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# An Evidence-Based Approach to Employability Curricula and Transferable Skill Development: A Mixed Methods Study

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# An Evidence-Based Approach to Employability Curricula and Transferable Skill Development: A Mixed Methods Study


## Abstract

Within Science, Technology, Engineering and Mathematics (STEM), there is cross cultural evidence of gaps in transferrable skills between new graduates' capabilities and employers' expectations. These gaps hinder graduates' ability to obtain employment. Herein we report the impact of an evidence-based approach to closing skills gaps in senior STEM students based on their self-perceived employability. A capstone-style, for-credit elective module was developed for STEM students based on the skills gaps found in prior research. The impact of this intervention was measured utilising a mixed-method design. Students' self-perceived employability pre- and post- module completion were measured, along with post-module reflections collected via a series of open-ended questions. Overall, the module had a positive impact on student self-perceived employability, with the greatest impact in the areas of 'awareness of opportunity', 'perceptions of future success', and 'confidence in skills'. A *post hoc* analysis indicated significant increases in post-module completion 'confidence in skills' for women, an important insight given the gender-based issues in career progress and retention in STEM. The qualitative analysis suggested that students highly valued the opportunity to develop job application and transferable skills. The results are discussed in the light of the importance of evidence-based, curriculum-embedded interventions in guiding students to employment.


## Practitioner Notes

1. Employer dissatisfaction with new graduates has been reported across multiple fields and studies in STEM, which has led to the discovery of skills gaps between graduate ability and desired employability skills.
2. There is a high demand for skilled STEM graduates, but low employer dissatisfaction and graduates report missing transferrable skills when they enter the workforce. This suggests that students need to further develop relevant transferable skills throughout their degree before they attempt to enter the workforce.
3. The curriculum for the described career development module was evidence-based and developed using the skills gaps found in prior research.
4. Students reported that the career development module built awareness around their transferable skills and enabled them to gain a stronger sense of self perceived employability.
5. The evidence-based approach to employability curricula has informed, prepared, and therefore likely empowered students to navigate an uncertain workforce.


## Keywords

Self Perceived Employability, Career Development Curriculum, STEM Employability, Graduate Outcome

# Introduction

The concept of employability is multifaceted and has various definitions depending on the perspective of stakeholders (Andrews & Higson, 2008; Harvey, 2005). In general terms, employability skills are a 'set of transferable skills' that individuals develop and/or identify that are highly desired by potential employers (Harvey, 2001). These skills include a mix of transferable skills (e.g. communication, critical thinking and teamwork) and career management skills (Bridgstock, 2009; Gilbert et al., 2004). However, obtaining these skills alone is not enough. To gain appropriate employment individuals also need to be aware of their employability and articulate it in order to be successful (Goodwin et al., 2019; Hill et al., 2020), a process rooted in metacognition (Knight & Yorke, 2002). There is evidence that graduates may have the skills required for employment but lack awareness of them (Jackson & Tomlinson, 2020; Strachan, 2016; Tymon, 2013), and may lack employability confidence at point of graduation (Durham et al., 2020). Additionally, the labour market and, therefore, graduates' careers, are becoming more unpredictable (Schoon & Heckhausen, 2019; Tomasik et al., 2009). With the addition of the COVID-19 pandemic and the rapid transition to online work, graduates need all the tools to meet the challenges of the modern workplace.

Employer dissatisfaction with recent graduates has been reported, with a review uncovering a skills gap between learning outcomes and employability skills across a wide range of fields (Bandaranaike, 2018; Eldeen et al., 2018). The concern that graduates lack basic employability skills extends to STEM students (Hill et al., 2019; McGunagle & Zizka, 2020; Rayner & Papakonstantinou, 2015; Sarkar et al., 2017) and is a challenge to STEM workforces in multiple countries (Hanson & Overton, 2010; Ryan & Benson, 2020; Wakeham, 2016). However, there is still a high demand for STEM graduates as they possess skills that can be transferred across various sectors (Lowden et al., 2011; Sarkar et al., 2016; Saunders & Zuzel, 2010).

The paradoxical association between the demand for skilled STEM graduates and the reported dissatisfaction with this same cohort's work preparation, suggests that students need to be given the opportunity to further develop relevant transferable/generic skills throughout their degree (referred to as 'transferable skills' in the rest of the paper). Promoting awareness and instilling confidence in employability skills are just as important as developing those skills throughout a degree (Jackson & Tomlinson, 2020). Collectively, these findings highlight the need for a career development intervention to specifically bridge to these gaps for STEM students.

## Career Learning Module

There have been many calls for universities to include employability curricula (learning and teaching shown to support key aspects of employability e.g., transferable skills and navigation of the job application process) and take responsibility to guide students through to the workforce (Bandaranaike, 2018; Goodwin et al., 2019; Tymon, 2013). Numerous universities have embedded

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short workshop interventions designed to assist students to gain employability skills (e.g. Akkermans et al., 2015; Bridgstock, 2009; Sarkar et al., 2017), which have all had positive impacts on student perceptions and/or awareness of employability. The career development learning module in this study was developed following a successful short workshop-based intervention (Sarkar et al., 2017), which focused on informing and developing student transferable skills for the workforce. The evidence-based career development module herein, was designed specifically to address the skills gap (and awareness of those skills) between the knowledge developed through undergraduate study and the skills required by employers for students in STEM (Sarkar et al. 2016). The module aims to enable students to a) develop transferable skills, b) to understand and articulate those skills and how they can use them, and c) to instil awareness of opportunity. The transferable skills explored throughout the module were tailored specifically for the skills gaps in new graduates and included commercial awareness, professional communication, leadership, teamwork, self-reflective learning, critical thinking, career management and workplace etiquette. The students were also given an opportunity to meet with individuals from a large range of STEM graduate employers. Additionally, the module aimed to help students understand the skills they had developed in the context of the workplace. Whilst these were STEM students, the approach of 1) evaluating skills gaps (either directly or via literature), 2) constructing a module to close those gaps and 3) following up by measuring student perceived-employability gains, is an approach that could be applied in any field.

The design of the career development module was informed by constructivism (Gil-Pérez et al., 2002; Matthews, 1993), where learning was guided with an understanding that students construct meaning of concepts based on their own beliefs and experiences, and through interactions with peers and educators. Throughout the module, students were exposed to authentic situations that emulated probable encounters they may experience within the workforce (e.g., an interview roleplay, emailing colleagues, or discussing the ethical considerations in an authentic workplace situation). Students also had the opportunity to discuss, reflect, evaluate their ideas, and compare them with the ideas of others. Details of the structure of the educational module and how it was run can be found in Appendix 1.

The aim of the current study was to evaluate the impact of a semester long module designed to increase the employability skills of students. The self-perceived employability questionnaire (Appendix 2) was used as an educational tool in the classroom.

## Perceived Employability

Self-perceived employability is thought to be complex and involve a variety of internal struggles and external labour forces that work together to shape an individual's self-perception (Rothwell et al., 2009). Individuals with low self-perceptions of employability have negative views of the labour market (Jackson & Tomlinson, 2020), low self-efficacy, career satisfaction (Dacre Pool & Qualter, 2013), experience job exhaustion (Kinnunen et al., 2011), and poor mental wellbeing (Berntson, 2008). This can lead to individuals feeling disempowered and not able to cope with ever changing demands (Holmes, 2006; Holmes, 2001) which may in turn, be a contributing factor to employer dissatisfaction. As such, an individual's confidence in ability (Jackson & Tomlinson, 2020), awareness of self, along with the capacity to reflect and to self-critique (Knight & Yorke, 2002) are just as important as transferable skills gained throughout a degree.

The self-perceived employability instrument used in this study was constructed by Rothwell et al. (2009) to bring together the students' self-perception of four domains: their self-belief, their university, their field of study, and the state of the external labour market. Importantly, the instrument includes internal (labour market, others view of the university/field) and internal forces (engagement with studies, confidence in skills, self-awareness of the labour market). Both forces are widely recognised as playing an important role in perceptions of employability (Kirschenbaum & Mano-Negrin, 1999; Rajan, 1997; Rothwell & Arnold, 2007) and their combination is key in achieving an instrument that accounts for that fact. Given the workforce structure that the modern graduate enters, and the importance of individual agency (as opposed to past models of mutual loyalty with an exchange of high job performance with job security (Sullivan & Baruch, 2009)), the individual self-efficacy lens used in this study is an important and deliberate choice.

It is important to note the specific role that self-perception has in employability. As articulated by Harari, McCombs and Wiernik (2021), perception is operative. An individual acts on, or reacts to, their own perception of their employability and has a known impact on those studying Science. For instance, (Correll, 2001) showed that women perceive themselves to be less competent at maths compared to men even though their test grades did not show that to be true. Further, work by Bench, et al. (2015) suggested further that men pursue careers in STEM more often than women do because they overestimate their ability. The use of the self-perceived employability instrument in the STEM careers learning context is therefore particularly apt.

## Method

A convergent mixed method approach was adopted (Creswell & Creswell, 2017; Creswell & Plano Clark, 2011). Students were asked to complete a 'Self-Perceived Employability' questionnaire (quantitative) in week one and again in the last week of the semester, along with a series of open-ended questions (post module, qualitative). By combining these methods to study the same effects, we can gain a deeper and more robust insight into the impact of the career development module on students.

### Data Collection

STEM students enrolled in the career skills module were invited to participate in the study during the first workshop. Students were asked to complete the pre and post self-perceived employability surveys as part of learning activities and were asked if they consented to their results being part of the study where their results would not be reviewed by the researchers until completion of the module.

A total of 296 out of 670 enrolled students were recruited throughout 2018 and 2019 (44% uptake) completing the self-perceived employability questionnaire both pre- and post- module completion, (Women, *n* = 162; Men *n* = 131; Other *n* = 3). Of these 296 students, 112 (38%) were studying a non-science STEM degree including biomedical sciences (*n* = 39), human health (e.g. immunology and pharmacology; *n* = 31), mathematics (*n* = 20), psychology (*n* = 12) engineering (n=8), and computing (*n* = 2). Therefore, we will refer to this module as being taken by STEM students. In addition, 55 students were enrolled in a double degree, a popular degree structure at the university and widely available in Australia. The double degree sees a student do at least one extra year and graduate with majors in two different Faculties (e.g. Bachelor of Arts/Science with

majors in Chemistry and Human Geography). For the qualitative portion of the questionnaire, 162 (women, *n* = 94; men *n* = 65; Other *n* = 3) students responded to the open-ended questions post completion.

### Self-Perceived Employability Questionnaire

The self-perceived employability questionnaire used in the current study is from Sarkar et al. (2017). It was originally used to assess the effectiveness of a career workshop that the career learning module in this current study was based on (as detailed in the introduction). The questionnaire was based on a 21-item questionnaire developed by Rothwell et al. (2008) which designated facets such as 'Confidence in Skills', 'Awareness of Opportunities' and 'Perceptions of Future Success' as internal factors which are related to an individual's self-belief, and external factors such as 'University Brand' and 'External Labour Force'. Sarkar et al. (2017) made some modifications to the wording of the questionnaire to cater for STEM students and included three additional items related to future skills building. Each item was measured using a 5-point Likert scale ranging from "Strongly disagree" to "Strongly agree" and was treated as ordinal data.

For a complete list of statements and for classification of statements into 'internal' and 'external' domains of self-perceived employability, see Appendix 2 and Table 1 in the results below.

### Open Responses

A series of open questions were designed to illicit a reflective response from the students to complement and expand on the self-perceived employability questionnaire responses, and were designed to capture the employability skills that students valued, how they planned to utilise the transferable skills they had become aware of, and their future concerns:

1. What do you think you learnt during this module that will be valuable for you as you apply for jobs and enter the workforce?
2. Of everything learnt in this module what do you value the most?
3. What have you done differently as a result of learning more about transferrable skills this semester?
4. What concerns you the most about your career in the near future?

### Data Analysis

The quantitative data were analysed using *SPSS* (version 26). In order to gain an accurate indication of the shift in responses pre- and post- module completion, a Wilcoxon Signed Rank Test was applied to each questionnaire item (Wilcoxon, 1992). As the data were gathered pre- and post- module completion and were non-parametric, comparing the median provides the most valid result (Pallant, 2020). After obtaining the *z*-values from the Wilcoxon Ranked Test, the effect sizes (*r*) were calculated in accordance with Rosenthal et al. (1994). It was assumed that 0.2, 0.5 and 0.8 denote small, medium and large effect sizes respectively, in accordance with Cohen's *d* for Wilcoxon signed rank test.

In order to determine empirical power, the r package 'MK power' in *RStudio* was used (Kohl, 2020) which determines required sample size via Monte-Carlo simulations (Raychaudhuri, 2008). The

power analysis revealed that with a paired group comparison (i.e. within group analysis) for a significance level of 0.05, a sample of 41 subjects per group (i.e. pre/post module) would be necessary to obtain statistical power at the recommended 0.8 level (Cohen, 1988). This was achieved with our sample of 296 participants.

For the open responses, a thematic analysis was conducted using *NVivo 12.* In accordance with the Braun and Clarke (2006) method, written responses were read many times over to gain a sense of the themes. Once themes were established, they were assigned a code manually. A series of inter-rater reliability tests was conducted with peers and co-authors to validate codes and was conducted by randomly choosing 20 (coded) quotes and assembling peers and co-authors independent coding. Codes were further developed to accurately encapsulate the themes and inter-rater reliability tests were repeatedly conducted until reliability was greater than 85% (3-4 times on average). Upon analysis, overarching themes were employed for Question 1 and 2, and were analysed together to determine students 'Most Valued Career Skills' that they had gained throughout the module. Questions 3 and 4 ('Current actions' and 'Future career concerns' respectively) were analysed separately.

# Results

### Quantitative Analysis: Self-perceived Employability

The reliability analysis revealed that the data had acceptable to good internal consistency (Taber, 2017), with a Cronbach alpha coefficient of 0.76 (pre-module completion) and 0.86 (post-module completion). A Wilcoxon Signed Rank Test revealed a statistically significant increase in students' overall self-perception of employability post-module completion for both 2018 and 2019 (2018; $Z = 8.75$, $p < 0.001$, $r = 0.75$, 2019; $Z = 7.30$, $p < 0.001$, $r = 0.60$). Therefore, the data from both 2018 and 2019 was combined ($Z = 11.18$, $p < 0.001$, $r = 0.72$). Sub-domains within the internal and external domains of the self-perceived employability were assessed to determine which domains of self-perceived employability were impacted the most (Appendix 2).

The statistical analysis (Table 1) revealed that the student perceptions were impacted across all three internal sub-domains, with effect sizes that were small to medium. Using the same self-perceived employability data, Figure 1 summarises the changes, or lack thereof, seen when comparing the students' Likert responses pre and post module.

Figure 1 shows that the change in internal sub-domains was due to a large number of students' perceptions positively shifting post-module completion. This demonstrates that the change in median score per sub-domain is a result of the movement of many students, instead of an extreme response by a smaller number of students. This is especially the case for the internal sub-domain 'Confidence in Skill', which saw a 19% score increase post-module completion (Table 1) and 79% of students increase their assessment of their confidence (Figure 1) indicating an impact on the vast majority of those in the study. Collectively, these findings suggest that the module enabled many students to become more aware of their work-related opportunities and become more positive about their work-related skills and their success in the future.

For the external sub-domains, overall student perceptions across both sub-domains became significantly more positive post-module completion (Table 1), although it must be noted that the effect sizes in all these cases were small (< 0.30) suggesting that the differences in each is trivial.

The statements which relate to 'Future Skills Building' (Sarkar et al., 2017) (Q19- Q21; Appendix 2), revealed no significant change of perceptions post-module completion (Table 1). However, with the high average domain score pre-module (14 out of a possible 15) there was little room for increase. This result gives us an insight into how important future skills building already was for these students.

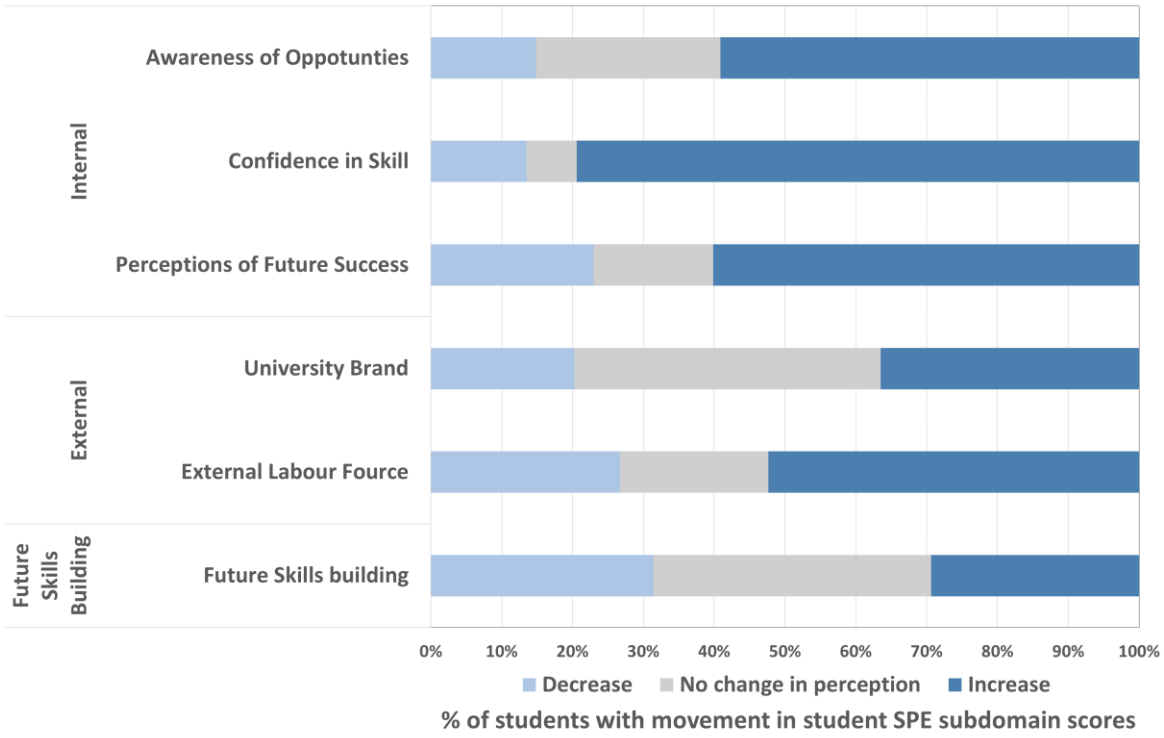
**Table 1**

*Effects Of Unit Completion on Individual Statements (N = 296) From the SPE Questionnaire.*

| | No. Items | *Mdn* Score | | % Difference | Z | *p* | *r* |
|---|---|---|---|---|---|---|---|
| | | Pre | Post | | | | |
| Internal Domains | | | | | | | |
| Overall | 12 | 45 | 50 | +11.1% | 11.97 | <0.001 | 0.70 |
| Awareness of opportunity | 2 | 7 | 8 | +14.3% | 9.204 | <0.001 | 0.54 |
| Confidence in Skill | 6 | 21 | 25 | +19.0% | 11.950 | <0.001 | 0.69 |
| Perception of Future Success | 4 | 16 | 18 | +12.5% | 7.697 | <0.001 | 0.44 |
| External Domains | | | | | | | |
| Overall | 6 | 22 | 23 | +4.5% | 6.00 | <0.001 | 0.35 |
| University Brand | 2 | 8 | 9 | +12.5% | 3.895 | <0.001 | 0.23 |
| External Labour Market | 4 | 13 | 14 | +7.6% | 5.312 | <0.001 | 0.31 |
| Future Skills Building | | | | | | | |
| Future skill building | 3 | 14 | 14 | 0% | 0.82 | 0.935 | 0.05 |

**Figure 1**

*SPE Subdomain Score Movement Pre- Post Unit Completion as a % of Total Cohort (N = 296).*




A *post hoc* analysis of gender was conducted to elucidate any gender differences in responses to statements pre and post module completion. A Mann Whitney-U test was conducted to test the gender-dependant effects and it was found that the greatest difference in responses was for 'Confidence in Skill'. When gendered effects were investigated (i.e. perceptions of men vs women, pre and post module completion); it appeared that men scored significantly higher than women pre-module completion, with the difference between men and women becoming non-significant post-module completion (Table 2). Collectively these results suggest that both men and women's 'Confidence in Skill' shifted divergently (i.e. men decreased, women increased) but led to more comparable scores post module completion. No other demographics analyses were possible due to both the lack of robust social economic status data and the fact that splitting the data by other variables (e.g. major) would result in groups that were too small for analysis.

**Table 2**

*'Confidence in Skill' Score comparison of Men and Women, Pre-Post Unit Completion.*

| | Mean Rank | | % Difference | Z | *p* | *r* |
|---|---|---|---|---|---|---|
| | Pre | Post | | | | |
| Men | 169.81 | 154.56 | -9% | -6.26 | <0.001 | 0.55 |
| Women | 128.55 | 140.88 | +11% | -9.38 | <0.001 | 0.74 |

## Qualitative Analysis: Open Responses

The thematic analysis of the open-ended responses identified three overarching themes: (i) 'Most Valued Career Skills' (the recognition or development of skills throughout the module which can be applied to future work or life experiences; open responses to Q1 and Q2) (ii) 'Impacts on Career Development' (things they have done differently because of module completion; open responses to Q3), and (iii) 'Future Career Concerns' (major career concerns students still have after completing the careers module; open responses to Q4).

### *Most Valued Career Skills Learned*

Students most valued skills were related to 'Job Application Development' (Table 3, 1.1). Closer examination revealed several sub-themes related to application preparation, interview skills, and response to job applications. This result is consistent with the quantitative results above, specifically to questions around 'Awareness of Opportunity' in which students were asked about their confidence to produce high quality job applications and their success in job interviews post module completion. This is reflected in the comment below:

> *This module has allowed me to learn not only about employment and how to apply or prepare a good application. I have also learned the importance of verbal and non-verbal communication. I learned how to write professionally, key words to show my skills and have become increasingly self-aware.*

Learning about transferable skills as a general concept was highly valued by the students (31%), with the recognition of current transferable skills and learning about transferable skills as a concept, both being reported (Table 3,1.2). Some transferrable skills were mentioned specifically (e.g., commercial awareness and communication) but more commonly students commented on the overall concept of transferable skills (Table 3, 1.2). These responses suggest that students may not have been aware of transferable skills, and/or which transferable skills they gained throughout their degree. One student commented,

> *I value learning about the concept of transferable skills and ways in which I can improve them and use them beneficially to acquire employment positions.*

Students also valued self-reflection as a tool for recognising their skills, strengths, and weakness (Table 3, 1.3). One student stated that through self-reflection:

> *I have been able to identify, articulate and accept my strengths and weaknesses which enable me to not only prepare more effectively for interviews and day to day work, but contribute to personal development as a human.*

Students also reported that self-reflection helped better understand and appreciate their academic learning and how they might use this learning in the workforce, as shown here:

> *Self-reflection and realising who I am, and the skills that I have, and noticing how relevant the things that I learn in class are in the real world e.g., when we learnt about copywrite, patents, trademarks, loss prevention plus money in companies. I understand why I have to do stocktake at work.*

***Impacts on Career Development***

The completion of the career's module inspired a sizable number of students to develop new skills for their entry into the workforce (Table 3, 2.1), which may be due to the module's emphasis that both developing transferable skills and learning how to articulate them is key to gaining employment. As a result, the concept of transferable skills influenced other aspects related to future employability leading to future student actions, as reflected in the following quote:

> *I have started acquiring important transferable skills. This has made me ready to put what I have learnt in this module into practice.*

In addition, self-reflection appeared in students' comments and was identified as a tool to improve awareness and develop self-confidence (Table 3, 2.5), which may also be attributable to the increase in the 'Confidence in Skill' quantitative result. As one student stated:

> *I have worked more on reflection, and I feel a lot more confident about my ability to find work after university knowing now how to find graduate jobs.*

***Future Career Concerns***

Students were very concerned with 'Gaining Employment' and their 'Future Career Path' (Table 3, 3.1 & 3.2). One student commented:

> *I'm not sure about where I'm supposed to start after university, and I'm very concerned about whether if my grades/skills would be enough to stand out among the different competitors for jobs in the future.*

Future work trends (i.e. 'External Labour Market') (Table 3, 3.2) concerned 16% of students. For example, one student reported:

> *My main concern is that due to the highly competitive nature of graduate jobs, I will not find a job. However, after completing this module, I have great confidence in my ability to present myself as "the best fit" for the role and valuing the skills I have learnt.*

**Table 3**

*Thematic Analysis for Open Responses as a % of Total Cohort (n = 324 for Q1 & 2 combined, n = 162 for Q3 & 4 individually).*

| Themes | Code | Explanation | Frequency | Example Quote |
|---|---|---|---|---|
| 1. Most Valued Career Skills | | | *n* = 324 | |
| 1.1. Job Application Development | | | 78% | |
| | PA | **Prepare for Job Application:** Includes writing a CV and cover letter. | 38% | "This module has allowed me to learn not only about employment and how to apply or prepare a good application." |
| | IS | **Interview Skills:** Improving and/or practicing interviewing skills. | 27% | "I learnt the importance of interview preparation, both in terms of professional appearance and practicing behavioural questions." |
| | RA | **Responding to Job Advertisement:** Understanding what employers require and how to respond to key selection criteria. | 14% | "I feel that the job application component taught me a lot about how to apply for jobs. I also learnt what employers are generally looking for." |
| 1.2. Transferable Skills | | | 42% | |
| | GN | **General Transferable Skills:** Recognising and learning about general transferable skills gained throughout personal and professional experiences. | 31% | "I learnt about skills and attributes that are important to employers that are not covered in my degree". |
| | CA | **Commercial Awareness:** Includes the specific understanding of their chosen discipline. | 11% | "Having a greater commercial awareness will be valuable, particularly as a science graduate." |
| | CM | **Professional Communication:** The improvement/development of professional communication. | 10% | "A lot of the discussion regarding verbal communication/ what to do when there is a communication breakdown will be useful." |
| 1.3. Self-Reflection | | | 16% | |

| | | | | |
|---|---|---|---|---|
| | SR | **Self-Reflection:** Obtaining or expressing awareness of oneself to recognise strengths and limitations. | 16% | "I have gained the ability to reflect upon myself and the skills and knowledge I have and identify once that I need to improve upon or gain." |
| 2. Impacts on Career Development | | | *n* = 162 | |
| 2.1. Skills Building | | | 35% | |
| | TS | **Gain Transferable Skills:** Learning (or seeking to learn) skills to improve employability. | 20% | "I have gone out of the way to learn more skills that would make me more employable. I have also focused on building upon some of my skills." |
| 2.2. Updating Job Application | | | 16% | |
| | UP | Updating Job Application | 16% | "I have updated my resume to include some of my transferrable skills that I hadn't really paid much attention to." |
| 2.3. Increasing Awareness | | | 18% | |
| | IA | **Increasing Awareness:** Regarding future employability, world events, and commercial awareness. | 18% | "I've built up more knowledge about what is happening in the world." |
| 2.4. Self-Reflection | | | 11% | |
| | SR | **Active Self-reflection:** Used self-reflection as a tool to grow personally and further develop employability. | 11% | "Reflected after situations so that I can complete tasks better next time. Noticed when I am using them and using them to my advantage." |
| 3. Future Career Concerns | | | *n* = 162 | |
| 3.1. Gaining Employment | | | 43% | |
| | NQ | **Not qualified Enough**: With respect to experience and/or skills to gain future employment. | 23% | "Not being able to find a job in my desired field as it's not related to my degree and I don't have adequate experience." |
| | UP | Under employment or Unemployment | 16% | "My major concert is finding employment in a competitive job market." |
| 3.2. Future Career | | | 35% | |

| | | | | |
|---|---|---|---|---|
| | CP | **Unsure of Career Pathway:** Includes job progression in future employment. | 16% | "I am still very unsure of what pathway I'd like to follow when I finish my degree." |
| | JS | **Job Satisfaction:** Concerns over not gaining job satisfaction, a well-suited career or maintaining work-life balance. | 15% | "My concerns for my career in the future is to find a job in the future that is fulfilling for me and I find interesting." |
| 3.3. External Labour Market | | | 16% | |
| | WT | **Workforce Trends:** Factors that impact chance of entering the workforce and/or sustaining a career. | 16% | "I am concerned that as time goes on, there will be less jobs available." |

Given the gender-based differences seen in the ‘Confidence in Skills’ subdomain of the quantitative analysis, the qualitative data were interrogated for indications of obvious gender differences. No noticeable variation in counts for a male versus female student comparison was found for the themes or sub-themes, therefore no further analysis was deemed necessary nor reasonable given that an exploration of gendered impacts was not part of the study design.

## Discussion

There has been a rise in discussions surrounding the responsibility of universities regarding the preparation of students for the workforce and the various approaches which could be used to highlight transferable skills in an attempt to facilitate job-readiness in new graduates (Bandaranaike, 2018; Jackson et al., 2022; Winchester-Seeto & Piggott, 2020). The career development module described in the current study is an approach that can prepare and inform students of the employment process ahead, whilst stimulating self-awareness in their transferable skills. The findings demonstrate that this evidence-based career development module resulted in significantly increased levels of self-perceived employability in this cohort of students.

The quantitative analysis specifically uncovered that ‘Confidence in Skill’ and ‘Awareness of Opportunity’ were highly impacted. As highlighted in the introduction, perception is operative. Thus, the increase in self-perceived employability in this cohort of students is likely to better equip or motivate them to put themselves forward and apply for meaningful work as they prepare to graduate. The qualitative analysis provides further insights into how students are preparing to enter the workforce after completing the career module. The analysis revealed students’ motivations to build on existing transferable skills and take a more introspective approach using self-reflection. These findings are consistent with studies that have demonstrated the importance of self-reflection when building awareness of employability (Hill et al., 2020; Sarkar et al., 2017; Sarkar et al., 2019) and the emphasis put on reflection in Knight and Yorke’s (2002) USEM model. Self-reflection builds self-confidence and better prepares students for future employment (Archer & Chetty, 2013; Brooks & Youngson, 2016) may need to be central to the module learning outcomes for such a strong impact via introspection to be observed.

It should be noted that there were a large proportion of students that valued skills related to job application development more highly than transferable skills. This may be due to an immediate need to find work as this was often the students last year of study. There is also the possibility that a proportion of these students have never applied for professional work (as opposed to casual work), and the job application development activities may have provided them with a ‘dress rehearsal’ before graduation. Despite the positive impact on student perceptions, especially within the quantitative facet of ‘Perception of Future Success’, students were still concerned about the prospect of not gaining suitable employment, as explored in the qualitative analysis. Concern was mainly centred around the uncertainty of their career paths and external labour forces. This concern may have arisen because they are now more aware of the number of issues that impact employability.

The students place high importance on their future as evidenced by the high pre-post career module quantitative score of 'Future Skills Building’ coupled with the concerns about being underqualified or being worried about future job satisfaction found in the qualitative analysis. It can pose an issue with student well-being, as employability is intertwined with self-identity. As

such, failure to transfer into a relevant graduate position might lead to a 'failed identity', where individuals feel rejected and unworthy (Holmes, 2006; Holmes, 2001). To avoid this, it is important to prepare students for various graduate outcomes, which includes not gaining a role in a desired position (Holmes, 2015; McDonald & Waite, 2018). Even though the module was aimed at showing students what their transferable skills were, how to articulate them, and the fact that they can be used in many different contexts, lack of qualifications and job satisfaction persisted as an ongoing concern for some students. Placing the module in the penultimate year would allow students more time to work on career related concerns. In addition, an extra year to address career preparation concerns could help some students' stress levels while they learn more about career options and the needs of different careers.

Increases to self-perceived employability were especially noticeable when gender was considered as the self-perceptions of 'confidence in skill' of women and men varied significantly pre-module completion but became more comparable post-module completion. Empirical studies have shown that men have higher confidence in their own ability compared to women (Bengtsson et al., 2005; Bernoster et al., 2018) which at times can work out well, especially when competing in the market (Niederle & Vesterlund, 2008) but can also lead to increased risk taking (Niederle & Vesterlund, 2008) and over-estimation of oneself (Reuben et al., 2012; Wüst & Beck, 2018). In fact, literature also shows men as having better options in the labour market and as being more employable (McQuaid & Lindsay, 2016; Qenani et al., 2014). Given the literature showing males tend towards natural "honest overconfidence" (Reuben et al., 2012) the decrease seen in 'Confidence in Skills' of the male students could come about via a tempering of natural "honest overconfidence" to a more informed and grounded level of confidence after the learning experience, especially given the level of reflection that was both taught in the module and commented on by the students in the qualitative analysis. This possibly leads to a more accurate self-perception that could position male students to better prepare for the workforce entry. Women are more likely to underestimate their ability (Wüst & Beck, 2018) and have lower wage expectations compared to men (Briel et al., 2021; Fernandes et al., 2021) The result of the current study suggests that the process of career development training equalises perceptions of confidence of skills between women and men, allowing them to be more self-aware of the value of their skills and ability. The process of if and how this translates to the workplace could make a fascinating follow up study.

**Limitations**

Employability is intertwined with identity and external factors. Thus, this study is limited by factors such as socioeconomic status and race which were not collected. By adding such demographics to the study design, we may gain valuable insight into how different groups of students respond to a career module differently. Further research in this area would be of particular interest, with many governments working to understand why some groups are underrepresented in STEM disciplines, in order to advance educational and workplace inclusion, and to expand their scientifically skilled workforce (Funk & Parker, 2018; JOBS, 2020; NCSES, 1994-). The study is also of modest size, and a larger study could give further certainty and depth to the conclusions herein.

The data was obtained from students from one Australian university, which risks homogeneous sampling and may not be reflective across other institutions or geographical areas. As the issue of employability after graduation is a global concern (Archer & Chetty, 2013; Khare, 2014; Pitan, 2016; Vargas et al., 2018) gaining an understanding of how a career module such as this one has the ability to support students across different cultural contexts would be useful. Investigation of the impact of gender on career skills confidence in a range of different environments would add significantly to the important insight that the module all but equalised confidence in skills between the genders, closing the significant difference seen between the two cohorts before the module.

Finally, this study does not seek to make conclusions about employment. Instead, it seeks to understand self-perceived employability at the time of the study. There are many other factors that determine whether a graduate gains employment. To assess long-term impact a longitudinal study focusing on actual graduate outcomes would make an informative follow up.

## Conclusions and Implications

This module was intended to provide a bridge to close the graduate skills gap by educating students about transferable skills, including how to articulate those skills through self-reflection. The study indicated an increase in the self-perceived employability in the cohort and uncovered that students valued the development of basic job attaining skills and were proactively working on developing their transferable skills including post-module plans. The growth in students undertaking this module indicates a strong interest from students in engaging in career-linked learning in a contextualised, in-curriculum module. In the light of scholarship of teaching and learning, the value this evidence-based career module lies within the approach, which gives visibility and credibility to the activities and is inclusive of students with work/caring/other responsibilities without time to access career development learning outside of the curriculum.

The surprising result of the *post hoc* analysis suggests that career learning may have different impacts on men and women, but ultimately led to more comparable perceptions in the domain of ‘Confidence in Skill’. The workplace impact of this change in the graduates is unknown, however, as self-perception is operative, it is possible that the women in this cohort will enter their career search with more confidence which will positively influence their path from being a student to being an employee. Additionally, men within this cohort may possibly enter their career with a more realistic approach and realistic self-perception. The evidence-based approach discussed in this paper can be seen as a model for addressing other skills gaps beyond STEM. Given the central role that reflection plays in career skills development, as the qualitative results indicate, future career interventions may need to prioritise the use of reflection to achieve similar results. The importance of showing students that career development is an incremental process may also be important in constructing a successful career development intervention.

Further, the career module made students more aware of their employment opportunities and different career pathways. Overall, the module appears to have inspired students to improve their employability and has helped them realise their potential. Providing students with these tools has become more important than ever, as the COVID-19 pandemic has further disrupted the workforce and increased uncertainty for graduates, at least in the short term. By informing students of their transferable skills and increasing their awareness of opportunity, we may be able

to provide further security for students through education, as they navigate their way into employment through economic instability.

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## Ethical Statement

All work was performed in accordance with Monash University's low risk human ethics committee (number: 12549).

## Conflict of Interest

The authors disclose that they have no actual or perceived conflicts of interest. The authors disclose that they have not received any funding for this manuscript beyond resourcing for academic time at their respective university.

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# Appendix 1

The module focused heavily on student self-reflection (50%), where students were required to reflect weekly on what they have learned and what it means to them personally and professionally (see appendix 2). The majority of the module was based around students learning how to find work, including understanding what their strengths and weaknesses are, understanding different workplaces, networking (e.g., building a LinkedIn profile) and constructing a job application (appendix 2). Each student also had to find a position to apply for based on the type of role they might apply for when they graduate. Two weeks later they then had a mock interview for the position as an in-class activity which gave students the opportunity to be interviewed and to be the interviewer.

Students were introduced to the concept of commercial awareness in the context of scientific industry and an associated assessed group product development pitch required students to work in a team to develop, manage and market a novel product for manufacture and distribution. Students were also introduced to professional practices, including professional communication, intellectual property, finance, marketing, team-work and problem-solving. Various non-graded in class activities were designed and included case-based and problem-based learning approaches and collaborative learning within small groups (appendix 2). The weekly reflections allowed students to self-assess their progress. The career development module was led by two scientists with significant experience outside academia.

**Table (i)**

*Assessment Summary of Career Skills for Scientists*

| Assessment | Description | Weighting |
|---|---|---|
| Career Plan | LinkedIn Profile | 2.5% |
| | Cover letter, CV & Response to selection criteria | 22.5% |
| | TOTAL | 25% |
| Reflective Portfolio | Reflective log | 10% |
| | Interview reflection | 10% |
| | Final reflection | 40% |
| | TOTAL | 60% |
| Business Pitch | Innovative shampoo or sunscreen | 5% |
| Blog Post | Scientific writing for a lay audience | 5% |
| Workshop Tasks | Peer to peer interviewing practice | 5% |

# Appendix 2

**Table (ii)**

*Self-perceived employability questionnaire questions*

Responses are on a 5 point Likert scale - strongly disagree, disagree to some extent, no strong opinion, agree to some extent and strongly agree. Shaded areas represent:

| | |
|---|---|
| Internal Domain | |
| 1 | Employers are eager to employ grads from my uni |
| 2 | The reputation of this university is a significant asset to me in looking for a job |
| 3 | The career I am aiming for is in high demand in the labour market |
| 4 | My science degree will lead to a career that is highly desirable to society |
| 5 | There is generally a strong demand for science grads at the present time |
| 6 | There are plenty of job vacancies for science grads in the geographical area where I am looking |
| 7 | I can easily find out about opportunities in my chosen career |
| 8 | The skills and abilities that I possess are what employers are looking for |
| 9 | I have clear goals for what I want to achieve in the next 3-5 years |
| 10 | I am satisfied with the development of skills at uni needed to achieve my career goals |
| 11 | I feel I need to work hard to develop the skills required to achieve my career goals |
| 12 | I want to be in a position to follow my preferred career |
| External Domain | |
| 13 | What I do in the future as my career is very important to me |
| 14 | I am confident in my ability to prepare a high-quality job application |
| 15 | I am confident of success in job interviews |
| 16 | I feel I could get any job as long as my degree in relevant |
| 17 | I feel I could get any job as long as my skills are relevant |
| 18 | In order to increase the likelihood of gaining employment I will need skills and attributes in addition to those developed in my degree |
| Future Skills Building | |
| 19 | I believe I have capacity to make a difference in the workplace |
| 20 | I am aware that I will need to learn constantly in the workplace |
| 21 | I believe I have ability to reflect upon my learning in the workplace |