

# Understanding and mitigating students' difficulties in undertaking complex practical activities on their computers

## Abstract

Hands-on practical activities can improve students understanding of technological concepts and provide an opportunity to improve their technical skills. In OU Computing & IT modules, practical activities often require students to download, install and configure specialised software to their own computers. This can be a daunting task for less technical students. When a problem occurs, getting immediate technical support is difficult as they are distance learners. Attention has been turned to virtualisation technology, which has the potential to mitigate installation problems by providing students with access to pre-configured virtual machines, which are virtual computers containing all the required software. There are two types of virtualisation technology: cloud-based or local. With cloud-based virtualisation, students do not need to download and install software as activities are undertaken online but it requires a reliable internet connection and involves a relatively high installation and maintenance cost to the provider. In contrast, local virtualisation requires students to install virtualisation software on their own computers but it does not rely an internet connection to run once installed.

This study investigated students' experiences of using virtualisation for their computing practical activities and identified the common difficulties they experienced. Using the 40 hour long practical activities in TM255: Communication and Information Technologies as an example, the study employed the OU's VLE Real-Time Student Feedback (RTSF) facility and telephone interviews to investigate TM255 students' experiences in using local virtualisation and their opinions about cloud-based virtualisation. The participants were from the 18J cohort, which had about 440 students registered at Week 24 which was when the survey took place. The number of responses from RTSF is 88, which equates to 20% response rate. Nine telephone interviews took place in the Summer of 2019, when the randomly chosen interviewees had completed the module.

Although the common perception is that students would prefer cloud-based virtualisation as no software installation is required and it is easier to use, 58 (64%) RTSF respondents preferred using local virtualisation techniques. The main reasons were that the process of installing the virtualisation software and virtual machines improved their understanding of virtualisation technology and developed a useful practical skill. It also allows students to stop, save their progress, and resume a practical activity when they wanted to. However, 2 of these respondents mentioned they wanted the cloud-based virtualisation as a backup. The main reason for those who preferred cloud-based virtualisation was that it allowed them to use any computing device to do the activities. All 9 telephone interviewees agreed the cloud-based option was useful and if the OU was to provide a virtual lab, it is important the appearance and design should be consistent according all modules.

As for study support, the module team provided a technical support forum with a list of frequently asked questions posted at the top of the forum and step-by-step guides for the practical activities. In addition, tutors provided tutorials focussed on the practical activities. All nine interviewees agreed these were very useful resources. However, a Mac user found the step-by-step guide was too PC specific and wanted a separate guide for Mac users.

Overall, 86 (98%) RTSF respondents could follow the instructions to complete all activities. However, 2 (2%) RTSF respondents said they encountered a technical problem but they were able to resolve the problems after seeking help from the technical forum. When asked to rate to what extent did the practical activities improve their understanding of the technical concept, the score is 8.1 out of

10. Additionally, 98% of students agreed virtualisation is an appropriate tool for facilitating the practical activities.

The finding of this study suggests that while students wish to do computing and IT practical activities without having to install and configure specialised software and do the activities using any computing devices, they also value the practical skills development opportunity provided by local virtualisation. Whilst enjoying the flexibility of local virtualisation provides, they also want to have the cloud-based virtualisation as a backup.

### 50 word summary

Practical activities can improve students understanding of technological concepts and their technical skills. Computing activities often require students to install specialised-software. When problems occur, getting immediate support is difficult as they are distance learners. This study investigated students' experiences of using virtualisation for their practical activities and identified difficulties experienced.