Changing pedagogies: The Open Networking Lab

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In the changing pedagogical landscape, universities will teach non-traditional students using non-traditional methods.

We illustrate this with a case study of teaching computer networking to young vocational learners. Materials were designed as open educational resources for flexible use and reuse by students and educators. Learning design encouraged active learning, with simulation to support experiential learning of a practical subject, and embedded self-assessment.

Initial evaluation with several hundred UK Further Education students shows that they valued the pedagogical approach. They particularly liked the active learning elements: practical activities with a network simulator; and quizzes with feedback to test and support learning.

The resources were provided freely as a ‘Badged Open Course’ on the UK Open University’s OER platform OpenLearn. Teachers and students used the resources flexibly to support their different learning and teaching needs.

This case study shows that, through online education and flexible, open approaches, universities can serve a wider population of learners and educators.

## Introduction

As the Higher Education context rapidly changes, universities need to reconsider who their students might be in the future, and how they will teach them. In years to come, students might: be younger (or older) than most HE students are now; already be employed and needing to retrain; have lower prior qualifications. Teaching this range of possible learners will require new approaches and flexibility.

In this article, we illustrate these challenges with a case study of teaching computer networking to young vocational learners. These learners have different backgrounds, motivations and attitudes to study compared to traditional university students. We are therefore developing a course which assumes no previous knowledge, teaches networking using a hands-on, practical approach, and uses examples from both home and workplace contexts.

## The Open Networking Lab

The course, called the Open Networking Lab, will be an open educational resource that can be used in flexible ways to suit different learning contexts — ranging from an individual learner studying at a distance to classroom use supported by a teacher. The final product will be offered on the UK Open University’s OER platform OpenLearn as a ‘Badged Open Course’ (BOC). A BOC is a form of MOOC offering a complete educational experience, including assessment, recognised by a badge and certificate of completion. Unlike cohort-based MOOCs, UK Open University BOCs are open for individuals to study at any time and any pace. The material has a CC-BY-NC-SA licence on OpenLearn Create, allowing educators to retain, reuse, revise, remix and redistribute the learning material (Wiley, n.d.).

![Figure 1 Learning material includes embedded screencasts and interactive activities under the headings: Think about, Try it out, Sort it out and Test yourself](image)
The subject of computer networking is a practical one, best approached through experiential learning (Kolb, 1984), but individual learners and pupils in many college contexts would not have access to the hardware required. Instead, in the Open Networking Lab, a web-based network simulator is used, opening up the subject by removing the cost barrier for FE colleges, and enabling individual learning in the home or workplace. The simulator, PT Anywhere, (Mikroyannidis et al., 2017) provides a simplified and easy-to-use ‘layer’ over the industry standard Packet Tracer simulator (DiCerbo et al., 2010). PT Anywhere hides the complexities of the Packet Tracer interface but supports authentic practical investigations; it can be used through a browser on any device without installation, opening it up to many more learners.

The pedagogical approach used in the Open Networking Lab (see Figure 1) combines acquisition and participation (Sfard, 1998), and maximises active learning (Brown et al. 1989). Concepts and techniques are introduced by screencasts and videos rather than written texts. Students are given opportunities for hands-on work using PT Anywhere, to reinforce their learning from the screencasts, and to enable exploratory learning (for example ‘troubleshooting’ problem networks). Embedded self-assessment questions/quizzes provide feedback to students to guide their learning. A further two quizzes, one at the mid-point and one at the end of the course, provide the summative assessment that leads to a badge and certificate of course completion.

Evaluation

We have evaluated the material in pilot presentations with 383 students at 14 partner colleges through the Cisco Networking Academy community. Evaluation methods included student surveys, classroom observation, teacher interviews and analytics (Rosewell et al., 2018). The Open Networking Lab material was made available to classes of students through their teachers, who chose a variety of different ways to use it within their own teaching. Because the pilots were carried out late in the academic year, some students encountered the material as revision and consolidation rather than initial learning.

Figure 2 Students’ responses to ‘I learnt something new from...’ different course components (5-point Likert scale: Strongly disagree to Strongly agree)
The evaluation showed that students found the learning approach effective and enjoyable, and they would like to study further using the same methods.

"I understood what was being taught to me and it was a fresh way of learning."

Students valued the components of the material differently. They reported learning most from the components which required them to engage actively, such as the PT Anywhere activities and the quizzes (Figure 2).

Although students liked the use of video and screencasts, they strongly favoured shorter durations (5 minutes or less).

"This video is very long and needs to be split into shorter segments of a few minutes each."

This is a challenge to authors who wish to include enough context and content to support learning.

Overall it was encouraging to see that students’ perception of the value and importance of the components matched the learning design envisaged by the course team.

Of particular note is that the material was used in a range of different ways, both by classroom teachers and by individual students. Teachers were observed to use the material as: an introduction to the subject; for revision; to fill in gaps of knowledge; to replace or complement teacher-led lessons. Anonymous server logs also reveal very different patterns of use by individual students. Some spent the whole study time viewing the website, others downloaded material as epub or pdf; some watched the video on mobile devices alongside using a computer for the practical activities.

**Conclusion**

The pilot evaluation showed that the pedagogical approach — experiential online learning through screencasts, practical activities using a network simulator, and automated assessment — is a good one for these mainly young vocational learners.

Offering the Open Networking Lab material as an open educational resource allows it to be used and reused in a variety of ways. It will be open to students in formal education and to lifelong learners; it can be used as self-directed learning by individuals or in classroom contexts.

We hope this case study demonstrates that universities can broaden their approaches to be inclusive to different kinds of learners in a range of learning contexts.