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Enhancing Student Engagement through Cloud Computing Coursework: Challenges and Opportunities in the time of COVID-19

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ABSTRACT

The COVID-19 pandemic has forced universities world-wide to adjust to an online delivery model resulting in many unforeseen challenges for module delivery and student engagement. The Glasgow Caledonian University (GCU) Cloud Platform Development (CPD) final year undergraduate module requires hands-on lab work and coursework, and thus call for more deliberation and interventions to maintain student engagement. The module teaching material created at GCU is also taught at the African Leadership College (ALC), Mauritius using a flipped classroom model. However, for the current academic year, the ALC campus was closed, with the enrolled students spread over many countries and time zones in Africa, resulting in a compounding of the challenges for maintaining student engagement.

In this study we describe the approaches and techniques employed at increasing the students' engagement for the CPD coursework.

CCS CONCEPTS

• **Social and professional topics** → **Computing education**.

KEYWORDS

Amazon Web Services (AWS), distance learning, artificial intelligence, online teaching, personal protective equipment

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1 INTRODUCTION

The COVID-19 pandemic has transformed the learning and teaching environments from a face-to-face in-person teaching to an approach using online systems.

The Cloud Platform Development (CPD) module under normal circumstances is delivered as blended learning [1][2] with online

material prepared at Glasgow Caledonian University (GCU) delivered with in-place activities by a tutor at the African Leadership College (ALC) at Mauritius. This module is covered using the Amazon Web Services (AWS) cloud platform and its content is mapped to the Knowledge Areas and associated Learning Objectives and content identified in [3] and [4].

During Trimester B, Session 2020-21, due to COVID-19, ALC was closed and most of the students had to return to their home countries. There is disparity in Internet penetration amongst the African countries [5]. The lack of sufficient internet bandwidth can be a source of frustration for the faculty and students for online delivery [6]. This placed additional burden on the ALC tutors and students who now had to adjust to a remote, fully online model of delivery.

The major objective of our study was to explore approaches to designing and implementing the main coursework assignment for the module such that it would keep these students engaged with online and distance delivery during COVID-19 pandemic.

2 RELATED WORK

Institutions worldwide have had to adapt rapidly to online delivery and a number of approaches and strategies have been reported. An interdisciplinary curriculum, termed COVID-360 was developed to increase students' engagement by designing material relating to the COVID-19 pandemic [7]. A review of online teaching and labs during COVID-19 concluded that strategies and teaching materials for distance learning should be preceded by an equitable Internet access to the learners [8]. Provision of alternate format of the study materials can help students to overcome problems for low-speed Internet and associated costs as compared to an online video lecture [9].

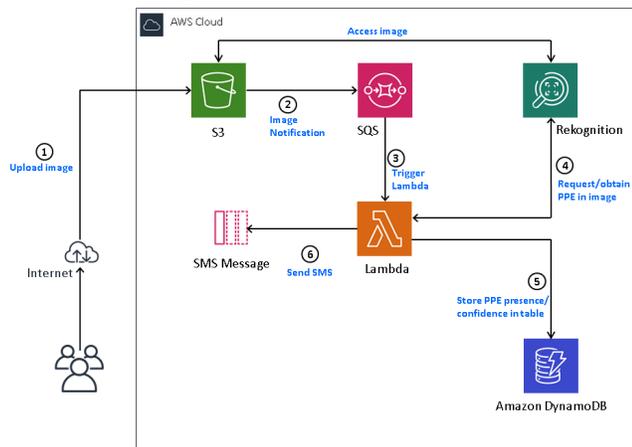
3 COURSEWORK DESIGN

The students were spread over nine African countries and it was a challenge to deliver online lectures due to varying Internet bandwidths in different countries, coupled with poor Internet connections, limited electricity supply timings and lack of access to Internet at home. Thus, the lab exercises and the coursework were designed taking these limitations into account.

Based on the students background we chose Python as the implementation language for the lab and coursework tasks. In order to introduce the students to developing applications on AWS the coursework was entitled, “Personal Protective Equipment (PPE) Detection and Notification System with AWS Artificial Intelligence Service”. This required the building of an end-to-end application by the students.

The specified application architecture and sequence of steps are shown in Figure 1 using circled numbers.

Figure 1: The application architecture for the coursework.



4 COURSEWORK DELIVERY

The very first lecture sought to motivate students by showing the results of a current technical skills survey depicting cloud computing and Python as one of the topmost in-demand skills. The benefits of cloud computing, choice and advantages of AWS platform were discussed.

It's very important that the students feel part of an online community. The students were arranged into peer groups for some of the tutorial work and some lab sessions were even student led with positive uptake.

The students could communicate with their tutor over Slack and WhatsApp channels which seemed to be more favoured by the students. This helped to keep the students engaged.

5 CHALLENGES AND OPPORTUNITIES

There are many challenges in terms of designing a coursework for fast evolving subjects such as cloud computing. Selecting a set of cloud technologies and services to develop the labs and coursework can be a major challenge [10]. A coursework based on detecting PPE through AWS Rekognition services was thus considered relevant and engaging.

It was difficult to support the students through synchronous communication because of different time zones and varying Internet quality across countries. Therefore, we designed the coursework such that all the tasks were enumerated clearly to lead the student towards the intended implementation.

Lack of sufficient Internet bandwidth created challenges of its own even after some effort from ALC to provide mobile data packages as the different students had varying types of Internet bandwidth available to them which in some case was not good enough to sustain the video communication.

The Learning Management System (LMS), Blackboard and the other communications channels were used for synchronous and asynchronous interactions, both between students and with the tutor.

6 EVALUATION

End of module evaluation through Module Evaluations Questionnaire (MEQ), determined the linkage between the taught concepts and coursework component as engaging by the students. It was stated by one student that the coursework helped him enormously, as by using the concepts, he helped develop a similar automated application during internship and saved a lot of time for the company. A survey [11] was also conducted post-delivery of the module to determine the student engagement with the coursework.

Most of the respondents were of the opinion that they would like to see more of web application development on the cloud platform where it could be linked with other technologies such as machine learning.

The major hurdles identified in completing the coursework off-campus were Internet connectivity issues, time zone differences, distractions, lack of motivation, and lack of access to real-time in-person assistance.

For changes to the coursework design and delivery, it was indicated that the weekly tasks should be laid out in advance to give a clear look-ahead to the students. Also, weekly student led sessions were recommended to motivate and engage the students.

7 CONCLUSION

COVID-19 has provided a lot of challenges and opportunities to the university learning and teaching. This paper describes the techniques used for coursework design and delivery, to increase student engagement for a final year undergraduate class.

Cloud Computing is a highly sought-after skill for computing graduates seeking employment. Cloud Computing skills are ranked as the top most skill in Scotland [12], and a highly in-demand specialised digital skill in African countries [13].

For an online delivery model, which is likely to continue for the near future, it is important that students are kept engaged through different communications channels, peer support, better coursework design by making the linkages clear between the theoretical concepts and their practical application.

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