

# PRESERVICE TEACHERS EXPERIENCE WITH ONLINE MODULES ABOUT TPACK

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## Abstract

*Despite the fact that Information and Communication Technology (ICT) is valued as a tool for learning, the modelling for preservice teachers of ICT integration in the curriculum areas is often limited. In the recently approved AITSL standards for Initial Teacher Education Programs, knowledge of ICTs is explicitly mentioned in three of the standards. In order to address these requirements, online modules on the use of ICT in teaching and learning were developed as part of the Teaching Teachers for the Future project. This study reports on one university's use of these modules and the preservice teachers' responses to them. The modules were used as a component of a methodology course with the students completing an online survey after they had finished the modules. The modules were based around the TPACK (Technological Pedagogical Content Knowledge) framework (Mishra and Koehler, 2006) and incorporated videos of teachers and their students using ICT, lesson plans and useful ideas for incorporating ICT into the classroom. The preservice teachers were asked about structure and navigability of the modules, what they found to be the most useful aspects and how they could be improved. Overall the preservice teachers were positive about the modules and valued the videos and specific examples that would enable them to more effectively embed technologies in the classroom.*

## Introduction

Quality teaching is essential to ensuring a world class education system with teacher effectiveness being a powerful influence on student success (AITSL, 2011). Information and Communication Technology (ICT) is recognized as a valuable tool for learning that can support teachers and engage students towards developing 21<sup>st</sup> century learning skills. High performing teachers are able to effectively utilize the technologies in innovative and meaningful ways. Therefore teachers must be confident in the content area, gain competence in the use of technologies and develop sound teaching strategies that will enable them to transform their teaching. Teachers and teacher educators require regular professional development to increase awareness of the capabilities of technologies and to explore how to successfully integrate them into their teaching and so enhance student learning.

The Australian Government through the Digital Education Revolution has recognized the importance of developing the ICT capabilities of both teachers and students by providing access to a computer for all Year 9-12 students. The Teaching Teachers for the Future (TTF) project, an \$8 million national project financed by Department of Education, Employment and Workplace Relations (DEEWR) recognised the importance of ensuring that graduating teaching possessed the required skills and preparedness to integrate ICT into their teaching with an increasing number of high school students having access to computers. Thus the focus of the project was to build the ICT capacity of graduate teachers and teacher educators with one of the strategies being to develop exemplar online modules. The online modules were developed by Education Services Australia for the TTF project and were made available through the Learning Federation econtent repository (<http://econtent.thelearningfederation.edu.au/ec/p/home>). The modules were based around the TPACK (Technological Pedagogical Content Knowledge) framework (Mishra and Koehler, 2006) The modules were designed for preservice teachers and text that describes the interaction of the teacher, the students and the technology. These modules were designed for pre-service teachers as professional learning packages that demonstrated the interrelated content, pedagogy and technology knowledge used in Mathematics, Science, History and English. The online modules incorporated videos of teachers and their students using ICT in the classroom, lesson plans, useful ideas for incorporating ICT as well as text that described the interaction of the teacher, the students and the technology.

National Professional Standards for Teachers (AITSL, 2011) further confirmed the value of the TTF project. Also a key recommendation in a recent national mapping of ICT-related professional learning identified the importance of raising the ICT proficiency of preservice teachers and teacher educators, and engaging them in ICT-rich environments (Mitchell et al., 2010). Thus preservice teachers must be given the opportunity to gain the necessary skills, to receive good modeling through their curriculum courses, and to develop strategies to integrate technologies in ways that would enhance student learning. Teacher educators often do not have access or have the skills to model effective ICT integration into their courses. Thus the TTF project provided teacher education institutions with the opportunity to employ an expert pedagogical officer to work with teacher educators to build their ICT capabilities and to support ICT integration into their courses in pedagogically sound ways. This study reports on one component of the TTF project that investigated the value of online modules in science and mathematics methodology courses to support secondary preservice teachers to more effectively integrate ICT into their teaching and learning.

## **ICT in learning and teaching**

Teacher quality is the key to improving student achievement and ensuring a world class education system (AITSL, 2011). With the rapid pace of emerging technologies and the need for students to develop 21<sup>st</sup> century capabilities required for productive participation in a global society, it is important the skills, knowledge and attributes required in tomorrow's teachers are identified. Thus National Professional Standards were defined under the auspices of the Ministerial Council for Education, Early Childhood Development and Youth Affairs (MCEECDA), and endorsed in December 2010, to ensure that graduands into the teaching profession can demonstrate the attainment of these standards and provide high quality education. The standards summarise professional capabilities at four career stages and identify what comprises quality teaching by specifying the standards under teaching domains of professional knowledge, practice and engagement. These standards explicitly indicate the requirement: of demonstrating a range of ICT resources that will engage and enhance student learning (Standard 3.4); of integrating ICT effectively into teaching strategies (Standard 2.6); and of understanding how to use ICT safely, responsibly and ethically (Standard 4.5). While teacher educators recognise the importance of integrating ICT into teaching and learning, there is little documentation or evaluation of their practice. (Pearson, 2003)

In order to give preservice teacher the strategies to teach in tomorrow's classrooms, teacher education programs must "infuse ICT's using authentic and pedagogically appropriate approaches" (Albion & Redmond, 2008). In an investigation of their ICT capabilities, preservice teachers expressed grave concerns about their development of ICT related pedagogy and practice (Black & Smith, 2009). With the TTF project focused on building the ICT capacity of preservice teachers, it was hoped that it would address such concerns. The project consisted of a number of components aimed at assist graduands to demonstrate their ability to creatively and effectively integrate the use of ICT into their teaching and thus enhance student learning. One of these components was the development of digital exemplars, in the form of online modules in the four curriculum areas of English, Mathematics, History and Science.

In order to use ICT to design meaningful learning environments, pre-service teachers need to understand how ICT relates to content and pedagogy (Mishra & Koehler 2006; Koehler & Mishra 2009). The Technical Pedagogical Content Knowledge (TPACK) framework (Mishra & Koehler 2006) highlights the relationship between the three types of knowledge: content knowledge, pedagogical knowledge and technological knowledge, and shows that a clear understanding of the relationship between the three components is essential for successful ICT integration. There is a danger that planning may focus on "what,,s most unfamiliar to many teachers: the technologies themselves ... and unfortunately this approach does not ensure that educational technologies will be well integrated into instruction that is keyed to specific content-based learning goals" (Harris, Mishra & Koehler, 2009, p. 393). TPACK thus became the theoretical underpinning of the TTF project as it would support preservice teachers in helping them identify what they needed to know. Further, it provided guidance for teacher education programs in designing and implementing strategies that would assist the development of technological pedagogical content knowledge (Schmidt et.al., 2009).

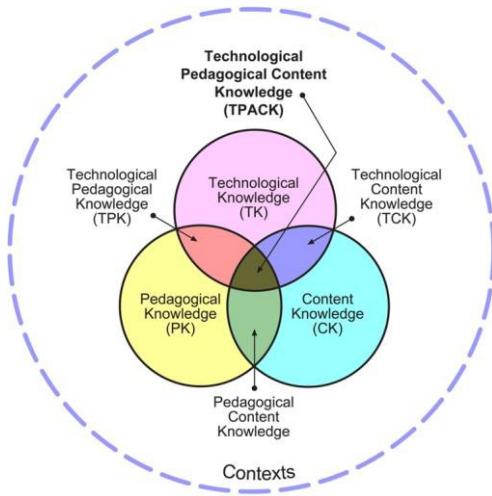


Figure 1: The TPACK framework and its knowledge components. (Koehler & Mishra, 2009)

Preservice teacher's ability to effectively integrate ICT is impacted by a number of factors such as their motivation, their personal knowledge, their confidence and competence with ICT, teacher preparedness through good modelling and their access to ICT resources (Cabanatan, 2001, cited in Albion & Redmond, 2008). Thus as a response to some of the difficulties faced by teacher educators, online modules were developed to support preservice teachers to effectively embed ICT into their classroom teaching.

Online learning offers many positive benefits. The learner has flexibility around when and where they access the resources. They also can revisit the module at any time and have control over their interactions with the media which may also prompt learner reflections (Means et.al, 2009). Online learning also provides opportunity to review the resources at a later date when there may be greater relevance; and offers "just in time" training. Means et.al. (2009) suggested in a meta –analysis of the literature that online learning was "more conducive to the expansion of learning time than is face to face instruction" (p.xvii) as learners have more time for reflection.

Today's world is far more visual with simultaneous texts, images and sounds, resulting in constant exposure to a variety of media that impacts on the way students interact, learn and use information (Jukes & Dosaj, 2006). Videos are proving to be an effective way of motivating and engaging students and explaining concepts, and in the case of the online modules, in demonstrating successful ICT integration strategies. As learners interact with the activities and manipulate the digital artifacts the quality of the learning experience becomes evident. Further to this, online learning has the potential to engage students in collaborative exchanges on the value of online modules. Students can more readily comment on particular activities or sequences with their peers as the modules can be accessed at any time. Knowledge construction occurs through the inquiry based approaches and the interactions with the content and with other learners. Online learning modules further enhance and complement face to face instruction.

As in the case of this study, the use of online modules also helps to increase the ICT confidence and competence of the learners. The online modules not only build on and further develop preservice teachers' content knowledge but they also identify teaching strategies that are conducive to effective ICT integration. This further supports the value of the three knowledge forms identified in TPACK. Currently the Australian Government has made a huge financial commitment to developing quality digital resources and yet these digital resources are being under-utilised by teachers (Gaffney, 2010). The use of online modules by preservice teachers in their training further increases their awareness of the value of digital resources while also modelling the appropriateness of technological tools to deliver the content in pedagogically sound ways.

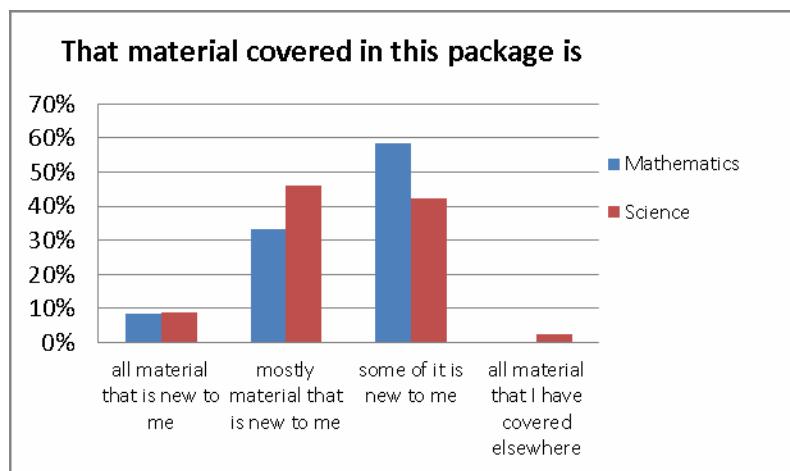
## Methodology

The study examined preservice teachers' perceptions of the effectiveness of the TTF secondary

Science and Mathematics online modules for developing their understanding of how to incorporate ICT into their teaching. The students involved in this study were enrolled at a South Australian University in one of the Secondary Teacher Education programs and completing either a secondary Science or Mathematics methodology course. As one of their coursework activities students were required to complete the TTF online module appropriate to their subject area and an online survey about the module. In addition they were expected to post on a discussion board a response to a set question and respond to two other student posts. The students were expected to complete the module in their own time during a week when there were no face to face classes scheduled, by watching the videos, reading through the support materials and reflecting on the questions posed within the module. The data for this study was drawn only from the online survey responses. An online survey was chosen as the most effective way of getting feedback about the usefulness of the modules in developing their understanding of how to incorporate ICT into their teaching. The survey consisted of seven statements that the students needed to complete by selecting from a number of options, a question about how long it took them to complete the module and two text responses. The statements were used to gain an overall perception of the students' views on the usefulness of the materials, while the text responses were used to elicit the most useful aspects as well as any areas for improvement to the module. A total of 171 students completed the module and the online survey; of these 24 students completed the Mathematics Module and 147 completed the Science Module.

## Results and Discussion

The first of the statements related to the actual content of the module and was designed to check if the material was at an appropriate level for the intended audience. The modules were intended for teacher education students and so the assumption was that the science or mathematics content and some of the education components would be familiar but that the TPACK material would be new. The students' responses confirmed this assumption; with very few of the students being familiar with all or none of the materials but as expected the majority indicated that some or most was new.



*Figure 2 Student responses to statement "That the material covered in this package is"*

The student comments provided some insight into what was new to them. For many it was the ICT aspects, for example

*The most useful parts of this material include: Demonstration of use of technology understanding of how different technologies help us with our teaching and also help students learning How visual stimulus seems to facilitate active learning Relation to real world matters using the skate park technology Shows how the science curriculum relates to the teaching of lessons*

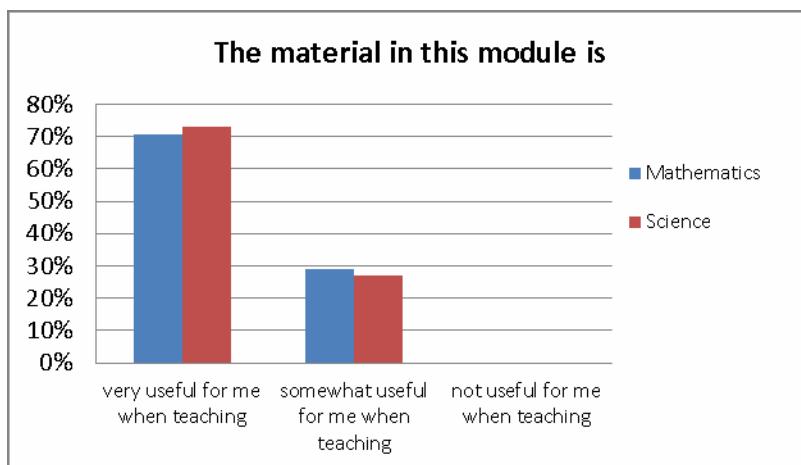
While for others it was not the TPACK material, at times it was an alternative view of material that they were familiar with, eg lesson planning and other resources.

*I liked the simplicity of the lesson plans, and the demonstration of linking concepts into the curriculum outcomes. I also liked quite a few of the external links. Gapminder in particular*

*looks like a useful resource.*

*I think for me most of the material was quite useful. But I think the material under the section of lesson planning was quite useful, because it covered all the information which has to be provided to the students and therefore must be covered by the teacher upfront the lesson. Without looking through this material I would have overlooked many of the information mentioned in the lesson plan section, for example cyber safety and digital literacy. I think these kind of information could easily be overlooked when preparing a lesson.*

The measure of effectiveness of the material will not be able to be judged with any certainty until the students are teaching but a first impression from the students was checked in the second statement which was simply getting them to reflect on the usefulness of the material. The chart below (Figure 3) indicates that none of the students indicated that they found the material not useful and approximately two thirds of the students indicated that they believed that it would be very useful for them when teaching.



*Figure 3 Students responses to the statement "The material in the module is"*

The ICT aspects were considered by many of the students to be the most useful e.g.

*Demonstrations of the use of the IWB and how to incorporate this into more relevant and engaging approach to mathematics.*

*I really liked how the topic was linked back to the TPACK, teaching/ learning standards as this is something that I often find difficult to do, also I think this helps a lot with assessment so that you know exactly what you are looking for in each stage.*

*The reference to the AITSL standards and the reference to TPACK throughout the content. Additionally, the types of digital content which can be used in the classroom.*

However while the focus was on the use of ICT in the teaching of science or mathematics, some students identified a more general value in terms of their learning, looking at teaching strategies in general.

*The most useful parts of this material was when it related back to how it could be implemented in a class as a teacher. The aspects that were also most useful were the sections on teaching strategies, classroom management and cooperative learning!*

*I found the lesson plan structure followed by the step by step explanation of how they would teach such a unit the most useful.*

*The 'how too' in the classroom points. The video's were useful for this reason. Because this type of learning is new to me, it showed how a teacher would interact with students and the simulation program in class.*

The comments also indicated that the students were aware that some of the material would not be useful straight away but may be useful in the future and will still need to be trialled by them.

*Links to curriculum and standards good - don't necessarily mean a great deal right now but can see that will be valuable as I become more familiar (as is required) with curriculum*

*The simulation was good but I will reserve my final judgment on how effective it will be until I've seen students use it*

The future usefulness highlights the value of having the material online as students can revisit the material when they will need it to refresh and expand on their understanding of what was covered.

*I will probably gain most by revisiting this material a number of times - there is lots of information that is covered and it is a bit hard to absorb it all in one sitting.*

The structure of any online material is very important to its success. The modules contained a variety of material and as such students needed to be able to follow that material in a logical manner but also are able to return and find the material they were after. Two statements gave insights into the success of the chosen structure one related to navigation and the other was looking at how the students interacted with the material. From figure 4 it is clear that almost all of the students found the modules easy to navigate. Students commented on various aspects of the module structure.

*I found the lesson plan structure followed by the step by step explanation of how they would teach such a unit the most useful. The presentation of the material was very logical and straight forward, easy to read and understand, and the navigation bar on the side was very helpful when I wanted to go back and re-read something.*

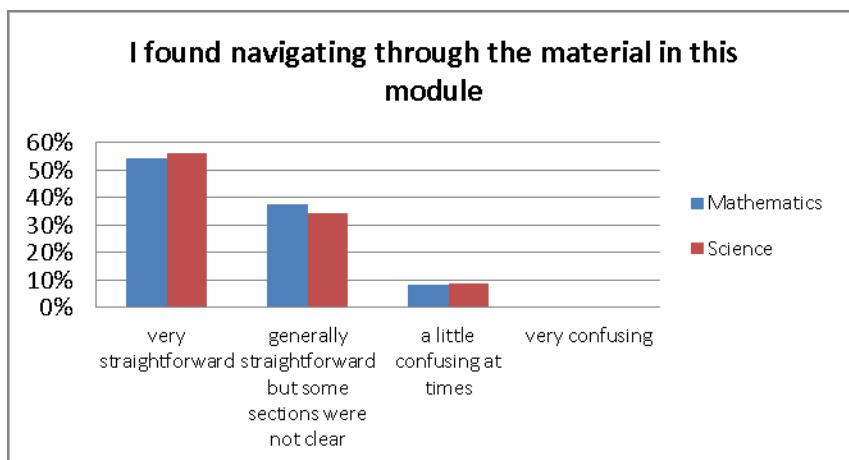
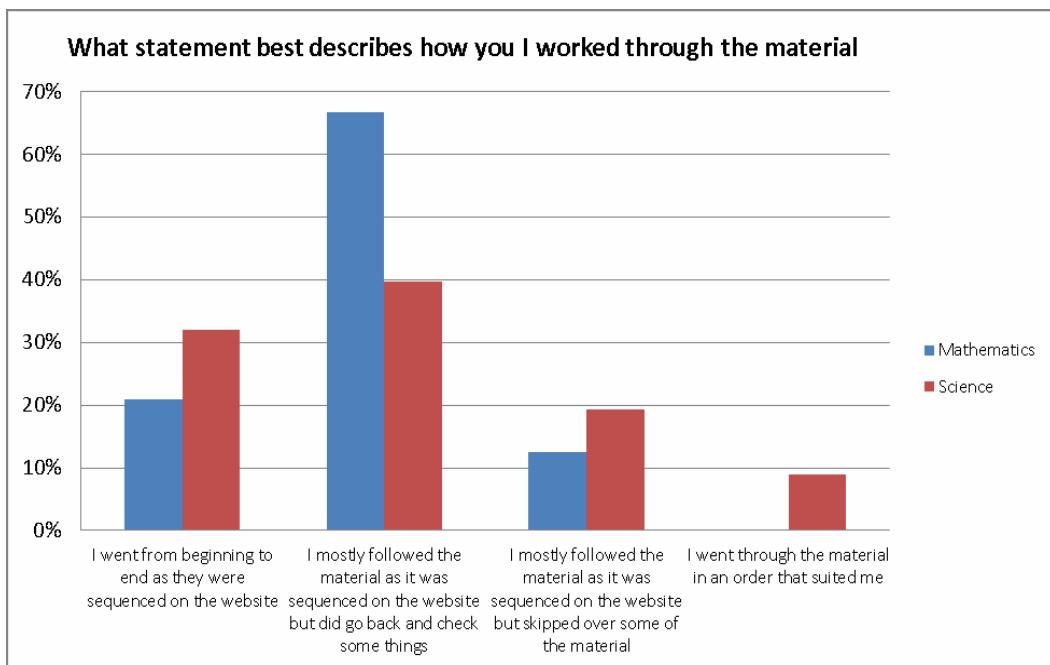


Figure 4 Student responses to the statement "I found navigating through the material in this module"

From Figure 5 it can be seen that over half of the students chose to follow the module sequence but did go back to check things when needed. The students completing the Mathematics Module were more likely to go back over material than the students completing the Science module. Approximately 10% of the science students and none of the mathematics students chose to follow a path that suited them.

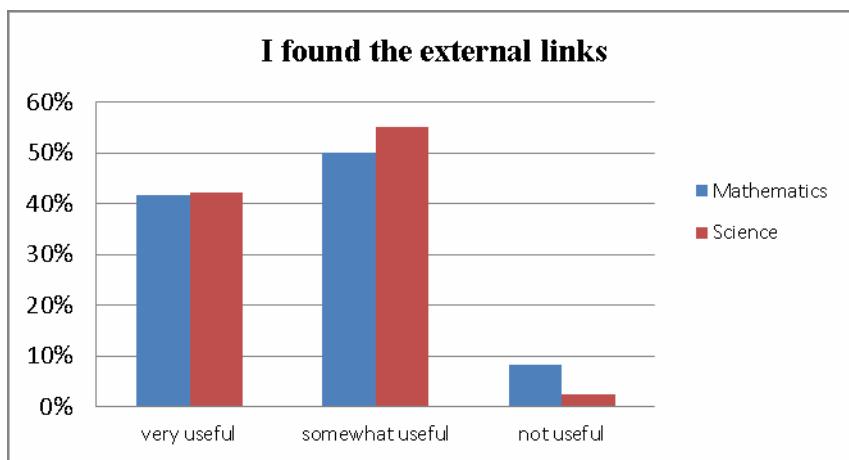
The flexibility to move through the material at their own pace and to revisit material as required obviously suited the students. This can be seen from an examination of the access logs which showed that the majority of the students accessed during "working hours". However a considerable number of students also accessed the online module during the evening and in fact, one student did the work a 2:00 am. The amount of time spent on the module varied between modules, 65 minutes on average for the science module and 72 minutes on average for the mathematics module. There was also a difference between how long individual students took on the material which varied from 20 minutes to 2 hours.



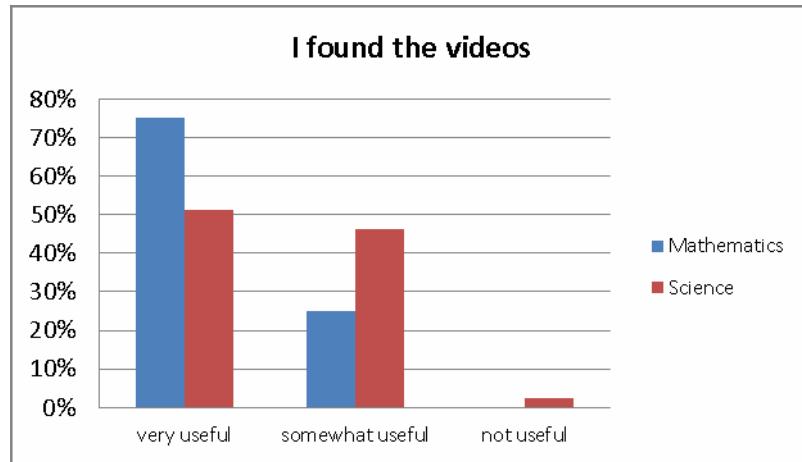
*Figure 5 Percentage of student responses by subject to the question “ What statement best describes how you worked through the material?”*

The students found the external links and the videos to be useful. There was no difference between the mathematics and science students in term of the value of the external links however the mathematics students appeared to find the videos in that module more useful. The students often commented on the value of the external links

*The external links were great - allowing you to research and develop a lesson plan to suit you.*



*Figure 6 Student response to the statement “I found the external links”*



*Figure 7 Students responses to the statement “I found the videos “*

The student comments strongly supported the data from Figure 7, with a majority of the students commenting that they found the videos the most useful aspect for various reasons.

*The videos which demonstrate how students respond to the simulation and how the teacher uses questioning to facilitate discussion in the group.*

*The videos were the most useful part - seeing a real classroom implementation of some of the technology was very valuable. I found the ways in which they were used, and in the case of sticky notes strategically not used, to be interesting, and it made me think about the strategies used and how they might work.*

*The videos really helped clarify some points and gave a good demonstration of how the use of technology can help the students' understanding of the topic.*

*I found the video most useful as they gave me both an aural and visual representation of what the material i was reading meant, which gave me a better and more sound understanding.*

While the overall response to the online modules was very positive there were some aspects of the navigation and the duplication of material that the students commented on as a means to improve the module.

## Conclusion

The online modules were clearly well received by the students who valued the information and the ability to engage at their own pace and at their own time. The students valued the video as indicated by the data from the questions. This was further supported in their comments from the text responses. While this study focussed on the use of the TPACK modules it does show that teacher education students do value quality online materials that they can access when and where they need them and that have a pedagogical focus. The students are discerning users of online materials, who value multiple perspectives and like to be able to see how things work in real classrooms.

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