

IMPROVING STUDENT ENGAGEMENT AND SELF-REGULATED LEARNING THROUGH TECHNOLOGY-ENHANCED STUDENT PARTNERSHIPS

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Abstract

Teaching and learning in higher education for the Science, Technology, Engineering and Mathematics disciplines are renowned for their challenges. This paper explores how embedding a personal learning platform (PebblePad) through a Students as Partners (SaP) initiative has resulted in a higher degree of student engagement in a second-year biochemistry course and unexpected benefits for students based on reflections about their experience. Adopting a digital platform enabled surprisingly honest, uninhibited and extensive student reflections. In addition, while the coupling of the SaP initiative with educational technology has exceeded expectations, early findings suggest that the process is also contributing positively to students' self-regulated learning.

Introduction

One of the major problems facing higher education is the decline in student engagement and participation in classes, particularly the low attendance of lectures (Armbruster, Patel, Johnson & Weiss, 2009). Even more concerning is the lack of participation in small problem-based classes and tutorials which are crucial for learning in STEM disciplines. Informal conversations with students highlighted their fear of failure or ridicule from fellow students as the reason for not being engaged. They also suggested that they were more likely to engage activities involving anonymity, such as clickers which are also used in our classes. One strategy that is currently changing this trend is a Students as Partners (SaP) approach, which has been shown to increase engagement, and subsequently student learning (Cook-Sather, Bovill, & Felten, 2014; Healey, Flint, & Harrington, 2014). This strategy involves building partnerships in teaching and learning between students and academics, allowing students to become empowered and part of a community, negotiating the terms of the partnership and taking ownership in the co-creation of curriculum and assessment (Bovill, Cook-Sather, & Felten, 2011; Cook-Sather et al., 2014; Healey et al., 2014; Matthews, 2017). Conceptual models for SaP have been developed as a means of exploring ways to develop partnerships between students and academics (Healey et al., 2014; Healey, Flint, & Harrington, 2016). More recently, a literature review of SaP in higher education (Mercer-Mapstone et al., 2017) uncovered a vast array of positive

outcomes for student-teacher partnerships through increased engagement, motivation, and ownership of learning as well as gaining trust and enhancing relationships. These are just a couple of the positive aspects of SaP which were key to our adoption of this strategy. To address the dwindling engagement in a second-year biochemistry course (~120 students), a SaP approach was adopted to provide students with an opportunity to choose topics for part of the course through a democratic vote and design multiple choice questions negotiating the terms of student-generated questions for assessment. A personal learning platform (PebblePad) enabled students to engage in the SaP approach, providing an environment for completing activities, negotiating the terms of the partnership and a safe space for reflection and evaluation. It has been suggested by Winne and Stockley (1998) that using computers as a medium for learning can not only provide detailed feedback about a person's learning efforts but also has the potential for raising self-observation to new levels.

Literature Review

Technology for Learning

It has been taken for granted that introducing technology will result in 'enhanced learning' (Kirkwood & Price, 2014) although it has been recognised that technology-enhanced learning environments can be effective platforms for student learning and reflection (Kori, Pedaste, Leijen & Matoes, 2014). Conole and Dyke (2004) have identified reflection as an ICT affordance but emphasise that there is nothing inherent about ICT that nurtures reflection. Instead, the key is **how** ICT is used as it "has the potential to enable reflection and criticality to be enhanced" (Conole & Dyke, 2004, p. 118). Salomon describes Gibson's concept of affordances whereby 'affordance' refers to "the perceived and actual properties of a thing, primarily those functional properties that determine just how the thing could possibly be used" (1993, p. 51). In the context of this SaP intervention, the affordance of PebblePad and Atlas (the learning analytics component of the tool), provided opportunities to monitor student progress with the assessment task and their reflective responses to the partnership experience. Another advantage of implementing a SaP approach through a personal learning platform was the opportunity to collect data (with ethics approval). From a research perspective, Winne and Stockley explain the value of technological tools "as replacements for the researcher's intrusive methods for gathering data" whereby they can "meticulously and reliably observe, tirelessly and unerringly sift, and usefully assemble and coordinate massive volumes of data that characterise a student's 1) achievements and 2) the studying tactics the student uses to forge those accomplishments" (1998, p. 132). Therefore, a technology-enhanced approach afforded opportunities to implement and evaluate the Students-as-Partners initiative.

Students-as-Partners for Learning

The metaphor of ‘students as partners’ “imagines and makes way for respectful, mutually beneficial learning partnerships where students and staff work together on all aspects of educational endeavours” (Matthews, 2017, p. 1). Such relational staff-student partnerships provide 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” (Cook-Sather, Bovill & Felten, 2014, p. 6-7). As Bovill, Cook-Sather, and Felten assert, “student voice is premised on the notions that students have a unique perspective on teaching and learning and that they should be invited to share their insights, which warrant not only the attention but also the response of educators” (2011, p. 133). Bovill, Cook-Sather and Felten explain that such assertions are supported by Hattie’s (2008) meta-analysis of student achievement, whereby he “argues that student learning is deepest when students become their own teachers and when their teachers learn from them through feedback and other means” (2011, p. 134).

However, it is important to consider that the form of student and staff participation needs to be fit for purpose in any students-as-partners initiative. Bovill (2013) clarifies that when it comes to staff–student partnerships, they are complex and contextual. Academic staff and students bring different levels of expertise to the process – an aspect that students recognised in their reflections, which is identified in the results and discussion section. Therefore, co-creation in either curriculum design and assessment “is not about giving students complete control, nor is it about staff maintaining complete control over curriculum design decisions” (Bovill, 2013, p. 464).

Partnerships are central to this case study. Partnerships involves “negotiation through which we listen to students but also articulate our own expertise, perspectives and commitments” (Cook-Sather, Bovill, & Felten, 2014, p. 8). This case study was guided by Matthews’ five propositions for good practice (2017), which underpin genuine Students as Partners approaches. These propositions are presented below with a brief reference to how this case study aligned with Matthews’ recommendations.

1. *Foster inclusive partnerships* - Diversity and inclusion are paramount to good practices in SaP approaches (Matthews, 2017). In particular, SaP in higher education “needs to create spaces for participation and partnerships where members from differing social classes, countries, backgrounds” and other diverse demographic groups can collaborate in teaching and learning (Matthews, 2017, p. 2). Extensive research across the STEM disciplines has demonstrated that active learning strategies form an integral part of teaching and learning to student success in the sciences, particularly for underrepresented minority groups such as ‘first in family’ (Freeman et al., 2014). For this case study, more than 50% of the 128 students were ‘first in family’ with 25% of students in this course from Non-English-speaking backgrounds at home.

2. *Nurture power-sharing relationships through dialogue and reflection* - Technology-enabled personal learning environments (PLE) and learning technologies can provide a 'safe' learning environment for students to reflect on a range of learning opportunities. In the context of this case study, students used a PLE called PebblePad in which a reflective assessment 'workbook' was designed that students shared only with the lecturer. This enabled students, as co-creators of curriculum, to choose two topics in a democratic process and justify the reasons for their preferences. The digital workbook also enabled students to reflect on and answer questions honestly about the whole 'students-as-partners' process.
3. *Accept partnerships as a process with uncertain outcomes* - As this initiative was a first foray into SaP, it was uncertain about the extent to which students would engage with the process and how successful it would be in achieving the desired outcomes. Therefore, two key aspects of the intervention's design were considered. Firstly, for students, any assessment would be low stakes but to encourage all students to engage with the process, marks (<10% of total grade) were associated with it. Secondly, students would receive full marks if they completed all the elements of the process and assessment. This 'competency approach with low stakes' was intentional to encourage students to be honest in their reflective comments for evaluation of the approach so they knew that they would not be penalised if their responses reflected that they did not like the SaP process.
4. *Engage in ethical partnerships* - Matthews identifies three components of ethical SaP practices:

the ethics of reciprocal, mutually beneficial practice necessitates a process of power-sharing between all involved; mutualistic partnerships benefit all involved who are working together for good; [and] ethical practices in learning and teaching partnerships mean serving more than the individuals involved as SaP is part of a broader movement for social good grounded in democratic principles. (2017, p. 5)

This case study aimed to be inclusive of all the students involved and created a safe and ethical learning environment.

5. *Enact partnership for transformation* - Matthews explains the transformative potential of partnerships to "create a culture of partnerships grounded in the values of respect, reciprocity, and shared responsibility for learning and teaching between students and staff as equal members of the university community" (2017, p. 6). This case study is shared through a range of professional learning opportunities and the SaP approach is part of the university's learning and teaching strategic plan.

Self-regulation for Learning

There are a variety of conative factors, such as self-regulation, which play a central role in influencing students' academic performance in higher education (Boekaerts, Pintrich, & Zeidner, 2000). Zimmerman defines self-regulated learning as “the self-directive process through which learners transform their mental abilities into academic skills” (1998, p. 2). Self-regulated learners are characterised as active learners who seek out further learning opportunities and resources when they encounter difficulty (Johnson, 2019; Zimmerman, 1990). Johnson succinctly explains that self-regulated learning “is the ability of learners to mindfully proceed through learning tasks, to continually check their understanding as they advance, and to reflect on the learning task after completing it” (2019, p. 133). Self-regulation involves “cognitive, affective, motivational, and behavioural components that provide the individual with the capacity to adjust his or her actions and goals to achieve desired results in light of changing environmental conditions” (Zeidner, Boekaerts, & Pintrich, 2000, p. 751). Essentially, conceptualisations of self-regulation embody the fundamental elements of goal setting, steering processes and strategies, feedback, and self-evaluation (Zeidner et al., 2000). An important distinction between self-regulation and regulation is that the person/student is driving the behaviour on setting a goal or defining a relevant procedure (Zeidner et al., 2000). Zimmerman (2000) proposes a social cognitive model which considers the processes in how university students self-regulate their learning in order to improve their performance. Self-regulation is achieved in cycles consisting of three phases: forethought; performance; and then, self-reflection (Zimmerman, 2000).

Proficient learners have the capacity to self-regulate (Butler, 1998). The key to how successful learners approach academic tasks is skilful strategy (Schunk & Ertmer, 2000). Such learners strategically analyse task requirements, define the criteria for successful completion, and establish realistic goals (Butler, 1998). An essential phase of self-regulation involves self-reflection (Zimmerman, 2000). In the light of the model of self-regulated learning, Butler explains that self-reflective practice requires students to “analyse task requirements carefully, evaluate and select strategic approaches, monitor the qualities of their performance and the success of their strategies they implement, and then modify goals or learning strategies adaptively based on the progress they perceive” (1998, p. 177).

Methods

Students-as-Partners Strategy

Our SaP approach was designed to encompass those propositions outlined by Matthews (2017) which demonstrate a genuine partnership with students in the learning process. Empowering students by providing opportunities for them to be involved and contribute to the course design and the assessment

would hopefully increase participation and engagement in the course. As our first venture into partnerships with students in learning and teaching, we decided to start small, providing an avenue for student to reflect on their experiences and evaluate the impact of the partnership. Technology supported the SaP approach by using scaffolding to complete the partnership activities and negotiations as well as capturing students' reflections. There were three aspects to the partnership: to allow students to choose from a range of topics for part of the course through a democratic voting process; to provide an opportunity for students to design assessment and negotiate the level of student generated questions in the final examination; and finally, to provide a forum for students to reflect on their involvement in the partnership.

Topic Selection

Many science courses are jammed full of content and this second-year biochemistry course is no exception, although a proportion of the core content in this course is required knowledge for transition through to future second and third year courses. The introduction of this SaP approach was designed to maintain the required core concepts for progression and allow students to choose topics they wanted to learn for the remainder of the course. A reduction in the semester length by the university as it transitioned to trimesters provided an opportunity to re-frame the content. Students were able to vote for the two topics they wanted to learn from a selection of six topics. As the topics were inter-related, we felt it wouldn't matter whether they were learning protein engineering and proteomics, or protein therapeutics and protein crystallography. If students could choose what they wanted to learn, then this might increase their engagement in the course.

Student-generated Assessment

In addition to choosing topics for the course, students were provided with an opportunity to contribute to the assessment, designing multiple choice questions and negotiating how many student generated questions appeared on the final exam. Scaffolding resources and instruction on developing multiple choice questions were provided to assist students in creating exam questions. Students were provided with feedback in the form of written comments and a rubric, and approximately 100 questions were created that were relevant to the topics covered in the course. A negotiation was conducted to decide on the percentage of student generated questions that would appear on the final exam. Students were able to vote a minimum of 10% up to a maximum of 50% for the multiple choice section on the exam. The student generated questions were used to create an online practice quiz which could be used as a study resource. The practice quiz generated 10 random questions and students could take the quiz as many times as they wished.

Partnership Reflection and Evaluation

Understanding the student's perspective of the partnership activities and negotiations was vitally important for reflection and improvement of the SaP

approach, and to gain an insight into the ways students were engaging in partnership negotiations and contributions. Students were required to provide a reflection on both choosing topics and designing multiple choice questions. In addition, an overall evaluation was conducted as one of the partnership activities and students were questioned on whether the partnership increased their engagement; had an impact on their learning; the importance of contributing to the assessment and the course design; and if they were able to contribute further, would it be to the curriculum, the assessment, or both.

Results and Discussion

Student reflections in the personal learning platform provided the real insight into student motivation and engagement. The level of student engagement in the SaP in the course surprised the authors, particularly student reflections, which were a minimum of 20 words, and students provided paragraphs, elaborating in detail and with honesty. Of the students who participated in the SaP task, 86.4% rated the partnership experience for the curricula and assessment design as useful (52%) or very useful (34.4%), and 80.5% indicated that they were engaged (32%) or more engaged (48.5%) through involvement in the course design and assessment. Student reflections provided direct insight into students' perceptions of the partnership, and endless information about student learning, metacognition, motivation and knowledge construction.

Student Voice – On Topic Choice

The majority of the reflections on the choice of topic related to students' future courses or degree programs or topics that they thought would be interesting, for example, *"I believe these topics could be of use in my future as a researcher"*, and *"I chose Protein Therapeutics because I find it fascinating how proteins can be used to treat medical conditions"*. Another student stated that, *"I liked that I got to study a topic I chose for once"*. With respect to designing multiple choice questions for assessment, students overwhelmingly commented on the difficulty of this task, such as *"It was a lot more difficult than I anticipated"*. While many suggested that this supported their learning, for example, *"it forced me to have an understanding of the content to create questions in which I could ultimately test myself on, further improving my knowledge"*. However, some students would prefer greater autonomy, e.g., *"I felt like the student topics weren't long enough or in depth enough. I'm not sure if that's Griffith Uni policy issue or something but if the choice we get isn't equally weighted against the others it kind of defeats the purpose in a way"*. A final student comment is a testament to our successful foray into SaP, but also demonstrates how student choice "contributes to learners taking more responsibility for their own learning" (Bovill et al. (2011, p. 135): *"Choosing a topic meant an increase in engagement and interest, and choosing questions for assessment meant that I had to filter through what I know, didn't know and what gaps I had in my knowledge"*.

The SaP process continued for the 2019 offering of Protein Science. While the student cohort chose a different topic to the 2018 cohort, early student comments appear to reflect similar responses to the 2018 cohort. For instance, choosing a topic has reflected elements of personal and/or professional relevance for students as well as intrinsic motivation. For example:

Proteomics – I did not understand what proteomics was, so I conducted a google search that led to some incredibly interesting articles regarding the increasing push of proteomics research, aiming to fill the gaps and shortfalls of gene analysis, genomics. I therefore feel enhancing my understanding of proteomics would have a practical use in future stages of my study.” and “Protein therapeutics – I am currently a nurse, and have a fundamental interest in medical interventions, especially the science behind them. Personally I’d love to learn more about how many of the treatments I may already be using function at a molecular level.

Student Voice – On Assessment Design

Students designed multiple choice questions (MCQ) and voted on how many should be on the exam. Students were asked to: *Comment on your experience in developing a multiple-choice question for an exam.* Many students commented that the task was valuable, enjoyable or interesting. In particular, 36.4% of students stated that the task was challenging and more difficult than they anticipated. Approximately one third (32.3%) mentioned that designing an MCQ required knowledge and understanding of the topic and this improved their learning and understanding. Another six percent of students stated that designing an assessment assisted with revision of the topic. For example, *“The ability to write your own multiple choice question was a great learning experience as it was a great way to reorganise notes and study for the different modules in a new way which led to learning more conceptually instead of rote learning”.* Many students not only found the task of designing exam questions difficult but also they reflected on their understanding of the topic and if improvements were required, such as *“Writing a multiple choice question was harder than I thought it would be, however, it did help highlight the topics I understand well, and those that may need improvement”.* Clearly students are not only reflecting on their level of understanding and adjusting their learning as a result, which appears to follow the self-regulated learning process outlined by Zimmerman (2000).

Student Voice – Insights into Self-regulated Learning

Early findings suggest that self-regulated learning is central to students completing the assessment tasks. Several student comments on designing multiple choice exam questions appeared to align with Zimmerman’s cyclical phases of self-regulated learning (2000). For example:

Generating a multiple choice question that can be both challenging and requires thinking time for the person trying to answer the

questions can be both daunting and time-consuming. During this exercise I had to go over some notes from lectures and textbooks. From this, I was able to reinforce the method of gel electrophoresis. I tried my best to use it in an applicable situation. I found the exercise worthwhile and a good study revision. (see Figure 1).

I found this experience to be more difficult [than] I had anticipated and often found myself formulating questions that were either far too difficult or obscure and others that had been too blatantly obvious. Despite this I did enjoy reflecting on exam questions I have read in the past and trying to emulate their tone and level of difficulty in order to help me create this multiple choice question. Overall I am grateful for the opportunity to design a question even if it may be a poorly structured one and I now appreciate the difficulty behind having to create an exam question.

Interestingly, Steffens (2006) asserts that self-regulated learning can be considered too narrowly or does not explicitly take into account the learner's personal goals. This student's comment captures not only the goals of performing the task but also their professional aspirations:

It puts you in an examiner's shoes. You must consider what questions will best test not only the memory of a topic, but the understanding of a topic as well. Prompts you to analyse concepts in detail and apply them to real world problems or questions you might come across in the field [of] protein science. Also places you in the perspective of a scientist in terms of solving problems, asking certain questions or performing certain tasks by referring to the knowledge of these topics in the field of protein science.

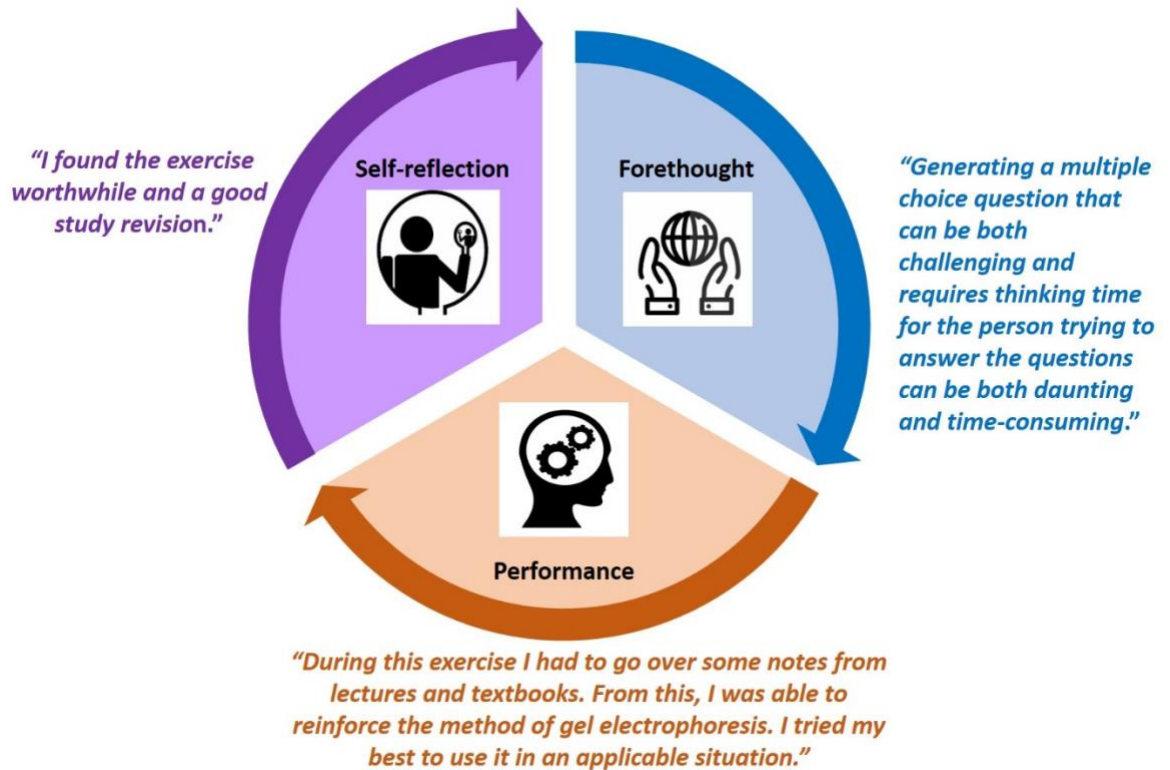


Figure 1. Student reflection on assessment design: our interpretation of self-regulated learning.

Student Voice – On the Students-as-Partners Experience

Providing a forum for student reflection and evaluation of their partnership experiences was a very valuable aspect of the SaP initiative. In particular, the students' reflective responses to the topic-choice question provided insights not only into the extent to which they valued the democratic process but also their experiences of the process. For example: *"I liked the idea of putting the topic choices to a democratic decision, for the cohort to choose what would be the best for them to learn, and as to what would prove the most interesting for the entirety"*. Several students emphasised the importance of having a say was important to them as the learners, for instance *"I seriously loved the idea of actual students contributing to the assessment and I would love, love, love to see more of this in future courses. It's simple really because at the end of the day it is US who are learning the content and being able to have a say on what parts of that content we get to be assessed on is totally awesome"*. There were no specific questions that focused on the adoption of a PLE; however, there were two specific comments about the technology in students' overall reflections: *"I don't like PebblePad though ... no reason why ... If you guys could find another platform to use that would be cool"* and *"While PebblePad was annoying, I think that it was a good way to do this assignment"*.

Conclusions

The overall impact of introducing a Students-as-Partners (SaP) approach to improve student engagement in the Protein Science course has been extremely successful. The surprising collateral benefits of this SaP approach were the unexpected ways that the process supported student learning. While students indicated that they were more engaged in the course as they could select topics of their choice and contribute to the assessment, based on our observations, this did not appear to lead to greater participation in classes or increased attendance in lectures. However, the uninhibited reflections provided direct insight into students' positive perceptions of the partnership, and valuable information about student learning, metacognition, motivation and knowledge construction. The technology-enhanced approach also enabled an unforeseen richness in students' reflections. This surprising level of students' reflections provided was enabled by the implementation of a personal learning platform (PebblePad) where each student could privately and honestly reflect on their learning experience.

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