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Distance Learning Practices: A Reflective Study

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Abstract: Well-planned online delivery of content can be a challenging experience and is of significant importance, especially these days due to COVID-19 pandemic. Online delivery of computer security subjects in a pure distance learning environment is no exception. The modules should have high quality and be designed in an engaging, interactive and fun way for students, who happen to have different motivation levels and educational backgrounds. The quality of education for distance learning degrees varies significantly, so does the experience of the teaching staff. There have been few studies focusing on the teaching practices of online degrees especially those with a computer security major. This work presents a comprehensive reflective paper that demonstrates the evolution of a world-class distance learning degree at the University of Liverpool (UoL) in the UK over the last ten years. We report on the teaching practices adopted in cybersecurity-related modules/courses as well as the experience of the first author (who is a subject matter expert for cybersecurity-related modules) in teaching those modules. The paper describes the structure of the modules and how online teaching/learning is taking place along with the assessment types. Besides, we discuss both positive and negative observations and the lessons learnt. We believe our work can pave the way for successful and well-planned online delivery of cybersecurity modules in future.

Keywords: Distance Learning, Online Students, Teaching Cyber-security, Assessment Rubrics, Student Satisfaction

1. Introduction

Distance learning has gained a high momentum during the current COVID-19 pandemic, where education providers across the globe have been forced to cancel all face to face classes and move their courses online, in most cases with limited notice or preparation time. While some institutions have both the experience and resources to handle this situation smoothly, many others have been struggling to convert the traditional course materials to suit online learners and provide meaningful learning experiences. The lack of preparation time was also a major factor that affected the online conversion process, especially if the institution had no prior experience in module development and delivery of content in a distance learning environment. Before the pandemic, there was an established trend for online degrees, but we forecast the trend will gain significant attention from young learners as well such as school leavers and career-changing seekers.

Accreditation and degree certification can be used to assure the quality of distance learning degree programs. Given those challenges, the teaching practices need to be published and discussed by the research community. This reflective paper describes one of the popular distance learning degrees from the University of Liverpool (UoL) during the last ten years, as experienced by several of the authors. The paper discusses reflections on many dimensions of the online course, such as class organisation, the evolution of content material, curriculum development, and student satisfaction. It concludes with recommendations for teaching computer security courses for distance learning students, which could also benefit the wider distance learning community.

2. The Reflective Analysis Research Methodology

Reflective practices of teachers and academic staff have been around for some time now, and are a significant activity within the learning cycle (Fathelrahman, 2019). The utilisation of such an activity in

distance learning has proven its importance, as reported by many researchers (e.g. Liu, 2019; Gasparic and Pecar, 2016; Smith and Greene, 2013; Chen et al., 2009; Salmon, 2002). Reflection is considered a crucial mental activity that enables academics to engage more in a meaningful relationship with the academic practices they employ (Mortari, 2015). The hermeneutic perspective of Van Manen (1977) is followed in this paper to cover technical, and practical reflections to improve the quality of distance learning modules, particularly the cyber-security ones. The reflection methodology applied in this paper uses four types of data. Those are the students' feedback (i.e. responses to the end of module satisfaction survey), the self-generated feedback from the authors while teaching the cybersecurity-related modules, the feedback from course moderators, and the feedback from the program director. As highlighted by Karsten et al. (2019), "For [the] formative purpose, such as improvement of courses over time, it is generally considered best practice to follow this [reflective] method instead of using quantitative tools, such as students' questionnaires, which are better at assessing individual teacher performance than improving course quality over time".

3. The Distance Learning Model: Evolution and Illustration

Over the years, our program has evolved several times, while keeping some of its fundamental foundations such as the teaching week structure and the learning management system (LMS). The LMS used is Blackboard (BB), and each module is structured in eight and ten weeks cycles. For an intake module, it is ten weeks, and for a regular module, it is eight weeks. The different components of our online module are depicted in Figure 1, which will be demonstrated throughout this paper.

Until 2014, each week's resources, including the reading materials, were provided in a textual format, since the majority of the students were from countries where reliable Internet access was not the case. To overcome this hurdle, the decision was made to develop lightweight (i.e. textual) resources that the students could download easily and study offline. The use of multimedia was restricted to links to online YouTube tutorials or similar services. While the idea was appealing back then, the resources were less engaging and less interactive, judging by some of the students' feedback. In 2014, a decision was made to shift into more multimedia-rich resources, which was in line with the mature stream of using multimedia-rich content at the time (Chen et al., 2009). This includes introductory videos for each week, hand-on tutorials, etc.

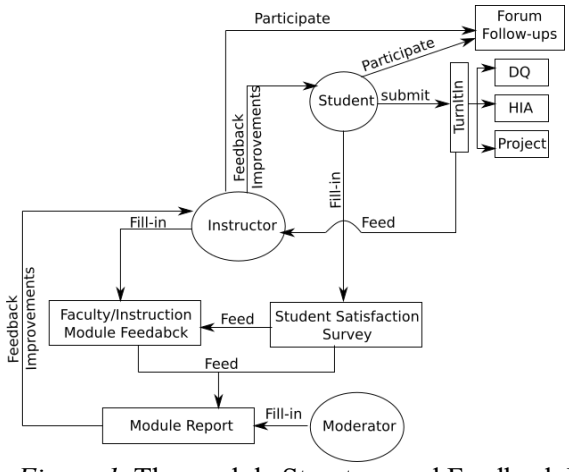

Figure 1. The module Structure and Feedback Loop

It is worth noting that a week-cycle starts on Thursday every week and ends on the following Wednesday, where there are mainly three assessment items. Firstly, the initial Discussion Question (DQ) answer, which is primarily a discussion question that is released before the beginning of the week where the students have to research a topic and compile an answer for. The submission deadline of the initial DQ answer is on Sunday midnight. This simply means the students would have four days of studying/researching the topic and going through the provided resources, before compiling their initial DQ answers. Secondly, the Follow-up posts which the students have to participate in an online forum related to the initial DQ answer where they post 3-5 'substantial' posts in each DQ. Substantial is defined as 1) a critical review of another student's work and additional information/synthesis that adds or increases the discussion, 2) analysis that includes synthesis of prior week's work, or multiple

examples in the current week, 3) outside readings that are summarised, 4) reading and comment on another student's outside readings, and 5) a personal experience/example that applies to the content. Those 3-5 substantial replies need to be submitted on at least three different days out of the seven days of the week cycle. This is the main attendance requirement of the module. It is worth noting that the day of the initial DQ answer submission is not counted if there are no replies posted on that day! Thirdly, the Hand in Assignment (HIA). There is another assessment item which replaces the HIA at the last week (i.e. or weeks) of the module, which is the end of the module project (i.e. sometimes called group project). It is worth noting that for an eight-week module, there are at most 18 assessment points that are distributed evenly, based on the complexity, not the number of submissions as one can see in the sample assessment grid for the Cyber Crime Prevention and Protection module in Table 1.

Table 1. *CKIT-530: ASSESSMENT GRID*

Week	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Weight**
Initial DQs and Follow-ups	X 5%	X 5%	X 5%	X(2) 10%	X 5%	X(2)10%	X 10%	X 5%	50%
Individual Assignments	X 5%	X 10%	X 5%	-	-	-	-	X 10%	30%
Group Project	-	-	-	⇒∗	X 10%	⇒∗	X 10%		20%
Number of Assessments	2	2	2	2	2	2	2	2	16 %100

⇒∗: starts on the current week and is due the next one.

The students provide feedback using a link to a Student Satisfaction Survey after the end of the module, which is instrumental in module evaluation and module continuous improvement (Tricker et al., 2001). Generally, the qualitative research methodology (i.e. using online surveys) is employed in analysing the student satisfaction for distance learning (Kutluk & Gulmez, 2012; Suzek & Ozcan, 2017). In our modules, students would voluntarily and anonymously rate the overall satisfaction with the module content and structure, the interaction with other fellow students and how such interaction made a helpful contribution to the student's understanding of the module subject, the learning outcomes for the module and whether they are communicated well (Aslam & Rao, 2017), the learning outcomes for the module were met, the consistency of the module structure with other modules, the overall satisfaction with the instructor, etc.

Since this is a reflection paper, which has not originally been designed as a research project, no ethical approval is needed (Karsten et al., 2019). None of the students' feedback is quoted in this paper; however, as highlighted earlier, the students' feedback has affected the authors' reflections. Each instructor is required to respond to a Faculty Feedback request that requires responses on the overall class performance, the occurrences of academic integrity incidents compared to previously taught classes and the steps taken for those incidents to ensure current student evaluation methodology is efficient against plagiarism as investigated in (Çalışkan, 2019). As depicted in Figure 1, after the end of the module, a faculty member carries out the moderation process, which includes assessing the delivery of learning objectives, the application of policies and procedures.

4. Reflective Analysis: Method, Discussions and Recommendations

Designing a module based on a week-cycle (i.e. Waterfall-like model) should assure the learning outcomes are achieved cumulatively and systematically. Some modules, in other educational institutions, only specify the start and the end time of the whole module while offering the full module content all at once. However, in this case, there is no way to make sure that the students progressed seamlessly from the beginning of the module to the end in a sequential manner. Rather, students can start wherever they like. While this provides flexibility, it does not assure the build-up of knowledge in a proper way. For example, a student may find the topic of access control interesting thus jumping to that first, before studying the basics of cryptography, which are extensively used in access control. This creates knowledge loopholes that could be easily sorted out by organising the module in week-cycles. Our observation here is that commitment and motivation are important factors in the success of learning

online, and it is measured by several factors, including the amount of time a student is willing to devote weekly and the willingness to accommodate the study schedule in their day-to-day activities. Given the recommendation of organising modules in week cycles, two issues need to be considered:

1) It is important to mind the overlapping tasks (i.e. the submission of work while waiting on the reception of the feedback of the previous submission). Module designers should take into consideration quite carefully the time it would take the teaching staff to compile personalized feedback and the time it would take the students to go through and understand that feedback, especially the improvement tips. Failing to observe such a factor (i.e. time) would render the feedback useless.
2) A period of 12 hours or so needs to be considered for those students in the Far East. For example, releasing the discussion questions needs to be 12 hours before the actual due date to accommodate those students 12 hours or so ahead of the time. Besides, marking the student participation and submission should take into consideration the same time window (i.e. 12 hours or so) so that it starts 12 hours or so after the deadline.

Providing constructive feedback for an online class can be challenging for many reasons, such as the diverse backgrounds of the students and the lack of a physical medium to elaborate upon the feedback. Our observation regarding the feedback (supported by responses from the student satisfaction surveys, the module coordinator, and the program director) reveals that a personalised message does not only show what went well and or not during the week but also motivates the students to engage more with the content and contribute actively to discussions in the class.

As the module runs on a weekly cycle, as seen in Figure 2, timely feedback is important. Our experience is that, by policy, the feedback is due no later than three days after the end of the week (i.e. the week cycle ends on Wednesday) thus by Saturday midnight students need to get their previous week's feedback. This is a bit problematic as the new week starts on Thursday and students need to submit their initial DQ answer before or by Sunday midnight. The preparation takes time, and the expectation is that students may not have enough time to go through the improvement tips in the previous week feedback well before they start compiling their initial DQ answer for the new week. This simply means, students may not accommodate the comments of their instructor in the week following it; at least for the initial DQ answer. Giving the instructor less time to evaluate students' work as a solution to this problem will affect the quality of the feedback, especially in large classes. The authors attempted to sort this issue out by saving partial feedback in BB rubrics section on the go during the week to not to wait until the end of the week. Unfortunately, the authors realised that BB does not store part of the feedback and all comments saved during the week were gone! Until BB solves this issue or a third-party software does, there is no way but to save those comments off the system (i.e. BB) then consolidate them all at once after the end of the week cycle. To help to mitigate this (i.e. short time for sending the feedback to the students), the teaching teams used a peer assessment mechanism. Ahmed et al. (2020) highlighted that "Peer assessment is considered as a common strategy for evaluating open assignments, increasing learners' engagement with the educational content and/or for breaking the social isolation some learners might feel during their learning journey". The details of an innovative method of incorporating peer assessment in the online modules taught by the authors of this paper have been discussed comprehensively by Ahmed et al. (2020) and are outside the scope of this paper.

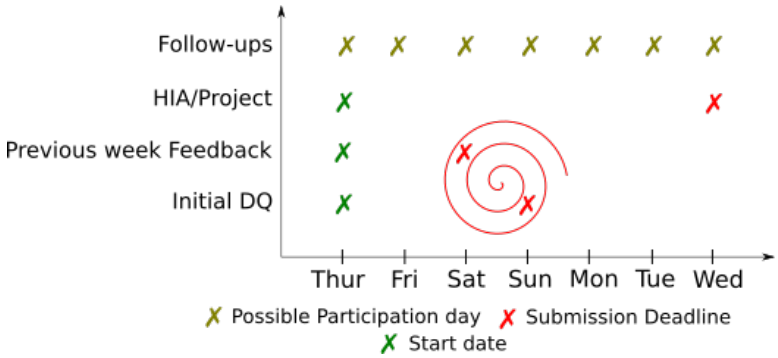

Figure 2. The Week Life Cycle

The existence of solid rubrics is as equally important as the personalised feedback, and it makes the whole process more transparent for the learners. By the UoL faculty handbook, the assessment

rubrics specify a 6-points grading system (i.e. F: Fail, D: Marginal Fail, C: Satisfactory, B: Merit, A: Distinction, A*: High Distinction. What we observed here regarding the rubrics is while it is comprehensively demonstrating what constitutes a particular grade, the interpretation of those constituents are different from teaching staff to another. The first author as a Core Faculty witnessed cases where various teaching staff record different grades for the same submission. The discrepancy amongst instructors interpreting the marking criteria was considered significant that needed the program director to interject a couple of times to clarify the requirement. This was an unnecessary overhead that, sometimes, delayed the release of grades and, hence, impacted the performance of the students in the new week, since they have not received the instructor comments for enhancement for the previous week. Having said that about the assessment criteria, a decision was made to embed the rubrics inside BB's Grade Book. Our observation is that embedding the rubrics in the BB grade-book made it easier for the instructors to follow the book and not to get confused about the interpretation of the grading system as provided in the Faculty Handbook. The only concern here is that if an instructor is following the rubrics section and ticks those corresponding boxes without accompanying it with a personalised feedback message, the assessment process becomes mechanical that lacks personalisation of the feedback.

Another important feedback component is the student satisfaction survey (i.e. student feedback on the course), which helps to improve the online modules. The quality of the feedback starts earlier by proposing actions to issues identified in the student feedback and thus closing the loop. Without a systematic process in place to accommodate the issues raised by the students, student feedback loses its significance. The process of accommodating student feedback in module improvement at our institution is somehow blurred. While the Faculty Feedback form requires the teaching staff to reflect on their teaching and to comment on their actions taken to address issues raised by the students there is no enforcement by either the course moderator or the program director to implement (some of) changes to the course. More often than not, the instructors decide not to take any action for the issues from student feedback, and this goes unnoticed by the moderation process. For example, out of date materials and course content will not be considered an actionable item, unless the instructor confirms the need for a material update and the existence of a budget for the change. Another observation regarding the student feedback is the university does not have a methodology to identify biased feedback. For example, feedback by a student that grades are not released on time while grades are being released on time will be normally processed by the Data Analytic team without double-checking. As such reflective feedback is important in evaluating the instructor performance, especially where such 'anomalies' need to be identified.

Our final two minor observations consider group formations and the use of multimedia in online classes. Our experience in building student groups is that there are no major differences when forming the groups randomly or based on the time zones. We have had no major issues in the last ten years for group members who are geographically dispersed. We are seeing potential gain within groups with various time zones or backgrounds and skills (Karsten et al. (2019)). Different time zones provide continuity of work in a way that a group member could post his/her contribution overnight to another group member, who will be working on it on the evening of the same day due to time difference. Thus, there is always someone who is working on the project. We acknowledge, however, the challenge this may impose to synchronous communication (i.e. online meetings etc.). Evolving from text-based modules where multimedia is restricted, due to Internet access challenges in the last decade, to the multimedia-rich curriculum has proven to be beneficial to the students, as experienced by the teaching teams and as reflected in the students' satisfaction survey. Since some instructors are not native English speakers, some video tutorials are hard to follow due to thick dialects. This has been raised by the students many times and needs to be taken into consideration when institutions prepare their video tutorials. As a solution to this problem, the video transcript was embedded in the video for those who cannot follow the video (i.e. including those with a diagnosed hearing disability), which partially sorted out the issue.

5. Conclusions

Delivering successful online courses is challenging due to many reasons. Facilitating the learning of cybersecurity courses are proven to be more challenging due to extensive hands-on nature of these courses, requiring specific infrastructure (i.e. tools, processing power, case studies, etc.). This paper

discussed the program design, evolution, and teaching practices at the university. It also summarised those lessons learnt while teaching computer-security-related modules. Topics such as assessment feedback, assessment rubrics, multimedia-rich content, student feedback, and the overall week-based modules are discussed. The quality of assessment feedback and the existence of clearly defined assessment rubrics are major factors in offering successful online learning experiences. Personalised, timed, and positive-toned feedback are amongst other attributes that contribute to the success of teaching online. Our observation in the past ten years is that personalising the feedback enhances its quality and further helps with establishing a positive relationship with the learners and improves social interaction (Wu He, S., 2014). On-time feedback is also important especially for modules structured as week cycles. To assure fairness and reduce grade challenges, the assessment rubrics need to be embedded in the module's Grade Book. Exemplary cases need to be shared frequently amongst the teaching team to assure consistency across different instructors, teaching different modules.

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