authors to create a national language processing (NLP) based sentiment analyzer to predict the sentiment of the responses accurately. Therefore, an NLP-sentiment analyzer was created to identify whether the given responses were in the scale of positive, negative, or an objective side. The NLP sentiment analyzer was programmed using a collection of a few opensource Python libraries (nltk and bs4 (beautiful soup)). A detailed flowchart of the algorithm used in the NLP-sentiment analyzer is shown in Figure 4.

The NLP processing unit initially collected the responses from participants of the online survey and exported it into a CSV file. Later the CSV file was passed into the sentiment analyzer, which then followed the below-mentioned procedure to identify the sentiment of the responses. Initially, the NLP-sentiment analyzer removes the punctuations from the sentences in the responses and then tokenizes each word of the responses into an array. Later, the stop words are removed from the tokenized array, after which we normalize the words using a lemmatization process. Followed by this, we assign part of speech tags for each word and identify the sentiment of the word using the sentiwordnet library, which assigns a score of positivity, negativity, and the objectivity of the word. A sum of these values is taken for the whole response to calculate whether the response is positive, negative, or objective (neutral). Figure 5 illustrates the distribution of the results obtained from the NLP-sentiment analyzer for the whole dataset, and Table 3 highlights the individual sentiments of the responses.

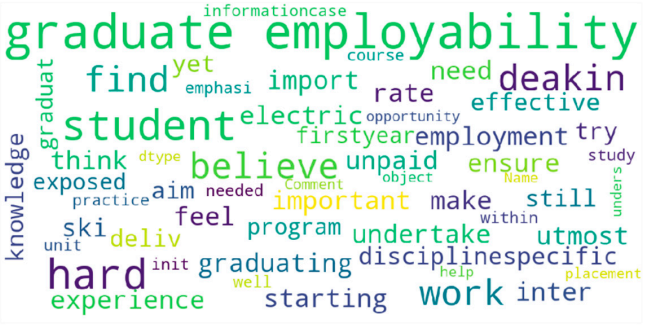

Figure 3. Word cloud of the most repetitive words in the student responses.

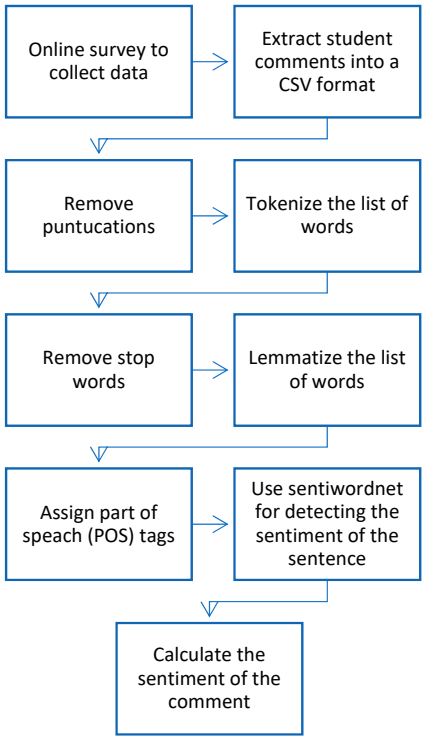

Figure 4. Operational flow chart of NLP-sentiment analyzer.

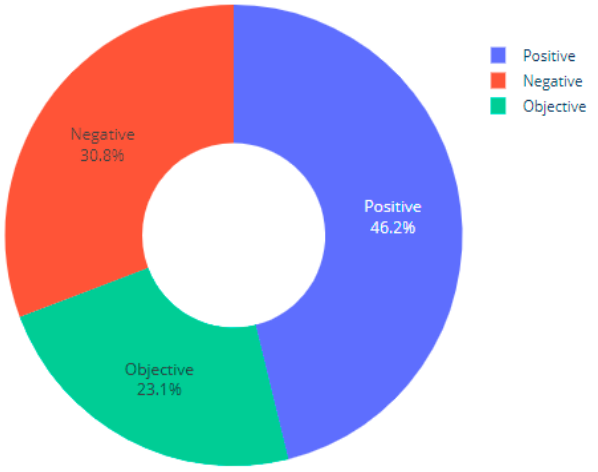

Figure 5. Distribution of the results of the NLP-sentiment analyzer.

Table 3. Student comments and corresponding NLP sentiment analysis results.

Student ID	Comments	NLP Sentiment
A	I think the employment rate of graduating electrical/electronic engineers is moderate, however, I don't think the university helped to make this happen for its students. In my curriculum, I heard nothing about graduating jobs or about what would happen after University. The only jobs I got offered were from Engineering lecturers on Deakin email that were irrelevant to my course.	Negative
B	I feel graduate employability is of utmost importance. Through various industry engagement programs like networking events and Internship programs, I feel Deakin Engineering is providing the best opportunities for students.	Positive
C	Graduate employability should ensure that students have the skills, knowledge, and attributes needed to successfully negotiate future career paths. University prepares you with the skill sets, but doesn't prepare you for the constraints and obstacles faced in the workforce.	Positive
D	It makes it hard for students to undertake unpaid internships. Students generally are struggling for money without forcing work without pay. All internships should come with some form of payment to cover basic costs.	Negative
E	Graduate employability is very important and Deakin Engineering trains us for it, however, opportunities for internships for international students should be increased.	Objective
F	Graduate employability is very hard to find, starting even from finding an internship. International students especially don't seem to get a window to showcase their skills even if they are hard-working individuals. I feel the university should have more industry connections too.	Negative
G	It is too hard to find work experience by yourself and there is a need for Deakin to connect with businesses to allow a certain number of students per year/trimester/month to start work experience/networking opportunities. I have several ideas such as Deakin business workshops, community work programs for engineer students, research opportunities for undergraduates.	Negative
H	I believe that more discipline-specific knowledge should be delivered in order to form a fully qualified engineer in the said field.	Objective
I	They try to aim for it, but it is still not that effective as of yet.	Positive
J	As I am a first-year student, I have not been exposed to most of the programs for graduate employability, but I have attended talks by engineers Australia which have emphasized the importance of employability.	Positive
K	More information/case studies needed in units to emphasize how the skills being taught can be applied in industry, and which employers look for these particular skills.	Positive
L	I believe that the practices within the Course well initiate you for later employability in the field if the work is put in.	Positive
M	There are no opportunities for work placements because these help us understand professional engineering environment.	Objective

Inferences obtained from the analysis made on the student's perception on the awareness and importance on graduate employability clearly depicted that there exists a gap when it comes to the adaptation of the pro-active measures incorporated into the engineering education curriculum. While there exist pieces of evidence of academic bodies working towards attracting industry collaboration in different ways, the above student perceptions explain their difficulty to approach

employability. Even though Engineers Australia and other engineering bodies open their doors to involve young engineering graduates to be part of their engineering community, it is still like a maze for all graduates to find a network to develop their skills and abilities from an academic environment to a practice-based industry environment. Students do believe that the engineering courses delivering in-depth, discipline-specific knowledge, but it is not exposed to the level of industry expectations of a graduate engineer. Opportunities such as internships, industry projects, workshops, community work programs are not possible to be given to all students, and there are some instances where the students do not completely understand the requirements and expectation of the industry market. In order to develop an ideal academic curriculum focused on closing the gap with the industry, it is essential to understand the future of education, industry needs, societal importance on upcoming trends. This digital age expects our graduates to work on their in-depth discipline-based knowledge and compete with the practice-based environment. Therefore, the study highlighted the gap between the existing curriculum and proposed the academic bodies to pro-actively address these gaps by incorporating the above-mentioned precautionary measures to make the graduates more employable. This research project outcomes extends its focus on the sustainable development of curriculum structure to obtain quality education. It reveals the need for academic environment to deliver a quality education and to ensure the skills acquired by the students should support their requirement to access the job market and attain employment [48].

6. Conclusions

Through the study conducted on the cohort of students' perceptions, having an industry-based co-designed curriculum for engineering students is identified as one of the critical factors influencing graduate employability. Many academic environments have already obtained formal policies for encouraging their academic staff to collaborate with the industry on specific research projects as a measure to address this gap. Despite the proactive measures undertaken, it is clear from the survey data that a gap exists in the collaboration of academia and industry along with the pro-active participation of the students. However, there are many opportunities for collaborating with industry partners in the existing course structure. The need for satisfying the requirements of the research agenda of both industry and academic partners, along with the research and development plans, makes this collaboration even more challenging and productive. In research and development, the university requires support from the industry in the form of funding and technology, while industry obtains new innovations created by the university, which makes the collaboration a fruitful venture for both the parties. Along with the retrofitted modifications incorporated into the curriculum, there needs to be a significant improvement in the interest of student participation, which will lead to an effective change in improving the graduate employability. Therefore, the study highlighted in this research article played a vital role in highlighting the gap that exists within the current system, and highlights the significant benefits associated with the collaboration between the industry and academics which will help in gaining increased access to students to explore on their future employability.

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Appendix A

Q1. What is your age?
Q2. What is your gender?
Q3. Are you an international student?

Q4. Which of these fields best describe your major/discipline of study?
Q5. Your area of study?
Q6. Have you secured graduate employment now?
Q7. In which year of your course did you realise the importance of knowing about the skills required for employability?
Q8. Could you please tick the list of strategies that are imposed in your course of study to improve graduate employability?
Q9. Please complete the following questionnaire specific to your year of study, by giving individual rating for every year based on your expectations/ experiences? (1—expected and experienced, 2—expected but not experienced, 3—experienced but not expected, 4—Not expected nor experienced, 5—not applicable).

Question 1—Does your course emphasis on the discipline-specific knowledge and capabilities associated with one's degree?—Comprehensive, conceptual, and an in-depth understanding of engineering fundamentals is delivered.

Question 2—Does your university engage you with respect to oral, written and interpersonal communication in line with the course structure?—Effective oral and written communication in professional and lay domains in the forms of assignments and presentations.

Question 3—Does your course underpin the use of digital technologies to find, use and disseminate information form the digital world effectively?—Fluent use of engineering techniques, tools and resources to enhance the research.

Question 4—Does your course give you a chance to improve your critical thinking by in-depth analysis of the problem and evaluation of information?—Helps you in using engineering methods to solve a complex engineering problem.

Question 5—Does your course give you a chance to quickly adapt to the change and incorporate new perspectives to solve a problem?—Gives you a chance to be creative, innovative and pro-active in incorporating new ideas to solve a problem.

Question 6—Does your course involve phases of study which make you work and learn independently and take responsibility for your own actions?—Do you manage yourself independently and maintain professional conduct.

Question 7—Does your course give you an opportunity to work in a group to effectively collaborate your ideas?—Effective team membership and team leadership.

Question 8—Does your course engage you ethically in a professional context to mingle with diversified communities and culture in a global aspect?—Ethical conduct and professional accountability.

Q10. What is your opinion about graduate employability and how effectively is this incorporated in your curriculum?

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