RESEARCH ARTICLE

A multidisciplinary STEM and liberal arts students-as-partners project promoted the development of employability skills and embodied partnership values

Louise Lexis and ***Brianna Julien,** Department of Microbiology, Anatomy, Physiology and Pharmacology, La Trobe University, Australia.

Birgit Loch, Faculty of Science, Agriculture, Business and Law, University of New England, Australia; and La Trobe University, Melbourne, Victoria, Australia.

Mark Civitella, Department of Politics, Media and Philosophy, La Trobe University, Australia.

Brianne Keogh, Department of Politics, Media and Philosophy, La Trobe University, Australia.

Marc Boffa, Department of Politics, Media and Philosophy, La Trobe University, Australia.

Tessa Jelley, Department of Microbiology, Anatomy, Physiology and Pharmacology, La Trobe University, Australia.

Fiona Sawyer, Department of Microbiology, Anatomy, Physiology and Pharmacology, La Trobe University, Australia.

Selin Ramadan, Department of Microbiology, Anatomy, Physiology and Pharmacology, La Trobe University, Australia.

Pranita Pokhriyal, Department of Microbiology, Anatomy, Physiology and Pharmacology, La Trobe University, Australia.

Jarrod Carpenter, Department of Politics, Media and Philosophy, La Trobe University, Australia.

Contact: B.Julien@latrobe.edu.au

ABSTRACT

Few studies have explored student perceptions of participating in STEM multidisciplinary students-as-partners (SaP) projects integrated into the curriculum. We conducted content analysis on focus groups to determine partner perceptions of a STEM and liberal arts SaP project and used a mixed methods concurrent triangulation design to explore the degree to which partners thought the underpinning SaP values had been

enacted. Four staff and seven students participated in the study. Perceptions of the project were aligned to four themes: outstanding student experience, development of student employability skills, a transformative change in the student-to-staff relationship, and barriers to success and enabling strategies. Qualitative and quantitative data indicated strong inclusion of the partnership values. This paper provides new insights into STEM and liberal arts SaP projects, indicating they may be well-suited to the embodiment of the underpinning SaP values, and help students prepare for the world of work.

KEYWORDS

higher education, student experience, staff experience, student engagement

There is an expectation in the 21st century that higher education institutions will graduate students with a repertoire of employability capabilities that equip them for an uncertain professional future (Bridgstock, 2009; Clarke, 2018; Matthews, 2016; Oliver, 2015; Tomlinson, 2008). Universities have responded to these expectations by focusing attention on student development of soft skills, otherwise known as generic skills, transferable skills, or graduate capabilities (Bridgstock, 2009; Clarke, 2018; Oliver & Jorre de St Jorre, 2018). There is notable consistency in the desirable graduate capabilities sought by employers and industry bodies and those articulated by universities, and this typically includes skills such as communication, teamwork, critical thinking, problem-solving, self-management, digital literacy and global citizenship (Hajkowicz et al., 2016; Jorre de St Jorre & Oliver, 2018; National Association of Colleges and Employers, 2016; National Network of Business and Industry Associations, 2015).Despite a focus by universities on student development of soft skills, it is generally recognised that there is a workforce soft skills gap (Deloitte Access Economics, 2017), with many employers of the opinion that university graduates need to be better prepared for the world of work (Hart Research Associates, 2015). Industry has increasingly called for university graduates with creativity and collaboration skills (Berman & Korsten, 2010; Lichtenberg et al., 2008; Trigwell, 2005), and, related to this, several high-profile initiatives in the USA have investigated the links between the arts and science, technology, engineering, and mathematics (STEM) for cultivating innovation and discovery (National Academies Keck Futures Initiative, 2016; National Academies of Sciences, 2018). These collaborations are commonly referred to as science, technology, engineering, and mathematics plus arts and design (STEAM). The Expressive and Creative Interaction Technologies (ExCITe) Center at Drexel University is an example of a stand-alone institute that facilitates cross-disciplinary STEAM collaborations, primarily with external arts and education partners, with evidence indicating that the institute's projects have been impactful for learning (Kim et al., 2019). Such initiatives are of significant importance, as it has been shown that studying a STEM subject was associated with a higher consumer orientation and lower academic achievement (Bunce et al., 2017).

A number of leading scholars have campaigned for a students-as-partners (SaP) approach in higher education, where students are engaged in their learning in a way that is

founded on valuing them as capable and collaborative partners (Bovill, 2017; Felten et al., 2014; Healey et al., 2014; Matthews, 2016). Students as partners in higher education exemplifies students and staff as active collaborators in learning and teaching to further common educational goals, and is intrinsically process oriented rather than outcomes driven (Mercer-Mapstone et al., 2017). Felten et al. (2014) defined partnership as "a collaborative, reciprocal process through which all participants have the opportunity to contribute equally, although not necessarily in the same ways, to curricular or pedagogical conceptualization, decision-making, implementation, investigation, or analysis" (pp. 6–7). Healey et al. (2014) developed a SaP model with four overlapping classifications identifying where students and staff may partner in learning and teaching activities: learning, teaching, and assessment; subject-based research and enquiry; curriculum design and pedagogic consultancy; and scholarship of teaching and learning. Prominent scholars argue that successfully engaging students and staff as partners in learning and teaching is one of the most important issues confronting higher education institutions in the 21st century (Healey et al., 2014). It is contended that to remain relevant in a modern world, partnership strategies should be implemented and that failure to do so could lead to the downfall of higher education because students and staff will experience a limited scope of learning experiences (Healey et al., 2014). Indeed, a systematic literature review of SaP in higher education (65 works published 1968–2016) reported increased student engagement, confidence, understanding of others, and enhanced relationship or trust between students and staff through partnership work (Mercer-Mapstone et al., 2017). Students recognise the benefits of partnerships; for example, Matthews et al. (2017) found that biomedical science and science students wanted to be more involved in partnership practices across their degree program. Studies have reported negative outcomes of partnerships, though these are limited. Students have experienced issues with relationships such as not being listened to or sensing that their proficiency was under- or over-estimated (Matthews et al., 2019), negative relationships with staff, and projects that were not challenging or engaging (Mercer-Mapstone et al., 2017).

SaP scholars have developed models and frameworks to assist institutions and practitioners to conceptualise and engage in successful partnerships. SaP frameworks include Matthews' (2017) five guiding propositions underpinning genuine SaP approaches (engage in ethical partnerships, foster inclusivity and nurture power-sharing, enact partnership for transformation, and accept that partnership is a process with uncertain outcomes); Felten et al.'s (2014) commitment to the guiding principles of respect, responsibility, and reciprocity; and Bovill's (2017) participation matrix designed to offer transparency regarding partner roles through various stages of a SaP project. Healey et al. (2014) intended their model to be used as a lens through which to investigate and advance SaP practice and to provide a shared language for discourse (Healey et al., 2016). The model is underpinned by the values of authenticity, inclusivity, reciprocity, empowerment, trust, challenge, community, and responsibility (Healey et al., 2014). Indeed, the institution-wide SaP program at McMaster University in Canada (Ahmad et al., 2017) is based on this model, and investigators have used the model in their exploration of SaP practice, helping progress understanding in the field and demonstrating that the framework can be productively applied (Ahmad et al., 2017; Ali et al., 2021).

Eminent scholars have called for more research to better understand cross-disciplinary SaP initiatives (e.g., Mercer-Mapstone et al., 2017). Few studies have explored student

perceptions of participating in STEM multidisciplinary SaP projects (Bourguet et al., 2020; Burling et al., 2020; Giles et al., 2004; White et al., 2015; Woolmer et al., 2016). Some STEM multidisciplinary SaP projects described in the literature were based on partnerships between different STEM disciplines, such as materials science and engineering, and multimedia engineering (Bourguet et al., 2020), and physics and astronomy, geographical and earth sciences, and chemistry (Woolmer et al., 2016). Other studies had partners from both STEM and liberal arts (Burling et al., 2020; White et al., 2015) and STEM and medicine (Giles et al., 2004). The expertise of the STEM partners in the projects incorporating STEM and liberal arts disciplines were varied, comprising nutrition and psychology (Burling et al., 2020), environmental science, biology, agriculture and systems engineering (White et al., 2015), and anatomy (Giles et al., 2004). The products of the multidisciplinary projects were all educationally focused and include an online learning game on food insecurity (Burling et al., 2020), virtual reality and augmented reality simulations to teach materials science (Bourguet et al., 2020), a biodiversity recording app for teaching and research in environmental studies (White et al., 2015), design and evaluation of an online anatomy module for medical students (Giles et al., 2004), and a lesson plan to teach science skills to undergraduate students (Woolmer et al., 2016). In some cases, student partners were paid to work on the project (Burling et al., 2020; Woolmer et al., 2016), and in other projects, students completed the work as part of their course work (Bourguet et al., 2020; Giles et al., 2004). Students perceived that they had developed professionally (Burling et al., 2020) and acquired transferable skills important for the workplace (Bourguet et al., 2020; Giles et al., 2004; White et al., 2015). None of the aforementioned studies, however, have explored student partner perceptions of the degree to which the underpinning SaP values (Healey et al., 2014) were present in the partnership. Moreover, to our knowledge, no study is yet to explore student partner experiences of a STEM and liberal arts project where students engaged in the project as part of their course work, and it is therefore unclear if this type of partnership can promote the development of employability skills reported in previous studies (Bourguet et al., 2020; Burling et al., 2020; Giles et al., 2004; White et al., 2015).

We build on previous research by exploring partner experiences of a multidisciplinary STEM (nutrition, biomedicine, health sciences, physiology and mathematics) and liberal arts (arts and media and communication) SaP project in an Australian university where partners designed and created a series of videos to educate the public on the potentially life-threatening disease, hypertension (otherwise known as high blood pressure). Student partners voluntarily took part in the project as part of their final year of coursework. The objectives of this study were to:

1. Determine partner perceptions of a multidisciplinary STEM and liberal arts SaP project integrated into the curriculum.
2. Explore the degree to which partners thought the underpinning SaP values had been enacted.

STUDENTS AS PARTNERS HYPER10SION PROJECT

Institution and project details

La Trobe University is a multi-campus (urban and regional) university with a diverse student body of approximately 38,000. The university has a commitment to social justice with a tradition of high rates of students from low socioeconomic backgrounds. The project in this study was based at the largest campus located in Melbourne's northern suburbs. Seven third-year undergraduate students worked with four academics on the multidisciplinary (STEM and liberal arts) Students as Partners in Global Learning project over the course of a 12-week semester as credit for assessment. Students and staff collaborated to produce resources that would educate the public on an issue of global significance. In this project, partners designed and created a series of 10 videos to educate the community about hypertension. The project was affectionately named "Hyper10sion" by the student partners. Students and academics met regularly (initially weekly, then less frequently as the semester progressed) in The Agency (see below) workspace to discuss ideas and report on progress; the team also communicated via email and a closed Facebook group. Students met in their own time to work on the project and had access to professional media equipment and spaces such as cameras, studios, and editing suites provided by the institution. Academic staff initially led the meetings and guided students as they chose a topic and mode of communication. As the project progressed, students took control of the project with academic staff providing advice and feedback. This project was part of a much larger Australian Learning and Teaching Fellowship which brought together students and academics from diverse disciplinary, cultural, and national backgrounds to co-develop rich global learning experiences in the formal and informal curriculum (Green, 2019). Our project was one of 13 pilot projects developed in four Australian universities (Green, 2019). Students were not paid for any component of their work in the project, and staff did not receive a workload allocation from the institution. Staff had collaborated with each other prior to this project but had not worked with any of the students. The students had not worked with each other prior to embarking on the project.

Academic staff and student recruitment

Staff partners included a lecturer in liberal arts (strategic communication) and three STEM academics: a lecturer in human physiology, a senior lecturer in human physiology, and a professor of mathematics education who was also the teaching chair in the College of Science, Health and Engineering. The professor of mathematics education had prior experience with a SaP initiative (Loch & Lamborn, 2016) and brought the strategic communication and physiology staff together to launch the SaP project, which formed part of the larger national project described above (Green, 2019). Academic staff members brought their discipline-specific knowledge and skills to the project, as well as their leadership, communication, and inquiry skills.

The liberal arts academic was the subject coordinator of a third-year work-integrated learning (WIL) subject in which student groups worked on a real-world project for the semester. As part of the subject, students engaged with The Agency, a student-run public relations

consultancy at the university. The liberal arts academic invited all students in the WIL subject to join the SaP project to fulfill the subject requirements; three students accepted the invitation.

The STEM (human physiology) academics were teaching in a third-year pathophysiology subject in which students completed an assignment where they creatively communicated the pathophysiology of a disease to a non-scientific audience (Lexis et al., 2021). These STEM academics invited all students in the pathophysiology subject to join the SaP project instead of completing the assignment; four students accepted the invitation.

Liberal arts student partners

Three liberal arts students (2 male and 1 female) enrolled in the Bachelor of Arts (n=1) and the Bachelor of Media and Communication (n=2) were student partners in the Hyper10sion project. Liberal arts students brought their expertise to the project in the form of use of media equipment for creating and editing the videos and in communicating effectively to the target audience.

STEM student partners

Four STEM students (all female) enrolled in the Bachelor of Health Sciences (n=1), Bachelor of Human Nutrition (n=2), and Bachelor of Biomedical Science (n=1) were student partners in the Hyper10sion project. STEM students brought their expertise to the project in the form of understanding the science behind hypertension, as well as their capabilities related to researching the scientific and grey literature.

Tangible project outcomes

Although it is widely recognised that SaP is by nature process-oriented, rather than outcomes focussed (Mercer-Mapstone et al., 2017), the only proviso for the project was that the partnership would produce an effective communiqué that would be suitable for educating the public on a disease of significance globally.

The partnership significantly exceeded any expectation and produced 10 videos in a series titled "Hyper10sion." The videos ranged in length from 2.11–4.05 minutes and had the following titles: (a) What is Hypertension?, (b) Different types of Hypertension, (c) Who is Affected (Genes and Ethnicity), (d) Who it Affects (Environment), (e) Symptoms, (f) Lifestyle (Smoking and Drinking), (g) Lifestyle (Exercise and Stress), (h) Nutrition and Salt, (i) Pregnancy and Children, and (j) 7-Day Plan. The videos included talking heads, interviews, and footage recorded by students. Videos were available through a Facebook page designed by the students and via YouTube.

At the end of the year, all staff and five students (three from the liberal arts and two from STEM) attended the Engaging Students as Partners in Global Learning Symposium at the University of Tasmania as part of the Australian Learning and Teaching Fellowship previously described (Green, 2019). All 13 teams, including ours, presented the partnership work to each other and interested others at a critical friends' café. This experience gave the students an opportunity to share their work alongside the academics and be recognised as professional peers. Travel for all partners was funded by the professor of mathematics education.

METHODS

Participants

Four staff (all staff partners) and seven students (all student partners) from the Hyper10sion project participated in the study. Staff partners included one liberal arts academic and three STEM academics. Student partners included three liberal arts students and four STEM students, all of whom were in the third year of their degree.

Researchers

Embracing the true spirit of SaP, staff partners invited student partners to participate as co-investigators of this research and to contribute to this piece of academic writing (Cook-Sather et al., 2021). All student and staff partners are co-authors on this manuscript.

Study design and data analysis

To address the research questions, the study was conducted in two parts: (a) perceptions of the multidisciplinary SaP project and (b) perceptions of the underpinning SaP values.

Student perceptions of the multidisciplinary SaP project

To explore overall student perceptions of the multidisciplinary SaP project, all student partners participated in a focus group. The focus group questions were formulated by staff partner, and author, and experienced education researcher, Professor Birgit Loch, and were designed to draw out overall student perceptions of the project. Inductive content analysis (Hsieh & Shannon, 2005; Vaismoradi & Snelgrove, 2019) was conducted on transcripts of the students' interview responses.The questions/prompts used during the student focus group were as follows:

- Describe what you've been producing on the topic of hypertension.
- What resources or equipment are required?
- How important is your contribution to the project outcomes?
- What did you get out of the project?
- What would you suggest to a new group of liberal arts and STEM students?
- S hould we continue the project on a larger scale?
- Did you learn from each other, and if so, what?
- What has been the best and worst thing about this project?
- Would you agree to join a project like this again?
- Has the relationship between students and academics changed over the project? Talk about the collaboration with academics.
- If you had to describe the project in three words what would these be?
- Any other comments?

Staff perceptions of the multidisciplinary SaP project

To explore overall staff perceptions of the multidisciplinary SaP project, three staff partners (Dr Louise Lexis, Mr Mark Civitella, Dr Brianna Julien) participated in a semi-structured group interview. The focus group questions (listed below) were formulated by staff partner, author, and experienced education researcher, Professor Birgit Loch, and were designed to draw out overall staff perceptions of the project. Inductive content analysis (Hsieh & Shannon, 2005; Vaismoradi & Snelgrove, 2019) was conducted on transcripts of the staff interview responses.

To glean information more specifically on staff perceptions of the challenges and outcomes of the Hyper10sion project, all staff completed a brief questionnaire designed by staff partner, Dr Louise Lexis, comprising open-ended questions. Inductive content analysis (Hsieh & Shannon, 2005; Vaismoradi & Snelgrove, 2019) was conducted on the open-ended responses. For this study, a challenge was viewed as a barrier to partnership dynamics or a functional process that was overcome through problem-solving and changing process or behaviour. Adverse outcomes were viewed as unresolved negative aspects of the project.

The questions asked of staff partners during the focus group were as follows:

- Describe what the students have been producing on the topic of hypertension.
- What resources or equipment are required?
- Has your attitude towards SaP changed since the start of the project?
- What would you approach differently with a new group of students if we extended the SaP project?
- Did you learn from each other, and if so, what?
- What would you say were the best things about the SaP project and any drawbacks?
- Has the relationship between students and academics changed over the project?
- If you had to describe the project in three words what would these be?
- Any other comments?

The questionnaire included the following open-ended questions:

- What were the challenges present in the partnership?
- What were the positive outcomes of the partnership?
- What were the adverse outcomes of the partnership?

Student and staff perceptions of the underpinning SaP values

We used a mixed methods concurrent triangulation design to explore partner perceptions of the SaP values present in the project (Figure 1). In this design, a researcher collects and analyses quantitative (numeric) and qualitative (text) data concurrently (Creswell et al., 2003). The rationale for this approach is to attempt to confirm, cross-validate or corroborate findings within a single study resulting in well-validated and substantiated findings (Creswell et al., 2003). We analysed closed and open questionnaire responses.

Figure 1. Mixed methods concurrent triangulation design used to investigate perceptions of underpinning SaP values
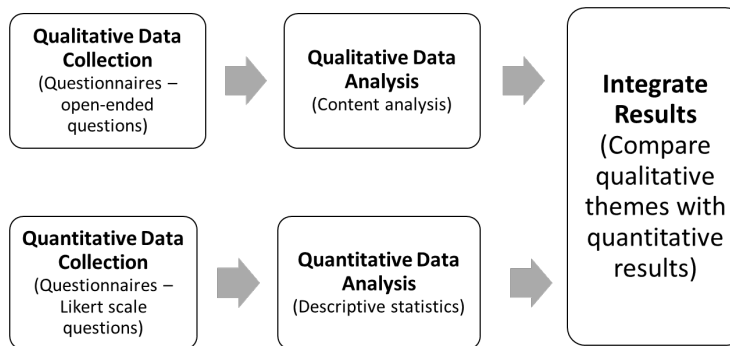
In line with recently published research (Ali et al., 2021), we used Healey et al.'s (2014) theoretical framework for conceptualising partnership as a lens through which to evaluate the eight underpinning values (authenticity, inclusivity, reciprocity, empowerment, trust, challenge, community and responsibility; see Table 1) present in the partnership (Healey et al., 2016). We chose Healey et al. (2014) theoretical framework because it allowed us to explore a wide range of underpinning SaP values, and it enabled us to build on previous research (Ali et al., 2021). Given that working and learning partnerships are complex, with the actions and behaviours of each partner playing an important role in the dynamic of the partnership, it stands to reason that the inclusion or lack of SaP values could significantly influence the success or failure of partnerships. Therefore, we propose that analysis of values should be broadly inherent in evaluation of SaP projects.

Table 1. SaP values and definitions (Healey et al., 2014)

SAP VALUE	DEFINITION
Authenticity	All parties have a meaningful rationale for investing in partnership and are honest about what they can contribute and the parameters of the partnership.
Inclusivity	The partnership embraces the different talents, perspectives, and experiences that all parties bring, and there are no barriers (structural or cultural) that prevent potential partners getting involved.
Reciprocity	All parties have an interest in, and stand to benefit from, working and/or learning in partnership.
Empowerment	Power is distributed appropriately, and all parties are encouraged to constructively challenge ways of working and learning that may reinforce existing inequalities.
Trust	All parties take time to get to know each other, engage in open and honest dialogue, and are confident they will be treated with respect and fairness.

Lexis, L., Julien, B., Loch, B., Civitella, M., Keogh, B., Boffa, M., Jelley, T., Sawyer, F., Ramadan, S., Pokhriyal, P., &   79
Carpenter, J. (2023). "A multidisciplinary STEM and liberal arts students-as-partners project promoted the development of employability skills and embodied partnership values". *International Journal for Students as Partners, 7(1)*. https://doi.org/10.15173/ijsap.v7i1.5032

Challenge	All parties are encouraged to constructively critique and challenge practices, structures and approaches that undermine partnership and are enabled to take risks to develop new ways of working and learning.
Community	All parties feel a sense of belonging and are valued fully for the unique contribution they make.
Responsibility	All parties share collective responsibility for the aims of the partnership and individual responsibility for the contribution they make.

A questionnaire comprising eight 5-point Likert-scale questions, and an open-ended question was administered to determine student and staff partner perceptions of the underpinning SaP values. The questionnaire first asked respondents to rate the degree to which the partnership embodied the eight values that underpin SaP (see Table 1); respondents could choose between "never," "rarely," "sometimes," "usually," and "always." A second open-ended question asked, "What circumstances explain the degree to which the values were present in the partnership?" Students and staff were provided with definitions from Healey et al. (2014) for each of the eight values.

The questionnaire was developed by staff partner, Dr Louise Lexis, with the quantitative strand focused on determining the degree to which participants perceived the underpinning SaP values to be present in the partnership, and the qualitative strand focused on understanding why participants held those perceptions. All student and staff partners completed the SaP values questionnaire. The distribution of responses (i.e., % never, rarely, sometimes, usually, always) for each SaP value are presented as stacked bar charts in Figures 2 and 3 in the Findings and Discussion). Inductive content analysis (Hsieh & Shannon, 2005; Vaismoradi & Snelgrove, 2019) was conducted on the open-ended responses. The quantitative and qualitative strands of the study were integrated at the interpretation phase of the study as illustrated in Figure 1.

FINDINGS AND DISCUSSION

Student perceptions of the SaP project
Content analysis of the student focus group transcript identified four main themes relating to student perceptions of the SaP project: (a) outstanding student experience, (b) development of employability skills, (c) transformative change in the student-to-staff relationship, and (d) barriers to success and enabling strategies.

Outstanding student experience
Students reported that the project was an overwhelmingly positive and meaningful experience, reflected in the comments: "Extraordinary learning experience," "I have loved this project," and "This is the tail end of my degree . . . it's definitely been the best university experience to date." A student commented that the project gave them "creative freedom" and provided a "real-world experience," sentiments that were also reported in other

multidisciplinary projects (Burling et al., 2020; Woolmer et al., 2016). Students appreciated the opportunity to co-present with staff at a symposium and described it as "a fantastic experience" they hadn't had "through any previous assignment at university." One student said the project had given them "a life" and "a reason to wake up in the morning"; another commented that the project had given them their "own sense of—it's my project, it's my baby." Student partners referred to their experience as "the most exciting" part of their course so far and commented that they had "never been more enthusiastic about any assessment or project." STEM students commented that they were "excited about working with people who were not science students," reflecting the appeal of the multidisciplinary nature of the project. Students reported that new friendships were an important part of the overall experience: one student commented that "it's been a very good bonding exercise," another stated, "I can truly say that I've made friendships in this project that I will stay in touch with post university," and another used the phrase "friends for life." Burling et al. (2020) also reported enhanced student-to-student relationships in a multidisciplinary project that worked on the development of an online learning game.

Findings related to the overall student experience in multidisciplinary SaP projects are not dissimilar to the wider SaP literature showing increased student engagement, motivation, and ownership for learning (Mercer-Mapstone et al., 2017), and positive outcomes relating to the theme of relationships (Matthews et al., 2019). However, multidisciplinary projects are by nature more reflective of the workplace, with each partner bringing their unique experience and expertise to the project. We argue that this is more likely to lend itself to the "real-world experience" and "creative freedom" that students have identified in our and other multidisciplinary SaP projects (Burling et al., 2020; Woolmer et al., 2016). In the studies of our peers (Burling et al., 2020; Woolmer et al., 2016), student partners were paid to work on the project, whereas in the present study, student partners completed the project work as part of their assessed coursework. Taken together, these findings indicate that multidisciplinary SaP projects that give rise to real-world experiences, and therefore help students prepare for the world of work, can be generated by projects undertaken from within the assessed curriculum or as co-curricular activities.

Development of employability skills
Student partners in the present study reported that their SaP experience involved a "steep learning curve" and promoted development of "real workforce skills" and "skills for life." Specifically, students thought they had developed teamwork, organisation and time management, communication, research, analysis, multimedia, writing, and editing skills.

These findings are aligned to other STEM (Bourguet et al., 2020), STEM and liberal arts (Burling et al., 2020; White et al., 2015) and STEM and medicine (Giles et al., 2004) projects, where projects were either funded (Burling et al., 2020; White et al., 2015) or integrated into the curriculum (Bourguet et al., 2020; Giles et al., 2004). Students developed professionally (Burling et al., 2020), enhanced their employability skills (White et al., 2015), and specifically developed research, data collection, teamwork, interdisciplinary collaboration, and presentation skills (Bourguet et al., 2020), as well as project management skills (Giles et al., 2004). Taken together, findings indicate that multidisciplinary STEM projects of a variety of

forms, either integrated into the curriculum or funded, have the capacity to promote the development of students' employability skills.

Interestingly, students in the present study anticipated before starting the project that the partnership would provide opportunities to develop employability skills. Students commented that the driver for volunteering to participate in the SaP project was not for marks, but rather the "wider kind of implications" that "[extend] into so many different parts of our futures and different opportunities and skill sets." One student commented:

> Part of the reason I volunteered to be in the project was because I'm looking at potentially having my own business in the health and wellness industry . . . and it's going to be useful to know these skills.

A key factor underpinning student learning and skill development in the present study appears to relate to the multi-disciplinary nature of the project. Students recognised that they had come from "very different disciplines" and the partnership meant they could "always learn a lot from somebody." Student recognition of the diversity in the group and its importance for preparing them for the world of work is illustrated in the following comment:

> We're all very different people, so we've had to learn to work together, but that's just the nature of the world these days. Any employment, whether it be our own business or working for a large or small organisation, we're going to be working with people who are different.

Students in the present study acknowledged that they had learnt more about disciplines they previously didn't know about but also understood that they had played a role in teaching others, which in turn, helped them learn more. The STEM students felt that they had the "scientific knowledge" as well as the "ability to actually go and research" and could "draw on the pathophysiology lecturers for advice" if needed. They also thought that the liberal arts students had taught them principles of audio and video recording and editing, on-camera presentation, and how to use a range of professional equipment and software. The STEM students noted that the liberal arts students and staff had helped them appreciate how the public would receive the scientific message. A liberal arts student commented that they had "seen an improvement in the health sciences students in front of the camera" as with the first day of filming "it took pretty much a whole day to get through one episode." The liberal arts students commented that they had learnt a lot about nutrition and that it had even helped with some personal weight loss. Students not only acknowledged but embraced the group diversity, as they identified this as a strength that helped create their product (the 10 videos). Students attributed their success to "coming at it [development of videos] from different angles" and with "different perspectives." It was interesting that different knowledge and skill sets were identified even from within the STEM student partner group. It was noted that the biomedical and health science students approached the work from a more medically focused angle (genetics and disease) with the nutrition students approaching the work from a more diet- and lifestyle-focused angle.

The rich student learning opportunities arising from the diversity of partners' knowledge and skill sets in the present study has also been recognised in other multidisciplinary projects (Bourguet et al., 2020; Burling et al., 2020; Woolmer et al., 2016). Burling et al. (2020) reported that the multidisciplinary nature of a STEM and liberal arts project (nutrition, computer science, communication, digital media) to develop an online learning game facilitated the sharing of multiple forms of expertise, improved learning outside of the discipline, and culminated in a collective knowledge of the project. Similarly, in a multidisciplinary STEM project (physics and astronomy, geographical and earth sciences, and chemistry) aimed at developing lesson plans to promote scientific skills, student partners considered working with students from diverse backgrounds as one of the highlights of the project (Woolmer et al., 2016). Because students had their own areas of expertise, they could take the lead with different topics, and they valued the freedom they had to use their initiative and creativity. Bourguet et al. (2020) reported that their STEM project (materials science and engineering and multimedia engineering), which was undertaken by students as part of their final year project, provided insights into new fields, such as product development. Collectively, findings indicate that multidisciplinary STEM SaP projects of a variety of forms are well placed to provide students with a transformative real-world learning experience that promotes the development of employability skills. Such partnerships seem ideal for the embodiment of the SaP values of inclusivity and community due to the varied experiences and expertise of partners.

Transformative change in the student-to-staff relationship

Early in the partnership some students experienced a level of awkwardness working with academic staff, which is illustrated in the student comment: "I remember being quite, almost uncomfortable in the beginning, because I didn't know how to interact with everybody. I didn't know if it was supposed to be professional . . . did I need to . . . look like I knew everything." Similarly, Marquis et al. (2019) found through a survey of 433 students who had not participated in partnership schemes that students viewed the idea of working with a professor as intimidating and that they would be worried that professors would not value their contributions. Similarly, Matthews et al. (2019) found that the most frequently reported inhibitors of partnerships were related to relationships, such as navigating the perceived power differential between staff and students.

Pleasingly, by the end of the project students thought they had an equal and positive relationship with staff. We attribute this in large part to the instinctive and conscious effort of staff partners to create a partnership that embodied the SaP values of inclusivity, trust, empowerment, and community. Upon completion of the project, students realised that "lecturers were actually human," and they considered the academics to be "friends" and noted that "there is definitely a closer relationship than you would normally have with academics." Burling et al. (2020) similarly found in their multidisciplinary project that the power dynamics were positively shifted between students and faculty, but unlike our findings, the hierarchy continued to exist on some level.

In the present study, student partners provided insight into their views of normal university life and how SaP can challenge the status quo to positively influence relationships with staff. Students acknowledged that the university sector is traditionally "very much us

[students] and them [staff]" and that the SaP experience was a chance for staff to "actually build relationships with students." Students felt that they understood staff better by finding out "more about how hard they [staff] work to get to where they are" and "the different skill sets and work experiences they've had over the years." Students also commented that staff had "started to get an understanding of some of the issues that students face." Students noted that the relationship developed over time and that by the end of the project it was "completely different. . . . We can just talk to each other like we are just a big team."

In line with our findings, a systematic review of the wider SaP literature found the fourth most commonly identified positive outcome for students was an enhanced relationship or trust between students and staff (Mercer-Mapstone et al., 2017). Taken together, these findings indicate that staff should be cognisant of student partners' potential trepidation in the early stages of a partnership and should purposefully commit to modelling the values of inclusivity, trust, empowerment, and community as the relationship is established. The authors of this paper propose that multidisciplinary SaP projects are inherently well suited for positively shifting the power dynamic between staff and students due to the varied expertise that each partner brings to the project. Students that have experienced such projects should be well placed to enter a workforce composed of colleagues of all different ages, backgrounds, and levels of experience and expertise.

Barriers to success and enabling strategies

Students in the present study found it difficult to timetable both meetings and synchronous group work around everyone's busy schedules but noted that "it's just something we've had to work around." Similarly, Woolmer et al. (2016) reported that students experienced time pressure to balance studies with opportunities to co-develop curricula. Marquis et al. (2019) found lack of time deterred students from engaging in SaP projects and proposed integration of SaP activities in the curriculum to overcome this perceived time-barrier, with students given the option to participate. The present study incorporated the SaP project into the curriculum and invited students to volunteer to participate, yet time pressures were still an issue; this requires further investigation. In another multidisciplinary project focused on development of an online learning game about food insecurity, partners also experienced difficulty coordinating action, with team meetings and access to a shared "Collaboratory" space described as factors that helped in overcoming the challenge (Burling et al., 2020, p. 104). In our project, we also held regular team meetings and had a shared physical workspace, The Agency. In a systematic review of the broader SaP literature, one of five themes developed from an analysis of factors inhibiting SaP related to logistical issues that included time constraints (Matthews et al., 2019). Similarly, in an in-curriculum partnership that worked on developing e-learning resources for dentistry students, partners identified that time pressures were a major factor, with students concerned about competing demands in the final year of their clinical degree (McKerlie et al., 2018). Partners engaged in multidisciplinary SaP projects may face additional pressures around coordination of very different and busy schedules, and it is suggested that this be considered and discussed at the beginning of a project, and, if possible, a shared physical space be allocated for project work.

Students in the present study thought that the three main enabling strategies were the scaffold that staff put in place to launch and maintain the partnership (e.g., regular face-to-face meetings and online communication), the equipment and resources required for creating the videos, and the high level of interest and commitment of partners to the project: "for a project, particularly the size that this one became, having that degree of commitment was vital." Students attribute their motivation and commitment to the fact that they volunteered for the project and that it was not forced group work.

Interestingly, students noted that staff had "committed to the project" as much as students and that the high level of commitment "helped them [staff] to make themselves available for meetings where they've been able to." It is evident from these data that the underpinning SaP value of responsibility was present in the partnership, which is consistent with our quantitative data. Students in a science/biomedical sciences degree program at another Australian university (Luo et al., 2019) had similar attitudes to our student partners. Although these students had limited exposure to SaP, analysis of survey data revealed that they identified responsibility/commitment as one of four key values. Students in the study by Luo et al. (2019) also believed that both staff and students were responsible for upholding these values.

Staff perceptions of the SaP project

Overall, staff perceptions were closely aligned to those of students. Staff were of the firm belief that the student partner experience was overwhelmingly positive and that students had developed employability skills during the project that would put them in good stead for their future careers. Staff partners experienced a positive change in the staff-to-student power dynamic.

Staff reported that the project was an overwhelmingly positive and meaningful experience for students, reflected in the staff comment: "This [SaP project] has lifted their student experience enormously, I believe the students would recommend La Trobe to potential students any time." Staff observed that students' confidence grew throughout the project, and that students were highly motivated, reflected in their ambitious plan to create 10 videos. Staff also observed that there were "very strong friendships between students," that students were "all very respectful of each other and on the same page," and overall, the student dynamic was "nice to watch."

Staff partner observations of the students' development "into young professionals" was viewed as a positive outcome of the project. Staff felt that the project had an "incredibly positive impact on the students' . . . employability capability development," with students gaining a "new understanding . . . of the value of real team work and collaboration." Like students, staff observed students learning from each other through the multidisciplinary nature of the project:

> I know certainly from the media communication [liberal arts] students they wouldn't have known what hypertension was until they started the project; I think each [different student groups] has learned from the other—our students in media [liberal arts] would

have known nothing about the subject matter and conversely I don't think anyone [STEM students] really knew how to point a camera.

Anecdotal evidence coming to light since completion of the study is aligned to student and staff perceptions that the project had a positive influence on students' employability skills. One of the liberal arts students has since become a web support officer in digital marketing at La Trobe and recently commented: "working on Hyper10sion helped build my love of science communications." One of the STEM students gained ongoing casual work as a professional voice-over actor because of the project. She has subsequently completed a Master of Dietetics and recently posted the following on her LinkedIn profile:

> Feedback Nutrition is on Instagram! I'm working hard to prepare educational, digestible and evidence-based content for a non-scientific audience here. I have my pathophysiology tutors, Louise Lexis and Brianna Julien to thank for preparing me for work like this through the Students As Partners program at La Trobe University.

Like students, staff partners observed a positive shift in the power dynamic over the course of the project and felt that "the collaborations were beyond expectation." Staff thought that students took longer to become comfortable with having an equal relationship, with staff noting they were comfortable with an equal relationship from the beginning of the project. Staff thought time spent together as equals was a factor in shifting the power dynamic, such as having coffee and meals together, and co-presenting at a symposium.

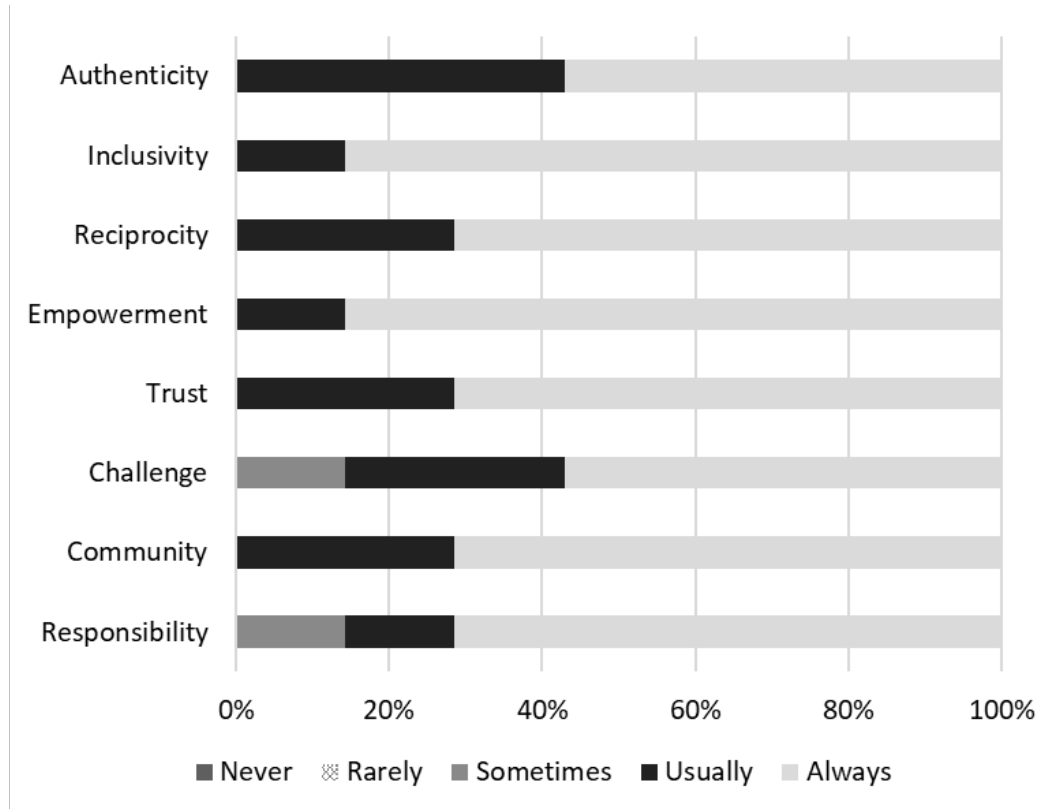**Student and staff perceptions of the SaP values**

To gain insight into the embodiment of SaP values in the partnership, students and staff rated the degree to which they thought all of the underpinning SaP values (Healey et al., 2014) were present in the partnership, and explained their ratings.

Student ratings of the values are shown in Figure 2. Except for responsibility and challenge, students rated the values as usually or always present in the partnership. One student rated responsibility as sometimes present, and another rated challenge as sometimes present. The student who rated responsibility as sometimes present, said that the project "felt like a student project with occasional staff oversight" but did acknowledge that "this feeling may be due to not being aware of a full breakdown of the responsibilities and there may have been more going on that I wasn't aware of." The student who thought challenge was sometimes present, noted that the "sheer size of the group" and "the inclusion of students and teachers as partners" were initial barriers to inclusion of the value, but that over time "these initial barriers were removed" and "left an equal playing field for the creativity to flourish."

Staff ratings of the values are shown in Figure 3. For most values, staff rated them as usually or always present. Every staff member rated trust and community as always being present. Two staff thought it took effort early in the partnership to establish challenge, with this achieved through staff modelling the value for students early in the partnership. Staff felt that informal weekly meetings at the beginning of the project were vital for developing trust in

the partnership. Community was reflected in staff and students travelling to a national SaP symposium together and catching up socially.

Figure 2. Student perceptions of the degree to which SaP values were present in the project (7 students)

Ratings provided after completion of the project on a 5-point Likert scale: never, rarely, sometimes, usually, or always.

Lexis, L., Julien, B., Loch, B., Civitella, M., Keogh, B., Boffa, M., Jelley, T., Sawyer, F., Ramadan, S., Pokhriyal, P., & Carpenter, J. (2023). "A multidisciplinary STEM and liberal arts students-as-partners project promoted the development of employability skills and embodied partnership values". *International Journal for Students as Partners, 7(1)*. https://doi.org/10.15173/ijsap.v7i1.5032

Figure 3. Staff perceptions of the degree to which SaP values were present in the project (4 staff)
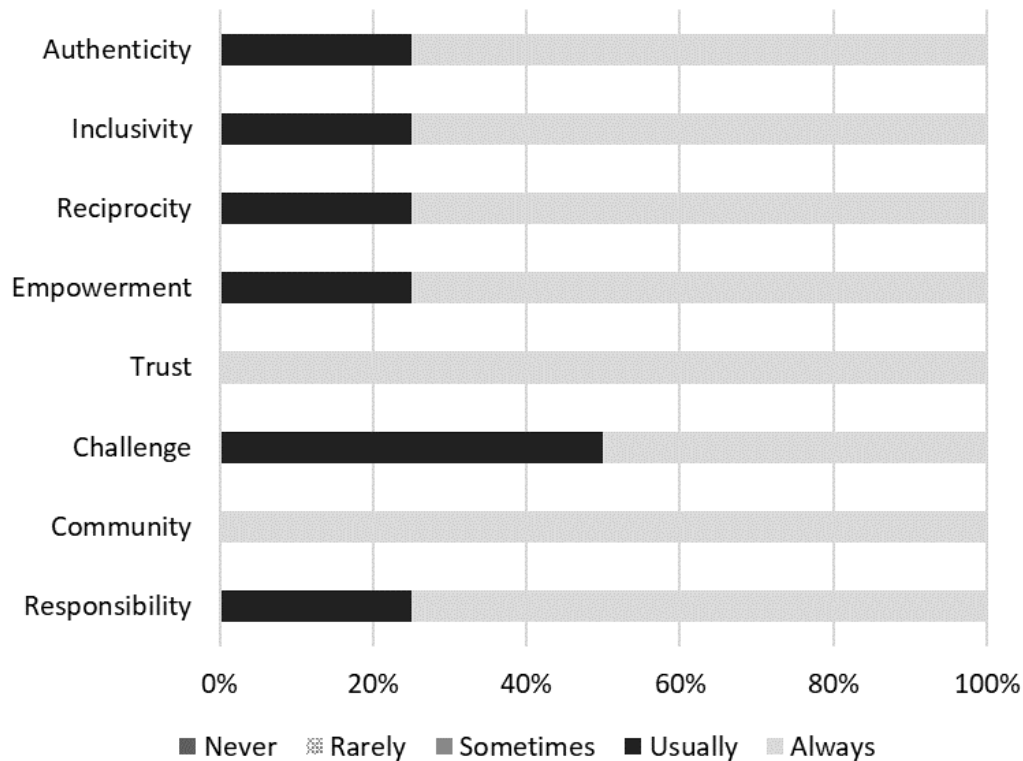
Ratings provided after completion of the project on a 5-point Likert scale: never, rarely, sometimes, usually, or always.

Quantitative data from our study shows that staff and students perceived the SaP values to be present in the partnership to a significant degree, and the circumstances they described to explain their high ratings were generally consistent with the published definitions for each of the eight SaP values (Table 1; Healey et al., 2014). In contrast to our findings, Ali et al. (2021) found notable differences regarding staff and student perceptions of the underpinning SaP values. In general, and except for trust, staff perceived the values of community, empowerment, and inclusivity as being difficult to always achieve. On the other hand, except for challenge, students thought the values were largely present in the partnership. The authors reported that the power dynamic existing between staff and students was very hard to overcome. The underlying reasons for the differences between studies is not known but may be due to differences in staff attitudes between projects or the nature of activities that partners were working on (research in Ali et al.'s [2021] study versus resource development in the present study). It is possible that both staff and students perceived staff partners to have more research expertise in the study by Ali et al. (2021), and this may have been a barrier to empowerment. In the present multidisciplinary study, each partner brought their own expertise to the project, and we argue that this was empowering for students. For example, the liberal arts students had knowledge and expertise in digital communication that was far superior to

Lexis, L., Julien, B., Loch, B., Civitella, M., Keogh, B., Boffa, M., Jelley, T., Sawyer, F., Ramadan, S., Pokhriyal, P., & 88
Carpenter, J. (2023). "A multidisciplinary STEM and liberal arts students-as-partners project promoted the development of employability skills and embodied partnership values". *International Journal for Students as Partners, 7(1)*. https://doi.org/10.15173/ijsap.v7i1.5032

that of the STEM academics. Similarly, the STEM students had scientific knowledge and expertise exceeding that of the liberal arts academic and professor of mathematics education. We propose that multidisciplinary SaP projects are reflective of the workplace, where differences in expertise exist amongst a cohort of employees, with each bringing their unique ability to contribute to the group's goals. This dynamic inherent in multidisciplinary projects may promote the inclusion of the underpinning SaP values more so than projects where staff experience and expertise outweigh that of the students.

CONCLUSIONS AND FUTURE RESEARCH

Our best chance of dealing with the complex worldwide challenges we are facing is likely to come from collaboration between professionals from a diverse range of STEM and liberal arts disciplines. Preparing undergraduate students by supporting them to experience the benefits of collaboration for solving authentic problems enhances their repertoire of skills and prepares them to face the challenges of the 21st century.

This paper has contributed additional knowledge to the limited literature regarding partner experiences of multidisciplinary STEM SaP projects. Our project successfully brought together STEM and liberal arts students and academics to work on the authentic task of communicating about hypertension to the public through a series of 10 videos. The multidisciplinary nature of the project allowed students to develop a diverse range of skills likely to enhance their world view and their employability. This was determined by students' self-report and corroborated by staff observations. We expressly selected student and staff partners as participants in the project so we could determine partner perceptions of the student experience, and the degree to which partners thought the underpinning SaP values had been enacted in the partnership. From students' and staff perspective, the significant inclusion of the SaP values in the partnership appears to have been the foundation for the fruitful partnership.

Future research could broaden the scope of the present study and investigate strategies for scaling up multidisciplinary SaP projects to foster collaboration between STEM and liberal arts disciplines and give more students and staff the opportunity to engage with this positive learning experience. Longitudinal research that determines student perceptions of the impact of the SaP project on their professional lives would also add to the current knowledge on SaP.

This research was successfully reviewed according to institutional research ethics committee guidelines.

NOTE ON CONTRIBUTOR/S

Louise Lexis *is an Associate Professor of STEM education at La Trobe University, Australia.*

Brianna Julien *is an Associate Professor of STEM education at La Trobe University, Australia.*

Birgit Loch *is Dean of the Faculty of Science, Agriculture, Business and Law at the University of New England, Australia.*

Mark Civitella *was a lecturer in Strategic Communication at La Trobe University, Australia.*

Brianne Keogh *was an undergraduate student at La Trobe University, Australia, studying a Bachelor of Media and Communication.*

Marc Boffa *was an undergraduate student at La Trobe University, Australia, studying a Bachelor of Arts.*

Tessa Jelley *was an undergraduate student at La Trobe University, Australia, studying a Bachelor of Health Sciences.*

Fiona Sawyer *was an undergraduate student at La Trobe University, Australia, studying a Bachelor of Human Nutrition.*

Selin Ramadan *was an undergraduate student at La Trobe University, studying a Bachelor of Human Nutrition.*

Pranita Pokhriyal *was an undergraduate student at La Trobe University, Australia, studying a Bachelor of Biomedical Science.*

Jarrod Carpenter *was an undergraduate student at La Trobe University, Australia, studying a Bachelor of Media and Communication.*

REFERENCES

Ahmad, A., Ali, A., VanMaaren, J., Barrington, J., Merritt, O., & Ansilio, K. (2017). Partnership in practice: Implementing Healey's conceptual model. *International Journal for Students as Partners*, *1*(2). https://doi.org/10.15173/ijsap.v1i2.3197

Ali, X., Tatam, J., Gravett, K., & Kinchin, I. M. (2021). Partnership values: An evaluation of student-staff research projects at a UK higher education institution. *International Journal for Students as Partners*, *5*(1), 12–25. https://doi.org/10.15173/ijsap.v5i1.4354

Berman, S., & Korsten, P. (2010). Capitalizing on complexity. *Global Chief Executive Officer Study,* 76*.* IBM Institute for Business Value.

Lexis, L., Julien, B., Loch, B., Civitella, M., Keogh, B., Boffa, M., Jelley, T., Sawyer, F., Ramadan, S., Pokhriyal, P., &   90
Carpenter, J. (2023). "A multidisciplinary STEM and liberal arts students-as-partners project promoted the development of employability skills and embodied partnership values". *International Journal for Students as Partners, 7(1)*. https://doi.org/10.15173/ijsap.v7i1.5032

Bourguet, M.-L., Wang, X., Ran, Y., Zhou, Z., Zhang, Y., & Romero-Gonzalez, M. (2020). Virtual and augmented reality for teaching materials science: A students as partners and as producers project. *2020 IEEE International Conference on Teaching, Assessment, and Learning for Engineering (TALE)*, 452–459. https://doi.org/10.1109/TALE48869.2020.9368381

Bovill, C. (2017). A framework to explore roles within student-staff partnerships in higher education: Which students are partners, when, and in what ways? *International Journal for Students as Partners*, *1*(1). https://doi.org/10.15173/ijsap.v1i1.3062

Bridgstock, R. (2009). The graduate attributes we've overlooked: Enhancing graduate employability through career management skills. *Higher Education Research & Development*, *28*(1), 31–44. https://doi.org/10.1080/07294360802444347

Bunce, L., Baird, A., & Jones, S. E. (2017). The student-as-consumer approach in higher education and its effects on academic performance. *Studies in Higher Education*, *42*(11), 1958–1978. https://doi.org/10.1080/03075079.2015.1127908

Burling, M. G. H., Rahouma, L., Good, A., Kasper, J. C., Kranyak, S., Ramnarine, K., & Bramesfeld, K. (2020). Our quest for success: Using a multidisciplinary students-as-partners model to develop an innovative online learning game. *International Journal for Students as Partners*, *4*(1), 99–108. https://doi.org/10.15173/ijsap.v4i1.3928

Clarke, M. (2018). Rethinking graduate employability: The role of capital, individual attributes and context. *Studies in Higher Education*, *43*(11), 1923–1937. https://doi.org/10.1080/03075079.2017.1294152

Cook-Sather, A., Healey, M., & Matthews, K. E. (2021). Recognizing students' expertise and insights in expanding forms of academic writing and publishing about learning and teaching. *International Journal for Students as Partners*, *5*(1), 1–7. https://doi.org/10.15173/ijsap.v5i1.4626

Creswell, J. W., Plano Clark, V., Gutmann, M. L., & Hanson, W. E. (2003). An expanded typology for classifying mixed methods research into designs. In A. Tashakkori & C. Teddlie (Eds.), *Handbook of mixed methods in social and behavioral research* (pp. 209–240). SAGE Publications, Inc.

Deloitte Access Economics. (2017). *Soft skills for business success*. Deloitte Access Economics. https://www2.deloitte.com/au/en/pages/economics/articles/soft-skills-business-success.html

Felten, P., Cook-Sather, A., & Bovill, C. (2014). *Engaging students as partners in learning and teaching: A guide for faculty*. John Wiley & Sons.

Giles, A., Martin, S. C., Bryce, D., & Hendry, G. D. (2004). Students as partners in evaluation: Student and teacher perspectives. *Assessment & Evaluation in Higher Education*, *29*(6), 681–685. https://doi.org/10.1080/0260293042000227227

Green, W. (2019). Engaging "students as partners" in global learning: Some possibilities and provocations. *Journal of Studies in International Education*, *23*(1), 10–29. https://doi.org/10.1177/1028315318814266

Hajkowicz, S., Reeson, A., Rudd, L., Bratanova, A., Hodgers, L., Mason, C., & Boughen, N. (2016). Tomorrow's digitally enabled workforce: Megatrends and scenarios for jobs and employment in Australia over the coming twenty years. *Australian Policy Online*.

Hart Research Associates. (2015). *Falling short? College learning and career success: Selected findings from the online surveys of employers and college students conducted on behalf of the Association of American Colleges & Universities*. Association of American Colleges and Universities. https://www.aacu.org/research/falling-short-college-learning-and-career-success

Healey, M., Flint, A., & Harrington, K. (2014). *Engagement through partnership: Students as partners in learning and teaching in higher education*. The Higher Education Academy. https://www.advance-he.ac.uk/knowledge-hub/engagement-through-partnership-students-partners-learning-and-teaching-higher

Healey, M., Flint, A., & Harrington, K. (2016). Students as partners: Reflections on a conceptual model. *Teaching & Learning Inquiry*, *4*(2), 1–13. https://doi.org/10.20343/teachlearninqu.4.2.3

Hsieh, H.-F., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative health research*, *15*(9), 1277–1288. https://doi.org/10.1177/1049732305276687

Jorre de St Jorre, T., & Oliver, B. (2018). Want students to engage? Contextualise graduate learning outcomes and assess for employability. *Higher Education Research & Development*, *37*(1), 44-57. https://doi.org/10.1080/07294360.2017.1339183

Kim, Y. E., Morton, B. G., Gregorio, J., Rosen, D. S., Edouard, K., & Vallett, R. (2019). Enabling creative collaboration for all levels of learning. *Proceedings of the National Academy of Sciences*, *116*(6), 1878-1885.

Lexis, L., Weaver, D., Grills, B. L., & Julien, B. L. (2021). Teaching students to explain the pathophysiology of diseases to lay audiences with a scaffold that supports student choice. *Advances in Physiology Education*, *45*(2), 281-289. https://doi.org/10.1152/advan.00016.2020

Lichtenberg, J., Woock, C., & Wright, M. (2008). *Ready to innovate: Are educators and executives aligned on the creative readiness of the US workforce?* The Conference Board.

Loch, B., & Lamborn, J. (2016). How to make mathematics relevant to first-year engineering studetns: perceptions of students on student-produced resources. *International Journal of Mathematical Education on Science and Technology, 47*(1), 29-44. https://doi.org/10.1080/0020739X.2015.1044043

Luo, B., Matthews, K., & Chunduri, P. (2019). "Commitment to collaboration": What students have to say about the values underpinning partnership practices. *International Journal for Students as Partners*, *3*(1), 123–139. https://doi.org/10.15173/ijsap.v3i1.3688

Marquis, E., Jayaratnam, A., Lei, T., & Mishra, A. (2019). Motivations, barriers, & understandings: how students at four universities perceive student–faculty partnership programs. *Higher Education Research & Development*, *38*(6), 1240-1254. https://doi.org/10.1080/07294360.2019.1638349

Matthews, K. (2016). Students as partners as the future of student engagement. *Student Engagement in Higher Education Journal*, *1*(1). https://sehej.raise-network.com/raise/article/view/380

Matthews, K. E. (2017). Five propositions for genuine students as partners practice. *International Journal for Students as Partners*, *1*(2). https://doi.org/10.15173/ijsap.v1i2.3315

Matthews, K. E., Groenendijk, L. J., & Chunduri, P. (2017). We want to be more involved: Student perceptions of students as partners across the degree program curriculum. *International Journal for Students as Partners*, *1*(2). https://doi.org/10.15173/ijsap.v1i2.3063

Matthews, K. E., Mercer-Mapstone, L., Dvorakova, S. L., Acai, A., Cook-Sather, A., Felten, P., Healey, M., Healey, R. L., & Marquis, E. (2019). Enhancing outcomes and reducing inhibitors to the engagement of students and staff in learning and teaching partnerships: Implications for academic development. *International Journal for Academic Development*, *24*(3), 246–259. https://doi.org/10.1080/1360144X.2018.1545233

McKerlie, R. A., Rennie, E., Hudda, S., McAllan, W., Al-Ani, Z., McLean, W., & Bagg, J. (2018). Facilitation of student-staff partnership in development of digital learning tools through a special study module. *International Journal for Students as Partners*, *2*(1), 121–129. https://doi.org/10.15173/ijsap.v2i1.3235

Mercer-Mapstone, L., Dvorakova, S. L., Matthews, K. E., Abbot, S., Cheng, B., Felten, P., Knorr, K., Marquis, E., Shammas, R., & Swaim, K. (2017). A systematic literature review of students as partners in higher education. *International Journal for Students as Partners*, *1*(1). https://doi.org/10.15173/ijsap.v1i1.3119

National Academies Keck Futures Initiative. (2016). *Art, design and science, engineering and medicine frontier collaborations: Ideation, translation, realization: Seed idea group summaries*. The National Academies Press. https://doi.org/10.17226/23528

National Academies of Sciences, Engineering, Medicine. (2018). *The integration of the humanities and arts with sciences, engineering, and medicine in higher education: Branches from the same tree*. The National Academies Press. https://doi.org/10.17226/24988

National Association of Colleges and Employers. (2016). *Job Outlook 2016: The Attributes Employers Want to See on New College Graduates' Resumes*. National Association of Colleges and Employers. https://www.naceweb.org/career-development/trends-and-predictions/job-outlook-2016-attributes-employers-want-to-see-on-new-college-graduates-resumes/

National Network of Business and Industry Associations. (2015). *Common employability skills: A foundation for success in the workplace*. https://s3.amazonaws.com/brt.org/archive/Common%20Employability_asingle_fm.pdf

Oliver, B. (2015). Redefining graduate employability and work-integrated learning: Proposals for effective higher education in disrupted economies. *Journal of Teaching and Learning for Graduate Employability*, *6*(1), 56. https://ojs.deakin.edu.au/index.php/jtlge/article/view/573

Oliver, B., & Jorre de St Jorre, T. (2018). Graduate attributes for 2020 and beyond: recommendations for Australian higher education providers. *Higher Education Research & Development*, *37*(4), 821-836. https://doi.org/10.1080/07294360.2018.1446415

Tomlinson, M. (2008). 'The degree is not enough': Students' perceptions of the role of higher education credentials for graduate work and employability. *British journal of sociology of education*, *29*(1), 49–61. https://doi.org/10.1080/01425690701737457

Trigwell, K. (2005). Teaching–research relations, cross-disciplinary collegiality and student learning. *Higher Education*, *49*(3), 235. https://doi.org/10.1007/s10734-004-6665-1

Vaismoradi, M., & Snelgrove, S. (2019). Theme in qualitative content analysis and thematic analysis. *Forum Qualitative Sozialforschung/Forum: Qualitative Social Research*, *20*(3). https://doi.org/10.17169/fqs-20.3.3376

White. E., Basford, L., Birch, S., Black, A., Culham, A., McGoff, H., Wells, M. (2015). Creating and implementing a biodiversity recording app for teaching and research in environmental studies. *Journal of Educational Innovation, Partnership and Change, 1*(1), 56. https://journals.gre.ac.uk/index.php/studentschangeagents/article/view/166

Woolmer, C., Sneddon, P., Curry, G., Hill, B., Fehertavi, S., Longbone, C., & Wallace, K. (2016). Student staff partnership to create an interdisciplinary science skills course in a research intensive university. *International Journal for Academic Development*, *21*(1), 16–27. https://doi.org/10.1080/1360144X.2015.1113969