How COVID-19 Changed Computer Science Education

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Abstract

The global pandemic has forced lecturers and academics to transform how computer science is taught. Discover how innovative technology and techniques are being used during lectures that can now reach an international audience.

1. Introduction

The emergence of the COVID-19 pandemic has affected both staff and students within higher education. The Advance Higher Education Academy (AHEA) during the pandemic has supported academics in enhancing their pedagogical practices. The AHEA offers a teaching qualification called Postgraduate Certificate in Academic Practice (PGCAP) or PGCert and awards the Fellowship of the Higher Education Academy (FHEA) after successful completion of PGCAP. PGCAP assists academic staff to improve their teaching skills by reflecting on their teaching practice, evaluating their teaching methodology and considering enhancements to their current teaching approach. UK academics must complete this qualification before being confirmed in post. It comprises four modules, three related to teaching and one focused on actioning research into education. With the advent of the COVID-19 pandemic, teaching a module has become particularly challenging, especially when it has to be done online, and students are scattered across various locations. One particularly challenging aspect of the new way of teaching is to keep students engaged. Therefore, the content of PGCAP must be adapted and changed to fit the new online setup and the challenges brought by the COVID-19 pandemic.

2. Post-Covid Era

It is now more important than ever for PGCAP to support academics to teach students both face to face and online, using the latest tools and technologies. In this article, we discuss how PGCAP helps new academics to improve their blended delivery. The pandemic is an opportunity for higher education to reform their current teaching delivery by including online and face to face teaching.
as a part of the curriculum. PGCAP encourages academics to adopt technology-oriented teaching techniques (e.g., gamification) to enhance the delivery of their module via face to face and online mediums. Hence during the pandemic, pedagogy has been enhanced by the adoption of the following:

2.1 Online Teaching Platforms and Tools

During this pandemic, online teaching platforms have played a crucial role, where content has been delivered using platforms such as Microsoft Teams, Zoom, Google Meet and Blackboard Collaborate. In addition, online quizzes (Kahoot or Mentimeter) have also played a key role and have been used at different stages of an online session:

- **Start of a session**: to test the prior knowledge of the students and reinforce content from previous sessions.
- **During the session**: to test active learning of the students.
- **End of the session**: to assess the learning of the students after the delivery of the entire content.

On the other hand, relying on too many unnecessary Mentimeter quizzes can lead to students losing interest. Hence, this should be used with care. The online teaching platforms also facilitated lab exercises and coursework (e.g., coding based group projects). For group projects, this enabled students to interact and engage with each other while making teams despite being in various geographical locations. Virtual Learning Environment (VLE) tools such as online pools on Moodle can be used to perform this function.

Various drop-in sessions were also scheduled to replace on-campus tutorials to solve student’s queries; this gave an opportunity to introverted students to ask questions via typing using the chat facilities available within the mentioned online platforms. The interaction was instant for both the students and the teaching team, but required meticulous planning to facilitate this for classes over 200 students. Solving student’s problems fast helps their confidence as well as improves the satisfaction rate of the teaching module.

2.2 New Learning Methodology

The flipped classroom model has now become commonplace during the pandemic. It has allowed teachers to utilize various resources to improve their teaching practice. This includes (but not limited to): Kahoot or Mentimeter based quizzes, short videos or podcasts to introduce a topic, a case study for Problem Based Learning (PBL), solve some problems during the live session, animated PowerPoint presentations, team-based group activity such as think pair and share activity to enable teamwork, annotated exemplar and demonstrating concepts using various online games. Below are some examples of good practices:

- **Interaction and Engagement**: The utilization of interactive videos using H5P helped measure a student's level of engagement with the teaching content. Furthermore, it was used as a
formative assessment, to identify the learning needs of students. The teacher can then adjust
the pedagogic approach to help students better understand the content.

- **Lecture Recording:** Most teachers recorded their live sessions and uploaded them on the
  media server of their universities, which helped students who are attending the module from
  various geographical locations with different time zones. Despite being affected by the
  COVID-19 pandemic in March 2020, lecture recordings helped students follow the material
  through the recorded lectures at a later stage.

- **Remote Project Deployment:** Students are involved in a variety of mini-project assessments
  that require them to deploy their outputs using a dedicated platform. With the pandemic, these
  platforms have been utilized more extensively, as students have been working on their projects
  remotely. One such example is the use of the OpenShift Container Platform, on which students
  deployed their projects, making it easily accessible for remote assessment.

- **Lab Interaction:** Lab sessions were facilitated using Microsoft Teams and online
  Google/Microsoft forms to enable the interaction between students and demonstrators. The
  forms were used by students to get support from demonstrators and request demonstrators to
  evaluate their assessments. Furthermore, the assessment of lab work, quizzes were also used
to measure the progress of the students, both in terms of summative and formative
  assessments. Demonstrators can record the videos of every lab demonstration and upload
  them to the media prior to the lab session. The implementation of this approach can save time
  and reduces student queries during the lab session.

2.3 Curriculum Development

During the pandemic, it was paramount to redesign curriculums to facilitate online and face to face
teaching. The curriculums were redesigned in such a way that it also fulfilled all the Intended
Learning Outcomes (ILOs) of modules given a Flipped classroom approach.

3. Challenges Ahead

During the pandemic, various techniques have been successfully used and implemented. Still,
various challenges remain:

- **Hardware based Practical’s:** Some project work requires access to physical infrastructure or
  hardware labs to complete their coursework or capstone projects (e.g. Final year project based
  on embedded systems) and both students and tutor need to go to campus for the practical’s.

- **Ability to Focus Online:** Ensuring and monitoring student engagement during live sessions is
  a challenge during the pandemic. Indeed, it is very difficult to spot how engaged students are
  without the direct (physical) observation of the students.

- **Attitude:** The implementation of online teaching is challenging if students and teachers
  believe that face to face teaching is more productive. For example, some subjects in
  engineering require face to face teaching for effective delivery.

- **Misconduct:** Finally, preventing cheating during summative assessment is difficult because
  students take exams from remote locations.
4. Conclusion

In this article, we discussed the change in teaching from pre-Covid era to post-Covid. We identified various key findings, as shown in Figure 1. Furthermore, the positive influence of PGCAP on the implementation of flipped classroom teaching was discussed, and we shared some good practices. We hope that this article will help higher education teachers to improve their teaching practice.

Figure 1: Key Findings

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Further Reading