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Research-based versus work-integrated learning: Are there any differences in perceived learning of employability skills and attributes?

Siew Hong Lam[1], Cynthia He[1]

[1]*National University of Singapore, Singapore, Singapore*

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Abstract: Employability skills and attributes are perceived to be essential for the modern workplace. Employers expect university education to produce graduates with such skills and attributes. While research-based learning (RL) and work-integrated learning (WIL) have long been used for training undergraduates, the perceived learning of employability skills and attributes between students who had undergone RL or WIL have not been compared. This study compares the perception of employability skills and attributes between undergraduates who had completed an RL or WIL program. The study identified differences in perceived importance of employability skills and attributes between RL and WIL students that may motivate learning differently. The findings also indicate that RL is viewed less positively compared to WIL in terms of equipping students with employability skills and attributes. The study has implications on how we design RL and WIL to nurture employability skills and attributes within an undergraduate science curriculum.

Paper: Introduction

Employability skills and attributes could range from disciplinary-specific and generic skills to interpersonal skills and personal attributes that increases the likelihood of an individual in gaining employment and develop successful career (Yorke & Knight, 2006). Employers perceive that graduates with these skills and attributes will better adapt, perform and progress in the modern workplace (Succi & Canovi, 2019). Employers expect university education to produce graduates with such skills and attributes to meet the rapidly changing demands of the workforce (Tomlinson, 2008).

The National University of Singapore (NUS) life science curriculum have long employed undergraduate research programs, and more recently incorporated a work-placement program, as part of its efforts in preparing graduates for the workforce. Traditionally, research-based programs have been used to train science undergraduates in many universities. Benefits of research-based learning (RL) programs include gain in knowledge, skills, attributes and preparation for future career have been reported (Seymour et al., 2004; Stanford et al., 2015). Likewise, work-integrated learning (WIL) programs have been recognized to be useful for the development of employability skills and

attributes especially in professional degrees (Crebert et al. 2004; Jackson, 2015). However, the perceived learning of employability skills and attributes between science students who had undergone RL or WIL have not been compared. This is especially important in the training of science undergraduates where RL has been the traditional mode of training and WIL is gaining wider adoption. This study compares and determines the differences in perceived importance and learning of employability skills and attributes in life science students who had undergone either the RL program or WIL program under the NUS life science curriculum. It also determines the perceived difficulty of their training programs and their perceived usefulness in preparing them for future employment and work-readiness.

Method

An online survey was conducted on soon-to-be-graduating fourth (final) year undergraduates at the end of their work-based or research-based programs under the NUS Life Sciences curriculum in the year 2018 and 2019. The total respondents consist of 171 and 147 Life Sciences undergraduates who completed their respective work-based and research-based training programs as part of their graduation requirements. There are no specific pre-requisites for the two programs and the students were not selected for the programs based on their academic performance.

The study investigated 18 items that can be broadly grouped under five categories i.e. (I) *Disciplinary Knowledge and Skills*, (II) *Ethics and Professional Awareness*, (III) *Thinking Skills*, (IV) *Information, Communication and Interpersonal Skills* and (V) *Employability Attributes*. The investigated items were adapted from Rayner and Papakonstantinou (2015) and Sarkar *et al.* (2016) who compiled a list of knowledge, skills and attributes based on a substantial literature review and tested them on science graduates and the employers.

The survey consisted of three major sections; section 1 focused on student's perception on the importance of the 18 items in the course of their work or research training. Section 2 focused on student's perception of their own abilities and their perceived learning gains. Section 3 focused on student's perception of the difficulty of their training, usefulness of their training for future employment and their confidence in joining the work-force (work-readiness). Using a five-point or seven-point Likert scale, students were asked to rate the items in the questionnaire. Descriptive statistics were generated and Student's *t*-test was employed to infer statistical significance of mean ratings between students from the RL program and WIL program. Statistical significance was inferred at $P<0.05$ and $P<0.0025$.

Results

In addressing the perceived importance of the 18 items in a student's training program, it was found that all the survey items have mean rating above 5 (Quite Important) except for *Disciplinary Skills* rated by students from WIL. Based on the mean ratings, the top and bottom three items rated by students from RL were different from WIL. RL students indicated significantly higher mean rating than WIL students for *Disciplinary Knowledge, Disciplinary Skills, Quantitative Thinking* and *Resilience*. On the other hand, WIL students rated significantly higher for *Professional Awareness*, *Ethics Awareness,*

Management & Organizational skills, and *ICT* skills when compared to RL students. The findings suggest differences in perceived importance by RL and WIL students which may motivate learning of knowledge, awareness, skills and attributes differently.

In addressing perceived learning gain, RL students retrospectively indicated lower average rating than WIL students in all the 18 items and 14 of them were significantly (P<0.05) different, including five items that were highly significant (P<0.0025) at the start of their training programs. With the exception of *Disciplinary Skills*, RL students had lower average rating than WIL students on 17 items, and 15 of them were significantly (P<0.05) different, including 12 items that were highly significant (P<0.0025) at the end of their training programs. However, the average gain in rating, i.e. the difference between end rating and start rating, was significantly (P<0.05) different only for six items including three that were highly significant (P<0.0025). The findings suggest that RL students tend to rate themselves lower than WIL students with respect to their own employability skills and attributes although the learning gain were more comparable for some of the items.

Interestingly, 63.9% of RL students rated their work as 'Difficult/Very Difficult' compared to only 19.3% of WIL students. The greater 'difficulty' experienced by the RL students may have psychologically impacted their perceived employability skills and attributes. Moreover, only 66% of RL students rated their training program as 'useful/very useful' in preparing them for their future employment compared to 89.5% of WIL students. Even so, 81.6% of RL students were 'quite/absolutely' ready and confident to join the workforce compared to 97.1% of WIL students. Taken together, the findings suggest that the RL program is viewed less positively compared to the WIL program in terms of equipping students with employability skills and attributes. The study suggests the need to enhance RL program and to strategize its placement with WIL program within the undergraduate science curriculum to nurture employability skills and attributes.

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