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WHAT DOES CBL, ESD AND SAP SPELL? ACTIVELY ENGAGED STUDENTS WHO LEARN. (THE BENEFITS OF USING A CHALLENGE BASED LEARNING (CBL), AN EDUCATION FOR SUSTAINABLE DEVELOPMENT (ESD) AND A STUDENT AS PARTNERS (SAP) APPROACH IN EDUCATION)

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Abstract

This paper looks at the integration of Challenge Based Learning (CBL), Education for Sustainable Development (ESD) and Student Partnership into a module underpinned by the Sustainable Development Goals (SDGs) for computing students. It provides a brief overview of Challenge Based Learning and outlines the three phases of the approach (Engage, Investigate and Act). It explains the approach to integrating Education for Sustainable Development (ESD) as a core element of the module, rather than an add-on element. It describes how the Students as Partners (SaP) approach was a key component of the module, whereby students were given the opportunity to choose the challenges they wished to address as well as submission formats. It shows how digital technologies underpinned the module to provide a coherent and beneficial learning experience for students. This paper highlights the feedback from students on this innovative approach to learning and some suggestions for others considering adopting this approach.

Keywords:

Challenge Based Learning, Education for Sustainable Development, Student Partnership, innovative teaching.

Introduction

Education should be informative, engaging and beneficial to learners, but it can be hard to achieve this for many reasons. Learners want active, authentic and meaningful learning experiences, but it can be difficult to provide them in certain traditional and institutional contexts. When things get innovative, things get messy and it can be difficult to envision how these innovations will work in practice. There are big challenges facing education - how to engage learners, how to ensure that they learn, how to enable them to become lifelong learners, how to ensure academic integrity in authentic and meaningful learning contexts. There are even bigger challenges facing society, including the need to address the Sustainable Development Goals (SDGs https://sdgs.un.org/goals). This paper provides an overview of how it is possible to give students creative, challenging and beneficial learning experiences with the use of digital technologies combined with a Challenge Based Learning (CBL) approach imbued with an Education for Sustainable Development (EDS) lens and having the students as active participants in their own learning. There are challenges but the opportunities outweigh them and it is worthwhile to adopt these innovative approaches for a better future from both an educational and sustainable perspective.

Background

Challenge Based Learning

Challenge Based Learning has been an approach that has been used since 2002 (Birol et al, 2002). While there is no one agreed definition, the definition by Malmqvist et al. (2015) encapsulates the essence of the approach. They define CBL as a learning approach where learning occurs via the identification, analysis and design of a solution to a sociotechnical problem. While there are some similarities, CBL differs from Project Based Learning and Problem Based Learning in that the solution is not known in advance, the process and not just the final product is important and there is an emphasis on sustainability. In their literature review of CBL, Gallagher and Savage (2020) identified eight characteristics of CBL. These are challenge definition, global themes, real-world challenges, technology, flexibility, multidisciplinary and innovation and creativity. Not all CBL experiences will have all of these characteristics, but most CBL experiences will include most of them as far as possible. One of

the main CBL frameworks is the Challenge Learning Framework (Challenge Learning, 2018) which has three interconnected phases: Engage, Investigate and Act.

Education for Sustainable Development

2005-2014 was declared by the United Nations to be the Decade for Education for Sustainable Development (ESD). ESD encompasses the environment, economy and society. It aims to ensure that learners have the relevant knowledge, skills and dispositions and values to enable them to become active contributors to a more sustainable future. ESD is a complex topic and one that must take the local context and culture into consideration. Huckle and Wals (2015) report that the decade was idealistic and did not achieve what it set out to achieve. In some ways, this is to be expected, given the complexity of the topic. However, it is important to continue to integrate ESD into educational systems. McKeown et al. (2002) provide a very accessible overview of ESD. They outline the need to reorient education and the need to address knowledge, skills, perspectives, values, and issues in a formal curriculum.

Students as Partners

Students as Partners refers to activity engaging students in all aspects of the learning process from the design of the curriculum, how teaching and learning takes place and assessment design. Student choice and the concept of co-creation is very important. Mercer-Mapstone et al., (2017) provide a good overview of the topic of students as partners in Higher Education. Harrington et al. (2014) note that engaging students and staff effectively as partners in the learning process is one of the key issues facing higher education in the 21st century. Respect, reciprocity, and shared responsibility in learning and teaching are key principles in student partnership (Felten et al., 2014). One area of focus in the research literature to date is of student partnership activities at the undergraduate level, and focused on teaching and learning enhancement. Research shows that with a student partnership module, there is increased student engagement and self-efficacy and staff can gain new insights that can improve their teaching (Mercer-Mapstone et al., 2017). While it can be difficult to achieve full partnership across all aspects of teaching, learning and assessment, it is important to give students some control and ownership over their learning. The degree to which this is feasible and achievable will depend on the local context and is something that takes time to develop.

Methodology and Approach

Many modules are designed with the content as the main focus. This is understandable as the module designers are subject matter experts and their module is part of a larger programme that should deliver a comprehensive and coherent learning experience for students. “Content is king” is a phrase that comes to mind in this regard. It is not often that educators get a chance to develop a module from the beginning that focusses on combining innovative teaching approaches to create an enjoyable and beneficial sustainable development learning experience for students. The module [name redacted] is delivered to final year computing students and focusses on how technology can be used to address the SDGs. A student partnership approach underpinned the module, with students being given choice on the SDG they wanted to address as well as the regular discussions about the topics covered in the module. The module follows the three phases of CBL: Engage, Investigate and Act.

Challenge Based Learning – Engage Phase

In the Engage phase, students are introduced to the concept and approach of CBL, so that they can understand the unknown nature of the module. They learn about the SDGs, which they have not encountered before on their programme. They also learn about innovative and potentially disruptive technologies that could help to address the SDGs. Resources are provided on the VLE (Moodle) along with some HP5 quizzes for self-assessment. The Engage phase ends with a blitz where the students have a chance to select which SDG they want to focus on and a general subtopic within that goal that they would like to address. The board feature on Moodle is used to enable students to see what SDGs are popular with the class and to post some ideas of possible topics for investigation. The students self-coalesce in a group by the end of the blitz and this is their group for the rest of the module.

Challenge Based Learning – Investigate Phase

In the Investigate phase, the students have an opportunity to learn about emerging technologies that might be used to address their chosen SDG. There are master classes on a variety of topics, most of which are new to the students. These classes cover both technical and non-technical topics so students can consider the potential ethical, psychological and society impacts of any proposed technical solution. Some of the master classes are delivered online, and there is extensive use made of Moodle boards to showcase group progress and provide feedback on a weekly basis.

Challenge Based Learning –Act Phase

In the Act phase, students come up with their proposed solution. In this module, they have to produce an artefact for their chosen client. In an ideal scenario, there would be a real-world external client, but in this case, students decide who their real-world client would be. For example, a group looking at a technical solution to micro plastics in European waters, might have the European Commissioner for Environment, Oceans and Fisheries as their client. Students can decide what their artefact is, but in general, it is usually a project report. Some students also submit an infographic, a podcast or a video along with their report. Students also do an Interactive Oral assessment (Sotiriadou et al., 2020) at the end of the module, where they get to engage in a discussion with their real-world client (a role assumed by the module coordinator). Students are also required to submit a group technical report and an individual module reflection at the end of the module.

Digital Technology

Digital technology plays an important role in this module. It is used to provide access to resources, submission of assignments and live webinars throughout all phases of the module. Extensive use is made of Moodle boards which allow students to give their opinions on different topics and enable both the students and module coordinator to see progress across the semester. Vevox (vevox.com) is used for quizzes throughout the module to gauge students' knowledge before teaching a topic so that known areas are briefly reviewed and unknown areas are explored in greater depth. Vevox quizzes are also used to get anonymous student feedback at the midpoint of the module. Students work in groups in face-to-face sessions and online synchronously and asynchronously. They develop (digital) resources throughout the lifetime of the module and they use a range of digital tools and apps for regular group communication.

Results and Discussion

This module has been delivered twice, in 2021 and 2022. In both years, the module followed the engage, investigate and act phases of CBL. This module is an optional module for students and in both years around 80% of the students (36 and 42 respectively) have chosen the module. Many aspects of the module are novel for the students. They would not have experienced CBL before. Up to this point in their education, the students would only have been familiar with modules with known or expected solutions to assignments and assessments. The concept of an unknown solution can be challenging for them.

This module could not incorporate all aspects of ESD but there was a strong focus on the SDGs throughout the module. Somewhat surprisingly, they were unfamiliar with the SDGs. There is an image in the public's consciousness that 'young' people are very engaged with the issues surrounding climate change, but the experience to date on this module is that they are unaware of the other SDGs. The students would have mainly focussed on technical and information management topics in their education prior to this module. The incorporation of ethical, psychological and societal considerations into their (technical) recommendations was novel for the students.

On this programme, students have very limited choice over the modules they take and the topics of their assessments. This is one of the few modules where they can choose the topic and how they want to submit their work. Initially, students feel a bit uncertain about this, but it has worked well so far. Students are more invested in their learning and it is also more interesting for the other students and the module coordinator as they get to learn more about different topics.

Individual and Group Assessment

It is always important to have a balance between individual assessments and group assessments in a CBL module. Individual assignments enable the student to demonstrate their own knowledge and thinking on a particular topic. Group assignments are more natural in the CBL context as the students should all be working towards the same goal across the duration of the semester. There is always the issue of free riders in group activities and students who work hard on the group activity always feel aggrieved when those who have not contributed get the same marks as those who do. The regular weekly check-ins with the students and the record of their interactions with the VLE and other technology tools (e.g. Google docs) enabled the module coordinator to monitor individual student contributions to the group project. While most group members have received the same grade for group work, students have been given different marks for the group component when there was a lesser contribution from certain group members.

Student Feedback

Although the feedback from students in the first year of delivery (2021) was generally positive, the students said they would like more clarity at the start of the module, particularly in regards to assignments and the overall approach to assessment. Some of the issues relating to this stemmed from the fact that the module coordinator was new to the CBL approach and there was an evolving of expectations as the module progressed. This issue was addressed in the second delivery of the module (2022).

At the end of the module, students were asked to reflect on collaborative situations, CBL and assessment and feedback in the module. The feedback reported here is from the 2022 cohort, but the feedback from the 2021 cohort was broadly similar. 86% of the students (36 out of 42 students) did a reflection and most students submitted a report, while others submitted slides, podcasts, and videos. The students were honest and open - one student recorded three separate audio files, one for each component - the last one was around five minutes, the other two were almost 15 minutes each.

Students were happy to use technology for collaboration throughout the module. One student remarked that "... *sharing documents and presentations through google was how all of the projects were completed, this was incredibly helpful as everyone could work on their own time at their own pace…. we wouldn't have been able to complete our projects without them*". Students liked the CBL approach. They reported that "*A lot of college can be theory work, which is important to know but I think that a CBL approach is more beneficial when it comes to implementing knowledge from college into the real world and the workplace*." . They also noted that it enabled them to "actively engage with their learning". One student said that CBL "*clearly facilitated the enrichment of my knowledge gained during my projects*.", while another noted that "*it encouraged me to think critically and creatively*".

In relation to assessment, the feedback from the students was also positive. Students reported that a closed-book, timed, invigilated exam would not have been appropriate for the module. According to one student, "*In my opinion, timed, closed-book exams are not a testament to what you learnt in a subject, given the pressure, nor would an exam indicate the personal impact the CBL had*." and another student agreed with this sentiment - "*I also feel that continuous assessment provides a clearer and more accurate representation of my knowledge and understanding*". The positive benefits of Moodle boards were also noted by one student "[*the Moodle] boards ensured that our group engaged in discussions revolving around our topics. These discussions were often then brought to the class, where our lecturer could provide feedback that could help alter the direction of our project*."

Staff

Mercer-Mapstone et al. (2018) note that often the literature on student partnership is student-focussed and there is a need for more research on the staff aspect. The experience of this module is that it is challenging, enlightening and invigorating for staff. Challenging because 'control' is shared between the academic and the students. Enlightening because it can show the academic what students can do when correctly supported. Invigorating because students' enthusiasm to learn can remind the academic of what education can be and re-invigorate their pedagogy of job philosophy.

Limitations

This module has only been delivered twice and there are elements that need to be enhanced in order for the module to be truly a CBL module. There are two main components that would strengthen the module. The first is the involvement of real-world stakeholders. Instead of the students producing their solution artefact for an external client that they will not actually interact with, it would be ideal if they could work with a real client who is intrinsically interested in the challenge. This is difficult to achieve and the issue of parity would be very important - would the students with an actual external stakeholder have an unfair advantage over students who did not? This would be something that needs to be addressed in future.

The second enhancement would be to include students from other disciplines into the module. In the two iterations to date, the students have all been from the same programme. However, it is planned that students from different disciplines will take the module in future years and it will be interesting to see how the students interact and learn together to produce their proposed solutions.

Suggestions

There are four main suggestions for others considering using this approach of combining a CBL, ESD and a Students as Partners approach in their teaching. The first is to familiarise oneself with the literature on CBL, learn from others who have used a CBL approach and decide on how best it will fit with the module in the local context. The second is to leverage the existing resources available in the institution and across academic networks, particularly in relation to speakers for the master classes. Many academics and researchers are happy to talk about their areas of expertise with students and this usually makes for an engaging and interesting learning experience. The third suggestion is to use technology extensively throughout the module - it makes things much easier for students and staff, it enhances flexibility and gives students the opportunity to learn key transversal and transferable skills in a safe environment. The fourth and final suggestion is to just go for it. It can be daunting for an academic who is used to having control over a module and being a subject matter expert, to cede control over to students and not know the answers to questions that students might ask. However, it can be a rewarding and rich experience. If the students are being asked to step into the unknown, the module coordinator should also walk with them on this journey.

Conclusion

People can sometimes feel deflated when they consider the challenges of the SDGs. Academics can feel overwhelmed at the difficulties in integrating ESD into their modules in an interesting and coherent manner. Experience to date indicates that staff are interested in this multifaceted approach, but they are slightly concerned about how to go about it and would like to learn more about a real world example. While there are limitations in this case study, it is important to show others what can be done and that it is possible to transform learning. The approach adopted in this case study to weave CBL, EDS and student partnership approaches into a beneficial and enjoyable learning experience for students and staff demonstrates the art of the possible in this space and interesting approaches for future education.

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