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Lessons from the pandemic: Teacher educators' use of digital technologies and pedagogies in Vietnam before, during and after the Covid-19 lockdown

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ABSTRACT

This article reports on responses from an online survey designed to explore the before, during and after lockdown experiences of higher education teacher educators in Vietnam (n = 145) who were required to use digital technologies and pedagogies exclusively in their teaching during the 2020/21 lockdown. The data is interpreted using the TPACK framework (Koehler & Mishra, 2009) which enables analysis of the participants' technological, pedagogical and content knowledge in relation to teaching online using digital tools. The findings indicate mixed responses and experiences of teacher educators during this period with many having struggled with new technologies and unfamiliar pedagogical strategies whilst others enjoyed the opportunity to develop new approaches to their teaching. The paper concludes with key recommendations for best practice in this sector going forward post pandemic including the development of national and institutional e-learning policies, improvements in IT infrastructure and increased provision of professional training.

1. Introduction

The World Health Organisation officially declared COVID-19 a pandemic in March 2020, impacting on the lives of civilians worldwide (WHO, 2020). One significant disruption as a result of the pandemic, was the introduction of 'lockdown' periods where all but essential services were closed in a bid to reduce the rate of transmission amongst society. As part of this, education institutions were forced to transition to online teaching rather than on campus and as of April 2020, 173 countries across the globe had school closures (UNESCO, 2020). In Vietnam, school and university closures were introduced from February to May 2020, again in September 2020, and from February to March 2021 (Nguyen et al., 2021). An e-learning programme was introduced as a result of the Ministry of Education and Training (MOET) announcing the importance of 'suspending school, not stopping learning', which saw over 100 HEIs (Higher Education Institutions) offering online learning as an alternative to more traditional teaching methods (MOET, 2020; Pham and Vo, 2021). For HEIs in Vietnam, this resulted in a rapid change of practice, as more traditional face to face teaching methods is generally preferred to support students' learning (Phamn and Dao, 2020). With an awareness in Vietnam of the benefits and potential of using technology in Higher Education (HE), but limited use in actual practice prior to the pandemic, HE educators required a significant shift in pedagogical practices as they grappled with both technical obstacles and a change in teaching methods to minimise disruption to learning (Tue and Hanh, 2021). Of particular challenge, is the limited technological skills and experience of teachers in incorporating technology into their practice, alongside limited finances for HEIs to offer training in developing online teaching skills (Nguyen, 2021). As Vietnam are already reportedly under pressure to reform their teaching practice to

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teach in line with current practices across the globe (Nguyen and Chung, 2020), as researchers we were keen to explore how teacher educators in Vietnam adapted their teaching styles and strategies to teach online during the pandemic.

This project reports on the findings of a survey which captured the experiences and perspectives of 145 HE teacher educators from institutions across the country who taught exclusively online during the pandemic. The data is analysed using Koehler et al. (2020) Technological, Pedagogical and Content Knowledge (TPACK) framework and key lessons learnt in relation to best practice going forward post pandemic are outlined in the discussion.

2. Literature review

2.1. A change in perspective

The shift in practice to move from traditional, face to face teaching to teaching online has required a change in perspective regarding the potential of how education can be facilitated. Smart education is now viewed as a more commonplace method of educating students, largely owing to the pandemic and need to continue teaching and learning. Nguyen and Chung (2020) explain smart education is a 'comprehensive integration of technology, accessibility and connecting everything via the internet, anytime and anywhere'. With this perspective of education dominating teaching practices across the globe, in Vietnam, educators required significant changes to their traditional practices to remain in line with education progression amongst their competitors.

Bahcivan et al. (2019) suggest that incorporating technology into the curriculum is a 'critical pillar' to support the future of education, and that due to advances in technology, this is increasingly becoming more possible and accessible to a wider number of learners (Thai et al., 2021). Recent studies have provided examples of educational technologies that can be used to improve higher education such as LMS interactive technologies, visualisation and mobile technologies, web-based tools, and social media Chugh et al. (2023)) and computers, laptops, tablets, smartphones and interactive boards (Amhag et al., 2019).

Nguyen and Chung (2020) further state that to keep up to date and to continue improving the quality of education, HE lecturers in Vietnam need to reflect on and change their perspectives of educators as 'traditional knowledge transferers, to instructors and designers of advanced learning environment[*s*], helping learners to direct their own work and learning'. Taking into account that Tue and Hanh (2021) report how all of their teacher educator participants had never taught online prior to the pandemic, this is a significant challenge requiring time, space and appropriate facilities to support such a shift in practice and pedagogical approaches. Thai et al. (2021) question whether it is possible to implement online learning across HEIs in Vietnam, due to the largely underdeveloped technological infrastructure available to meet this demand.

It is widely acknowledged that training is essential to facilitate such a change, with new pedagogical approaches such as blended learning and more student-centred practices incorporated into Vietnamese teaching (Dhawan, 2020; Thai et al., 2021; Tran et al., 2021; Nguyen and Nguyen, 2021). Yet even with training, educators need to also be willing and have a positive outlook on using technology to teach, for it to be successful (Son et al., 2020). With less favourable opinions on the potential of technology to facilitate teaching, and a strong desire to maintain traditional teaching practices, it is reported how these perspectives potentially could lessen the quality of online teaching sessions due to limited motivation and willingness to try a new teaching approach (Nguyen and Nguyen, 2021; Tue and Hanh, 2021).

Yet of those studied, large numbers of teachers in HEIs reported how open they were to develop new approaches, reflecting on the suitability and potential of teaching online in the future. 91% of participants in Tue and Hanh's (2021) study expressed positive reactions to teaching online during the pandemic, with educators reporting that whilst this move was necessary to support continued learning, it was in fact a useful strategy to teach and there was keen interest in continuing to do so after the lockdown periods. Teachers in Nguyen et al.'s (2021) study also reported how initial expectations had been exceeded and they were keen to continue teaching in this way, whilst almost three quarters (98) of participants in Tran *et al.*'s (2021) study suggested it was necessary to combine both methods of teaching – both face- to- face and online in the future. Blended learning was viewed more favourably by teachers within this study. It can be therefore suggested, that whilst the initial challenge of pedagogical disruption and the requirement to significantly shift practices was apparent, due to training and trialling online teaching methods, large numbers of teachers in HEIs saw the potential of technology to facilitate new ways of teaching and learning.

2.2. Reported challenges associated with teaching online

Whilst the change in practice due to the pandemic enabled educators to continue teaching, several reported challenges arose. Of particular challenge for educators in Vietnam is a clear skills deficit in being able to deliver teaching materials in an online format (Tue and Hanh, 2021). Teachers from a range of studies have explained how they do not feel competent in using technology and are critical of the quality of their online teaching practices (Thai et al., 2021; Tue and Hanh, 2021). These concerns stem from a reported lack of preparation in developing appropriate materials, limited 'technological capacity of lecturers', and a lack of confidence in their own ability to teach online (ibid.; Nguyen et al., 2021). As such, teachers in all sectors were under pressure to deliver good quality sessions with a lack of skill and experience.

Technological infrastructure and support have been cited in several sources as significant challenges that impact upon Vietnamese teachers' ability to teach online effectively. In Thai *et al.*'s (2021) study, all teachers involved expressed a need for the infrastructure to be invested in if online courses were expected to be delivered. In addition, they explain how issues such as limited facilities and hardware, poor transmission signals and internet connection and compatibility issues between operating systems and software used all impact on the quality of sessions (Thai et al., 2021; Tue and Hanh, 2021). Combined with teacher concerns of their own competency in using online tools to teach, plus their confidence in doing so, teachers felt unable to adequately support their students experiencing technological issues (Thai et al., 2021).

With these challenges, Tue and Hanh's (2021) participants also felt they did not have appropriate support and guidance from an institutional level. In Thach et al.'s (2021) study, a lack of awareness of how to use a range of software, materials and the internet meant that many educators did not know how to enhance the quality of their teaching sessions and to ensure online teaching was effective.

Although these challenges persist, support has been made available for educators to develop a basic awareness of using a range of software and platforms from which to teach. Tue and Hanh (2021) report how almost half of the participants in their study had received guidance on how to transition towards teaching online. Microsoft Teams has been introduced in HEIs in Vietnam (Duong and Nguyen, 2021; Tran, 2021), as a tool to facilitate communication between educators and students alongside learner management systems already in place (Nguyen and Nguyen, 2021). Training has been offered to educators in learning how to run online sessions, use video equipment to deliver lectures and to manage the online environment during teaching sessions (Thach et al., 2021). Interaction was of importance for educators, with additional new approaches integrated into learning such as gamification. Delivering game-based sessions was considered for some educators to be important to both share key information with students, but also to increase levels of interactivity and engagement (Nguyen and Chung, 2020). This has been facilitated through the use of programmes such as Quizizz, Kahoot!, Mentimeter (Tue and Hanh, 2021).

Whilst there were several issues that required grappling with for teachers to feel like the move to online teaching was worthwhile and of good quality, there are also reports that support was provided to assist

educators with the transition to teaching online (see Pham et al., 2023; Vu et al., 2020). With such a shift in teaching practices, new methods of teaching, and the potential challenges for educators noted in this section, we were particularly interested to explore how teachers responded to the change and how they sought to teach online during the pandemic.

3. Research questions

- In what ways did the pandemic impact on the use of digital technologies and pedagogies by teacher educators in Vietnam?
- What were the perceptions of teacher educators in Vietnam about the benefits and drawbacks of increased use of digital technologies and pedagogies during the pandemic?
- What lessons can be learned from the use of digital technologies and pedagogies by teacher educators in Vietnam during the pandemic which can be taken forward to improve digital teaching and learning in this sector and beyond?

4. Theoretical framework

As we sought to establish how Vietnamese teacher educators incorporate technology into their teaching practices, and how this potentially changed as a result of the COVID-19 pandemic, Mishra and Koehler's (2006) Technological, Pedagogical and Content Knowledge (TPACK) conceptual framework guided the study design and analysis of the data. The TPACK model reflects how three key components of teaching: pedagogy, content, and technology, intersect to form the basis of good teaching. It 'describes the kinds of knowledge that teachers need in order to teach with technology, and the complex ways in which these bodies of knowledge interact with each other' (Koehler et al., 2020, p.2). Here, the authors argue that teaching practices no longer solely rely on teachers' pedagogical knowledge and content knowledge, and as times have changed and practices have developed, technology plays a key role in supporting students' learning (Koehler and Mishra, 2009). Recognising the emergence of (digital) technology within teaching, educators are required to go beyond learning about how to use technology, but instead learn *how to integrate* these effectively within their teaching practices as older methods of teaching and learning become obsolete. As such, technology should not be viewed as separate to Pedagogical Content Knowledge (PCK), but integrated, as technology causes a 'ripple effect' on teaching by defining or bounding the possibilities of teaching content in myriad ways. What occurs, is an intersection between PCK and technology, as represented in Fig. 1 below.

Important to acknowledge, is how technology cannot just be 'added' to teaching in order for good teaching to be achieved, and instead what is required is a shift in thinking and approaching teaching by taking into account the possibilities of technology as a tool to enhance, extend or reinforce learning (Koehler et al., 2020). The authors subsequently stress how good quality teaching and content requires careful consideration of how all three knowledge components interact. They acknowledge however, that one approach does not suit all, and as such there is flexibility within the model as teachers develop their practices by incorporating technology into their teaching in various ways. Context therefore is also considered to be an essential aspect within teaching and learning and should be taken into account when planning. Learning experiences should be tailored to the needs of students, developed with specific content in mind, and adapted for specific pedagogies within specific contexts. With this in mind, we were keen to explore how teacher educators integrated technology into their practice, enforced upon them as a result of widespread lockdowns across Vietnam in order to continue educating their students in Higher Education institutions. Taking into consideration the level of technology use within teaching practices prior to the pandemic was somewhat minimal, the researchers were curious as to how good quality teaching was ensured despite significant disruption to typical teaching practices. We were further encouraged to apply this model based on its integration within other studies in a similar light, such as Kushner Benson and Ward's (2013) study to evaluate teaching in Higher Education, and Vasodavan et al. (2019) study to analyse HE lecturers' TPACK to facilitate collaborative learning.

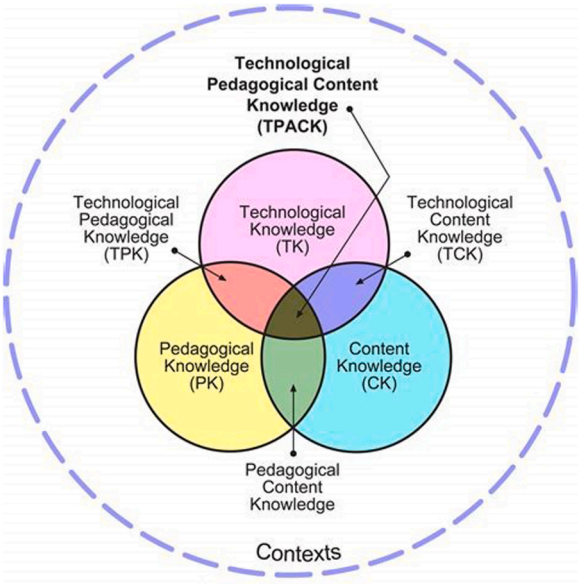

Fig. 1. Koehler et al. (2020) Technological, Pedagogical and Content Knowledge framework.

5. Methodology

5.1. Data collection tools and strategy

Data was collected from an online survey using google form. Random sampling was used with the survey being emailed to all teacher educators at two of the largest pedagogical universities in Vietnam (n = 205). The response rate was 71% (n = 145). The questionnaire included 33 questions, written in English by the international research team and then translated into Vietnamese, which were arranged into 6 sections. The first section (A) asked the personal information of respondents related to gender, age, working experience in higher education, qualification, teaching subject and institution. In parts B to E we asked respondents how they were trained to use digital teaching technology and tools and how they had implemented this expertise in teaching during Covid-19 pandemic lockdown periods. We also asked questions to explore how this compulsory directive to apply digital teaching technology and tools had enhanced their pedagogical competence such as teaching planning, methods, syllabus and use of online platforms. In the final section of the survey (F) we asked respondents to share their feeling and motivation in implementing digital teaching technology and tools both previous to and during the Covid-19 lockdown.

We used various question formats. To evaluate aspects relating to technology use and opinions we mainly used multichoice questions organised into matrix table with criteria in rows and levels (likert scale) in columns. The second format were tag questions with binary outputs (yes/no). The third format were open questions allowing respondents to freely input relevant information. We asked open questions in order to cross-check responses and get more insights into the outputs of multichoice and tag questions. All data was translated from Vietnamese into English for analysis and writing up purposes.

5.2. Data analysis

The quantitative data from the surveys was analysed using R, an open-source programming language that supports statistical calculations and visual representations for exploratory data analysis (Stowell,

2014).

The qualitative data from the free text questions in the survey was coded and organised thematically in relation to the three TPACK elements and used in tandem with the quantitative data to address the research questions. In total 411 free text responses were analysed. Overall, approximately 85% of the free text responses identified challenges and 15% identified benefits of online learning (these percentage are approximate due to some ambiguity in the wording of responses, such as 'normal'). The responses were coded and aligned with the thematic categories in order to identify patterns in the participants' opinions and experiences.

5.3. Participants

In total 145 (66M/77F/2O) teacher educators completed the survey from 19 HEIs across Vietnam. The vast majority were highly qualified, mid-career professionals with the sample comprising: 124 who had more than 10 years' service, 105 who had a PhD as their highest qualification and 129 who were aged between 31 and 50. Full demographic details of participants can be found in appendix I.

The project was approved by the Birmingham City University ethics committee prior to collection of data (project approval number 9543).

6. Findings

The teacher educator surveys produced both quantitative and qualitative data and the findings are presented and discussed here in relation to the three key areas of the TPACK theoretical framework. In order to understand the findings in relation to TPACK the data is discussed in relation to each research question under the sub-headings of: Technological Knowledge, Pedagogical Knowledge and where relevant, Content Knowledge. Findings which relate to more than one TPACK element are identified as 'Intersecting areas of TPACK'. The following sections will present and discuss the experiences and opinions of teacher educators in Vietnam in relation to their use of digital tools and technologies during the pandemic. The discussion which follows outlines associated recommendations for improving this practice post pandemic and beyond. In order to ensure all teacher educator respondents remain unidentifiable, only information about the academic discipline within which they work is provided with each direct quote from the data.

7. In what ways did the pandemic impact on the use of digital technologies and pedagogies by teacher educators in Vietnam?

7.1. Technological knowledge

Table 1 presents an overview of the ways in which the pandemic impacted on the use of digital technologies and tools by teacher educators. It can be seen that Powerpoint was used daily by most, but that the frequency of using other online tools and software also increased in frequency by many.

(n = 145).

Table 1
The frequency of using additional software/ digital tools during C-19 pandemic (in count and percents.

	White board	Padlet	Coggle. it	Powerpoint	Other
Never	78 (53.8%)	77 (53.1%)	95 (65.5%)	1 (0.7%)	30 (20.7%)
< Once a week	25 (17.2%)	27 (18.6%)	27 (18.6%)	7 (4.8%)	37 (25.5%)
1–2 times per week	24 (16.6%)	21 (14.5%)	14 (9.7%)	14 (9.7%)	32 (22.1%)
3–4 times per week	5 (3.4%)	11 (7.6%)	4 (2.8%)	30 (20.7%)	18 (12.4%)
Daily	13 (9%)	9 (6.2%)	5 (3.4%)	93 (64.1%)	28 (19.3%)

The increase in technological knowledge of different programmes, software and systems represented in the table above was also reflected in the comments provided by the participants in the relevant free text boxes on the survey, with 79 responses to the question of how their technology use changed during the enforced online teaching during the covid-19 lockdown:. For example, one educator clearly explained the journey from pre to post covid in relation to his use of technology in teaching:

Before Covid-19, I participated in many ICT training courses, the school's own online teaching website, Quickcom software and the Learn English Now app. During Covid-19, I implemented teaching, noting my advantages & disadvantages when applying the training programs. After Covid-19, not only me but also the teaching staff at the school were encouraged to continue practicing online teaching & increasingly effective application of technology in teaching. (Lecturer of English).

And another commented that:

Before the Covid-19 pandemic we often used online teaching through the LMS system, during and after the Covid-19 pandemic we were trained to use more software for online teaching. (Lecturer of Physical Education).

7.2. Pedagogical knowledge

Associated changes were also reported in pedagogic knowledge during this time as participants adjusted their teaching methods to the requirement to teach 100% online. This was a mixed experience with 102 commenting on the difficulties that came with online teaching and the importance of developing an approach that captured the best of both established face to face and online methods. For example,

Before Covid-19, online teaching was little, only used in interaction to solve problems about teaching schedules, urgent cases that need to be notified and collected; during the time of Covid-19 online teaching became the main approach, teaching methods and techniques were developed and consolidated; later too, it would be good to combine the two. (Lecturer of Geography).

Basically, the teaching methods are still applied as before, but the implementation method has changed. For example: still grouping, still working in groups, still discussing, still reporting,. But teaching techniques such as galleries, fish tanks, ball bearings,. are more difficult to implement. (Lecturer in Education).

Table 2 presents the responses to the survey question: 'What pedagogical methods did you use during the pandemic period?' A self-evaluation scale was incorporated for teacher educators to indicate how proficient they felt they were with each online method.

(n = 145).

The table indicates a developing or proficient level of ability with a range of pedagogical methods reflecting the efforts made by teacher educators to adapt their teaching to work online during the pandemic. Fewer respondents reported feeling 'very proficient' though, again indicating the need for training and support in digital pedagogies going forward.

7.3. Intersecting areas of TPACK

As outlined in the methodology it is difficult to separate out comments relating only to content knowledge and there were many comments (n = 51) which incorporated elements of two or three of the TPACK areas of technology, pedagogy and content. Indeed, as one participant pointed out 'I teach about IT, so IT is both a tool, a means and a teaching content' (Lecturer in Education).

Other comments also indicated the complex, intertwined nature of the TPACK elements for teacher educators during the pandemic, particularly around learning about the best programmes to support their teaching in terms of content, how to use the associated technology and

Table 2
Pedagogical methods used by teacher educators during the pandemic and self-evaluation of proficiency in using them (in count and percents).

	Blended-learning	Flipped Classroom	Webquest (LMS)	Assign and check via Facebook (social media)	Assign and check via Zalo (messaging App)	Assign and check via other way
Not yet	4 (2.8%)	9 (6.2%)	16 (11%)	12 (8.3%)	6 (4.1%)	1 (0.7%)
Not good	9 (6.2%)	11 (7.6%)	10 (6.9%)	17 (11.7%)	1 (0.7%)	3 (2.1%)
Normal	45 (31%)	50 (34.5%)	63 (43.4%)	45 (31%)	40 (27.6%)	41 (28.3)
Proficient	66 (45.5%)	60 (41.4%)	47 (32.4%)	45 (31%)	62 (42.8%)	66 (45.5%)
Very proficient	21 (14.5%)	15 (10.3%	9 (6.2%)	26 (17.9%)	36 (24.8%)	34(23.4%)

the best ways to teach with them. The need to train themselves in these areas is apparent in the following quotes:

Currently, I am still working hard while using and researching to improve the quality of teaching activities based on the websites and tools that I am choosing. Acquired achievements and expanding research on other methods, techniques, tools and software to organize online teaching activities. (Lecturer in Biology).

During the Covid pandemic: find a way to switch to online teaching, design and adjust some content and forms to meet online teaching. (Lecturer in Art).

One participant explained that this process varied according to each HEI and that the training and support available was also variable:

At each university, there is a different way of doing things, and there are specific instructions and training classes for using the software that the school chooses. (Lecturer of Preschool Education).

This issue of training will be further discussed in relation to RQ3.

8. What were the perceptions of teacher educators in Vietnam about the benefits and drawbacks of increased use of digital technologies and pedagogies during the pandemic?

8.1. Technological knowledge

Many benefits were identified in the free text responses to questions relating to the increased use of digital technologies during the pandemic (n = 49). Respondents noted positive factors such as; 'novelty' 'attractive' 'saving time and effort', 'exciting', 'adaptable', 'interesting', 'cool' and 'efficient'.

15 respondents noted that the shift to online teaching during the pandemic had resulted in them feeling more proficient and confident in their ability to teach online and one reported that in their university the online teaching 'has been very developed and the technical infrastructure is getting better and better.' (Lecturer in Geography).

However, it was more common for respondents to comment on the limitations of IT infrastructure and network coverage leading to frustration and technical difficulties in the delivery of their online teaching. Some illustrative quotes on this point are below:

I see that universities are not synchronized in terms of infrastructure, technology in online teaching, management is not effective and too dependent on free tools. (Lecturer in Geography).

Machines, poor configuration, bad image. The network system is often suspended, must go in and out. (Lecturer in Mathematics, Primary Education).

Students in many localities do not have the best means and conditions to study, and the transmission is poor. (Lecturer in Education).

In many instances, it seems, systems and infrastructure did not meet the requirements of the teacher educators or the students.

8.2. Pedagogical knowledge

Table 3 captures survey responses in relation to the question: 'How would you rate your ability to teach with technology after the C-19 lockdown?' There is a dominance of the response 'better than before' in reported improvements in this area, particularly in relation to frequency and skill in use. This suggests that post pandemic, online teaching continues to be used widely and that many teacher educators feel more able and confident in their use of digital tools and pedagogies.

Table 3
Teacher educators self-rated ability to teach with technology after the C-19 lockdown (in count and percents).

	Knowledge	Skill	Attitude	Confidence	Frequency
I don't know	1 (0.7%)	4 (2.8%)	5 (3.4%)	4 (2.8%)	5 (3.4%)
Same as before	54 (37.2%)	20 (13.8%)	45 (31%)	43 (29.7%)	11 (7.6%)
Worse/ Less than before	16 (11%)	33 (22.8%)	32 (22.1%)	21 (14.5%)	24 (16.6%)
Better/ More than before	74 (51%)	88 (60.7%)	63 (43.4%)	77 (53.1%)	105 (72.4%)

From the qualitative data it is clear that there were many benefits reported in relation to teacher educators' pedagogical knowledge during the pandemic including increased creativity and fun in their teaching. Key findings were that despite limitations, with the right tools and the right training the potential for increased effectiveness and enjoyment of teaching and learning was high. For example:

I myself have applied the basic tools in teaching and found it very effective, specifically: increasing the positivity, creating good learning excitement, lively live and online classes, the teaching process. study smoothly and solve the learning tasks well. (Lecturer in Physical Education).

Online teaching has some limitations on the interaction with the body language of teachers and students, but instead there is a lot of fun using interactive tools via online web, and teachers seem to do get more work for students in the same time unit. If you master technology, online teaching has some advantages over face-to-face. (Lecturer in Geography).

Many lecturers are creative when they know how to combine many online teaching technologies in a masterful manner. (Lecturer in Literature).

Respondents also commented on the importance of sharing techniques and methods of online teaching such as sharing videos, online discussion groups and interactive activities, a point that is picked up in the discussion section.

There were also drawbacks associated with pedagogical knowledge, particularly around the increased preparation time and lack of face to face interaction with students. For example:

Teaching online is a bit more laborious because it requires more preparation (like preparing content and recording video lectures to post on Youtube). (Lecturer in Korean Language).

First it's awkward, then it's gradually mastered, stabilizing the first class takes a long time, not seeing students, not knowing how well students understand the problem, students may not have understood the problem well enough. (Lecturer in Biology).

Online teaching is not as lively as classroom teaching. (Lecturer in Economics).

A particular issue arose with teaching practical skills activities in this respect as noted below:

(It is) difficult to control and direct the activities of the class and each individual, difficult to convey and interact with emotions in teaching, difficult to develop some hard skills of e-learning program. Many training activities cannot be substituted, such as practical activities, experiments, professional experiences, etc. (Lecturer in Chemistry).

Overall, a frequent comment from the teacher educators was that in their experience of online teaching the interaction between teachers and students is 'poor' (n = 26).

8.3. Content knowledge

There were 9 free text responses relating to content knowledge, all of which identified benefits. including the convenience in linking document pages with lecture context and the ways in which IT can help enrich teaching. For example:

Using a huge and diverse knowledge database connected to each other has created favourable conditions for teachers. The multimedia environment has maximized the learners' senses. Experiments and materials are provided with a variety of picture channels, text channels, and vivid sounds, making them easy to see and absorb for students. Thanks to the application of IT in teaching, teachers are more active in lesson planning, looking for resources for lectures, creating a link between more natural and rational knowledge units. (Lecturer in IT).

Other benefits were the ability to source subject specific information from the internet and the 'convenience' of having content always available.

However, as one respondent commented:

Even though there are modules and learning content related to professional practice, online teaching still has many limitations. (Lecturer in Biology).

Intersecting areas of TPACK.

23 comments identified benefits that related to two or more aspects of the TPACK model in relation to RQ2. For example, the following quote reflects on the strong commitment of the HEI, teachers and students to make a success of online teaching:

The department has a good technology infrastructure, training for teachers and students in the use of teaching, learning and assessment. There is exchange and discussion between teachers to increase teaching effectiveness. There is evaluation and summary of experience after teaching online. (Lecturer in Chemistry).

The obvious benefit of online teaching in relation to disease prevention was also noted by several respondents, with one commenting that:

Online teaching is appropriate in the context of Covid, if teachers prepare a good lesson plan, it will be highly effective. (Lecturer in Physics).

In terms of drawbacks, as can be seen in the following quote respondents identified these in relation to students engagement with online teaching, especially if they are using smartphones rather than computers. For example:

I have not seen the effectiveness of online teaching as with face-to-face teaching; students' internet resources are very weak, most students use their phones to study, so interaction with teachers is limited; Students often only listen to the teacher's lectures. (Lecturer in Physics).

This problem was recognised by 10 respondents as being an economic or regional issue with students from poorer backgrounds often less able to afford a computer at home:

There should be solutions and sanctions to support conditions for learners to participate well - equipping with internet and computers at community learning centres for students from poor households. (Lecturer in Education).

Another key weakness was seen to be lack of training in digital pedagogies for teacher educators and the overuse of online teaching in some contexts, for example:

Online teaching technology has not been covered in educational institutions, there is still no synchronization due to the concept of temporary, coping. Or in the direction of overusing online teaching technology. (Lecturer in Literature).

Another key aspect to come out of the free text data in relation to the sudden and compulsory use of digital tools and technology during the pandemic which was not covered by analysis using the TPACK framework was the emotional impact it had on many teacher educators in this study.

Respondents reported feeling 'bewildered' and 'uncomfortable' and 'tired' with 'more work and more anxiety.'.

Two mentioned the increased challenge for older teachers in particular to adapt to new technologies:

(I) always feel short of time because of the rapid development and variety of online teaching techniques, especially for teachers aged 50 and over (!). (Lecturer in Chemistry).

Due to old age, it is difficult to access modern technology. (Lecturer in Civic Education).

Even though they do not fall under the areas of TPACK which have framed this study, these emotional aspects are important to acknowledge and will be incorporated into the recommendations in the final section.

9. What lessons can be learned from the use of digital technologies and pedagogies by teacher educators in Vietnam during the pandemic which can be taken forward to improve digital teaching and learning in this sector and beyond?

Responses from the survey to the question: 'Which of the following factors are important in helping teacher educators teach effectively?' are presented in Table 4. They indicate that the most important factors are teachers sharing their experiences of using technology, managers having a clear strategy for using technology and the building of a technology infrastructure for each institution. These findings are further discussed in the relevant TPACK areas below and in the recommendations section. (n = 145).

9.1. Technological knowledge

In terms of Technological Knowledge the key lessons to be learned from the pandemic according to the survey responses were to have a strong, modern IT network and infrastructure (including consistent Wi-Fi for all regions) (n = 75) and teacher educators who are well trained and proficient in using digital tools and pedagogies (n = 91).

More direction from individual institutions of the use of tools/pedagogies was also a key issue. For example:

In the face of so many tools/applications, the school can orient and guide teachers on which tools are really useful, organize training so that teachers can make good use of these tools/applications. there. At the same time, the school also needs to synchronize and agree on the use of tools/applications in the lecturers, not letting the lecturers swim by themselves. (Lecturer in Korean).

And another commented that:

The use of technology in face-to-face teaching claims to have a positive effect: I personally find it interesting and want to study more, 2. Online teaching is a trend all factors of the context at and future, 3. Approaching any method, a technique, a tool, a website. there are many things that must be the most difficult. However, if we "try" to overcome it, we will gain valuable life experiences. (Lecturer in Biology).

9.2. Pedagogical knowledge

Teacher educators clearly learned many lessons relating to effective online pedagogies during the pandemic particularly around the importance of being creative with resources (n = 32), using diverse teaching methods (n = 17) and classroom management (n = 44) as illustrated by

Table 4
Factors identified as important by teacher educators in helping them teach effectively online (in count and percents).

	Building a technology infrastructure for each school	Management have a clear strategy for using technology in the school	Having a dedicated channel of Vietnamese television to teach general education to the whole country	Teachers sharing their experiences of using technology	Developing methods and pedagogies of blended learning
Normal	5 (3.4%)	8 (5.5%)	13 (9%)	11 (7.6%)	13 (9%)
Important	57 (39.3%)	64 (44.1%)	91 (62.8%)	70 (48.3%)	75 (51.7%)
Very important	83 (57.2%)	73 (50.3%)	41 (28.3%)	64 (44.1%)	57 (39.3%)

the comments below:

Pay attention to creating beautiful and attractive interfaces, slides, images, videos, to avoid boredom and attract the attention of learners. Give presentations only when absolutely necessary to avoid boredom. (Lecturer in Biology).

Even if it is online, it is still advisable to organize teaching with active teaching methods. (Lecturer in Civic Education).

Teachers need to have good classroom management skills, establish classroom rules from the beginning and implement them seriously, design lessons with a variety of activities, increase interaction through 3rd platforms manage learning by output products. (Lecturer in Education Management).

9.3. Content knowledge

Comments related to Content Knowledge focused on the practical aspects of making key information available to students by 'building a system of documents and learning materials' using the multimedia methods afforded by digital technology. As one educator explained:

In each item and subsection of the lesson, the lecturer needs to provide links related to the content of knowledge so that students can be more active in learning; use convenient multimedia such as: images, sounds, short videos,. to create more interactive effects. (Lecturer in Literature).

9.4. Intersecting TPACK areas

31 teacher educators in the study commented on the importance of a strategic vision nationally and within individual institutions in order to ensure online teaching is going 'in the right direction and developing strongly.'.

The active role of both teacher and students in ensuring successful online teaching was also a key issue. For example:

Teachers must be enthusiastic and have a reasonable teaching plan in combination with students to have a high sense of self-study to achieve effective educational results and vice versa. (Lecturer in Chemistry).

However, there were also several comments (n = 8) that face to face teaching is always preferable to online teaching and should be resumed either as a blended or singular approach as soon as practicable. For example:

Teach online when necessary. Normally, teachers and students come to class much better. (Lecturer in Biology).

More and better training' for teacher educators was seen as another key component for successful online teaching and will be discussed further in the recommendations to follow. (Lecturer in Law and Management Administration).

10. Discussion and recommendations

This study captured important information at a crucial and unprecedented time of crisis and change in teacher educators' professional practice in Vietnam. Research emerging from around the world indicates that the experiences of the respondents to this survey relate closely to experiences of teachers and teacher educators globally, who also had to face the same challenge of transferring their face to face teaching methods and resources to digital tools and pedagogies in response to the pandemic (e.g. Ali, 2020; Turnbull et al., 2021; Zawacki-Richter, 2021).

As Rashid and Yadav :1) (2020) highlight in their review of the impact of Covid-19 pandemic on Higher Education globally:

> 'The pandemic has exposed the shortcomings of the current HE systems and the need for more training of education in digital technology.'.

Therefore, the following recommendations arise from the Vietnamese teacher educator context, but are also intended as contributions to the global lessons from the pandemic that educators around the world

are currently documenting and sharing.

Using the TPACK framework to structure the survey questions and analysis for this study, it has been possible to identify key areas for improvement and development relating to Technological and Pedagogical Knowledge and to a lesser extent Content Knowledge. However, as many of the recommendations straddle two or three areas of these types of knowledge and some reach beyond this model, they will be presented in this section as the three thematic areas which came through from the survey responses as the strongest, most urgent aspects needing attention. These are: 'Institutions and Infrastructure'; 'Teacher Educators and Training' and 'Student Engagement'. Some of these recommendations are in the direct, translated words of survey respondents and are presented as such within quote marks.

10.1. Institutions and infrastructure

Overall, there was agreement that there needs to be a 'strategic vision' or 'roadmap' on how to best integrate online teaching for teacher educators which is developed and monitored both centrally by the Ministry of Education and Training in Vietnam, and by individual HEIs which provide teacher education. In tandem with this, the IT infrastructure needs to be upgraded to a consistently high level across the country with Wi-Fi available for all and HEIs having access to relevant networks and systems to support their teaching.

There were also calls for the quality of education in online teaching to be monitored and assured centrally by MOET, including 'regulations of testing and evaluation', and for HEIs to 'purchase and provide important software with copyright and full option for teachers and students' including for example MS office, SPSS, MS Teams, Zoom webinar, plagiarism checker software and online assessment software.

Overall, the key recommendations were for the technology infrastructure across the country to be improved and for institutions and MOET to 'systematically encourage and manage online learning'. Training for teacher educators is an integral component of this and will be discussed in the following section.

10.2. Teacher educators and training

The need for systematic, targeted and flexible training opportunities for teacher educators in using digital tools and pedagogies in their teaching came through as one of the strongest recommendations of the study. Respondents explained how teacher educators can only make good use of the tools/applications available if they (i) know what they are, and (ii) know how to use them.

Additional suggestions included having 'regular short training courses for university teachers', having 'MOET provided central training in key assessment and evaluation software' and building in 'appropriate incentive solutions' for teacher educators who attend IT training courses.

An associated recommendation was for HEIs to 'create time and budget for teachers to develop professional capacity' as many respondents felt that they had to upskill themselves on the use of digital tools and pedagogies in their free time and without support. There was also an important issue raised about providing specific support for older teachers who may not be as proficient with technology as their younger counterparts and who may experience additional stress and work-load issues with the obligations to teach online.

Further recommendations for practical support for teacher educators and students included the provision of 'a website which contains necessary technical instruction information for teachers and students' and having 'an effective helpdesk team to support teachers and students.'.

The final recommendations section explores the issue of student engagement further in the context of online learning.

10.3. Student engagement

A key reason for the need for a clearly defined roadmap for improving infrastructure and network access across the country as previously identified, was due to the potential for a 'levelling out' of student opportunity to ensure engagement for all in online lessons in disadvantaged and/or rural areas where there may be intermittent or inconsistent internet access. The associated problem of some poorer students not having their own computers and trying to learn online using only smartphones was also identified as a problematic issue that could be addressed by the provision of local computer centres or the development of centrally funded schemes to assist students in buying or borrowing computers. The recommendation here then is for strategies to be developed for providing all students with access to computers and reliable internet connection either at home or in their local area.

In line with previous studies (e.g. Phamn & Dao, 2021) teacher educators reported frequent issues with lack of student engagement when using online learning highlighting this as an important area to address. Useful pedagogic methods to overcome this were shared by survey respondents, including being creative with resources and using a variety of online activities. Having a mechanism, perhaps in the form of a website or social media platform, for teacher educators to continue to share good practice with each other in this area is therefore a key recommendation going forward.

The on-going success of online teaching and learning in teacher education has to be a joint endeavour between teacher educators and students, whereby 'training and fostering technology knowledge and skills raises the sense of responsibility in online teaching for both teachers and learners,' teachers are 'enthusiastic' and students have a commitment to 'self-study to achieve effective educational results.'.

A final key recommendation in this section relates to the balance of face to face and online teaching going forward post pandemic. In line with Tran *et al.*'s (2021) findings with HEI Maths lecturers, many teacher educators expressed a preference to use a 'blended' approach of the two in order to provide the optimal learning experience for students, and to ensure the benefits and enjoyment of being in a classroom with students are not lost in the transference of much teaching online.

11. Conclusion

There was a general recognition and consensus among the teacher educators in this study that the future direction of learning and teaching is online, in Vietnam and globally. The challenge now is to ensure that the lessons about using digital tools and pedagogies learnt during the pandemic are carried froward to facilitate this in the most efficient and engaging ways possible for all teachers and students. The associated challenge is to ensure that the effective elements of face to face teaching and pedagogy are also incorporated into a blended approach that best meets the educational, professional and social needs of teacher educators and learners.

Although this study is limited by the sample size and the respondents coming from only two pedagogical universities in Vietnam, important recommendations have been identified from the findings. These are:

- there needs to be a 'strategic vision' or 'roadmap' on how to best integrate online teaching for teacher educators
- the IT infrastructure needs to be upgraded to a consistently high level across the country
- the quality of education in online teaching should be monitored and assured centrally with institutions and MOET systematically encouraging and managing online learning
- HEIs need to provide systematic, targeted and flexible training opportunities for teacher educators in using digital tools and pedagogies in their teaching

- strategies need to be developed for providing all students with access to computers and reliable internet connection either at home or in their local area

Further research tracking teacher educators' use of digital technology in the coming years in Vietnam, along with student teachers' experiences of being taught in a blended model, will provide important information about the long term impact of the digital transformation of teacher education instigated by the pandemic.

Author statement

I confirm that this is an original piece of research that is not published elsewhere. Ethical approval was granted for the project from the Birmingham City University ethics committee before data collection began. There are no conflicts of interests in the submission or review of this paper.

Appendix 1. Demographic information of 145 survey respondents from 19 universities in Vietnam

Age	From 21–30	From 31–40	From 41–50	> 50
	2	68	61	14

Highest education	Bachelor degree	Masters degree	PhD/doctorate
	1	39	105

Years of occupation	Less than 3 years	From 4–6 years	From 7–9 years	> 10 years
	2	6	13	124

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