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Can Work-related Learning Activities Improve Student Engagement in Higher Education?

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Abstract

Research has found higher education students are typically passive and disengaged. This paper updates and expands upon the author's previous study of engagement issues in universities and the value of work-related learning for improving engagement and enhancing student learning. This previous work involved a case study designed to improve engagement in lab sessions with realistic/real-world work-based examples. While results indicated that activities like this can increase engagement and enhance student learning the study only involved a small sample and there were some areas for improvement. Consequently, the study has been repeated with an expanded case study which takes a holistic approach where students take on the role of an ethical hacker to identify security weaknesses and then fix those security issues. Findings corroborate the previous study's findings and add further weight to the argument that work-related learning activities can increase engagement and enhance the student experience and student learning.

Keywords: Student Engagement, Student Disengagement, Work-related Learning, Passive Learning, Active Learning

1.0 Introduction

Engagement in higher education is important for learning and academic success, and for a positive student experience [1, 2]. Yet, despite this, there is a lack of engagement and attendance among university students [2-4]. Recent findings [5, 6] show improvement in attitudes towards studying but low levels of engagement remain in many areas, such as classroom engagement, time spent on campus, time spent on private study, and use of peer and collaborative learning.

In a previous paper [7] this author showed that work-related learning can help increase engagement and enhance student learning. The study was designed to improve engagement in a lab session by involving realistic/real-world work-based examples based on the hypothesis that students are motivated by career ambitions and wish to see the vocational relevance of their studies [2, 8, 9]. Results indicated that activities like this can increase engagement and enhance the student experience and student learning. However, it only involved a small sample and there were some areas for improvement. Consequently, the study was repeated with an expanded and improved case study to cover additional content to increase learning opportunities, and to establish a deeper understanding of the value of work-related learning.

The improved case study takes a holistic approach, where students take on the role of an ethical hacker to identify the security weaknesses of a website and then fix those security issues. This approach increases learning opportunities by exploring both attack and defence through practical tasks. Students see how easy it is to breach the security of a poorly written/defended website, and then explore the code of the website to see its shortcomings and work on fixing the security problems.

This paper starts by covering the rationale for this study based on academic literature, covering engagement, disengagement and work-related learning. It then introduces the new improved case study and how it builds on the previous study. This is followed by an explanation of the data collection process and the results collected. Findings are then discussed, along with possible areas for future work. Finally concluding with an evaluation of the effectiveness of the study at meeting its objectives.

2.0 Rationale

2.1 Engagement and Disengagement

Interest in engagement in higher education has shown its importance for learning and academic success, and for a positive student experience [1, 2]. Governments use it as a measure of an institution's performance; educational institutions use it as a tool for measuring quality and for marketing purposes; and researchers and educators contemplate the relationship students have with academic institutions, and how engagement can improve students' learning experiences and academic achievements [1, 2].

Despite engagement being an important concept there is little agreement on its definition, and definitions tend to only describe parts of student engagement and approaches to measure it [1, 2]. Schaufeli et al.'s [10] definition of engagement being "a positive, fulfilling, and work-related state of mind that is characterized by vigour, dedication, and absorption" [10, p.465] is a useful basis for a more complete definition. This work is built on by Baron and Corbin [2] who conducted an in-depth analysis of engagement definitions to address the disagreement among definitions and argued that a wider definition is required. This work culminates in their own all-encompassing definition.

"...we propose a definition that combines the individual's state of mind with a sense of community. Thus, the definition by Schaufeli et al. [10], together with definitions that emphasise community and social engagement, capture individual engagement for us. Therefore, we suggest that the engaged student is the student who has a positive, fulfilling and work-related state of mind that is characterised by vigour, dedication and absorption and who views him or herself as belonging to, and an active participant in, his or her learning communities." [2, p.763]

Their substantial work exploring engagement and dealing with disagreements in definitions provides confidence in this being a reliable, accurate and complete definition.

It is not just engagement that is important, disengagement also needs clearer definition. Academics report that there is a lack of engagement and attendance among university students, and students are typically passive and disengaged [2-4]. Issues include students' poor attendance, lack of active involvement in learning, reluctance towards self-study, surface rather than deep approach to learning, inadequate preparation for lessons, spending as little time on campus as possible, and an overreliance on the teacher and teaching material [2, 6]. Recent findings [5, 6] show improvement in attitudes towards studying but low levels of engagement remain in many areas, such as classroom engagement, time spent on campus, time spent on private study, and use of peer and collaborative learning.

2.2 Work-related Learning

University students/adult learners are typically interested in and motivated by seeing the value of what they are learning and how it relates to their lives, with applicability to their future careers being particularly important to them [2, 8, 9]. This aligns with key adult learning theories such as Student-Centred Learning [11, 12] and Andragogy [13] which focus on the learner's personal learning experience, individual educational goals, and learning needs. This suggests orientating academic studies around future careers, such as via work-related learning activities, could aid engagement.

Work-related learning focuses on vocations to provide an understanding of work environments and job roles, and to show how knowledge and skills learned are valuable and can be used within the workplace, linking theory with practice [14, 15]. This learning can come from educational institutions, via work-related learning activities (learning based on work), or as a result of learners working within a work environment (learning from being in work) [14, 16]. Work-related learning activities within educational institutions, which this paper provides an example of, include simulated work tasks, scenarios and environments; role-playing; case studies; and project briefs set by employers [14, 15].

3.0 New Improved Case Study

This paper's case study is based on the author's previous case study [7] that focussed on whether work-related learning activities can help increase engagement and enhance student learning. This new improved and expanded case study takes a holistic approach, where students take on the role of an ethical hacker to identify the security weaknesses of a website and then fix those security issues. This was done to cover additional content to increase learning opportunities, and to establish a deeper understanding of the value of work-related learning.

3.1 The Original Case Study

The original/previous case study [7] was created in response to an identified lack of engagement among university students. It involved creating a lab session which is vocationally relevant with examples that are more realistic to a work environment than a traditional lab session. This approach aligns with best practice for adult education [11-13] and should appeal to university students motivated by seeing how topics covered relate to their lives and future careers [2, 8, 9].

The original case study looked at potential vulnerabilities within web pages and how to protect them. The existing/original lab session involved students writing code to test vulnerabilities and discover how to prevent them. The new lab session involved the identification of security problems via ethical hacking activities where students test a specifically created website's security by trying to exploit its security weaknesses. The existing and new labs were used together and complement each other by looking at security from different angles; defence (existing) and attack (new).

As the new lab session was about attacking websites (identifying vulnerabilities) and the original/existing lab session was about defending websites (preventing vulnerabilities) it would have been good to cover both angles in one session, but this wasn't feasible at the time.

The new lab's tasks were designed to be completed in groups of 3 to a) simulate a development team in a work environment, b) to develop team-working skills, and c) to allow students to help each other to achieve more in the time available.

The lab started with a mini-lecture to provide students with necessary information to complete the lab work. It also included content for a discussion afterwards on defence and how to prevent against the vulnerabilities discovered while doing the tasks.

Following the mini-lecture, the students were given 20 minutes to complete the tasks. This was followed by a discussion on what the students learned and how to resolve identified vulnerabilities. The students were then asked to provide feedback on the usefulness and value of the session, including whether it is useful for helping them enhance their coursework.

3.2 Changes Made for the New Improved Case Study

The study was repeated to address its limitations, to cover additional content to increase learning opportunities, and to establish a deeper understanding of the value of work-related learning.

One of the main issues with the original/previous case study was the illogical ordering of sessions and tasks. Due to logistical reasons its case study lab took place before the related lecture, which is unusual as typically labs occur after a lecture to aid understanding of topics the lecture covered. This meant the lab had to start with a mini-lecture to provide students with necessary information to complete the lab work. The new improved case study addressed the problem by having the lab occur after the related lecture, which is more logical and means learners receive key related information via the lecture prior to attending the lab. Consequently, the mini-lecture was no longer required which freed up time for reflecting on topics, additional tasks, and a more manageable pace. Selected slides from the mini-lecture, with minor improvements made for clarity/understanding, were however provided for reference and guidance. They covered extra content that didn't fit in the lecture and focused on specific aspects relating to the lab tasks.

The original case study lab was treated as a challenge and consequently lab resources (lecture slides and lab worksheets) were not made available before the lab. However, ideally such resources should be available before teaching sessions to allow students to prepare for the sessions should they wish. This is especially useful for students with learning difficulties who may, for example, find reading difficult so would appreciate extra time to read lesson content [17, 18]. Also, while challenging students to identify vulnerabilities within a website could make the lab more enjoyable, the challenge approach could cause unnecessary stress, anxiety and complexity, and prevent students from completing the tasks and learning about the vulnerabilities the lab focuses on. The new improved case study lab addressed the problem by removing the challenge aspect so that releasing lab resources before the session was possible, and by providing additional guidance.

The new case study lab retained the attacking a vulnerable website focus from the original case study to allow for further testing of its work-related learning approach. A second part was added which focussed on defending websites against security vulnerabilities. It involved students being provided with the code for the vulnerable website and being tasked with fixing its security problems/vulnerabilities. This made use of the time saved from the removal of the mini-lecture. Also, this greater focus on defence meant the end of session discussion on defence strategies was no longer required saving further time. Furthermore, it meant the previously used additional disconnected standalone lab with defence focussed tasks (what was the original/existing security lab, prior to both case studies) became no longer required, so could be scrapped, as defence tasks are included in the new case study lab.

Thus, for this new improved case study lab, security attacks and defence are handled via a holistic approach in one integrated lab session improving learning opportunities. While both topics were covered in the original study they were not integrated, and this approach addresses that limitation.

The attack worksheet allowed students to work in pairs if they wished, and many students chose to do this to help each other to understand and complete the tasks, thus retaining the team-working benefits of the original case study lab while also allowing for students who prefer to or need to work alone. The defence worksheet was designed to be worked on individually as students would need to use their individual web server accounts to test out the code they were working on, plus if they were unable to complete this work within the lab time they'd need to complete the lab tasks after the lab session which would be easier to facilitate when working alone.

A major limitation of the original case study, which caused limited confidence in its results, was a lack of participants with only 13 students taking part. This was probably caused by its case study lab being an additional optional session. The new case study addressed this problem by making its lab a regular lab session. 25 students participated and completed the feedback survey which, while still relatively low participation, combined with the original case study's results provides greater confidence in the value of work-related learning activities. It is particularly enlightening where results are similar across both surveys as it shows two separate samples concur.

4.0 Data Collection

Data collection took place during the case study lab sessions, and both case studies were evaluated via an anonymous voluntary student feedback survey. It asked for opinions on statements regarding learning and understanding, session organisation, general opinions, and views on the case study lab versus regular lab sessions; possible responses were Strongly Disagree, Disagree, Agree and Strongly Agree.

Originally a middle neutral opinion “Neither Agree or Disagree” was excluded for all questions to force students to think more carefully about their answers and to avoid indecision and the temptation of answering with the middle/neutral option which is a common problem when surveys have middle/neutral answers [19, 20].

On reflection this approach is not suitable for some questions, such as comparing the new case study lab to regular labs, as opinions could feasibly be the same, i.e. they have no preference for either style of lab. Consequently, for the new study middle/neutral answers were allowed for the questions about comparing the new case study lab to regular labs; although of course it increases the chance of undesirable results. This does however mean for these questions comparing the results of both studies lacks validity as one is not comparing like for like results. A free text box was also included for any comments students may wish to make about the session, such as things they liked or disliked and areas that could be improved.

5.0 Results

5.1 Original Case Study

Results from the original/previous case study were inconclusive as, while they appeared to show that work-related learning activities like used in the study may be able to increase engagement and enhance the student experience and student learning, the study only involved a small sample providing limited confidence in results, and there were some areas for improvement.

5.2 New Case Study

For the new case study, results from the student feedback survey are overall positive and better than the original case study’s results suggesting improvements made are beneficial; additional comments (omitted to save space) were also all positive.

5.2.1 Learning and Understanding

Responses for the learning and understanding statements were almost all positive.

72% strongly agreed and 28% agreed the session helped them understand web security better, with no negativity for this statement. This is slightly more positive than results from the previous study that had 61.54% strongly agree and 38.46% agree responses.

However, regarding whether the session improved students’ understanding of ethical hacking 64% strongly agreed, 32% agreed, and 4% disagreed. Given the ethical hacking focus of the session this disagreeing, albeit a negligible amount, is confusing, especially as there were no negative responses for the previous study, so perhaps some students didn’t realise that tasks set were ethical hacking tasks. However, in comparison to the previous study, over twice as many students strongly agreed with the statement (up from 30.77% (with the rest agreeing)).

All students were positive that the lab would enhance their assignment work with 76% strongly agreeing and 24% agreeing. This is slightly more positive than the previous study, which had 61.54% strongly agreeing, 30.77% agreeing, and 7.96% disagreeing, and appears to show the improvements made to the lab are beneficial and have tackled the previous negativity.

5.2.2 Session Organisation

64% of students strongly agreed (up from 53.85% compared to the previous study) that the session was well organised, and, just like previously, the rest agreed.

Regarding lab materials (worksheets and corresponding lab slides) being clear and informative the majority of students (56%) strongly agreed that they were, and the rest agreed. This is much more positive than the previous study which had the majority of students (53.85%) agreeing (rather than strongly agreeing), with the rest strongly agreeing.

Additionally, regarding information being presented in a concise way the previous study also showed a little less positivity. While the majority of students (61.54%) agreed with the statement only 30.77% strongly agreed and 7.69% disagreed, showing, despite generally finding lab materials clear and informative, some students felt lab materials were not as concise as they would have liked. Some of this lack of perceived conciseness could have been caused by students seeing the detailed explanations used for providing clarity and extra knowledge as excessive so a better balance between detail and conciseness could be required; this was considered for the new improved case study. For the new study, results were much more positive with 68% strongly agreeing and the rest agreeing, thus suggesting the improvements made to the lab materials are beneficial.

5.2.3 General Opinions

When asked if the lab would make them better web developers or designers the majority of students (60%) strongly agreed that it would, with 36% agreeing, but 4% disagreed. This 96% positivity shows the value of the session, and sessions like it. In comparison to the previous study these results are a significant improvement as that study had 38.46% strongly agreeing, 38.46% agreeing, and 23.08% disagreeing.

Regarding the session being valuable the new study had 72% strongly agree and 28% agree, while the previous study had 53.85% strongly agree and 46.15% agree, suggesting improvements made are beneficial.

Similarly, there is increased positivity regarding the session being worth repeating in future years. The new study had 84% strongly agreeing and 16% agreeing, while the previous study had 46.15% strongly agreeing and 53.85% agreeing.

5.2.4 The New Lab versus Regular Labs

Two questions compared the new lab, being a different style, to regular labs. In the new study these statements allowed a middle/neutral answer of neither agree or disagree as it is feasible for students to be indifferent over lab styles. This neutrality was however excluded for these statements in the previous study which was an oversight that the new study addressed. It does however mean direct comparison of results from the two studies for these statements is difficult and lacks some validity.

When asked about if they (students) felt they learned more in the case study lab compared to regular lab sessions there was no negativity, as 20% strongly agreed, 40% agreed and 40% neither agreed or disagreed. In comparison to the previous study these results appear to be more positive as there is no negativity, whereas the previous study had 23.08% disagree (with the other results being 23.08% strongly agree, 46.15% agree, and 7.69% gave no answer).

However, the middle/neutral answer option being unavailable for the previous study could have influenced these results. For example, were students overly positive or negative when there was no middle/neutral answer to choose. Likewise, when the option was available with the new study students could have chosen it instead of being negative due to not wanting to offend the teacher. Also, one could view the neutral “neither agree or disagree” option as a pseudo negative response as students don’t want to commit to a positive response; but it can also be considered positive as respondents don’t feel strongly enough to commit to a negative response.

Comparing the strongly agree and agree responses, these are slightly higher for the previous study, so maybe the lack of a neutral answer forced increased positivity; but there was 23.08% disagree, while there was no disagreement for the new study. So, it could be that the neutral option, being available for the new study, was chosen instead of being negative, or was the new case study lab better received and there was no need to be negative or students were indifferent over lab styles and given that there was no negativity at all this seems most likely.

When asked if they enjoyed the lab more than regular lab sessions students were a lot more positive about the new case study lab with 48% strongly agree, 32% agree and only 20% neither agree or disagree responses. In comparison to the previous study, which only had 7.69% strongly agree but with 76.92% agree, and disagree and no answer both having 7.69%, the positivity is almost the same (80% vs 84.61%), but with a lot higher strongly agree responses for the new study. The lack of negativity was also encouraging, but it may be the neutral response was used as a pseudo negative response.

Results across both studies were positive, with increased positivity about the new case study’s lab indicating improvements made were well received, which is a strong endorsement of the session’s approach compared to regular lab sessions.

6.0 Discussion and Future Work

Student feedback for the new case study lab was overall positive, corroborating findings from the original/previous study, showing the aims of the session have been met. The results are better than the original case study's results suggesting improvements made, such as security attack and defence now being integrated into one holistic lab session, are beneficial.

Informal observations showed students were engaged, and their survey responses show they enjoyed the lab and overall saw value in it. Additionally, the survey results show students felt they learned the skills the lab aimed to teach and that it would help them improve their future work. The informal observations also showed students understood the topics covered and could complete lab tasks. There were no strongly disagree responses for any survey question.

Negativity has been significantly reduced, and in most cases removed entirely, and where negativity remains it is a negligible amount. These small areas are 4% disagreeing that the session improved understanding of ethical hacking, and 4% disagreeing that the lab would make them better web developers or designers. While an insignificant amount one could still attempt to tackle this negativity, by for example improving session introductions to explain their relevance and value better.

While only 25 students participated in the study its findings, combined with the original case study's results, add further weight to the argument that work-related learning activities are valuable, are enjoyed by students, and can show the relevance of what is being taught. This appeals to students increasing the likelihood of student engagement, and informal observations showed engaged students, and enhances the student experience and student learning. A larger sample was originally planned but unfortunately session attendance was low.

This was only one session with a small number of students therefore to properly assess the value of work-related learning activities a wider sample over multiple sessions would be advantageous. This will provide a larger sample size, the ability to assess progress over a longer period including use of more complex assessment, and more results to allow for a deeper analysis to take place. Also, one could consider making further improvements to tackle the, now extremely small, areas of negativity.

7.0 Conclusion

This paper updated and expanded upon the author's previous study of engagement issues in universities and the value of work-related learning for improving engagement and enhancing student learning. The study was designed to improve engagement in a lab session by involving realistic/real-world work-based examples based on the hypothesis that students are motivated by career ambitions and wish to see the vocational relevance of their studies [2, 8, 9].

The original/previous case study's results indicated that activities like this can increase engagement and enhance the student experience and student learning. However, it only involved a small sample and there were some areas for improvement. Consequently, the study was repeated to address its limitations, to cover additional content to increase learning opportunities, and to establish a deeper understanding of the value of work-related learning.

The case study was improved and expanded by taking a holistic approach, where students take on the role of an ethical hacker to identify the security weaknesses of a website and then fix those security issues.

Student feedback for the new case study lab was overall positive, corroborating findings from the original study, showing the aims of the session have been met. The results are better than the original case study's results suggesting improvements made, such as security attack and defence now being integrated into one holistic lab session, are beneficial.

While only 25 students participated in the study its findings, combined with the original case study's results, add further weight to the argument that work-related learning activities are valuable, are enjoyed by students, and can show the relevance of what is being taught. This appeals to students increasing the likelihood of student engagement, and informal observations showed engaged students, and enhances the student experience and student learning. A larger sample was originally planned but unfortunately session attendance was low.

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