EXPLORING STUDENT PERCEPTIONS OF EMPLOYABILITY SKILLS DEVELOPMENT USING RADAR CHARTS IN FIRST YEAR SCIENCE

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Summary

Development of employability skills is globally expected in undergraduate students; this is frequently approached through Personal Development Planning (PDP). However, science graduates are often reported as lacking the skills necessary for graduate employment.

An online distance learning first-year science module required students to use radar charts for PDP in each assessment. An online questionnaire evaluated students' perceptions of their employability skills development, and the efficacy of radar charts as a means of recording this. The questionnaire was sent to 636 students and 115 responded; this report is a thematic analysis of the open text questions. Students recognised development of several employability skills, though some found difficulty due to lack of self-confidence and challenges participating in asynchronous groupwork. A proportion of students found radar charts easy to use, though the majority used them to gain marks. Students found benchmarking their skills at module start challenging, and would benefit from more support with this, as well as the option to use other means of recording PDP.

Introduction

Despite criticisms and limitations of Human Capital Theory (Marginson, 2019; Wheelahan, et al., 2022) the link between employability skills developed through Higher Education and economic growth has been recognised for over half a century (Gillies, 2015). For some time, there has been concern about the employability skills of graduates in certain science disciplines e.g., following a UK Government review, Biological, Earth and Environmental Sciences were among those identified as having relatively poor graduate employment outcomes (Wakeham, 2016). Problems highlighted were that graduates sometimes lacked the transferable skills necessary for employment, and/or awareness of when they had developed them (Wakeham, 2016).

Following the European Commission's (1996) identification of the need for a learning society, Delors (2013) recognised the global importance of this, linking it to the four pillars of education. This theoretical framework identifies four interlinked pillars (set against the backdrop of lifelong learning): learning to know, learning to do, learning to live together, and learning to be. Employability skills are most prominently situated in "learning to do", but the links to lifelong learning are also important in "learning to be", e.g. self-perception and confidence. While the model fails to account for learning by adaptation, it provides a theoretical framework within which to situate this study in the context of lifelong learning provided by the Open University.

Electronic Personal Development Planning (ePDP) is widely used as a means of helping students to develop and recognise employability skills. Through reflection, students identify their strengths and weaknesses, and plan for improvement, thus developing independent skills for future personal and professional development (Cowan and Peacock, 2017). While there is evidence that this can be beneficial, e.g. in interview performance (Lackner and Martini, 2017), practice across undergraduate education is variable, student engagement is frequently poor, and academic staff have differing attitudes to facilitating PDP (e.g. McKenna et al., 2017a; Peyrefitte and Nurse, 2016).

The challenge of improving students' employability skills is often approached by embedding generic graduate attributes, capabilities or learning outcomes in qualifications. However, the disconnect between these and student engagement has been attributed to student perceptions of them as generic and unassessed (Jorre de St Jorre and Oliver, 2018). Furthermore, the importance of students' self-efficacy, and facilitating easy use of software may also be important factors influencing acceptance of ePDP (Ahmed and Ward, 2016). While there is broad agreement that the links between ePDP and its intended outcomes should be made more explicit, and that contextualisation

and assessment improve engagement, most studies are small scale. The variability between institutions means broader research can produce inconclusive or conflicting results (e.g. McKenna et al., 2017b); this limits generalisability, thereby highlighting the need for specific information at institutional, as well as sector level.

Background to this research

A first-year Open University multidisciplinary science module was launched in 2017. Learners studied by distance learning over 9 months, using an interactive Virtual Learning Environment (VLE) and were supported by an Associate Lecturer. The module included radar charts which were used by students to self-assess and provide a visual aid which helped them to reflect on their skills development. This was the first time that an Open University module had recorded skills development on radar charts: they were postulated to be an easy way for level 1 students to visualise their skills development and evaluating this assumption led to this scholarship project.

Students completed the charts periodically by self-assessing their skill level on a number of parameters on an arbitrary scale between 1 ("not at all confident") and 10 ("extremely confident") – this was then automatically converted to a radar chart, with skills grouped onto a radar according to the learning outcome they were associated with. Two of these charts were used as proxies for employability skills:

1. *Collaborating with others* (commenting on others' work; contributing to discussions; working in a team; sharing digital content; business/customer awareness), and

2. *Self-reflection and planning* (time management; PDP; reflecting on feedback; reflecting on practice) (Figure 1).

The benefits of using radar charts were thought to be a collated visual summary of perceived skills development, enabling comparison of one set of charts with another to see progression.

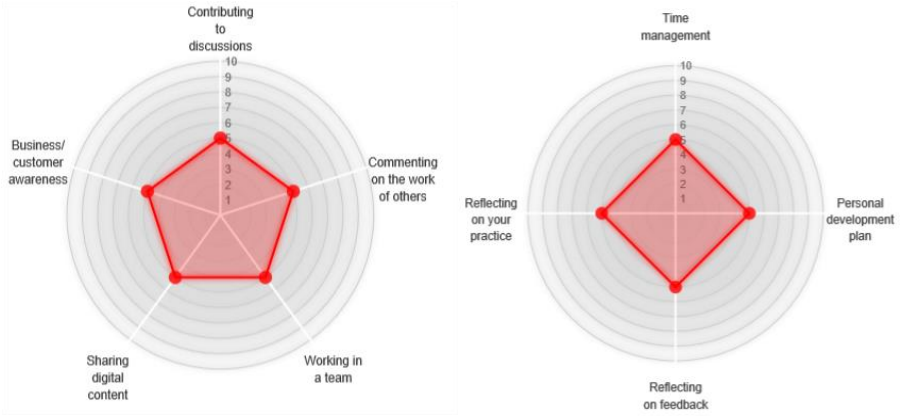

Figure 1: Examples of radar charts for Collaborating with others (left) and Self-reflection and planning (right).

Students were first directed to self-assess at the start of the module and advised to repeat this weekly; the only advice given in the module materials was to use the 1 to 10 scale from "not at all" to "extremely" confident. Subsequently, in each of six summative assignments spread throughout the module, students were asked to include certain radar charts and write a short reflection of 50 words on the skill in which they perceived they had made the most and least progress; this contributed approximately 10% of the mark for each assignment. Each student's Associate Lecturer who marked their work could see how the student was progressing and gave feedback.

There are limited examples of radar charts being used in ePDP. Chou et al. (2017) adopted radar charts to prompt student reflection on core competencies assessed via learning analytics but selected them solely as an effective means of visualising multivariate data. However, Bodily et al. (2018) evaluated the use of radar charts in a student-facing analytics dashboard to help students identify skills to develop: student perceptions were mainly positive due to their intuitive nature, and 89% of students surveyed (n = 70) found the tool user-friendly, engaging, useful and

informative. However, only 11% declared regular use of the tool, which correlates with the frequently poor engagement with ePDP reported elsewhere (e.g. McKenna et al., 2017a; Peyrefitte and Nurse, 2016).

Two research questions were addressed:

1. What are students' perceptions of their employability skills development?

2. What are students' perceptions of radar charts as a means of ePDP?

Methods

Three data collection methods were used in a mixed methods approach: collection of anonymised students' self-assessment scores from assignments; an electronic questionnaire which was sent to 636 eligible students who had completed the module [JISC Online Surveys, www.onlinesurveys.ac.uk]; and Associate Lecturer focus groups. Mixed methods enabled the strengths of different techniques to be combined to provide a robust and insightful investigation of the research questions (Creswell and Creswell, 2018). The approach devised met the criteria of the rigorous mixed methods framework in Harrison et al. (2020). Approval was obtained from the University's Human Research and Ethics Committee and Student Project Research Panel before data collection. Quantitative data from the study have been presented elsewhere (Aiken and Hutton, 2021). Here, a detailed examination of student responses to the open text questionnaire questions is carried out to enrich the quantitative findings.

The open-ended questionnaire questions were analysed using thematic analysis (Braun & Clarke, 2019) in the software NVivo [QSR International Pty. Ltd., www.qsrinternational.com]. Each questionnaire response was read by both authors separately and notes were made to help familiarisation. Codes for positive and negative comments were generated inductively by both authors together systematically. Data relevant to each code were then collated under common themes that were defined and named accordingly.

Results and Discussion

The electronic student questionnaire had 115 responses (response rate 18%); demographic data (not presented here) confirmed respondents were representative of the module cohort. The following themes, codes and numbers of responses (Table 1) were identified from the open text questions; this is followed by an examination of each theme in turn. All quotations are from students.

Category of Theme	Theme	Coded positive / negative comments
Skills development	Time management	Negative (6) Positive (10)
	Communication	Positive (4) Negative (3)
	Group work	Negative (11) Positive (10)
	Reflecting on feedback	Negative (0) Positive (7)
	IT skills (3)	
	General (21)	
Radar charts as a tool	Just for marks (20) Self-assessment problems (40) Technical or design problems (18)	Negative (53) Positive (17)

Table 1: Themes and codes identified from the student questionnaire (n=115). Numbers in brackets are the number of comments.

Skills Development Themes

The 10 positive comments on time management included statements that the module helped students develop time management as they learnt to balance studying alongside other commitments. Students developed skills in

planning ahead, using their time more efficiently and meeting deadlines. The 6 negative comments included statements that when students had to work in a group asynchronously on a forum, they found it frustrating waiting for contributions from others which were needed to progress to the next stage. There were also negative comments on the workload and needing to prioritise completing assignments over group work.

The 7 comments on communicating with others recognised that the module developed the ability to give and receive feedback constructively. There was close overlap with positive comments about group work, with students attributing improvements in communicating with others to being required to collaborate:

> Initially the team led work was taking me outside of my comfort zone, due to a lack of confidence in certain subjects. Fortunately, the way that [the module] is structured, it pushes you in the right direction as it is the only way to complete your work.

Negative comments on communication and group work also overlapped, including problems with time management, which again highlighted difficulties with asynchronous communication via forums:

> Contribution to discussions, commenting and teamwork will only work, if all members of the assigned tutor group participated and in a timely manner. I appreciated the objectives however it was frustrating, and the lack of cooperation set me back.

It is noteworthy that the main negative point on asynchronous communication and teamworking is not specific to this module and is commonly encountered in distance learning (Chang and Kang, 2016).

Students' comments on reflecting on feedback were few, though consistently positive. While some praised module and assessment design (use of radar charts, reflection in each assessment), another emerging theme identified the importance of Associate Lecturer feedback on assessed work and the encouragement of reflection on progress:

> Reflecting on my practice and feedback was shown to be important in a lot of [my Associate Lecturer's] online tutorials. He always had time for reflection and his comments made you reflect.

While the module's design was clearly recognised as promoting skills development, the importance of the role of the Associate Lecturer in helping students relate to the pedagogy of the module was clearly important.

There were only 3 comments on IT skills, two mentioned how skills and confidence grew:

> Sharing digital content was a new experience. I was very nervous at first but the more I had to do it the more confident I became. This is also true of most of the above skills. Just having to carry out the relevant tasks and being encouraged to improve on these tasks builds on confidence.

In summary, broad recognition of effective skills development in the module is captured in this student quote:

> As time went on […] I felt my skills getting more honed & activities set were very well tailored.

Radar Charts Themes

Of the 17 positive comments on radar charts, around 10 simply expressed a liking for the tool, or noted it worked as intended. The largest number of comments on radar charts were negative (53). Students commented that they didn't find radar charts useful, found them hard to understand and confusing. Some found them time-consuming and difficult to use. Students didn't think they helped with reflection on their skills development and one student said they caused stress and self-doubt. Twenty comments indicated that the motivation for completing radar charts was to gain marks. This quote summaries the views expressed by many:

> I feel that the radar charts were cumbersome and actually got in the way of any real reflection on how my studies were progressing.

These results contradict the notion that radar charts are easy to use and understand when displaying multivariate data (Chou et al., 2017). There is, however, close agreement with other research that linking PDP to assessment increases student engagement (e.g. Peyrefitte and Nurse, 2016).

Students found it a challenge to self-assess their skills development on the 1-10 scale, especially benchmarking themselves at the start of the module with very limited guidance; there were over 40 comments on this:

> Filling in the radar charts at the start of the course was a mistake for me as I overrated myself and quickly found during the course that I was not as good as I thought in many skills. As I proceeded through [the module] I found I had to downgrade myself on the radar charts at first instead of improving.

Technical and design problems were identified by 18 students as barriers to engagement. These students didn't find the bespoke in-house software easy to use. Further, some students felt that the charts presented an incomplete, simplified picture of skills development:

> It is a schematic approach that flattens complex realities without providing new or interesting insights. A bureaucratic imposition without reward.

However, a number also recognised that radar charts were potentially helpful for some learners, but felt that they hadn't benefitted from it themselves. This reflects similar findings to Bodily et al. (2018) where a majority found radar charts easy to use but made limited use of them as a tool for PDP:

> I personally didn't find them that helpful, but I think it depends on the person and the kind of learning they benefit from most.

The overall findings of this qualitative analysis triangulate with the quantitative results (Aiken and Hutton, 2021), and can be related to the four pillars of education (Delors, 2013). The acquisition of employability skills fits most clearly in "learning to do". However, students' perceptions of their skills and the importance of them are often challenged by their lack of self-confidence ("learning to be"), and difficulties with collaborative peer learning ("learning to live together"). The four pillars are inextricably linked (Delors, 2013) and this highlights the need for a holistic approach to employability skills development that is seamlessly integrated into the curriculum.

Limitations

Questionnaire data are inherently limited and student focus groups would have helped to further explore and enrich the emerging themes from open questions. However, an invitation to students to participate in focus groups was unsuccessful. Furthermore, the study was conducted on one cohort of students on a single module in the Open University. A longitudinal study would be required to confirm the findings of this research over future groups of students studying the module, and a study involving multiple institutions would make the conclusions more robust.

Conclusions

Addressing the research questions:

1. What are students' perceptions of their employability skills development? There is evidence that students perceived development of most employability skills in the module, most strongly in the case of collaboration, time management and communication.

2. What are students' perceptions of radar charts as a means of ePDP? Student engagement with ePDP could be better encouraged by allowing radar charts to be an optional tool alongside other means of recording ePDP, e.g an e-portfolio.

There is also a clear need to provide reference benchmarks when students first self-assess their skills and more comprehensive support in using the digital tool that generates the charts.

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